ICAR-NBSS&LUP Sujala MWS Publ.241

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

RAGHUNATHANAHALLI WEST-2 (4D4A2M4c) MICRO WATERSHED

Alavandi Hobli, 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 Raghunathanahalli west-2 (4D4A2M4c) Microwatershed, Alavandi Hobli, Koppal Taluk and District, Karnataka”, ICAR-NBSS&LUP Sujala MWS Publ.241, ICAR – NBSS & LUP, RC, Bangalore. p.129 & 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.241

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

RAGHUNATHANAHALLI WEST-2 (4D4A2M4c) MICRO WATERSHED

Alavandi Hobli, 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 Raghunathanahalli West-2 microwatershed in Koppal Taluk and District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micro-watershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date:04-07-2019

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

Contributors

Dr. Rajendra Hegde 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	Smt. Chaitra, S.P.
	Dr. Gopali Bardhan
	Mr. Somashekar T.N
	Ms. Arpitha G.M
	Dr. Mahendra kumar M.B
Field Work	
Sh. C. Bache Gowda	Sh. Mayur Patil
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. Umesh Jadiyappa Madolli
	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. Abhijith Sastry, N.S.
Smt. K.Sujatha	Smt. Shyla, B.
Smt. K.V.Archana	Smt. Swetha ,K.
Sh. N.Maddileti	Ms. Vidya, P.C.
	Sh. Deepak, M.J.
	Smt. K.Karunya Lakshmi
	Ms. Seema, K.V.

Laboratory Analysis	
Dr. M. Lalitha	Sh. Vindhya, N.G.
Smt. Arti Koyal	Ms. P. Pavanakumari, P.
Smt. Parvathy, S.	Ms. Rashmi, N.
	Ms. Leelavathy, K.U.
	Smt. Usha Kiran, G.
Socio-Economic Survey	
Dr. S.C. Ramesh Kumar	Sh. M.K. Prakashanaik
	Ms. Shraddha Hegde
	Mrs. Sowmya A N
	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 Raghunathanahalli West-2 microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and 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 238 ha in Koppal taluk and 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, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of 97 per cent is covered by soils and 2 per cent is by water bodies and less than one per cent by rock outcrops. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 9 soil series and 17 soil phases (management units) and 6 Land management units.*
- *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 320 m grid interval.*
- *Land suitability for growing 28 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 58 per cent of the soils are shallow to moderately shallow (25-75 cm), 13 per cent of the soils are moderately deep to deep (75-150 cm) and 26 per cent soils are very deep (>150 cm).*
- *About 55 per cent area has clayey soils at the surface and an area of 42 per cent has loamy soils.*
- *About 42 per cent area has non-gravelly (<15% gravel) soils and 56 per cent has gravelly to very gravelly (15-60%) soils).*
- *About 60 per cent area is very low to low (<50-100 mm/m) and 38 per cent area is very high (>200 mm/m) in available water capacity.*
- *An area of about 84 per cent has very gently sloping (1-3%) lands and 14 per cent area has nearly level (0-1%) lands.*
- *About 80 per cent area is slightly eroded (e1) and about 18 per cent area is moderately eroded (e2) lands.*

- *Major area of about 81 per cent is slightly alkaline (pH 7.3-7.8) to very strongly alkaline (pH >9.0) and 16 per cent area is neutral (pH 6.5-7.3) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *Organic carbon is medium (0.5-0.75%) in 59 per cent of the soils are and high (>0.75%) in 38 per cent area.*
- *An area of about 57 per cent is low (<23 kg/ha) and 40 per cent is medium (23-57 kg/ha) in available phosphorus.*
- *An area of 21 per cent is medium (145-337 kg/ha) and about 76 per cent is high (>337 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in 26 per cent area, medium (10-20 ppm) in about 41 per cent area and high (>20 ppm) in 30 per cent area.*
- *Available boron is low (<0.5 ppm) in about 55 per cent area, medium (0.5-1.0 ppm) in 39 per cent area and high (>1.0 ppm) in 3 per cent area.*
- *Available iron is deficient (<4.5 ppm) in 72 per cent area and sufficient (>4.5 ppm) in 25 per cent area.*
- *Available zinc is deficient (<0.6 ppm) in 45 per cent area and sufficient (>0.6 ppm) in 52 per cent area.*
- *Available copper and manganese are sufficient in all the soils.*
- *The land suitability for 28 major crops grown in the microwatershed were assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	-	*194 (82)*		*Pomegranate*	-	*89 (38)*
Maize	-	*104 (44)*		*Guava*	-	-
Bajra	-	*113 (47)*		*Jackfruit*	-	-
Groundnut	-	*104 (44)*		*Jamun*	-	*89 (38)*
Sunflower	-	*89 (38)*		*Musambi*	-	*89 (38)*
Cotton	*27 (11)*	*167 (70)*		*Lime*	-	*89 (38)*
Red gram	-	*89 (38)*		*Cashew*	-	*4 (2)*
Bengalgram	*27 (11)*	*114 (48)*		*Custard apple*	*27 (11)*	*171 (72)*
Chilli	-	*113 (47)*		*Amla*	-	*198 (83)*
Tomato	-	*104 (44)*		*Tamarind*	-	*89 (38)*
Drumstick	-	*89 (38)*		*Marigold*	-	*194 (82)*
Mulberry	-	*31 (13)*		*Chrysanthemum*	-	*194 (82)*
Mango	-	-		*Jasmine*	-	*105 (44)*
Sapota	-	-		*Crossandra*	-	*140 (59)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 6 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.

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

Soil is a finite natural resource that is central to sustainable agriculture and food security. Over the years, this precious resource is faced with the problems of erosion, salinity, alkalinity, degradation, depletion of nutrients and even decline in availability of land for agriculture. It is a known fact, that it takes thousands of years to form a few centimetres of soil, thus, soil is a precious gift of nature. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agroclimatic setting, and use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. As much as 121 m ha of land is reportedly degraded which leads to impaired soil quality. It is imperative that steps are urgently taken to check and reverse land degradation without any further loss of time. The improvements in productivity will have to come from sustainable intensification measures that make the most effective use of land and water resources. 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.

Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and use potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis. The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate

detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

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

The Land Resource Inventory is basically done for identifying potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high resolution satellite remote sensing data and Digital Elevation Model (DEM) data to prepare Landscape Ecological Units (LEU) map representing agro-ecosystem as a whole. The LEU is preferred over landform as the base map for LRI. LEU is the assemblage of landform, slope and land use. An attempt 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 Raghunathanahalli West-2 microwatershed in Koppal Taluk and 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 Raghunathanahalli West-2 Microwatershed is located in the central part of northern Karnataka in Koppal Taluk, Koppal District, Karnataka State (Fig.2.1). It comprises parts of Alavandi and Byrapura villages. It lies between $15^0$12' – $15^0$14' North latitudes and $75^0$57' – $75^0$59' East longitudes and covers an area of 238 ha. It is about 28 km southwest of Koppal town and is surrounded by Alavandi village on the northeastern and northwestern, Kallahalli on the southwest and Byrapura village on the southern side of the microwatershed.

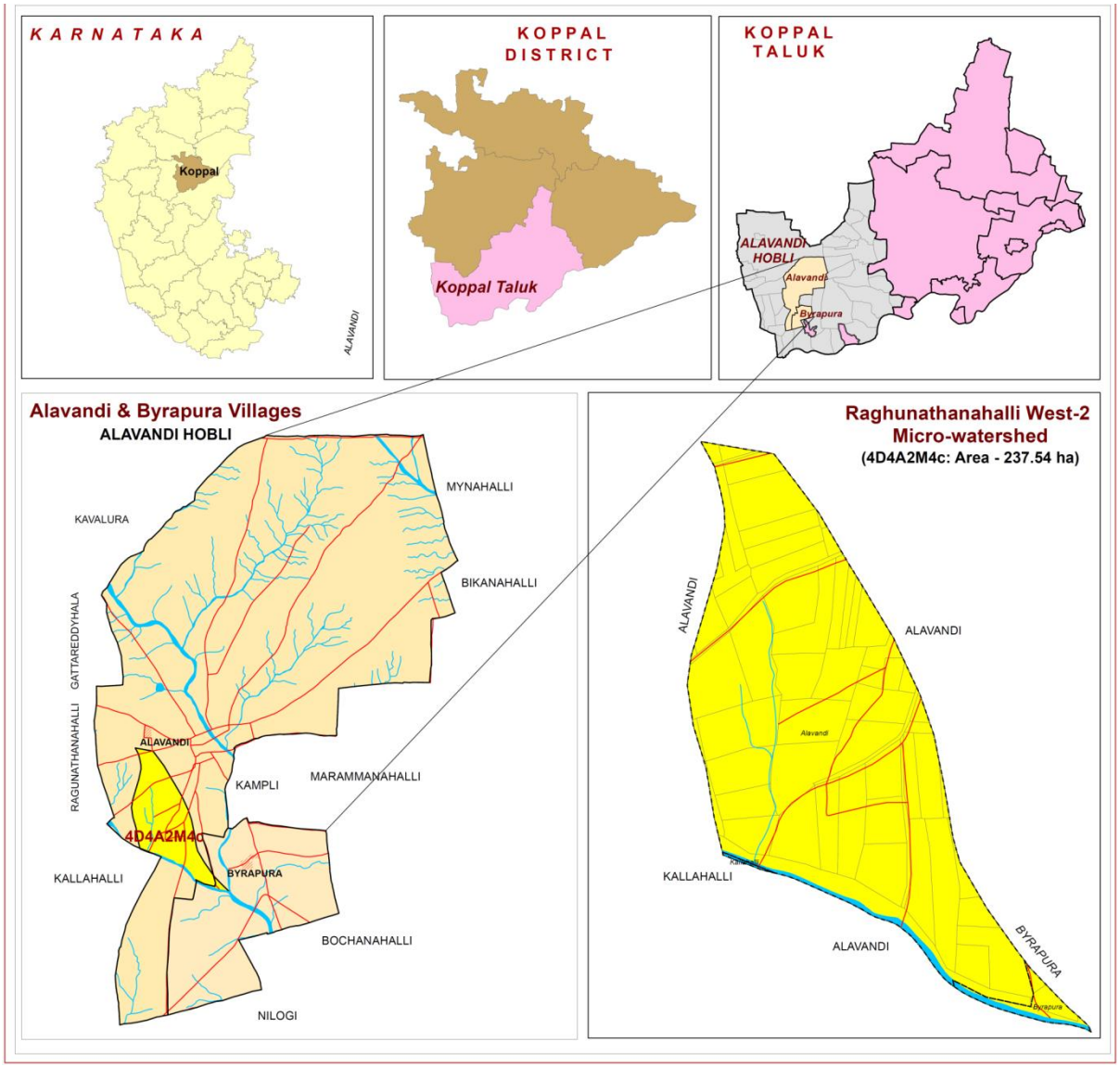


Fig.2.1 Location map of Raghunathanahalli West-2 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Figs.2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Bettageri village. The soil 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 mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level

plains based on slope and its relief features. The elevation ranges from 507-557 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

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 total annual rainfall of 662 mm (Table 2.1) Of this, a maximum of 424 mm precipitation takes place during 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 received 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 months 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**	

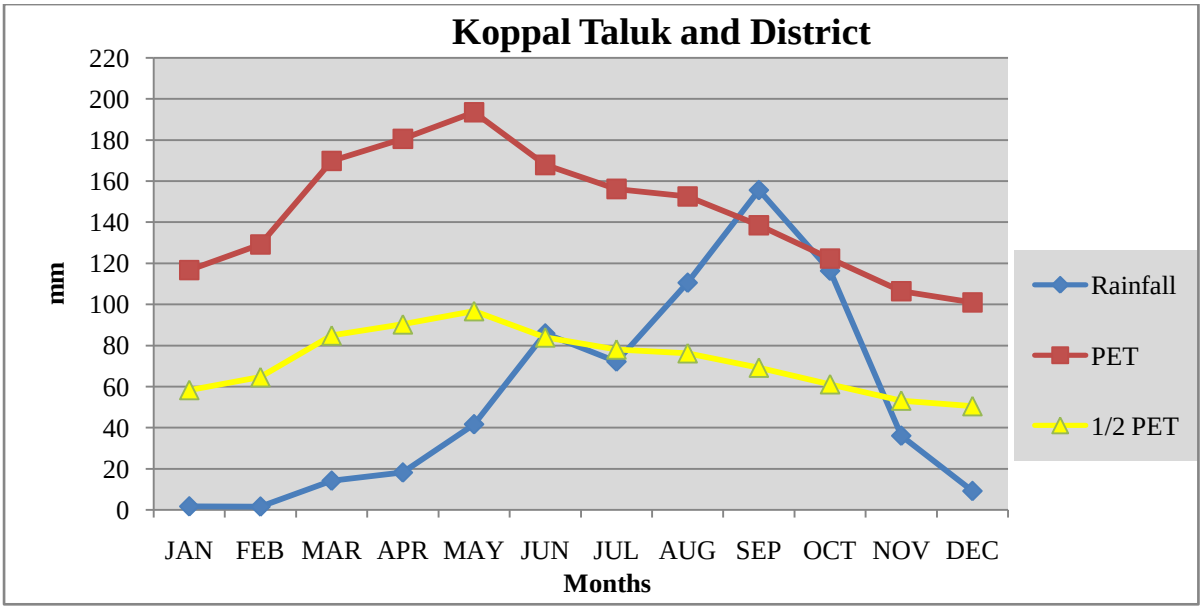


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Raghunathanahalli West-2 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. 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, marigold 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 Raghunathanahalli West-2 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 in Raghunathanahalli West-2 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

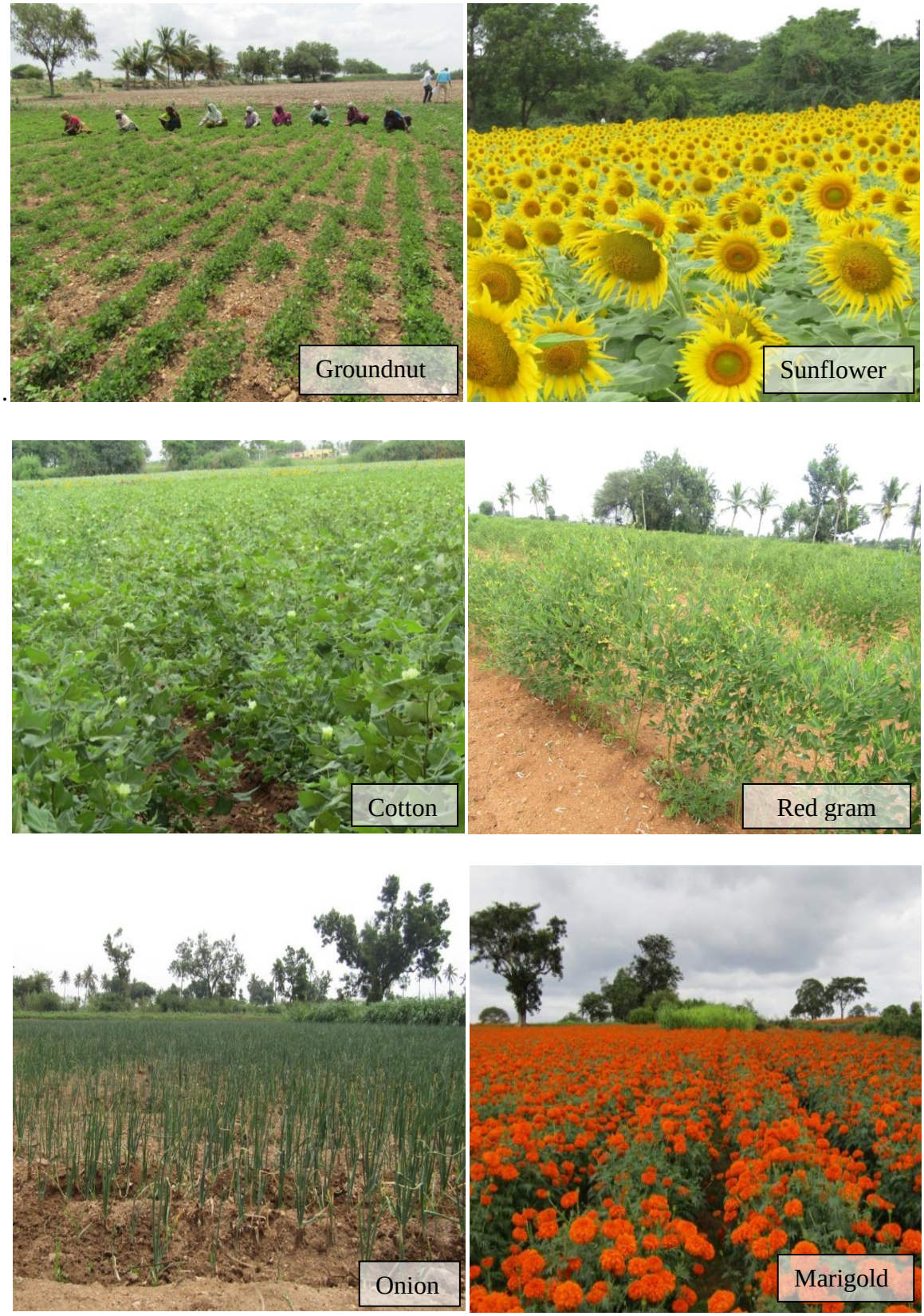


Fig.2.5 Different crops and cropping systems in Raghunathanahalli West-2 Microwatershed

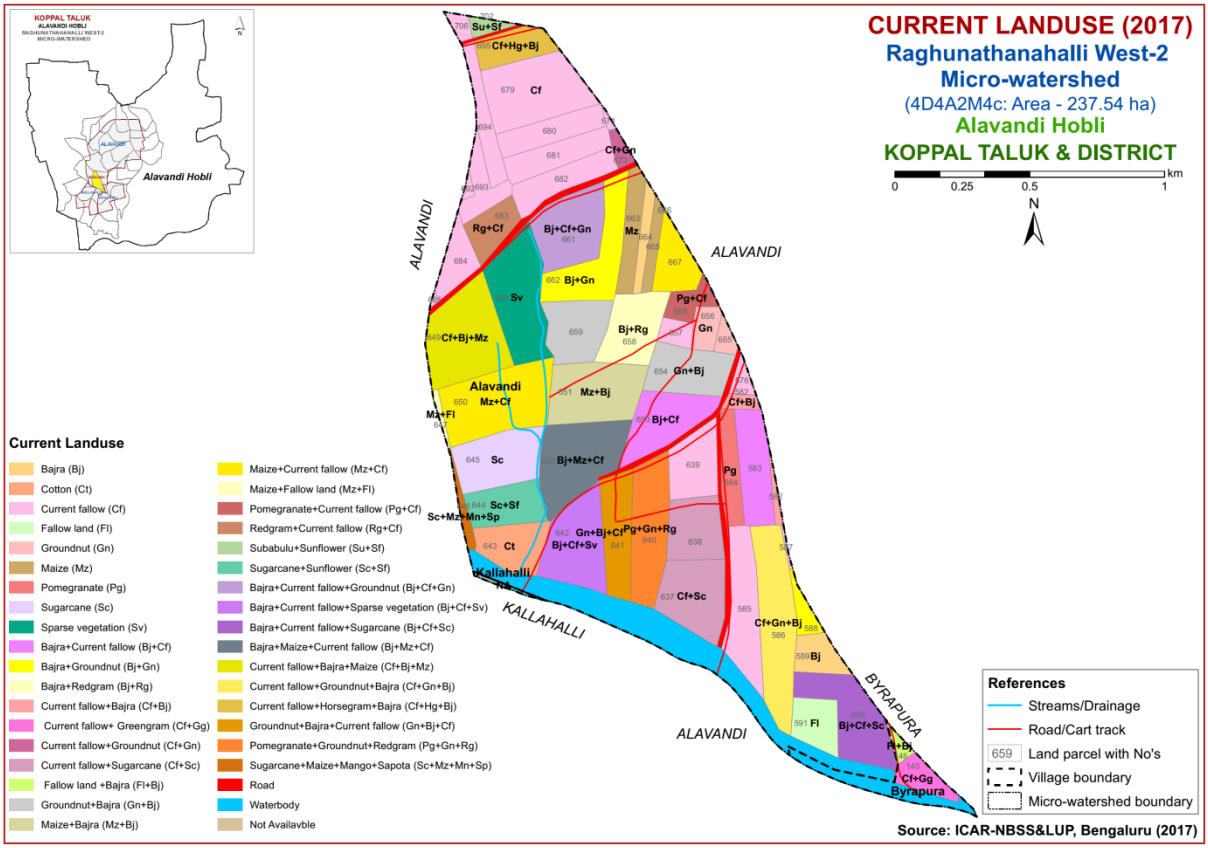


Fig.2.6 Current Land Use – Raghunathanahalli West-2 Microwatershed

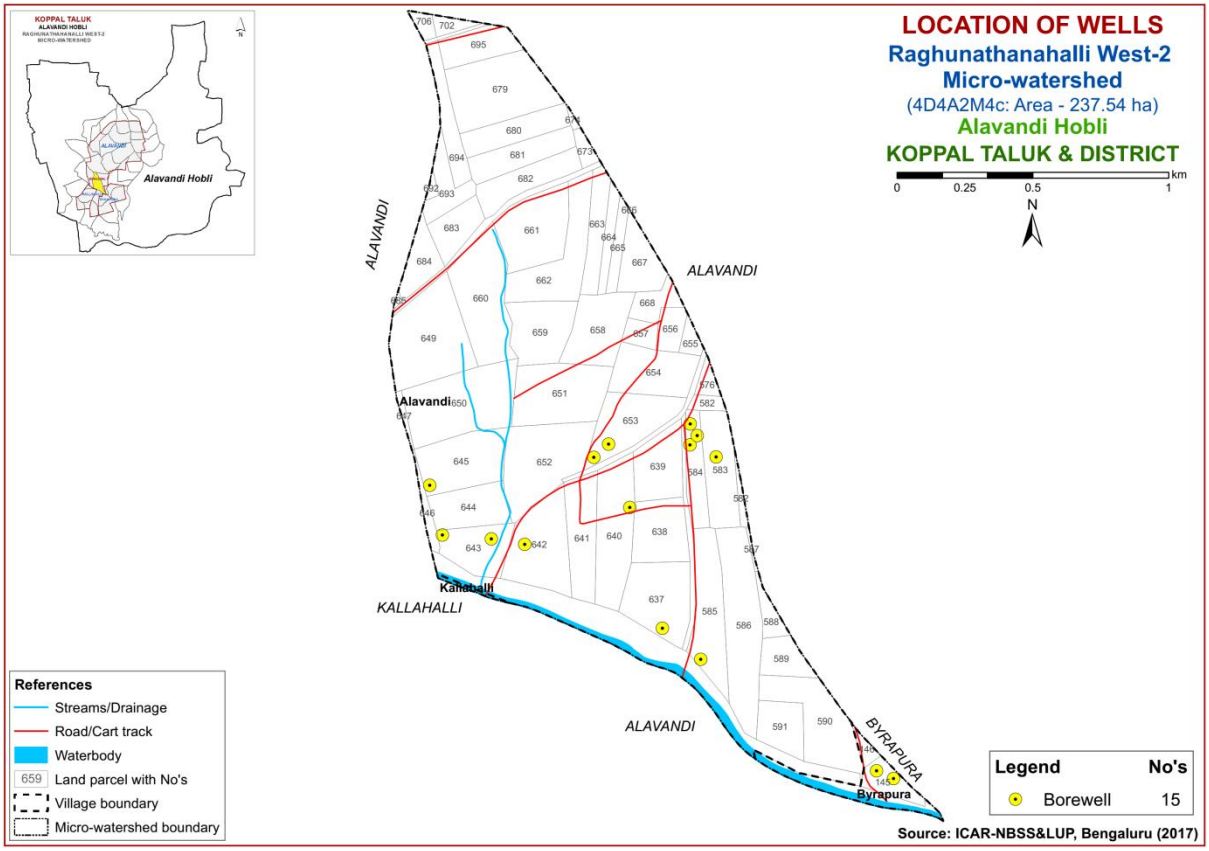


Fig.2.7 Location of wells - Raghunathanahalli West-2 Microwatershed

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 a given level of management. This was achieved in Raghunathanahalli West-2 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 238 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 uplands, summits and very gently sloping 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 gently 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

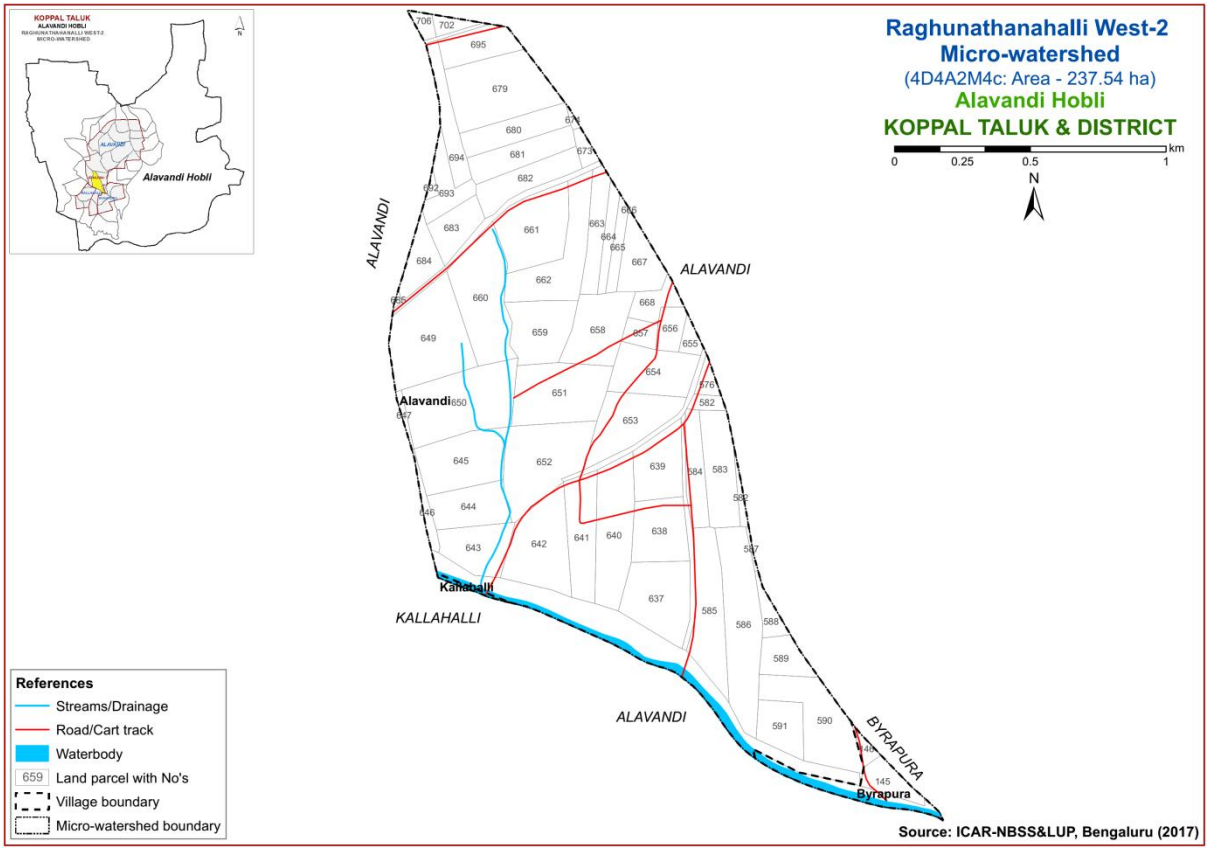


Fig 3.1 Scanned and Digitized Cadastral map of Raghunathanahalli West-2 Microwatershed

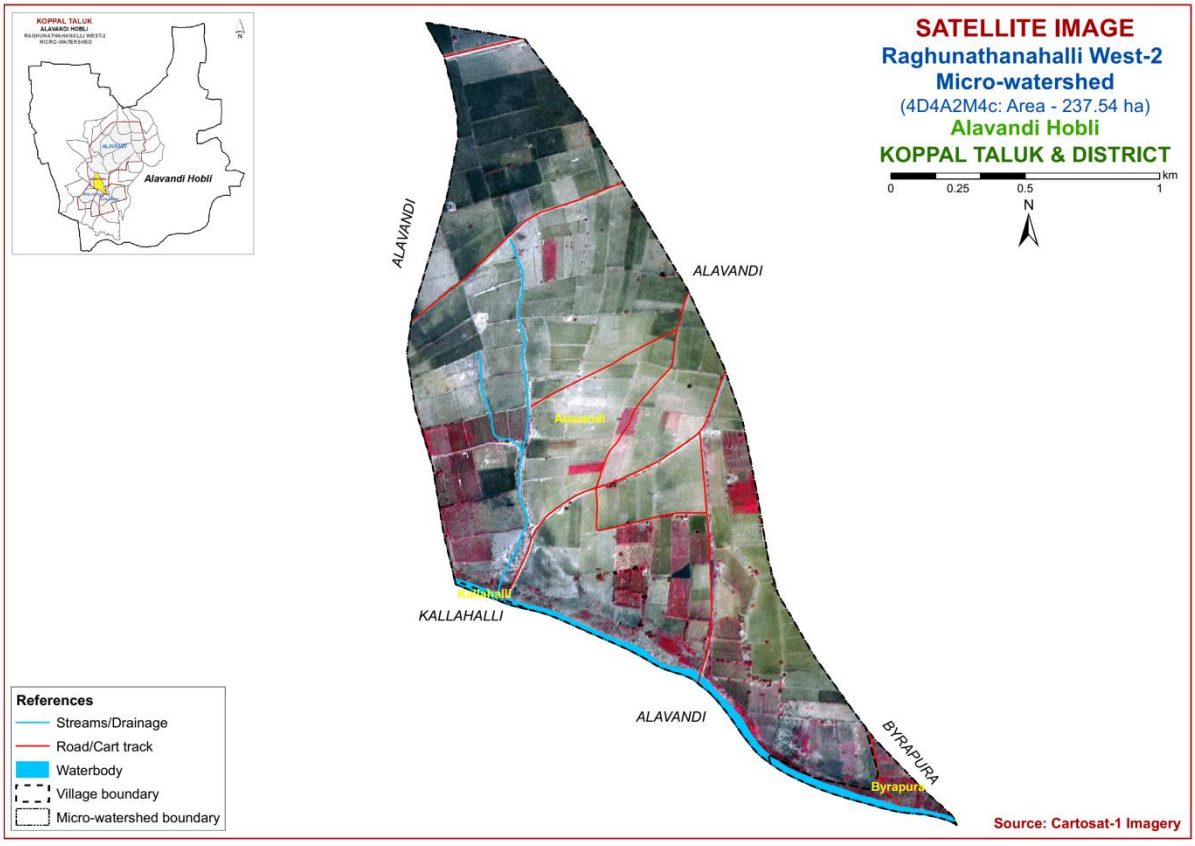


Fig.3.2 Satellite Image of Raghunathanahalli West-2 Microwatershed

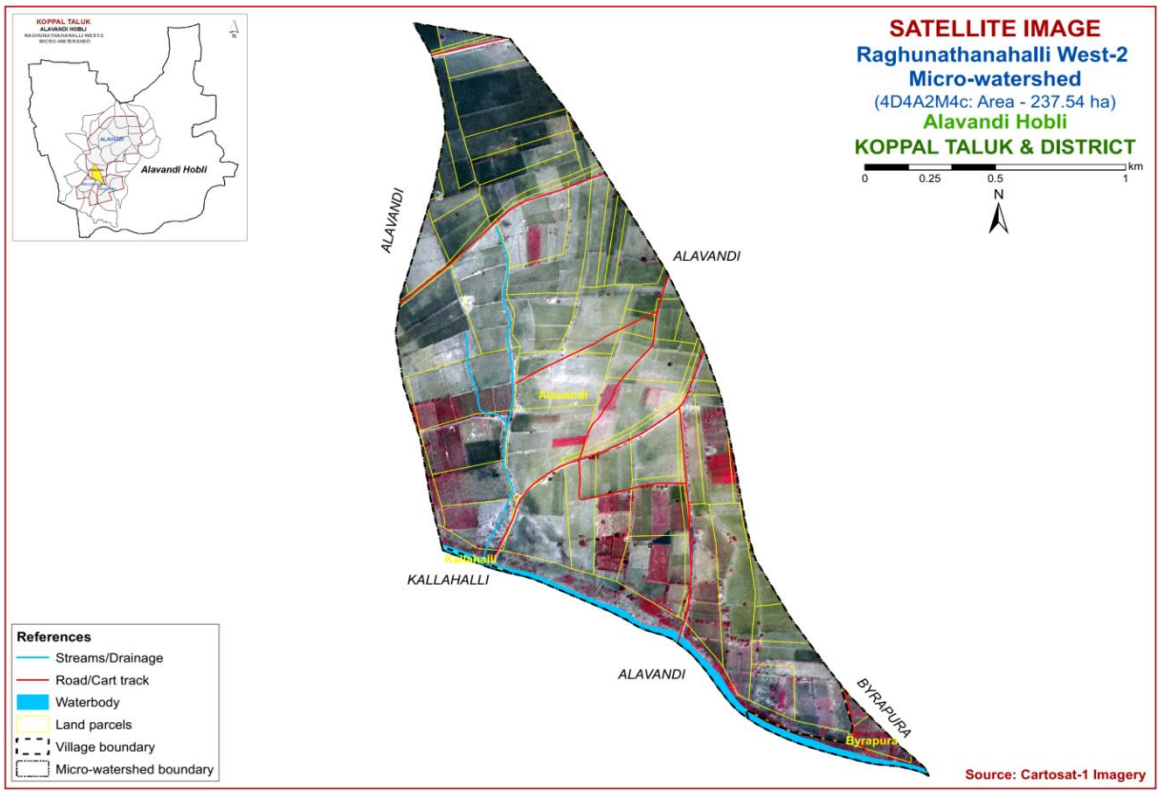


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Raghunathanahalli West-2 Microwatershed

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 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).

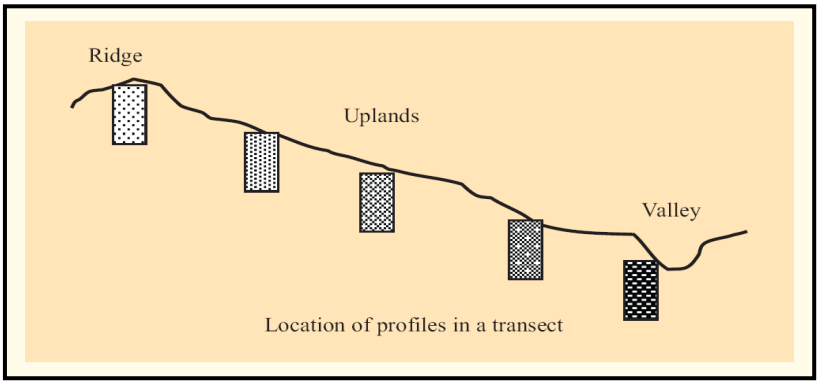


Fig: 3.4. Location of profiles in a transect

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, profiles (vertical cut showing the soil layers from surface to the rock) were opened up to 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.

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, 9 soil series were identified in Raghunathanahalli West-2 Microwatershed.

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

Sl. No	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareousness
Soils of granite gneiss Landscape							
1	Kaggalipura (KGP)	25-50	2.5YR2.5/4,3/4, 3/6	gscl-gsc	15-35	Ap-Bt-Cr	
2	Kethanapura (KTP)	50-75	2.5YR3/4, 3/6	sc	15-35	Ap-Bt-Cr	
3	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	
4	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	
Soils of Alluvial Landscape							
5	Ravanaki (RNK)	50-75	7.5YR3/2,3/3,5/2,5/3 10YR3/1,3/2,4/1, 4/2, 5/1,6/1	c	<15	Ap-Bw-Cr	e-ev
6	Handrala (HDL)	100-150	10 YR 2/1, 3/1,4/1,	c	-	Ap-Bss-Ck	es
7	Murlapur (MLR)	>150	10YR 2/1, 2/2, 3/1, 3/2, 4/1,	c	10-20	Ap-Bss	e-es
8	Alawandi (AWD)	>150	10 YR 2/1, 3/2,	c	<15	Ap-Bss	e-es
9	Bardur (BDR)	>150	10YR 2/1, 3/1, 3/2,	c	<15	Ap-Bss	es

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey many 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 and area extent of 17 mapping units representing 9 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 17 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 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 Raghunathanahalli West-2 farmer's fields (22 samples) for fertility status (major and micronutrients) at 320 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.

3.6 Land management units (LMUs)

The 17 soil phases identified and mapped in the microwatershed were regrouped into 6 Land management units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land management units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LMUs. For Raghunathanahalli West-2 Microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope erosion and gravel content have been considered for defining LMUs. The Land management units are expected to behave similarly for a given level of management.

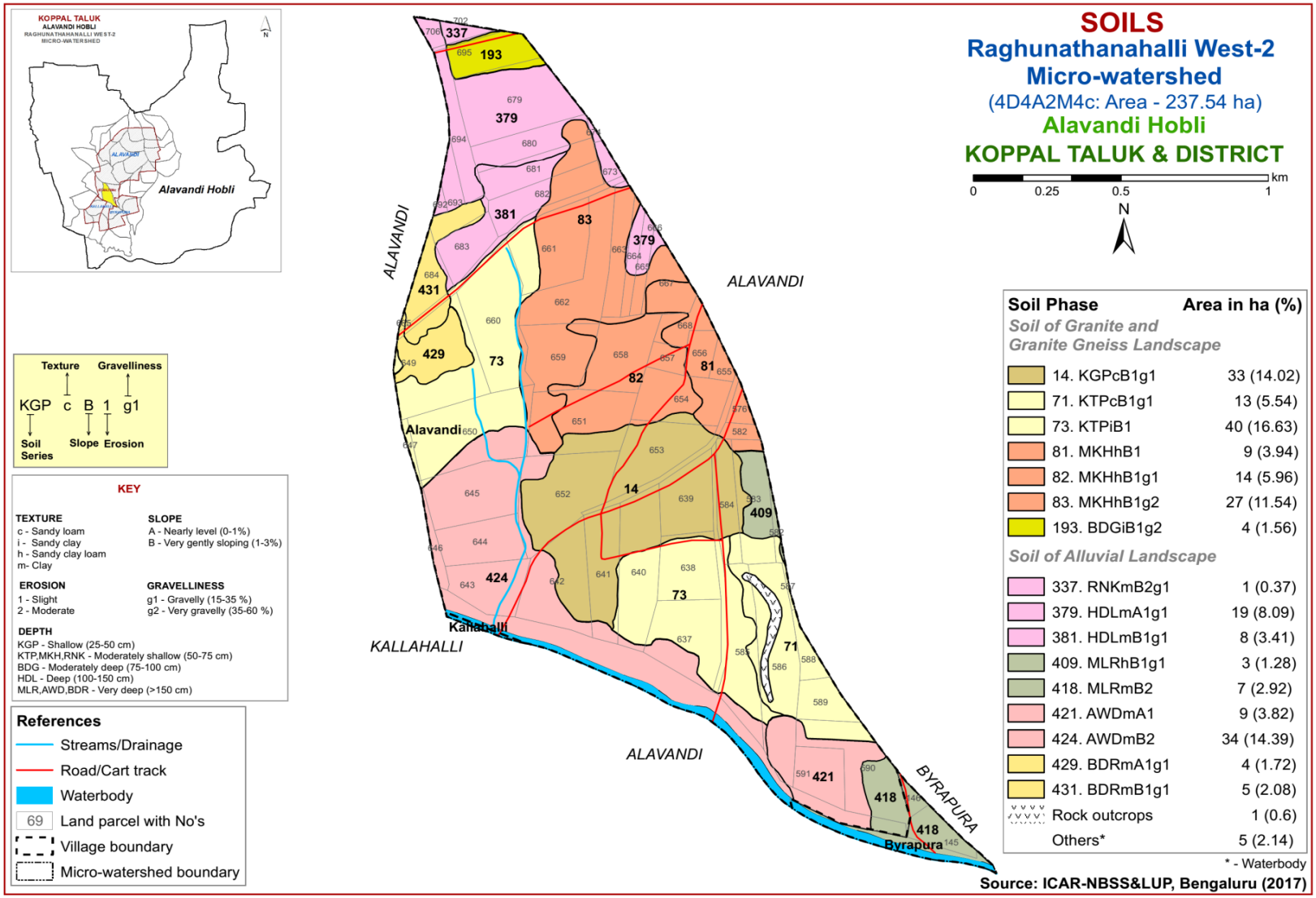


Fig 3.5 Soil Phase or Management Units- Raghunathanahalli West-2 Microwatershed

Table 3.2 Soil map unit description of Raghunathanahalli West-2 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of granite and granite gneiss landscape				
	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		**33 (14.02)**
14		KGPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	33 (14.02)
	KTP	Kethanapura soils are moderately shallow (50-75 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**53 (22.17)**
71		KTPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	13 (5.54)
73		KTPiB1	Sandy clay surface, slope 1-3%, slight erosion	40 (16.63)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown red gravelly sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**50 (21.44)**
81		MKHhB1	Sandy clay loam surface, slope 1-3%, slight erosion	9 (3.94)
82		MKHhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	14 (5.96)
83		MKHhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravelly (35-60%)	27 (11.54)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation		**4 (1.56)**
193		BDGiB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	4 (1.56)
Soils of Alluvial landscape				
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**1 (0.37)**
337		RNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.37)
	HDL	Handrala soils are deep (100-150 cm), moderately well drained, have dark gray to very dark gray, black calcareous cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**27 (11.5)**
379		HDLmA1g1	Clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	19 (8.09)
381		HDLmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	8 (3.41)
	MLR	Murlapur soils are very deep (>150 cm), moderately well drained,		**10 (4.2)**

		have very dark grayish brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		
409		MLRhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	3 (1.28)
418		MLRmB2	Clay surface, slope 1-3%, moderate erosion	7 (2.92)
	AWD	Alawandi soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to black , calcareous cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**43 (18.21)**
421		AWDmA1	Clay surface, slope 0-1%, slight erosion	9 (3.82)
424		AWDmB2	Clay surface, slope 1-3%, moderate erosion	34 (14.39)
	BDR	Bardur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**9 (3.8)**
429		BDRmA1g1	Clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	4 (1.72)
431		BDRmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	5 (2.08)
999		Rock outcrops	Rock lands, both massive & bouldery with little or no soil	1 (0.6)
1000		Others	Water body	5 (2.14)

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

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Raghunathanahalli West-2 Microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 9 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 9 soil series identified followed by 17 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Raghunathanahalli West-2 microwatershed is given in Table 4.1 along with soil classification.The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 4 soil series are identified and mapped. Of these, Kethanapura (KTP) 53 ha (22%), Mukhadahalli (MKH) 50 ha (21%) and other series occur in a small area. The brief description of each soil series along with the soil phases identified and mapped is given below.

4.1.1 Kaggalipura (KGP) Series: Kaggalipura soils are shallow (25-50 cm), well drained, have brown to dark reddish brown gravelly sandy clay loam to sandy clay soils. They have developed from weathered 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 very low (<50 mm/m).Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

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

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 with 15 to 35 per cent gravel. The available water capacity is low (51-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Kethanapura (KTP) Series

4.1.3 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 the 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 with 35 to 50 per cent gravel. The available water capacity is very low (<50 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

4.1.4 Bidanagere (BDG) Series: Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Bidanagere series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Rhodic Paleustalfs.

The thickness of the solum ranges from 78 to 99 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 2.5 YR and 5 YR hue with value 2 to 3 and chroma 3 to 4. The texture varies from sandy clay loam to sandy clay with 10 to 20 per cent gravel. The thickness of B-horizon ranges from 68 to 85 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 5 and chroma 3 to 4. Its texture is gravelly clay with gravel content of 35-60 per cent. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

4.2 Soils of Alluvial landscape

In this landscape, 5 soil series are identified and mapped. Of these, Alawandi (AWD) 43 ha (18%) and other series occur in a small area. The brief description of each soil series along with the soil phases identified and mapped is given below.

4.2.1 Ravanaki (RNK) Series: Ravanaki soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, calcareous cracking clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands. The Ravanaki series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Fluventic Haplustepts.

The thickness of the solum ranges from 50 to 75 cm. The thickness of A horizon ranges from 15 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 35 to 60 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay and is calcareous with gravel content of 10 to 20 per cent. The available water capacity is low (51-100 mm/m). One soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Ravanaki (RNK) Series

4.2.2 Handrala (HDL) Series: Handrala soils are deep (100-150 cm), moderately well drained, have black, very dark brown to dark gray calcareous cracking clay soils. They are developed from alluvium and occur on very gently to gently sloping uplands. The Handrala series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Typic Haplusterts.

The thickness of the solum ranges from 102 to 149 cm. The thickness of A horizon ranges from 14 to 26 cm. Its colour is in 10 YR hue with value 3 and chroma 1. The texture is clay. The thickness of B horizon ranges from 103 to 127 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 2. Texture is dominantly clay and is calcareous. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Handrala (HDL) Series

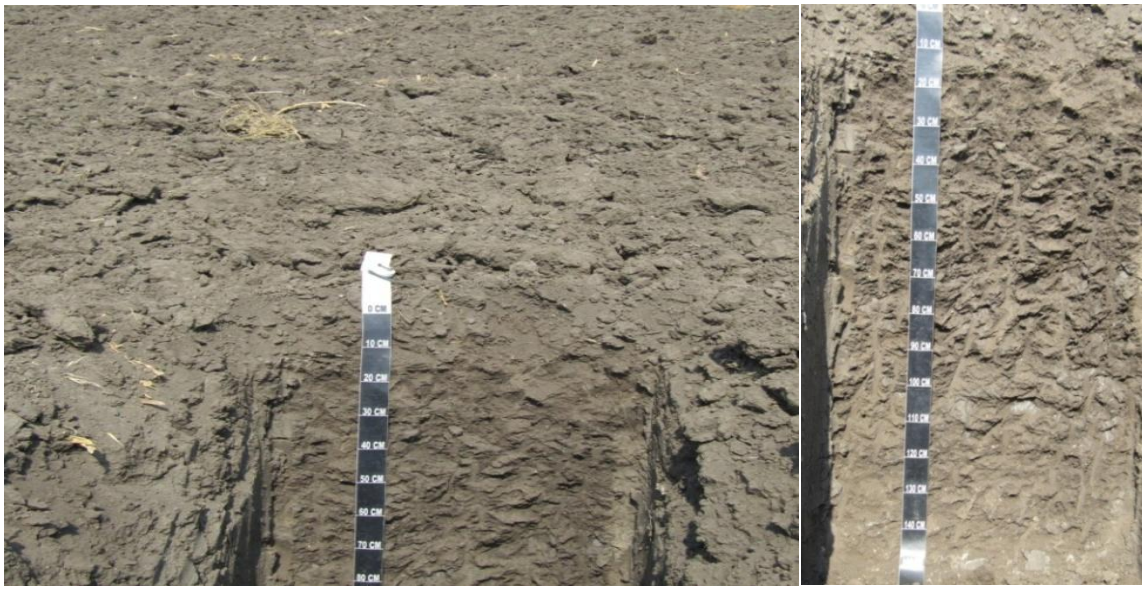
4.2.3 Murlapur (MLR) Series: Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands. The Murlapur series has been classified as a member of the very fine, smectitic, isohyperthermic (calc) family of Typic Haplusterts.

The thickness of the solum is >150 cm. The thickness of A horizon ranges from 20 to 25 cm. Its colour is in 10 YR hue with value 3 and chroma 1.The texture is clay with no gravel. The thickness of B horizon ranges from 150 to 190 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. Its texture is clay. The available water capacity is low (>200 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Murlapur (MLR) series

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

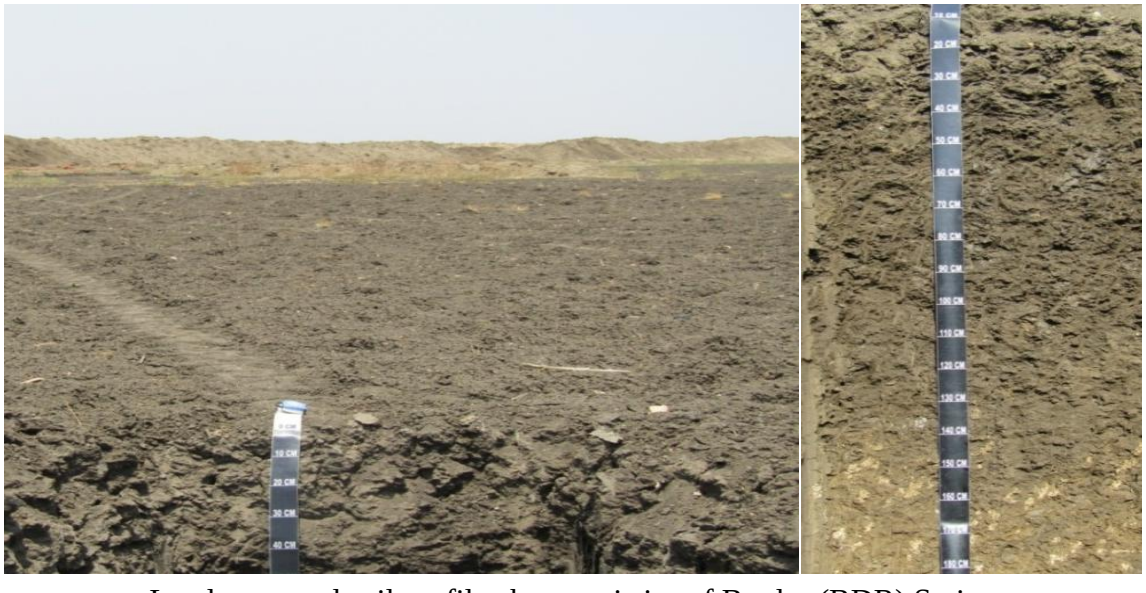
The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 16 to 26 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. The texture varies from sandy clay to clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.



Landscape and Soil Profile Characteristics of Alawandi (AWD) Series

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

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 15 to 19 cm. Its colour is in 10 YR hue with value 2 and chroma 1 with clay texture. The thickness of B horizon ranges from 146 to 180 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. Its texture is clay and is calcareous with less than 15 per cent gravel. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.



Landscape and soil profile characteristics of Bardur (BDR) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Raghunathanahalli West-2 Microwatershed

Series Name: Kethanapura (KTP) **Pedon:** R-9

Location: $15^0$25'28.81"N, $76^0$22'00.76" E Jabbaragudda 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
0-18	Ap	83.64	10.52	5.84	25.61	22.36	15.24	13.52	6.91	10	ls	7.92	2.58
18-38	Bt1	46.06	5.63	48.31	21.58	9.54	3.53	4.15	7.26	30	sc	19.62	14.48
38-73	Bt2	52.31	6.91	40.78	24.56	12.74	5.96	5.55	3.49	30	sc	17.73	11.95

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.42			0.07	1.24		2.95	0.93	0.57	0.02	4.48	4.41	0.75	100.00	0.05
18-38	6.63			0.09	0.70		11.71	3.53	0.98	0.08	16.31	16.59	0.34	98.30	0.50
38-73	6.88			0.15	0.48		11.36	3.30	0.72	0.13	15.50	15.75	0.39	98.42	0.80

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: Bidanagere (BDG), **Pedon**: RM-3

Location: $13^0$22'11"N, $76^0$38'03"E, (4D3D8G1a), Tharabenahalli village, Chikkanayakanahalli taluk, Tumakuru district.

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, 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
0-20	Ap	81.19	11.25	7.56	12.54	15.07	17.90	21.94	13.75	50	ls	-	-
20-35	Bt1	57.45	11.45	31.10	12.76	11.02	10.92	12.45	10.31	50	scl	-	-
35-92	Bt2	44.63	7.85	47.52	12.40	9.61	8.37	7.75	6.51	60	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}							%	%
0-20	6.24	-	-	0.06	0.60	0.00	1.61	0.26	0.10	0.01	1.98	3.76	0.50	52.56	0.35
20-35	5.99	-	-	0.02	0.40	0.00	4.25	0.46	0.08	0.28	5.07	8.02	0.26	63.18	3.46
35-92	6.70	-	-	0.03	0.20	0.00	5.45	0.31	0.10	0.22	6.09	9.90	0.21	61.48	2.24

Contd…

Series Name: Ravanaki (RNK), **Pedon:** RM-20

Location: $15^0$14’22.7”N, $75^0$57’45.8”E, Gatareddihalla village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calc) Fluventic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-28	Ap	24.43	17.76	57.81	5.30	3.89	3.78	7.14	4.32	20	c	41.40	29.60
28-55	Bw	18.77	15.59	65.64	2.74	3.73	2.85	4.83	4.61	10	c	46.71	35.18
55-80	Bc	12.53	15.43	72.04	2.60	1.92	1.47	3.16	3.39	10	c	56.82	43.73

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}							%	%
0-28	8.86	-	-	0.483	0.63	15.48	-	-	0.86	6.27		37.00	0.64	-	16.94
28-55	8.61	-	-	1.4	0.23	13.68	-	-	0.68	12.27		53.20	0.81	-	23.06
55-80	8.35	-	-	4.53	0.91	11.40	-	-	0.75	28.97		54.80	0.76	-	52.86

Contd....

Series Name: Handrala (HDL), Pedon: A2/RM-1

Location: $15^0$19'69.8"N, $75^0$58'00"E, Kavalura village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calc) Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-25	Ap	21.68	16.62	61.70	4.42	3.98	3.43	5.64	4.20	10	c	41.36	31.27
25-50	Bss1	14.93	15.76	69.32	2.64	2.53	2.99	3.33	3.44	05	c	48.92	39.19
50-82	Bss2	23.11	16.60	60.29	4.51	3.61	6.31	4.74	3.95	05	c	42.46	33.85
82-117	Bss3	10.50	18.38	71.12	1.98	1.98	1.63	2.57	2.33	05	c	52.95	42.82

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}							%	%
0-25	9.06			0.371	0.16	4.80	-	-	0.80	7.93	-	62.33	1.01	-	12.72
25-50	9.09			0.719	0.2	7.20	-	-	0.42	14.94	-	67.10	0.97	-	22.26
50-82	9.28			0.47	0.19	9.36	-	-	0.47	11.59	-	60.21	1.00	-	19.26
82-117	8.76			1.55	0.36	8.64	-	-	0.11	2.28	-	25.33	0.36	-	9.02

Contd....

Series Name: Murlapur (MLR), Pedon: R-A1/16

Location: $15^0$19'42.9"N, $75^0$55'84.7"E, Kavalura village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calc) Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-30	Ap	27.97	13.96	58.07	4.22	4.77	6.66	8.10	4.22	10	c	36.24	25.90
30-53	BA	26.34	17.48	56.17	4.17	5.05	6.04	7.24	3.84	05	c	38.55	28.98
53-83	Bss1	19.35	19.55	61.10	3.13	3.91	4.03	5.48	2.80	05	c	44.48	33.69
83-105	Bss2	16.63	17.47	65.90	2.70	3.93	2.92	3.93	3.15	<5	c	50.55	38.11
105-160	Bss3	14.69	20.34	64.97	0.79	2.26	4.07	4.18	3.39	<5	c	51.54	40.19

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}							%	%
0-30	9.19	-	-	0.313	0.57	10.08	-	-	0.64	5.67	-	42.08	0.72	-	13.48
30-53	9.22	-	-	0.449	0.24	13.08	-	-	0.35	8.23	-	41.02	0.73	-	20.06
53-83	9.17	-	-	0.377	0.82	16.92	-	-	0.39	14.28	-	51.20	0.84	-	27.90
83-105	9.18	-	-	0.477	0.61	15.48	-	-	0.35	13.19	-	53.11	0.81	-	24.84
105-160	9.01	-	-	1.17	0.24	16.92	-	-	0.43	19.61	-	53.95	0.83	-	36.35

Contd....

Series Name: Alawandi (AWD) **Pedon:** R-16

Location: : $15^0$13'08.2"N, $76^0$15'27.3" E Neeralagi village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine smectitic, isohyperthermic (calc) Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	20.88	25.75	53.37	3.31	4.31	4.31	5.19	3.76	-	c	33.11	25.58
17-39	Bss1	25.99	19.79	54.22	5.04	5.48	5.04	5.92	4.50	-	c	33.11	26.23
39-70	Bss2	26.76	17.80	55.44	2.93	5.31	5.53	7.37	5.63	-	c	36.15	28.67
70-111	Bss3	23.83	20.25	55.93	4.15	4.81	4.92	6.01	3.93	-	c	43.60	33.71
111-139	Bss4	21.21	20.40	58.40	2.79	4.80	4.91	5.25	3.46	-	c	46.92	36.28
139-162	Bss5	13.15	20.96	65.90	1.69	2.47	2.36	3.37	3.26	-	c	54.96	41.81

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-17	8.10			0.37	0.52	9.48			0.40	1.56		51.30	0.96	100.00	3.05
17-39	8.60			0.24	0.52	9.60			0.14	4.60		52.60	0.97	100.00	8.75
39-70	8.89			0.27	0.52	9.48			0.16	2.41		53.90	0.97	100.00	4.46
70-111	9.10			0.35	0.54	11.28			0.15	8.95		54.10	0.97	100.00	16.53
111-139	9.15			0.41	0.58	10.80			0.15	7.36		56.10	0.96	100.00	13.11
139-162	9.16			0.50	0.50	15.48			0.19	10.19		61.66	0.94	100.00	16.52

Contd…

Series Name: Bardur (BDR), Pedon: R-4

Location: $15^0$14'31.7"N, $76^0$01'19.1"E, Moranali village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calc) Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-25	Ap	21.78	22.78	55.44	2.17	3.68	4.44	6.61	4.88	-	c	36.78	26.95
25-53	BA	18.62	18.56	62.82	2.23	4.24	3.46	5.24	3.46	-	c	41.25	29.87
53-90	Bss1	15.87	18.60	65.53	2.23	1.34	4.25	3.91	4.13	-	c	44.73	33.64
90-126	Bss2	13.66	20.02	66.32	1.68	2.80	2.35	3.70	3.14	-	c	49.24	38.37
126-152	Bss3	11.64	20.79	67.57	1.69	1.81	1.81	3.50	2.82	-	c	53.50	41.90
152-210	Bss4	11.38	23.21	65.42	2.16	2.16	1.93	3.07	2.05	-	c	51.53	39.64

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}							%	%
0-25	8.73	-	-	0.203	0.24	5.76	-	-	0.65	4.43	-	40.56	0.73	-	10.93
25-53	9.17	-	-	0.295	0.45	4.92	-	-	0.32	10.47	-	74.70	1.19	-	14.02
53-90	9.27	-	-	0.388	0.66	6.00	-	-	0.24	10.49	-	76.20	1.16	-	13.77
90-126	9.22	-	-	0.608	0.57	5.88	-	-	0.21	15.93	-	77.20	1.16	-	20.63
126-152	9.21	-	-	0.936	0.33	6.60	-	-	0.37	20.88	-	80.90	1.20	-	25.81
152-210	9.03	-	-	1.47	0.33	8.16	-	-	0.24	15.34	-	73.10	1.12	-	20.98

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/alkali or gravelliness and "c" indicates limitation due to climate.

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

The 17 soil map units identified in the Raghunathanahalli West-2 microwatershed are grouped under 2 Land capability classes and 5 land capability subclasses (Fig. 5.1). Entire area is suitable for agriculture. An area of about 109 ha (46%) has good lands (Class II) with moderate problems of soil and erosion and major area of 122 ha (51%) area has moderately good lands (Class III) with severe limitations of soil and erosion. An area of 5 ha (2%) is under water bodies and <1 per cent area is under rock outcrops.

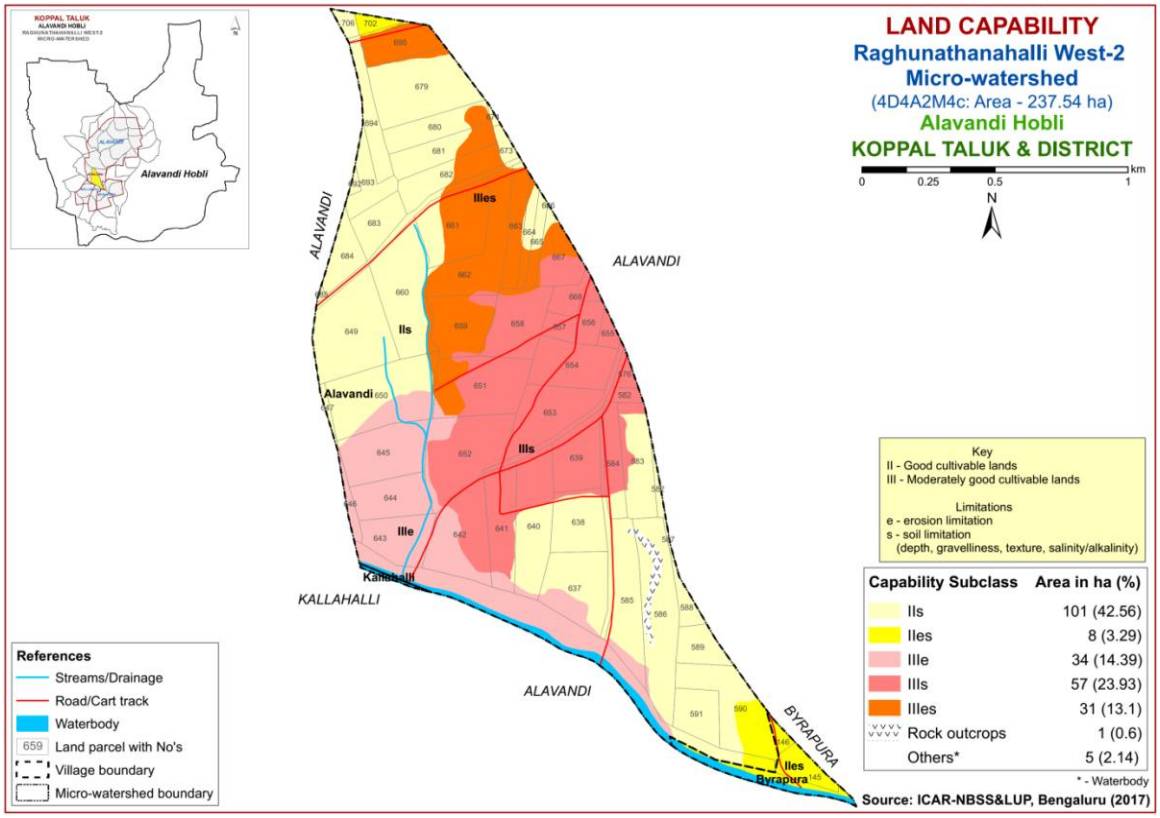


Fig. 5.1 Land Capability map of Raghunathanahalli West-2 Microwatershed

5.2 Soil Depth

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

Major area of about 137 ha (58%) is under shallow to moderately shallow (25-75 cm) soils and are distributed in all parts of the microwatershed. Moderately deep (75-100 cm) and deep (100-150 cm) soils occupy an area of about 31 ha (13%) and occur in the northern part of the microwatershed and very deep (>150 cm) soils occupy an area of 62 ha (26%) and occur in the southeastern, southern and southwestern part of the microwatershed. The most productive lands cover about 89 ha (38%) where all climatically adopted long duration crops be grown. The problem soils cover about 33 ha (14%) area where only short duration crops can be grown and the probability of crop failure is high.

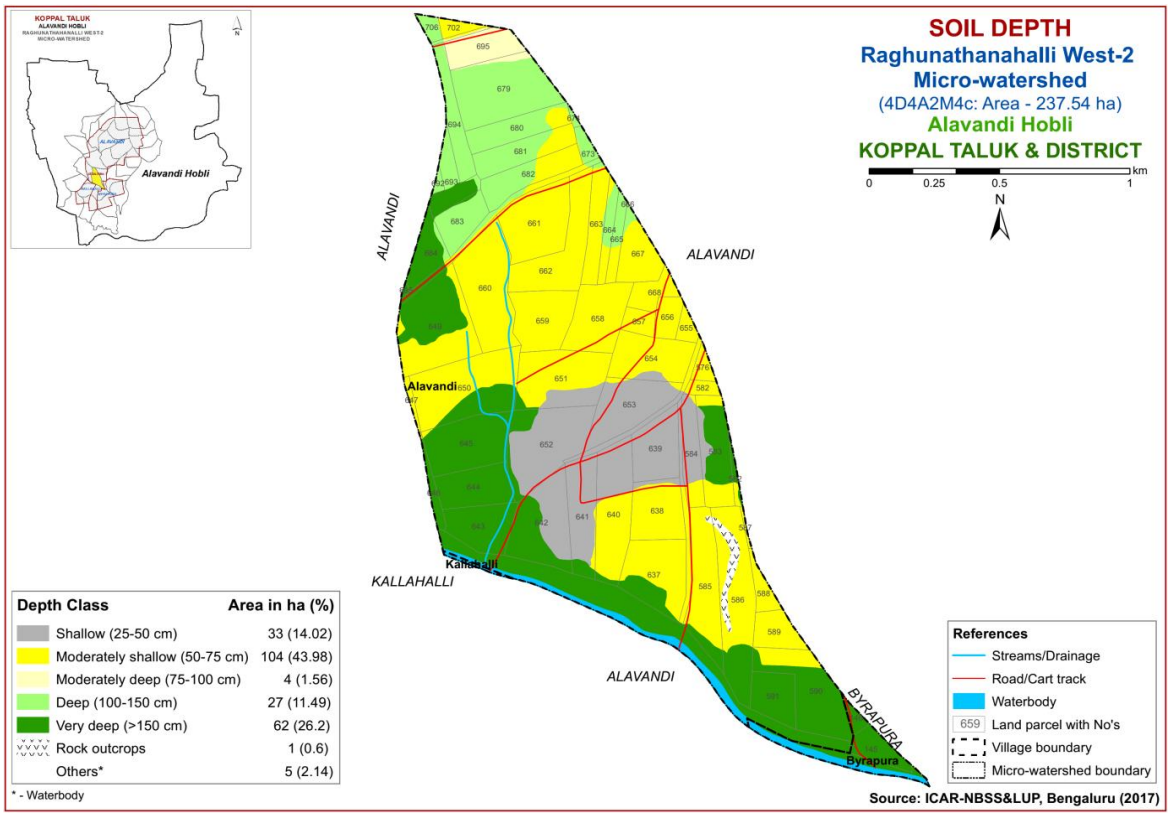


Fig. 5.2 Soil Depth map of Raghunathanahalli West-2 Microwatershed

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 showing sandy, loamy and clayey at the surface was generated. The area extent and their geographical distribution in the microwatershed is shown in Fig.5.3.

Major area of about 130 ha (55%) has soils that are clayey at the surface and followed by an area of about 100 ha (42%) loamy soils (Fig. 5.3) About 232 ha (97%) area has productive lands that have high potential for soil-water retention and availability, and nutrient retention and availability, but have problems of drainage, infiltration, workability and other physical problems in clayey soils and no such problems in loamy soils.

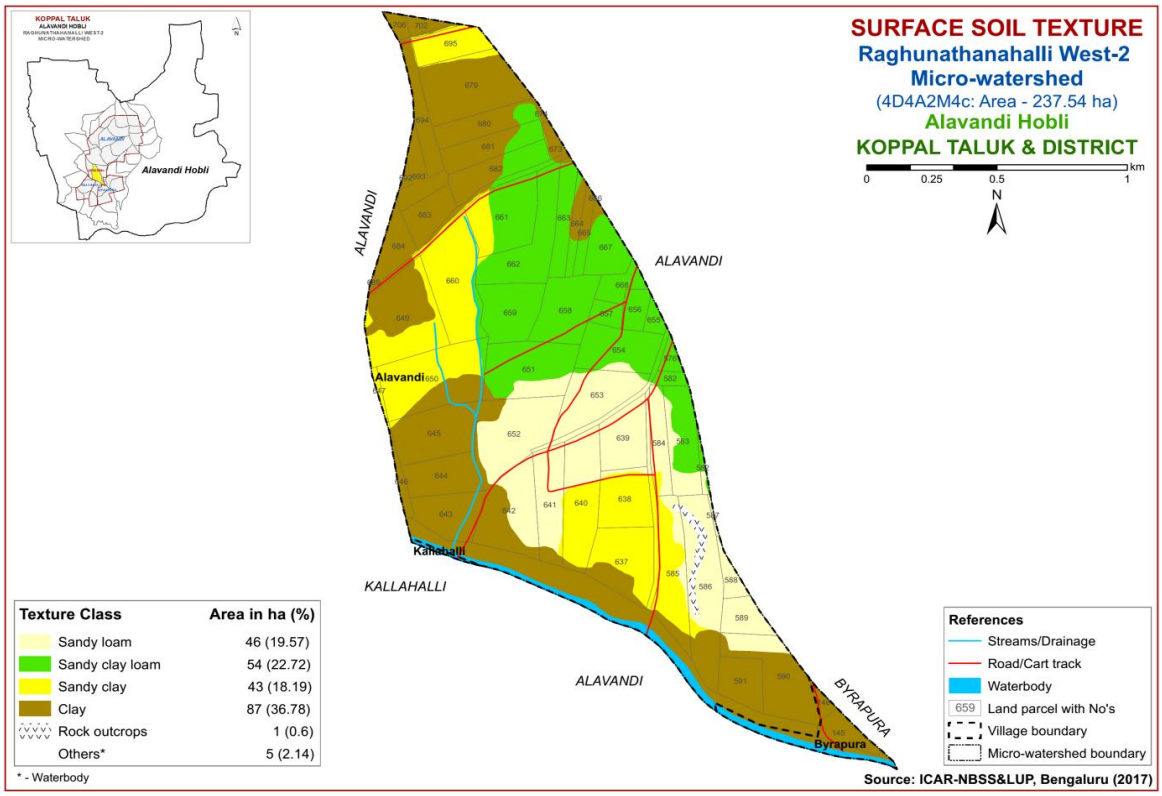


Fig. 5.3 Surface Soil Texture map of Raghunathanahalli West-2 Microwatershed

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 shown in Fig.5.4.

An area of about 99 ha (42%) has non gravelly (<15%) soils, major area of about101 ha (42%) has gravelly (15-35%) soils and occur in the central and northern part and a small area of about 31 ha (13%) has very gravelly (35-60%) soils and occur in the northern and northeastern part of the microwatershed.

An area of about 99 ha (42%) are most productive lands with respect to gravelliness. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem lands cover about 132 ha (56%) that are gravelly to very gravelly where only medium or short duration crops can be grown.

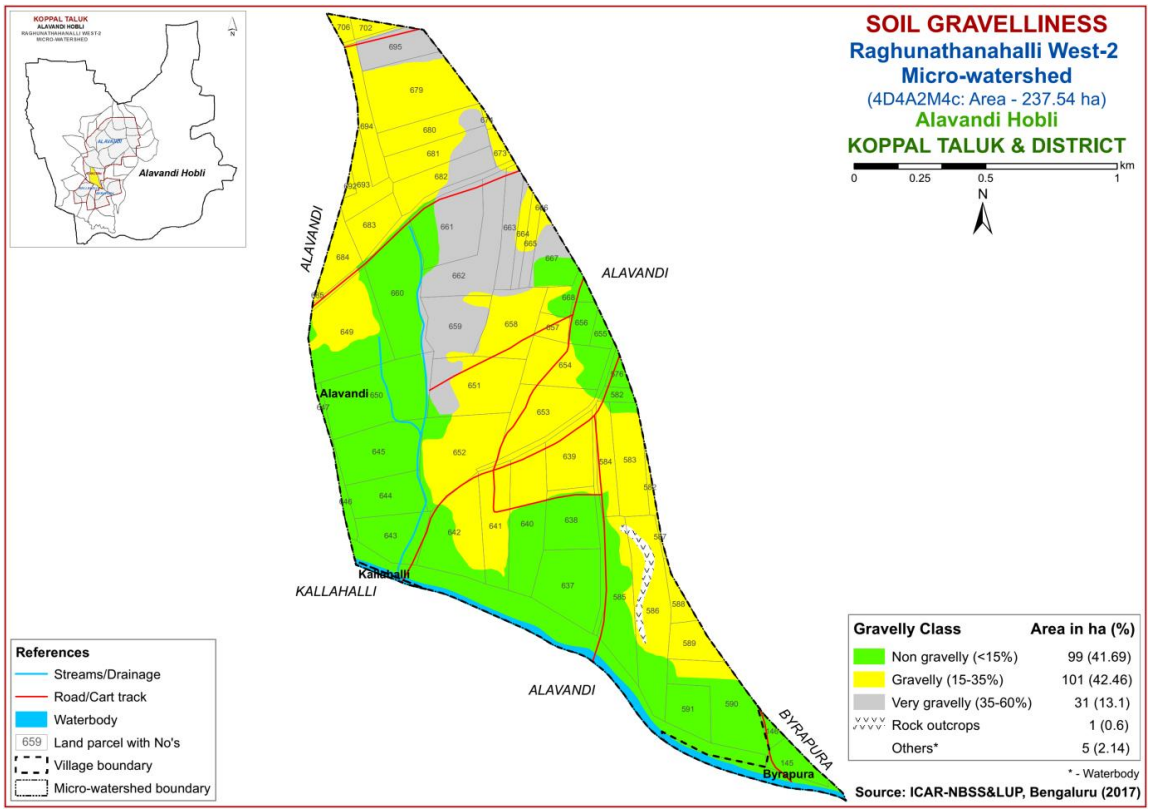


Fig. 5.4 Soil Gravelliness map of Raghunathanahalli West-2 Microwatershed

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).

An area of about 88 ha (37%) has soils that are very low (<50 mm/m) in available water capacity and are distributed in the central part of the microwatershed. About 54 ha (23%) area is low (51-100 mm) and occur in the southern and western part of the microwatershed. Major area of about 90 ha (38%) is very high (>200 mm/m) in available water capacity and occur in the southwestern and northwestern part of the microwatershed. An area of about 88 ha (37%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 90 ha (38%) has soils that have very high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

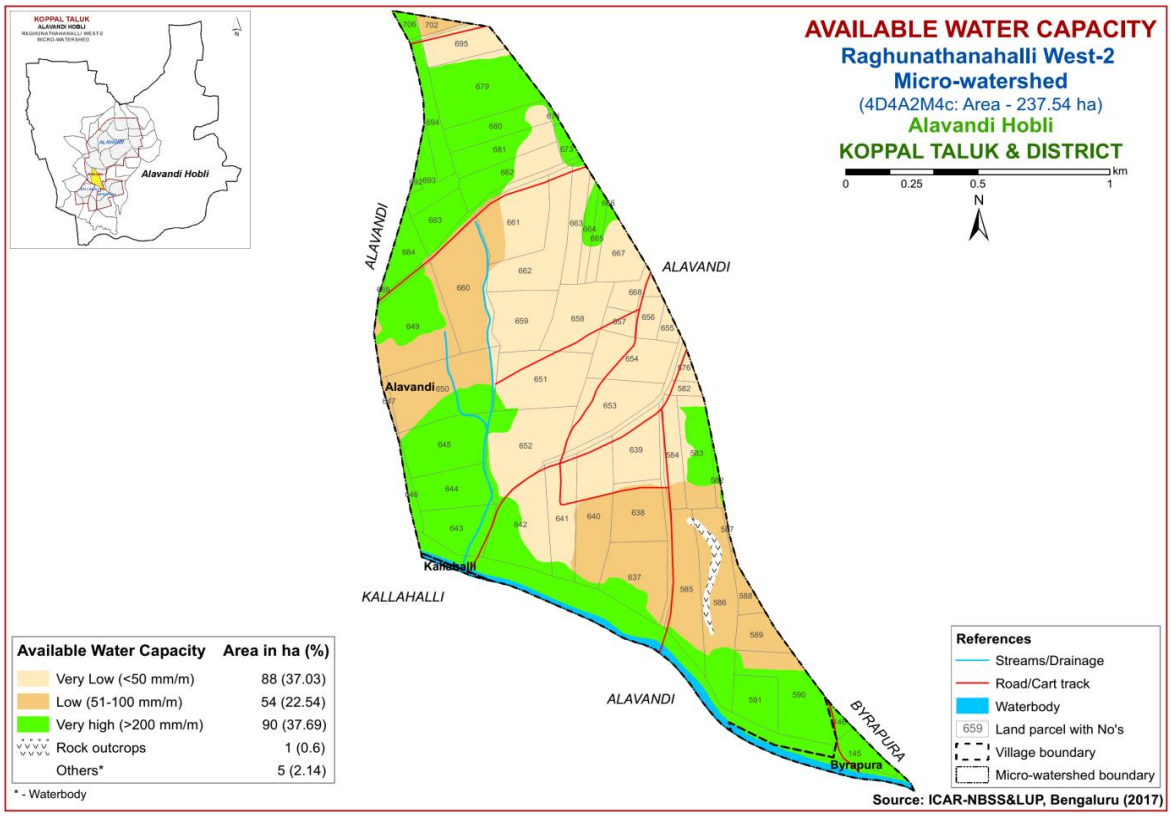


Fig. 5.5 Soil Available Water Capacity map of Raghunathanahalli West-2 Microwatershed

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).

Major area of about 199 ha (84%) falls under very gently sloping (1-3% slope) lands and 32 ha (14%) area falls under nearly level (0-1% slope) lands. In all these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

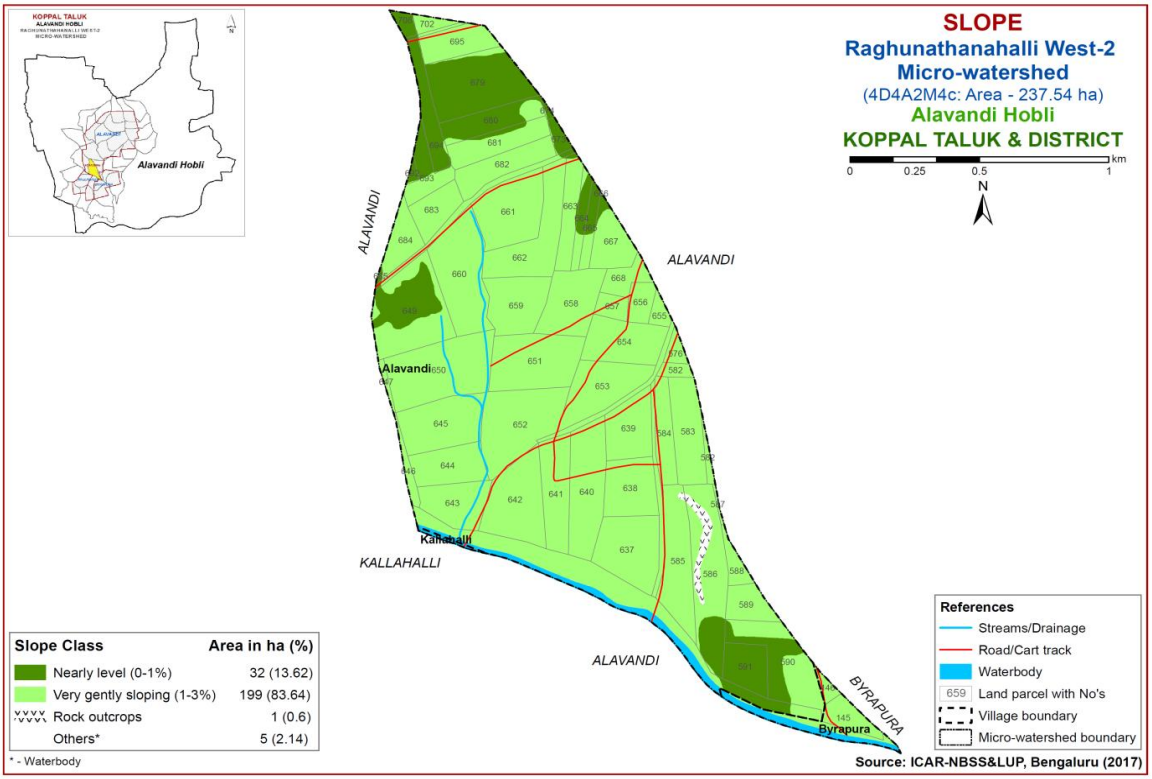


Fig. 5.6 Soil Slope map of Raghunathanahalli West-2 Microwatershed

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.

Major area of 189 ha (80%) has soils that are slightly eroded (e1 class) and occur in the western, eastern and southern part. Small area of about 42 ha (18%) has soils that are moderately eroded (e2 class) and occur in all parts of the microwatershed. These moderately eroded areas are problematic and need appropriate soil and water conservation and other land development measures.

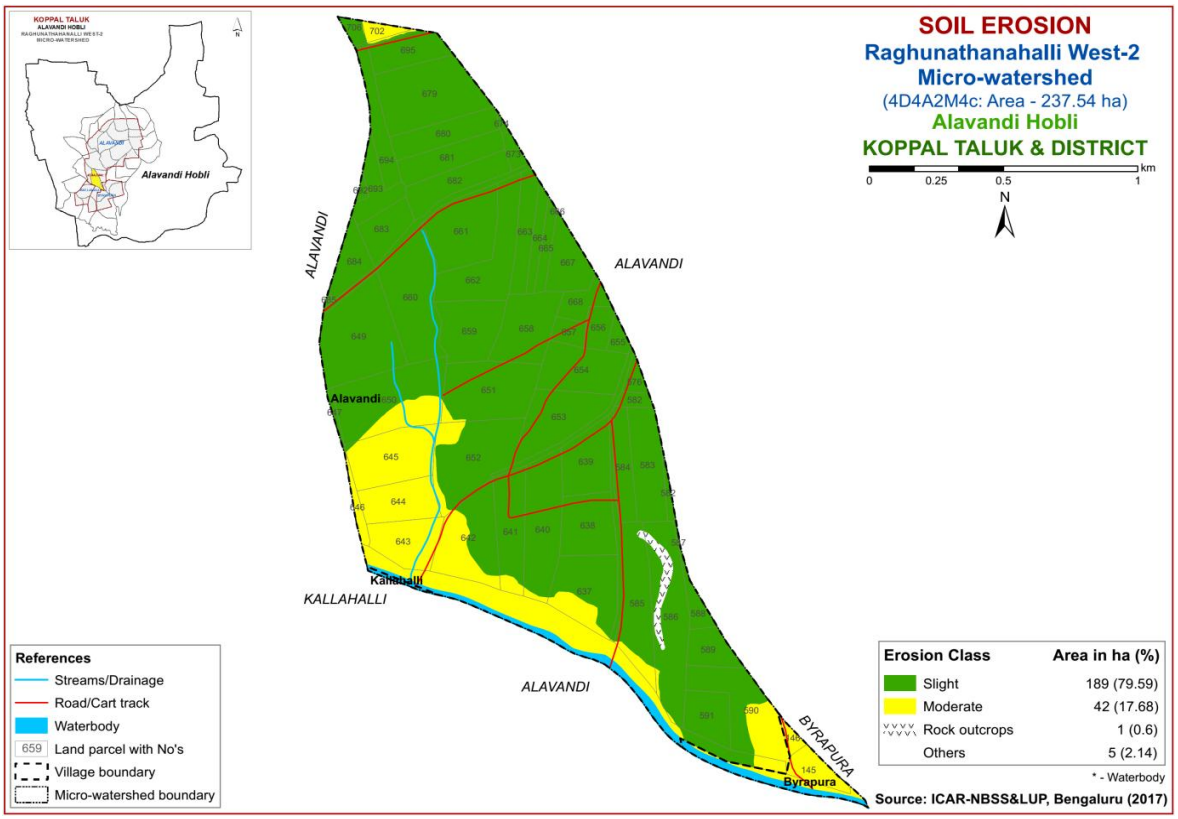


Fig. 5.7 Soil Erosion map of Raghunathanahalli West-2 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 320 m 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 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 Raghunathanahalli West-2 microwatershed for soil reaction (pH) showed that major area of 194 ha (81%) is under slightly alkaline to very strongly alkaline (pH 7.3- >9.0) and a small area of about 38 ha (16%) is neutral (pH 6.5-7.3) and occur in the eastern part of the microwatershed. (Fig.6.1).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) of the microwatershed is medium (0.5-0.75%) in 140 ha (59%) area and occur in the major part of the microwatershed. An area of about 91 ha (38%) is high (>0.75%) in organic carbon and is distributed in the southern and southwestern part of the microwatershed. (Fig.6.3).

6.4 Available Phosphorus

Major area of about 136 ha (57%) is low (<23 kg/ha) in available phosphorus and medium (23-57 kg/ha) in 95 ha (40%) area and occur in the eastern part of the microwatershed (Fig 6.4).

6.5 Available Potassium

Available Potassium is medium (145-337 kg/ha) in an area of about 50 ha (21%) and occur in the eastern part of the microwatershed. Hence, in these plots, for all the

crops, 25% more potassium than recommended may be applied. Major area of about 181 ha (76%) is high (>337 kg/ha) in available potassium (Fig.6.5).

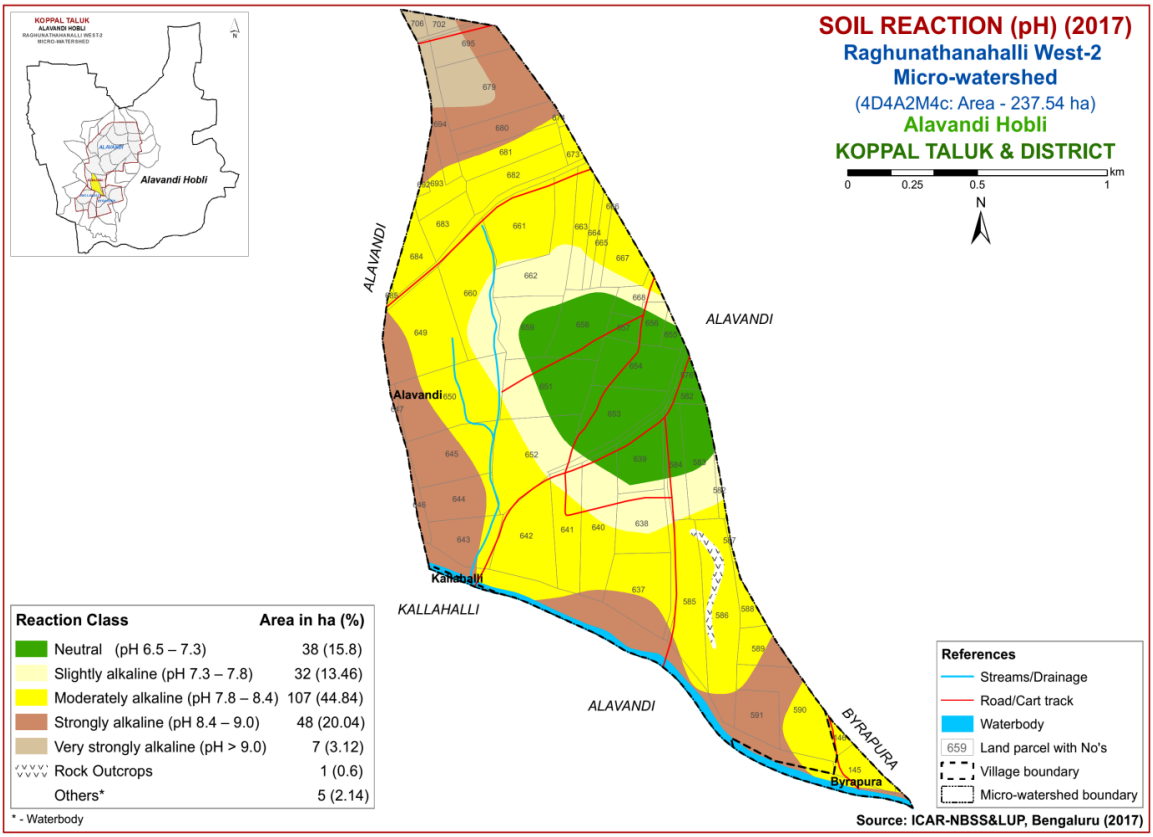


Fig.6.1 Soil Reaction (pH) map of Raghunathanahalli West-2 Microwatershed

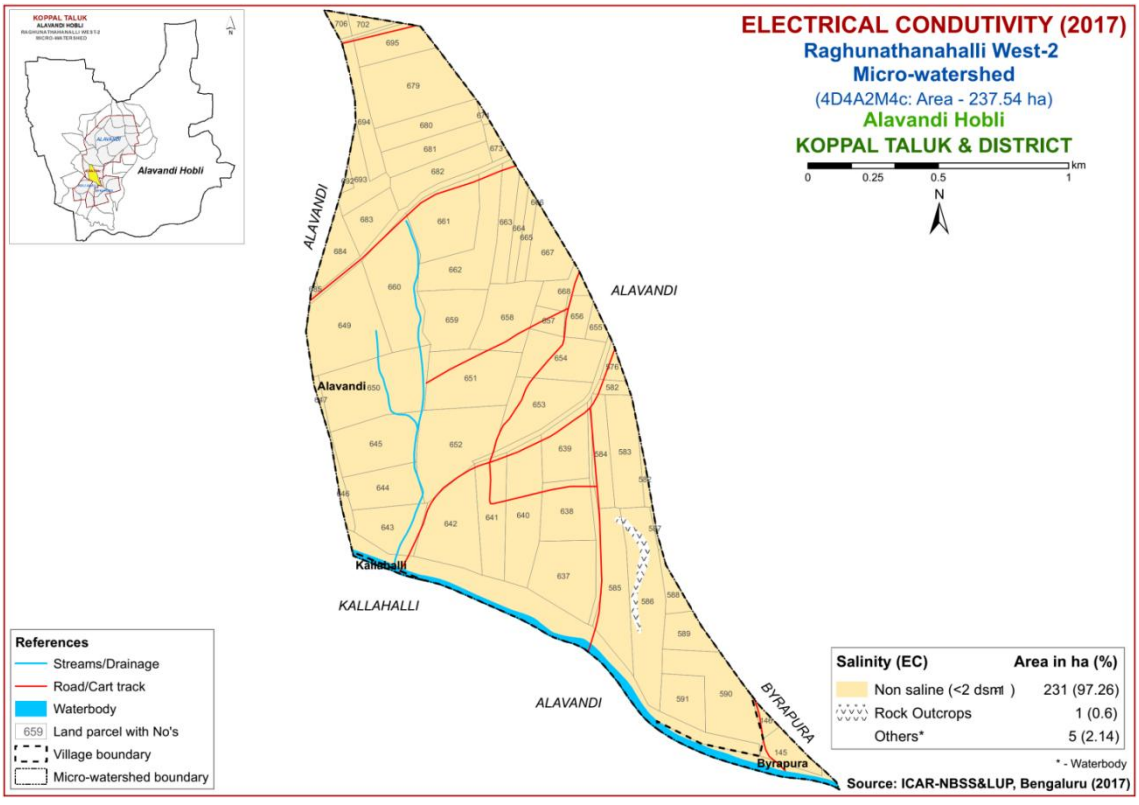


Fig.6.2 Electrical Conductivity (EC) map of Raghunathanahalli West-2 Microwatershed

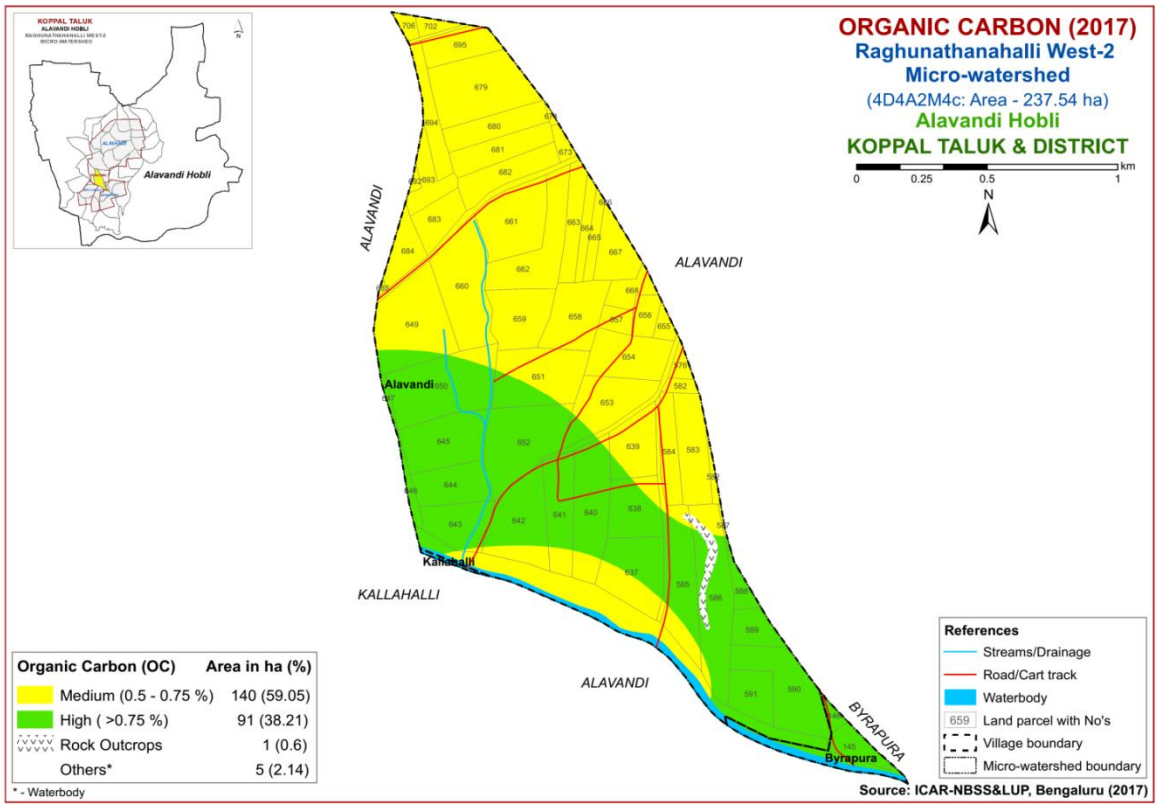


Fig.6.3 Soil Organic Carbon map of Raghunathanahalli West-2 Microwatershed

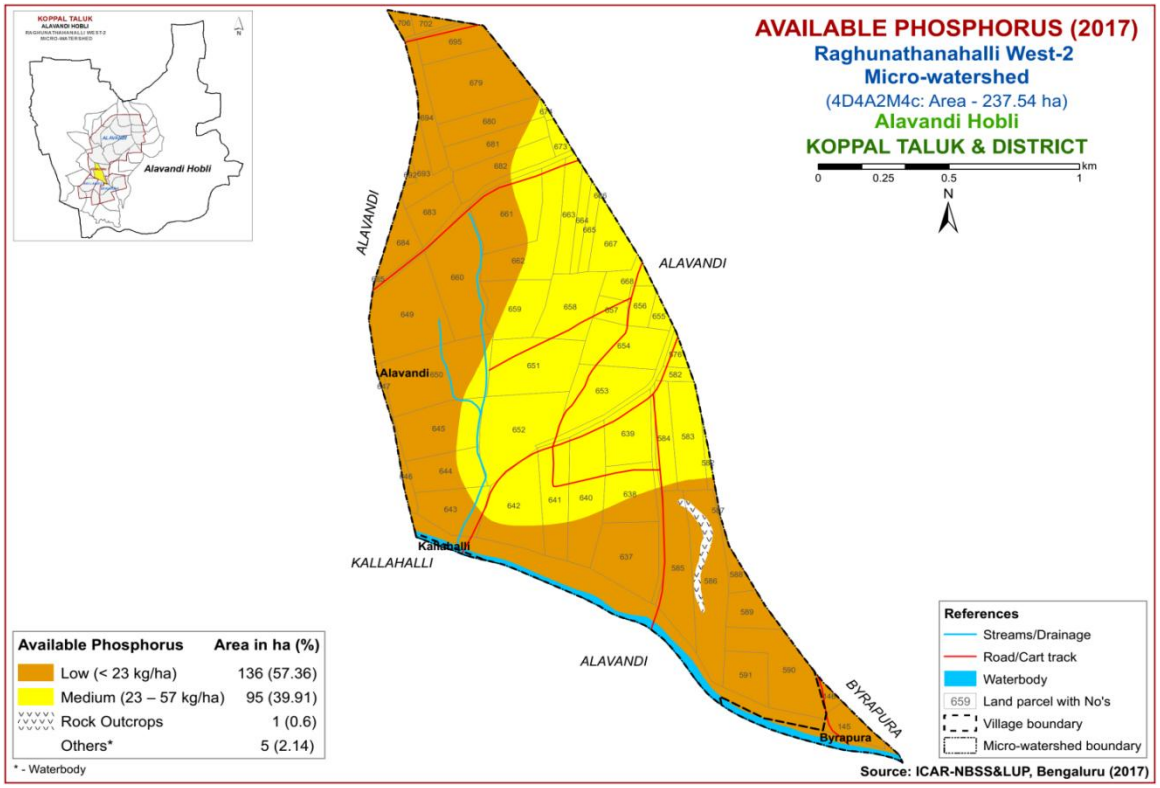


Fig.6.4 Soil Available Phosphors map of Raghunathanahalli West-2 Microwatershed

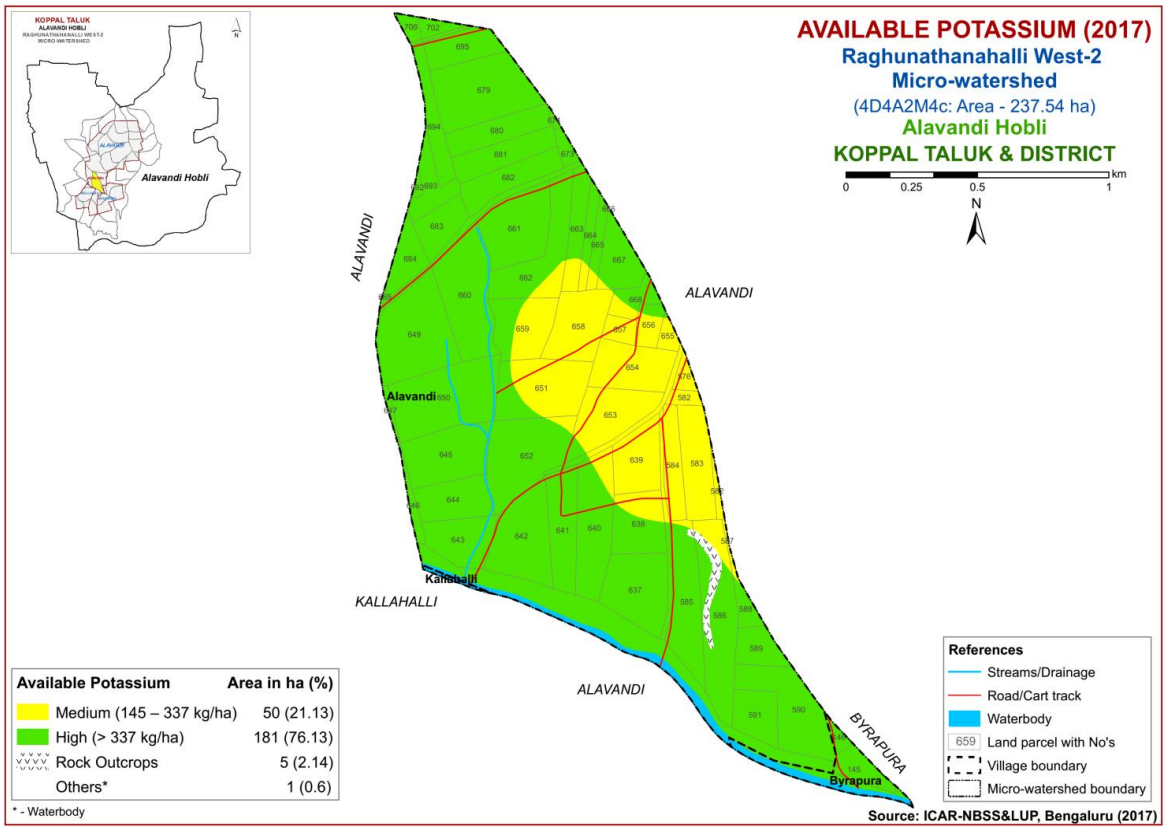


Fig.6.5 Soil Available Potassium map of Raghunathanahalli West-2 Microwatershed

6.6 Available Sulphur

An area of 62 ha (26%) is low (<10 ppm) in available sulphur and is distributed in the southern and eastern part of the microwatershed. Major area of about 99 ha (41%) is medium (10-20 ppm) in available sulphur and is distributed in the northern, central and southern part of the microwatershed. High (>20 ppm) in 70 ha (30%) area and distributed in the northern and western part of the microwatershed. 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. (Fig.6.6).

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of 131 ha (55%) in the microwatershed and is distributed in major part of the microwatershed. An area of about 94 ha (39%) is medium (0.5-1.0 ppm) in available boron and is distributed in the northern, western and southern part of the microwatershed (Fig.6.7). These areas need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency. High (>1.0 ppm) in very minor area of 6 ha (3%) and occur in southwestern part of the microwatershed.

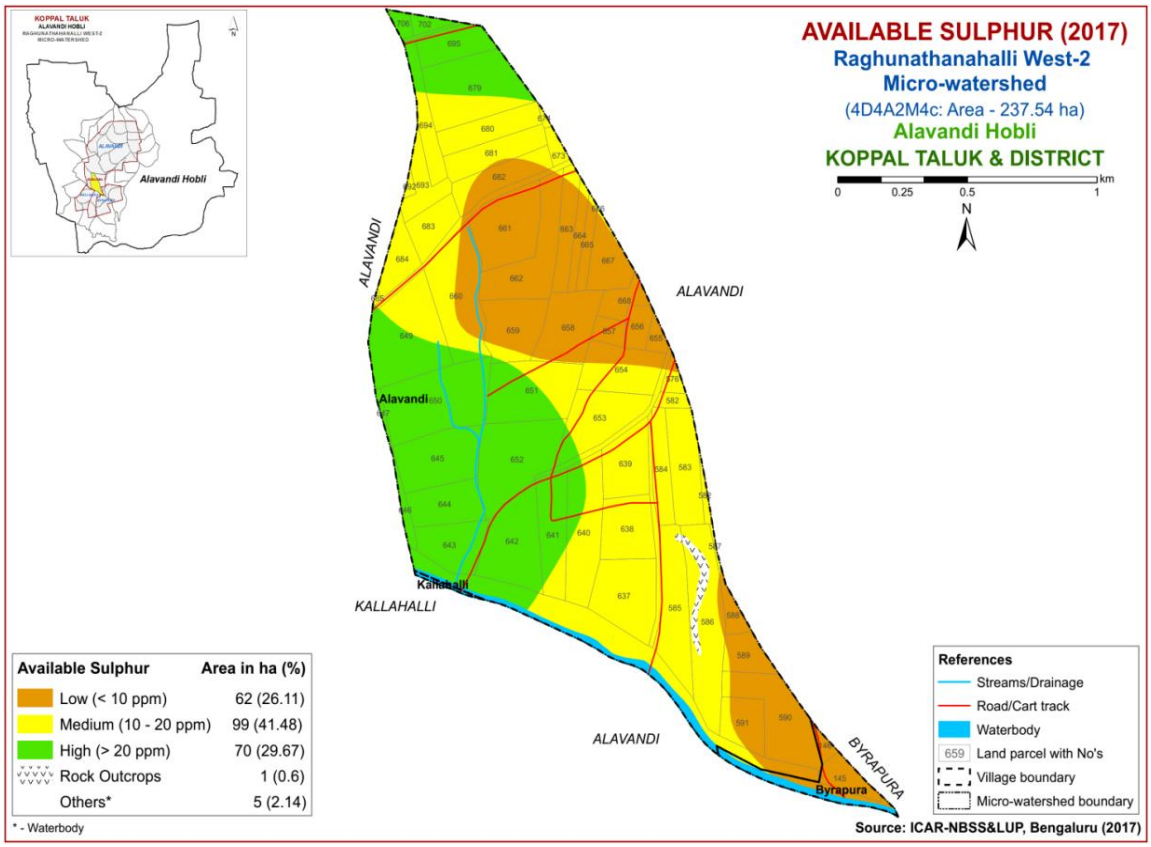


Fig.6.6 Soil Available Sulphur map of Raghunathanahalli West-2 Microwatershed

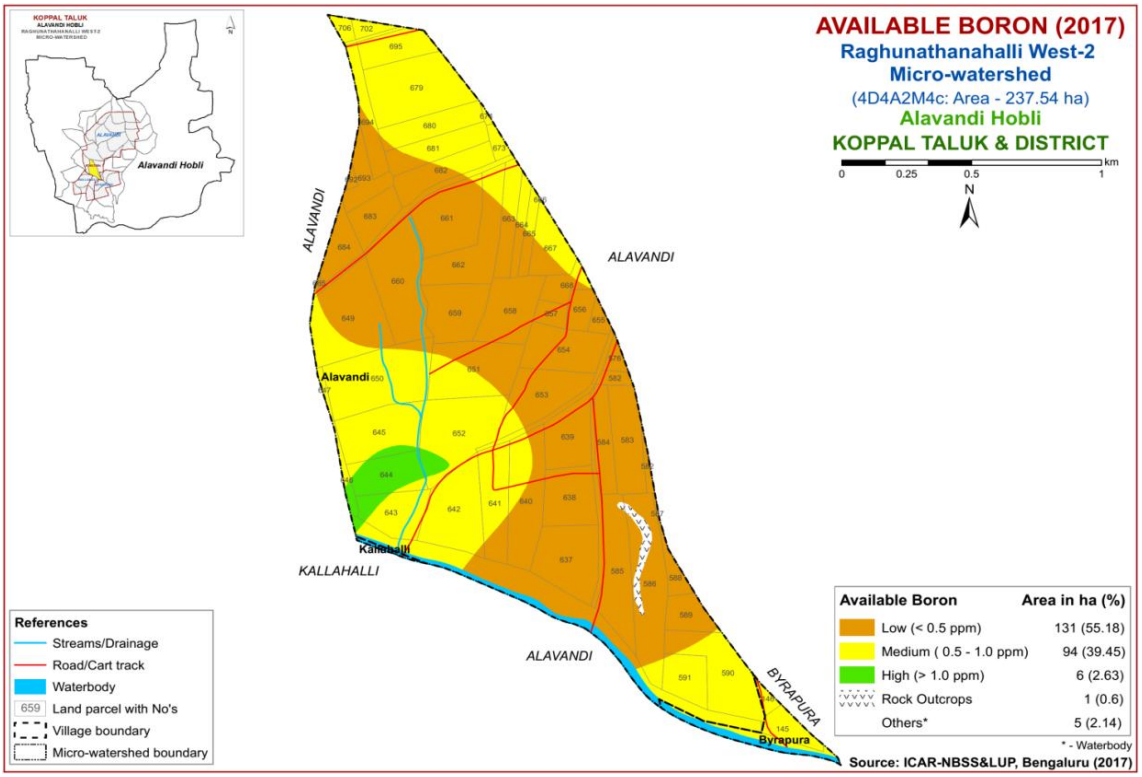


Fig.6.7 Soil Available Boron map of Raghunathanahalli West-2 Microwatershed

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in 171 ha (72%) area and sufficient (>4.5 ppm) in 60 ha (25%) area and occur in the eastern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in 108 ha (45%) and sufficient (>0.6 ppm) in 123 ha (52%) area Fig 6.11).

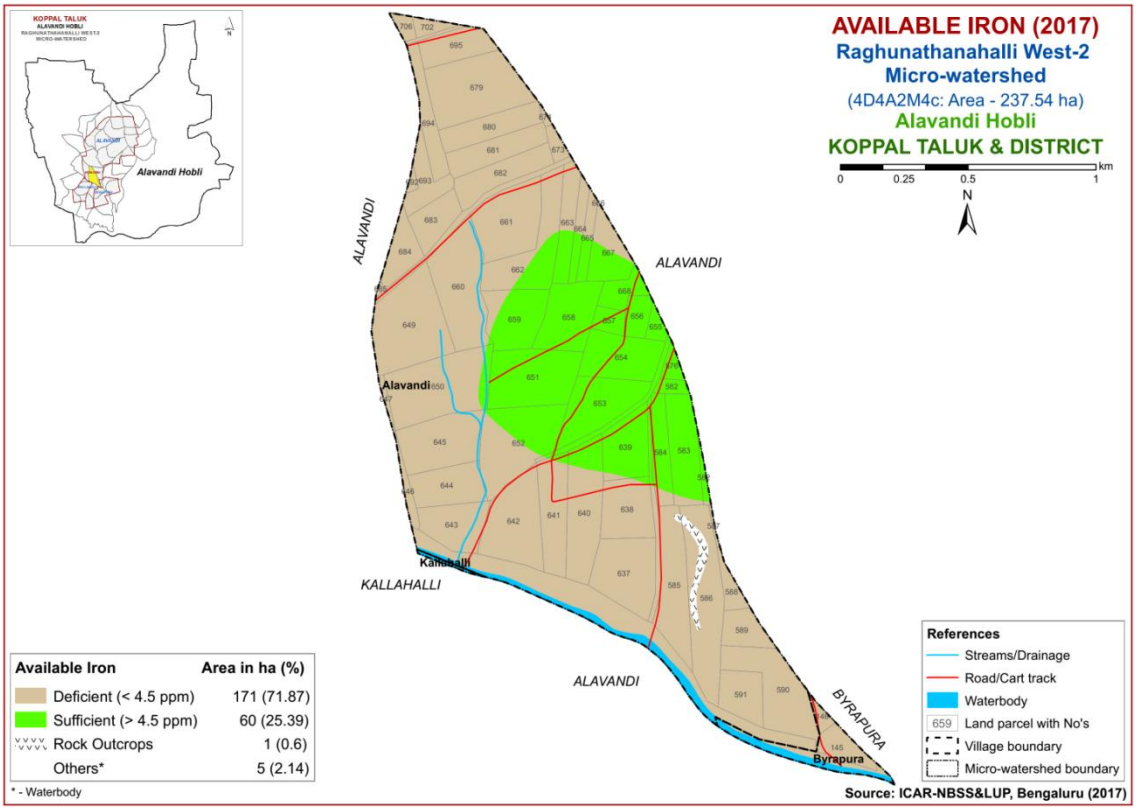


Fig.6.8 Soil Available Iron map of Raghunathanahalli West-2 Microwatershed

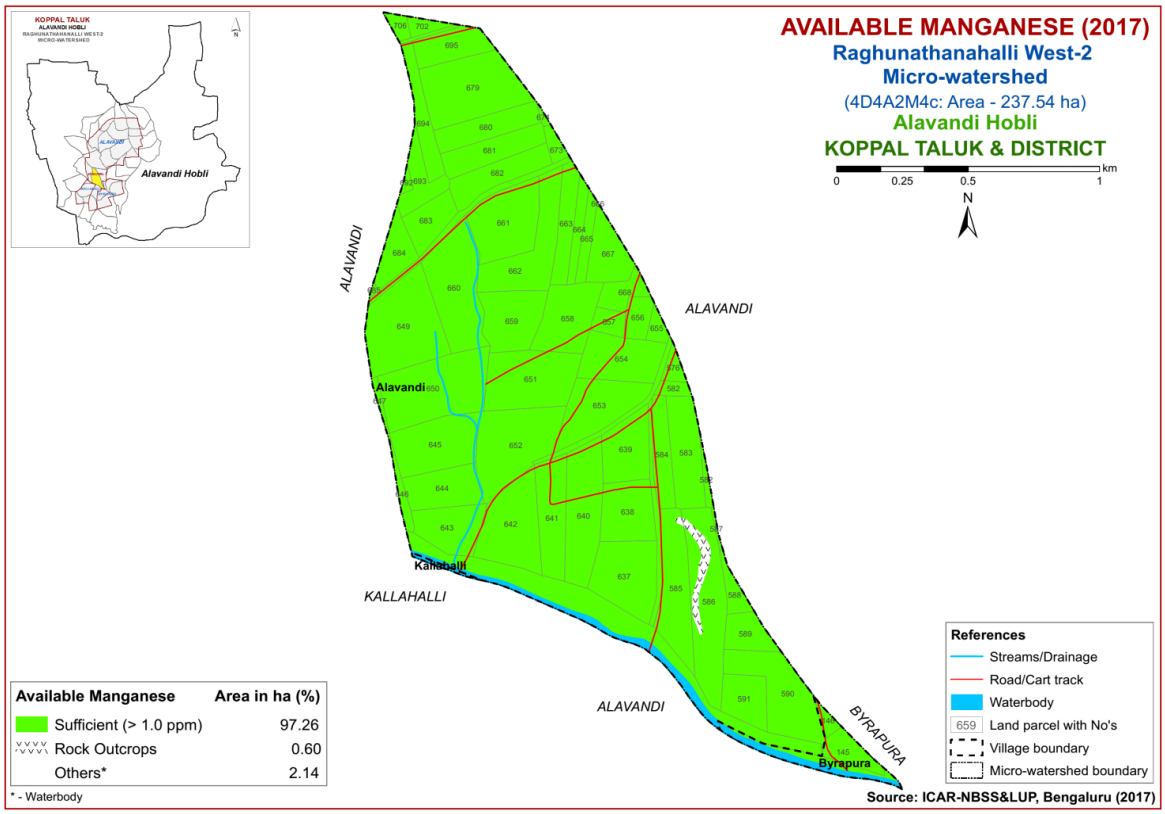


Fig.6.9 Soil Available Manganese map of Raghunathanahalli West-2 Microwatershed

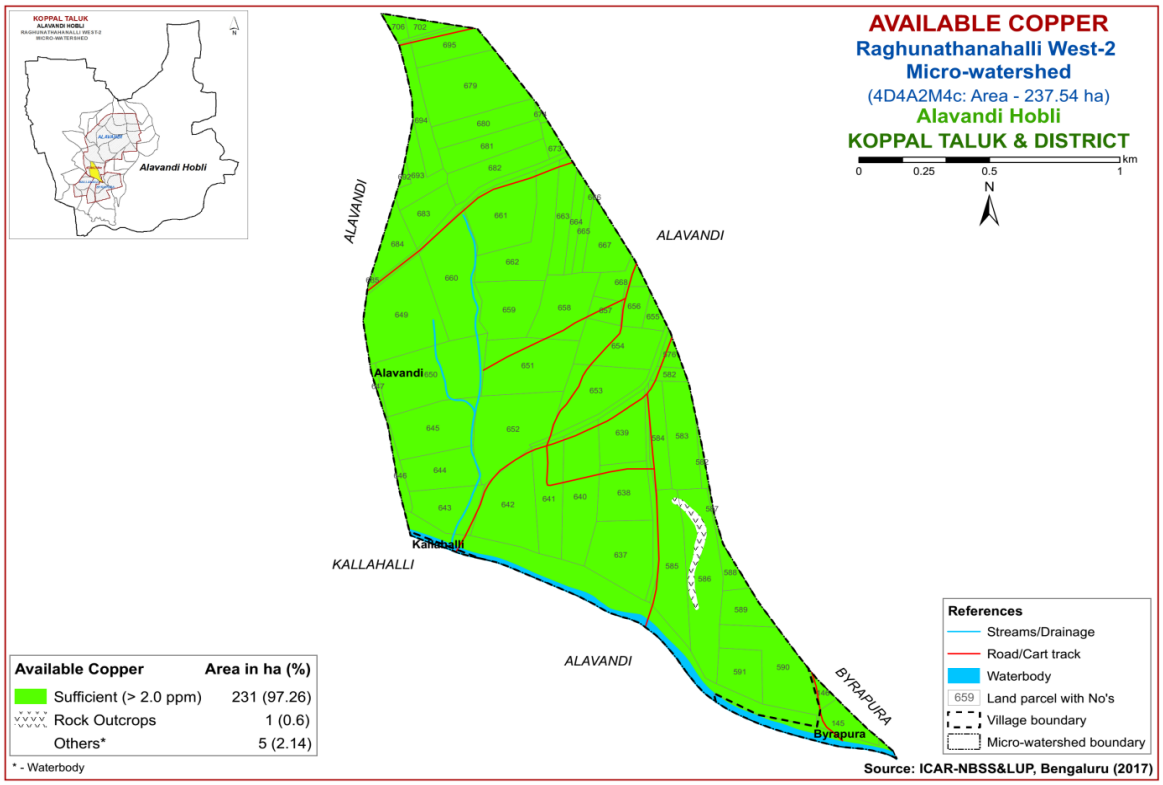


Fig.6.10 Soil Available Copper map of Raghunathanahalli West-2 Microwatershed

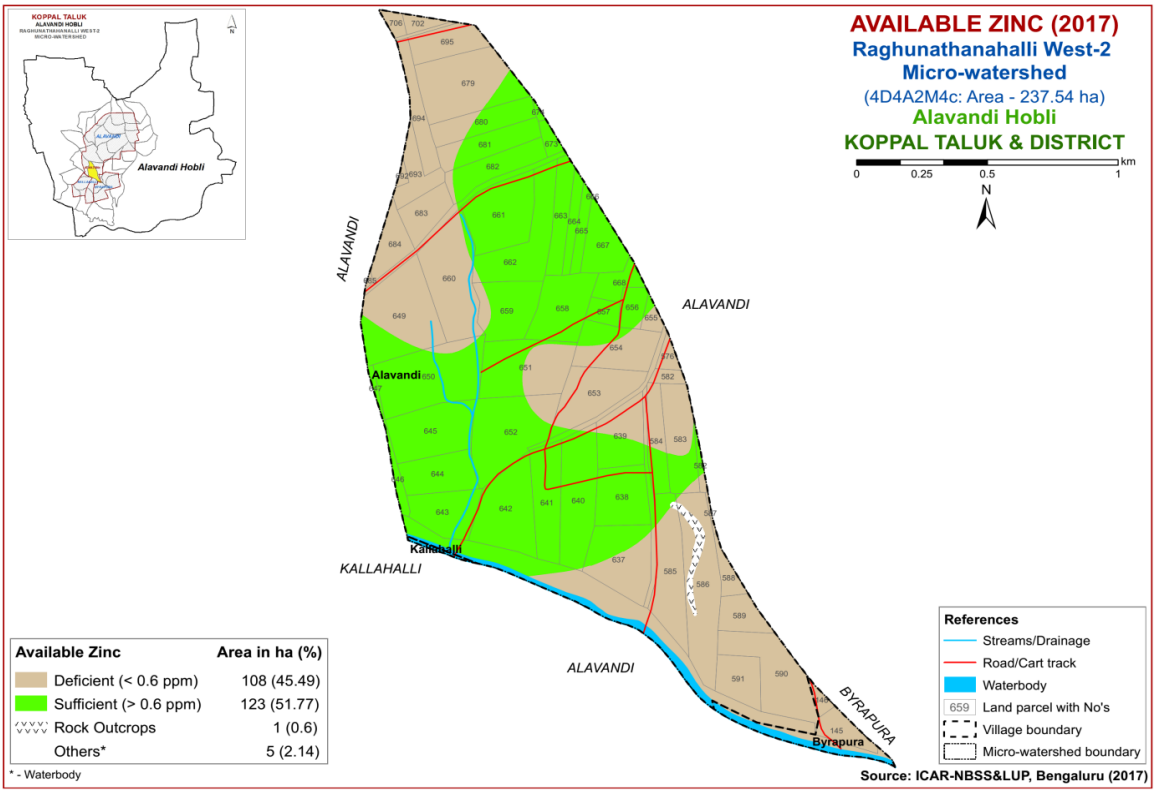


Fig.6.11 Soil Available Zinc map of Raghunathanahalli West-2 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Raghunathanahalli West-2 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 soil and land characteristics were matched with the crop requirements to arrive the crop suitability. The soil and land characteristics table (Table 7.1) and crop requirements tables (Tables 7.2 to 7.29) are given at the end. 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 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 land a suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure. 7.1.

There are no highly suitable (Class S1) lands for growing sorghum. Major area of about 194 ha (82%) is moderately suitable (Class S2) for growing sorghum and are distributed in all parts of the microwatershed. They have minor limitations of

calcareousness, gravelliness and rooting depth. About 37 ha (16%) area is marginally suitable (Class S3) lands. They have moderate limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

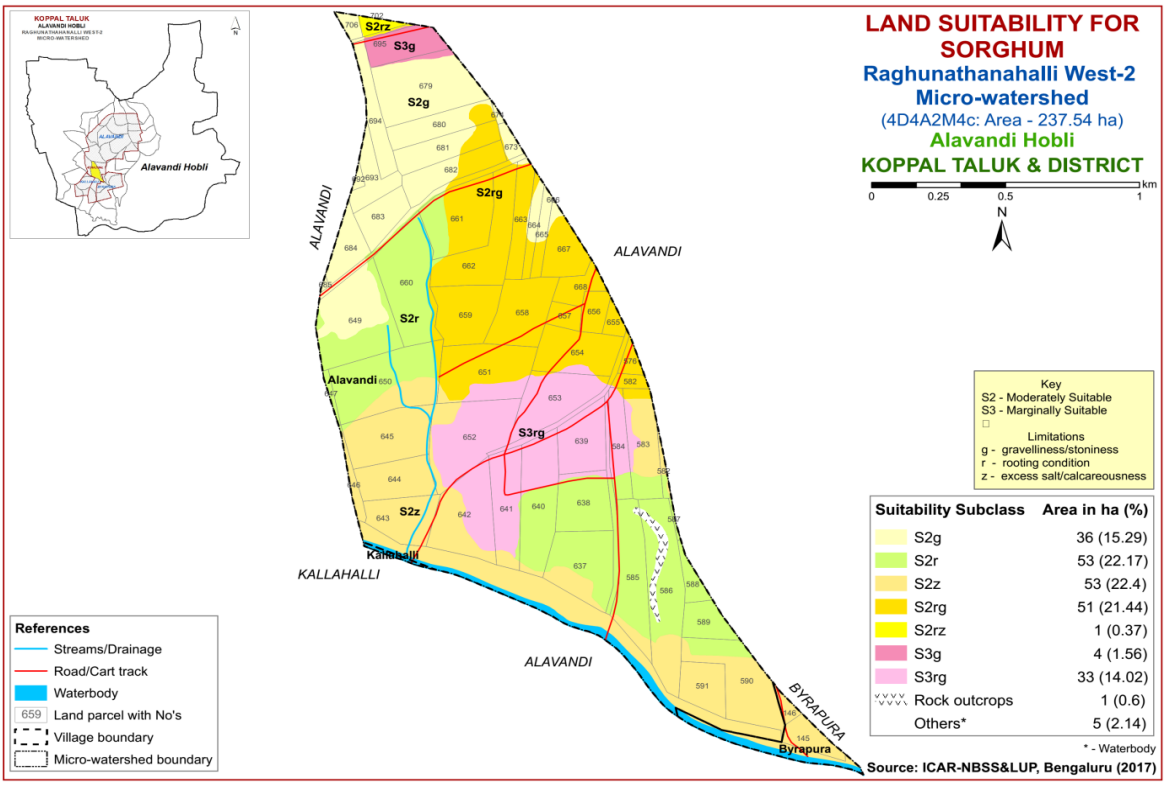


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

There are no highly (Class S1) lands for growing maize. About 104 ha (44%) area is under moderately suitable (Class S2) with minor limitations of rooting depth and gravelliness and occur in the southern and eastern part of the microwatershed. Maximum area of about 127 ha (54%) has marginally suitable (Class S3) lands. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness and are distributed in the major part of the microwatershed.

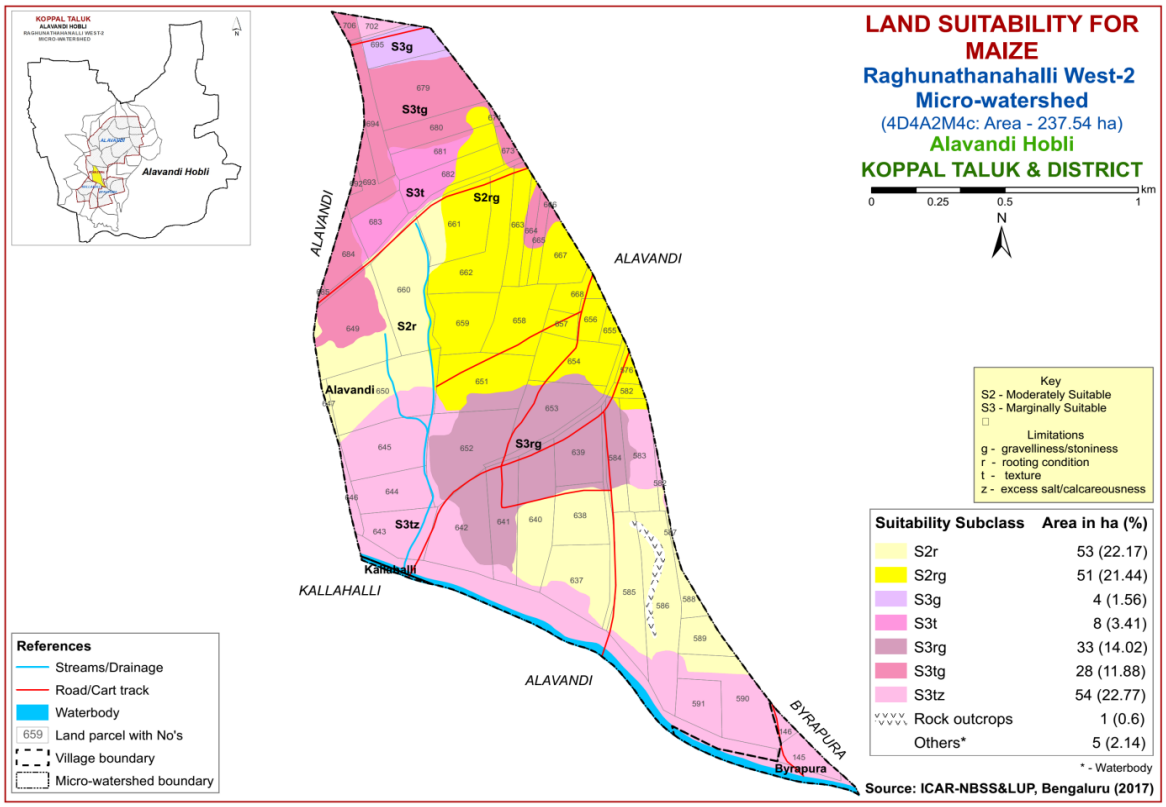


Fig. 7.2 Land Suitability map of Maize

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 Karnataka in the northern districts. The crop requirements (Table 7.4) for growing bajra were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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.

There are no highly (Class S1) lands for growing bajra. About 113 ha (47%) area is under moderately suitable (Class S2) with minor limitations of rooting depth, texture, calcareousness and gravelliness and occur in the southern and eastern part of the microwatershed. Maximum area of about 118 ha (50%) has marginally suitable (Class S3) lands. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness and are distributed in the southern, northern and southwestern part of the microwatershed.

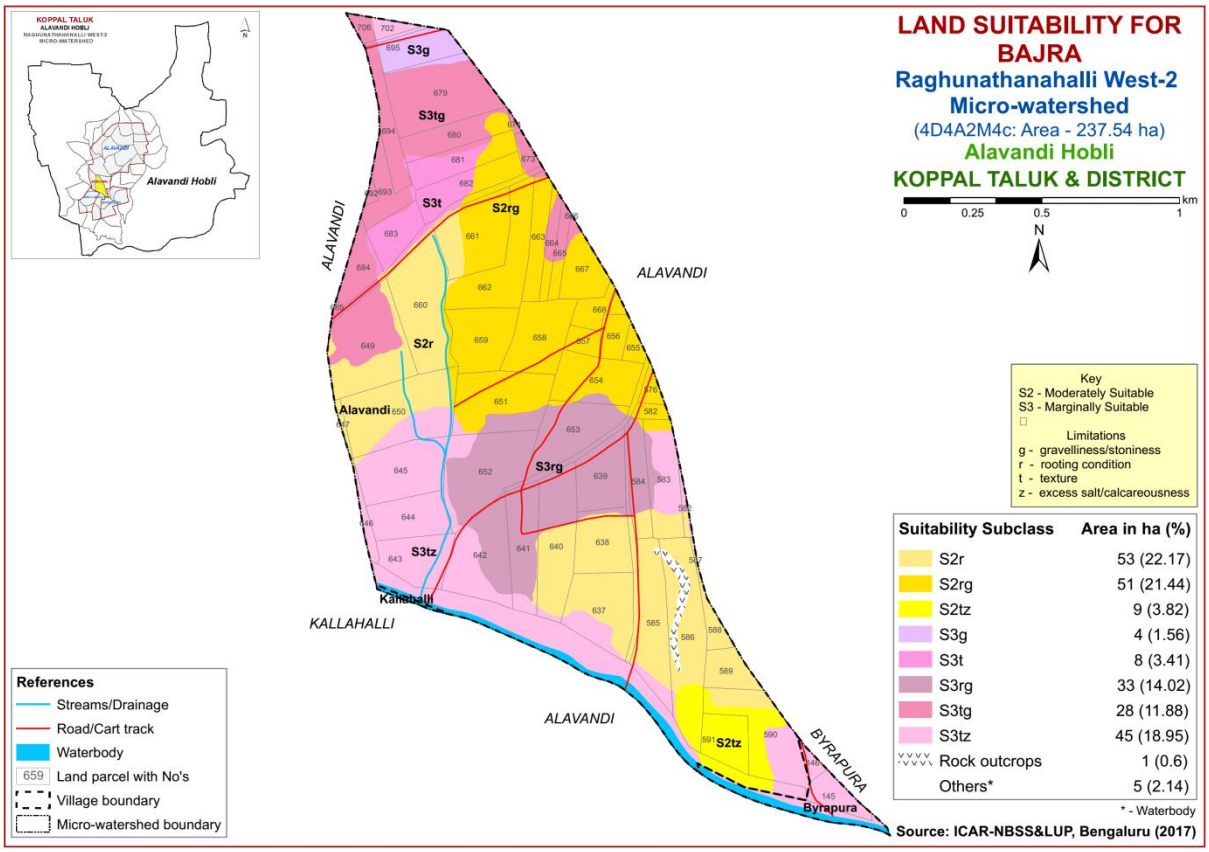


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

There are no highly suitable (Class S1) lands for growing groundnut. About 104 ha (44%) area is under moderately suitable (Class S2) with minor limitations of rooting depth and gravelliness and occur in the southern and eastern part of the microwatershed. Maximum area of about 127 ha (54%) has marginally suitable (Class S3) lands. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness and are distributed in the southern, northern, central and southwestern part of the microwatershed.

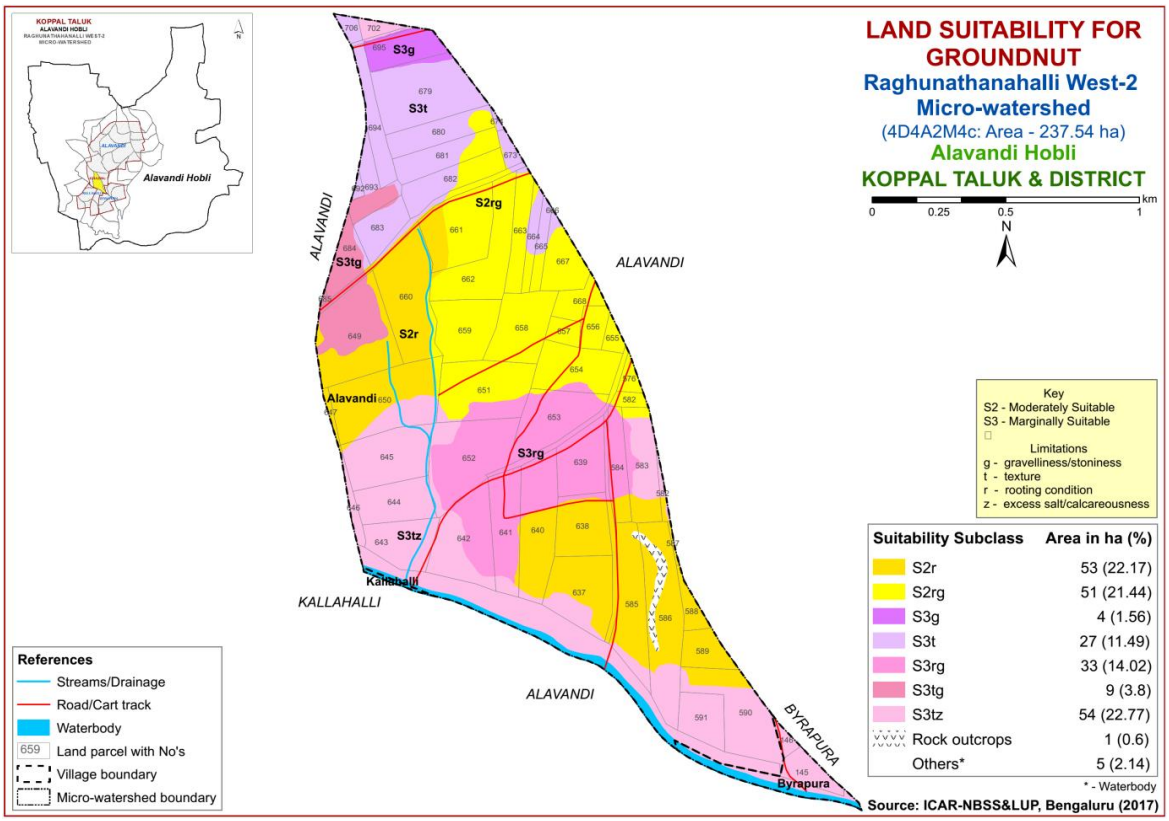


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

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

An area of about 89 ha (38%) is moderately suitable (Class S2) and is distributed in the southern, southwestern and northern part of the microwatershed with minor limitations of gravelliness and calcareousness. An area of about 142 ha (60%) is marginally suitable (Class S3) for growing sunflower and occur in the eastern and southeastern part of the microwatershed with moderate limitations of calcareousness, gravelliness and rooting depth.

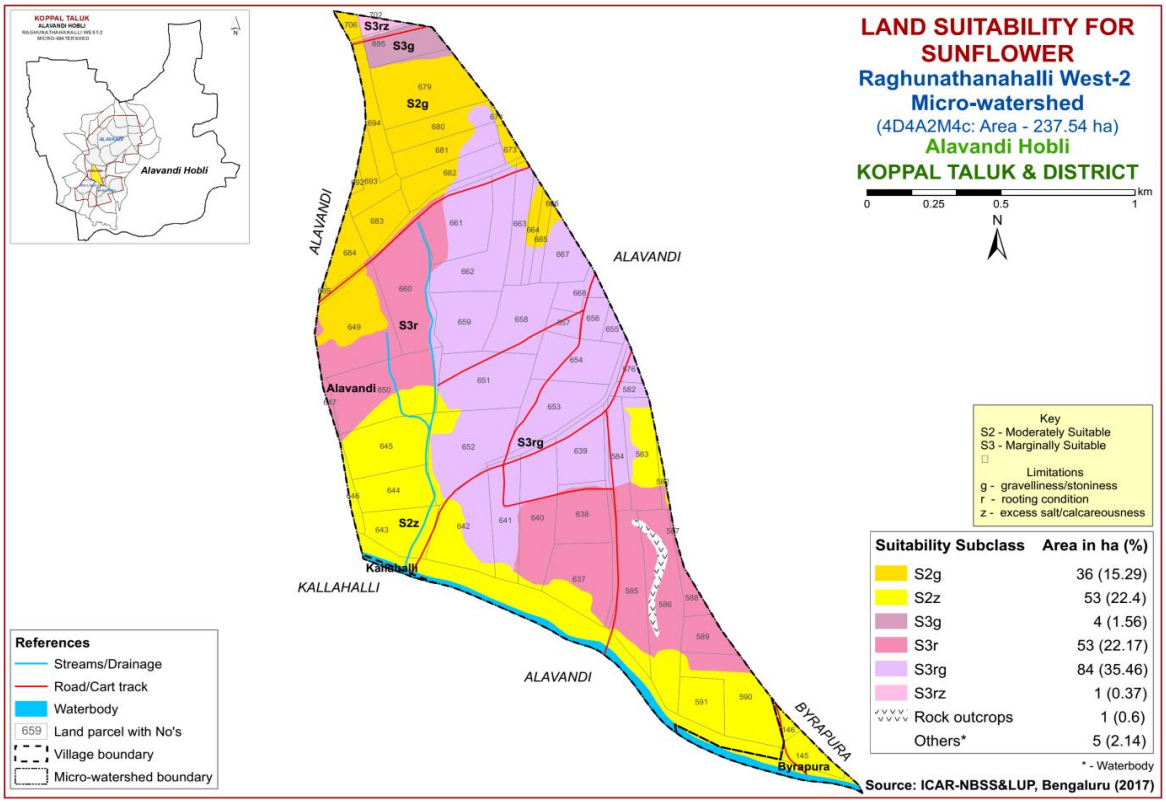


Fig. 7.5 Land Suitability map of Sunflower

7.6 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the state in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.7) 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 7.7.

An area of about 27 ha (11%) is highly (Class S1) suitable for growing cotton and occur in the northern part of the microwatershed. Major area of about 167 ha (70%) is moderately suitable (Class S2) for growing cotton and are distributed in all parts of the microwatershed with minor limitations of gravelliness, calcareousness and rooting depth. An area of about 37 ha (16%) area is marginally suitable (Class S3) for growing cotton with severe limitations of rooting depth, gravelliness and texture and occur in the central and northern part of the microwatershed.

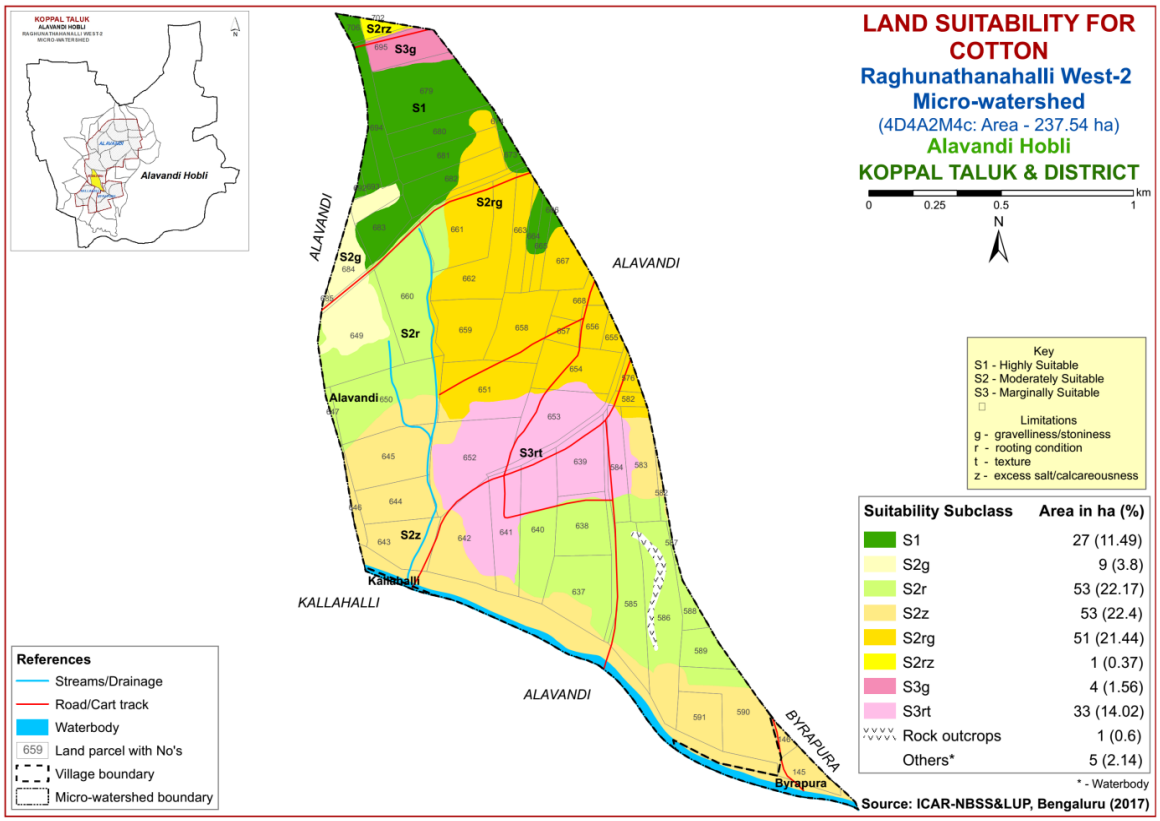


Fig. 7.6 Land Suitability map of Cotton

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

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburgi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red gram (Table 7.7) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

An area of about 89 ha (38%) is moderately suitable (Class S2) for growing red gram. They have minor limitations of texture, gravelliness and calcareousness and occur in the southern, southwestern and eastern part of the microwatershed. Major area of about 109 ha (46%) is marginally suitable (Class S3) for growing red gram with moderate limitations of rooting depth, gravelliness and calcareousness and are distributed in the eastern and northern part of the microwatershed. An area of about 33 ha (14%) area is not suitable (Class N1) for growing red gram with severe limitations of rooting depth and gravelliness and occur in central part of the microwatershed.

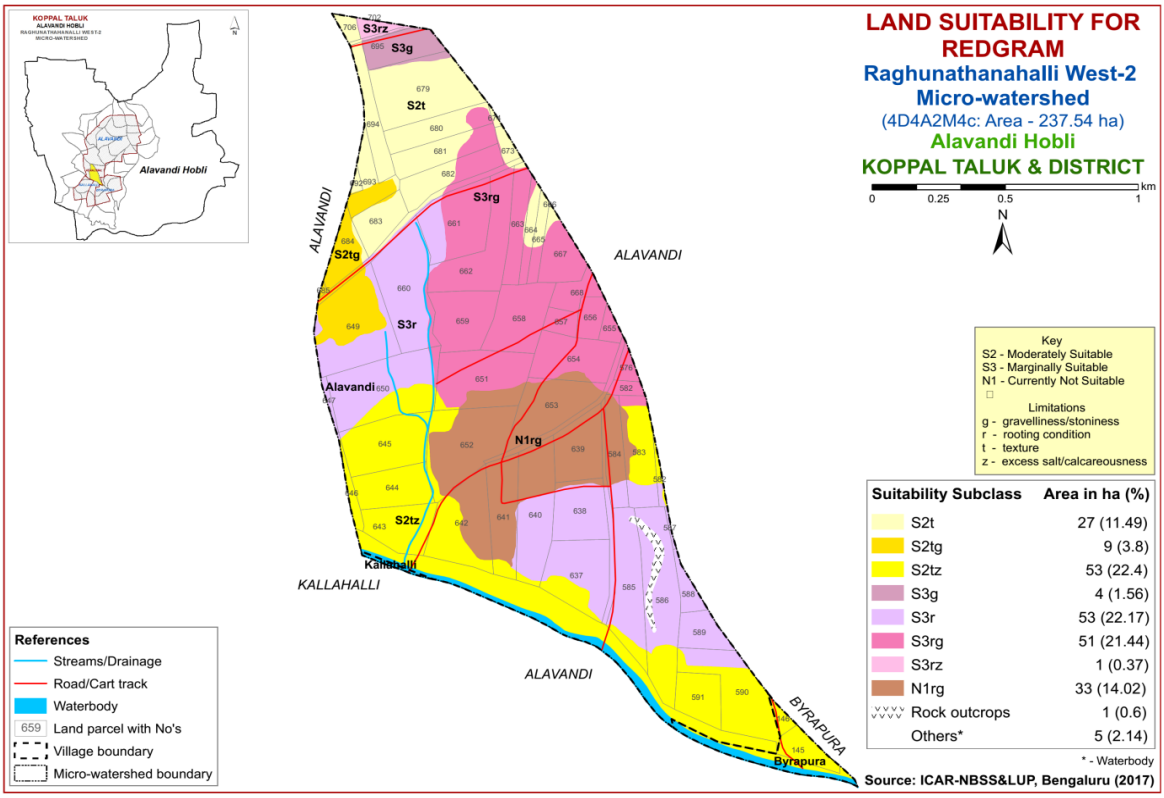


Fig. 7.7 Land Suitability map of Red gram

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

Bengal gram is one of the most important pulse crop grown in about 9.39 lakh ha area in Bijapur, Raichur, Kalaburgi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Bengal gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

An area of about 27 ha (11%) is highly suitable (Class S1) for growing bengalgram and are distributed in the northern part of the microwatershed. An area of about 114 ha (48%) is moderately suitable (Class S2) for growing bengalgram and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. An area of about 90 ha (38%) is marginally suitable for growing Bengal gram with moderate limitations of rooting depth, gravelliness and texture and occur dominantly in the central part.

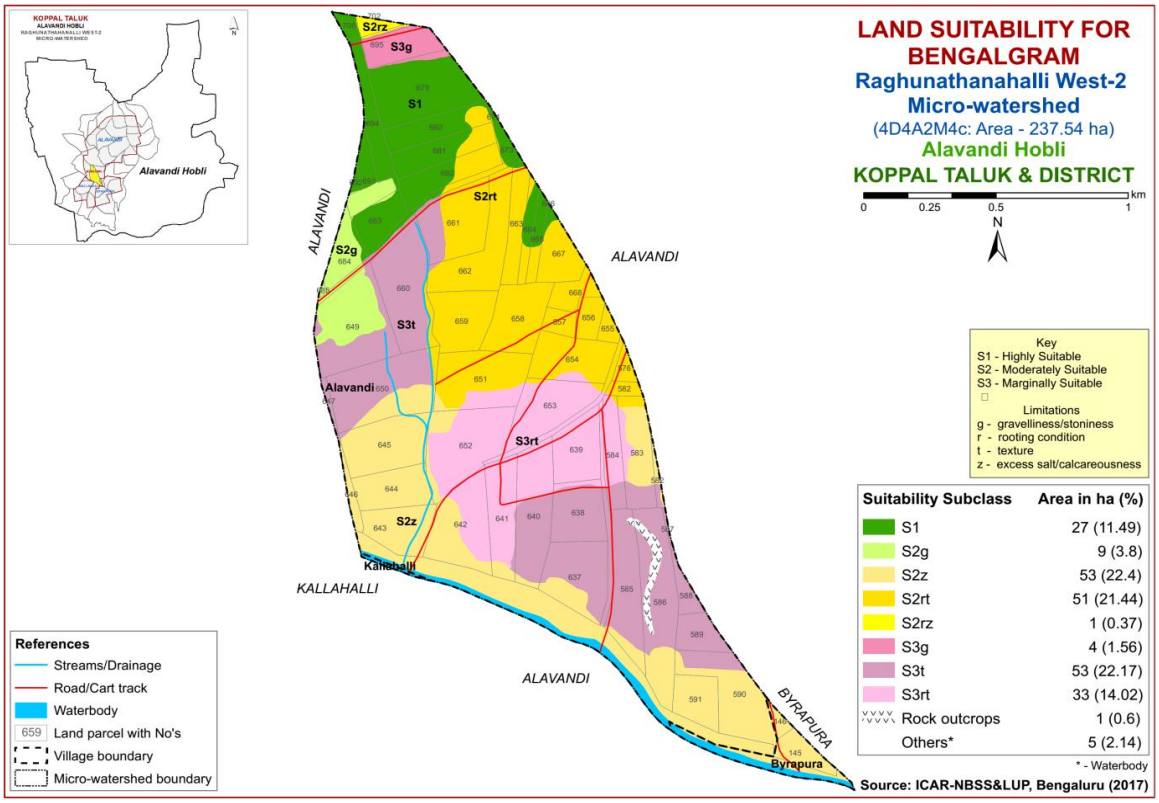


Fig. 7.8 Land Suitability map of Bengal gram

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

Chilli is one of the major fruit and spice crop grown in an area of 0.42 lakh ha in Karnataka State. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) 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.

There are no highly (Class S1) lands for growing chilli. An area of about 113 ha (47%) is moderately suitable (Class S2) for growing chilli in the microwatershed with minor limitations of rooting depth, gravelliness, calcareousness and texture and occur in the eastern and southern part. Major area of about 118 ha (50%) is marginally suitable (Class S3) for growing chilli with moderate limitations of rooting depth, texture, gravelliness and calcareousness and occur in the major part of the microwatershed.

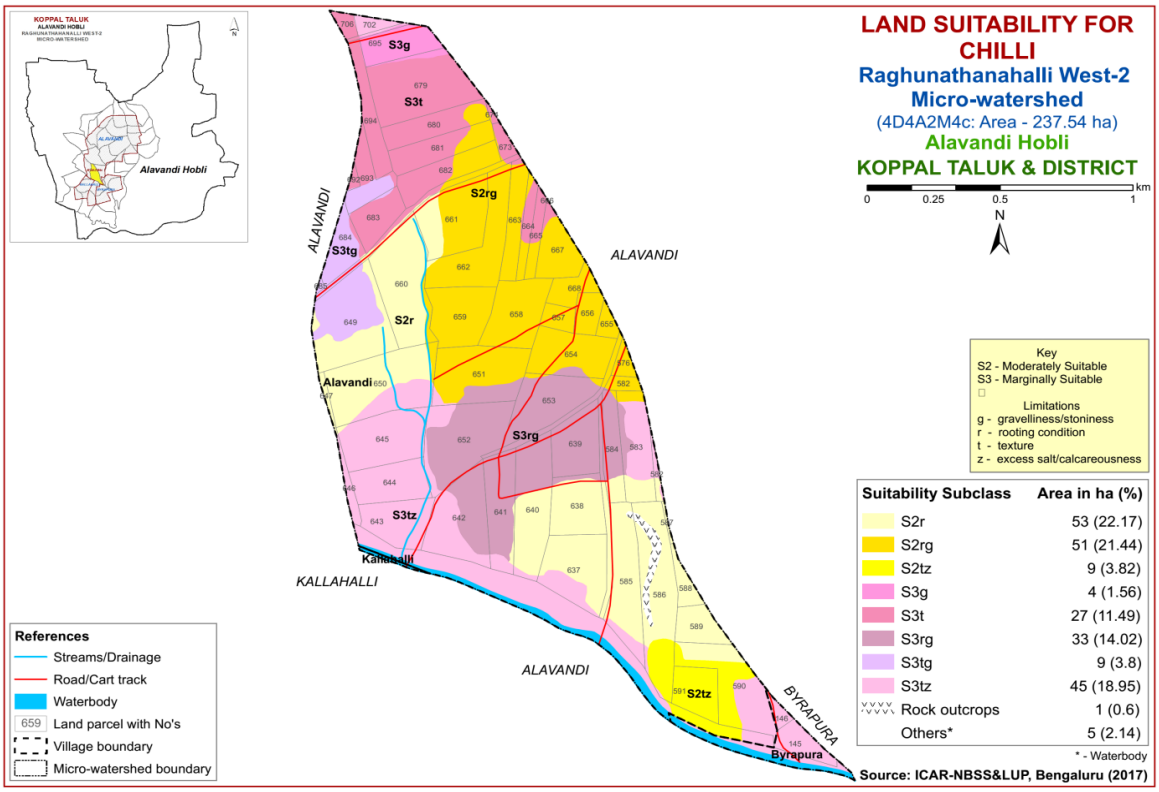


Fig. 7.9 Land Suitability map of Chilli

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 7.11) 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

There are no highly suitable (Class S1) lands for growing tomato. An area of about 104 ha (44%) is moderately suitable (Class S2) for growing tomato in the microwatershed with minor limitations of rooting depth and gravelliness and occur in the northeastern part. Major area of about 127 ha (54%) is marginally suitable (Class S3) for growing tomato with moderate limitations of rooting depth, texture, gravelliness and calcareousness and occur in the major part of the microwatershed.

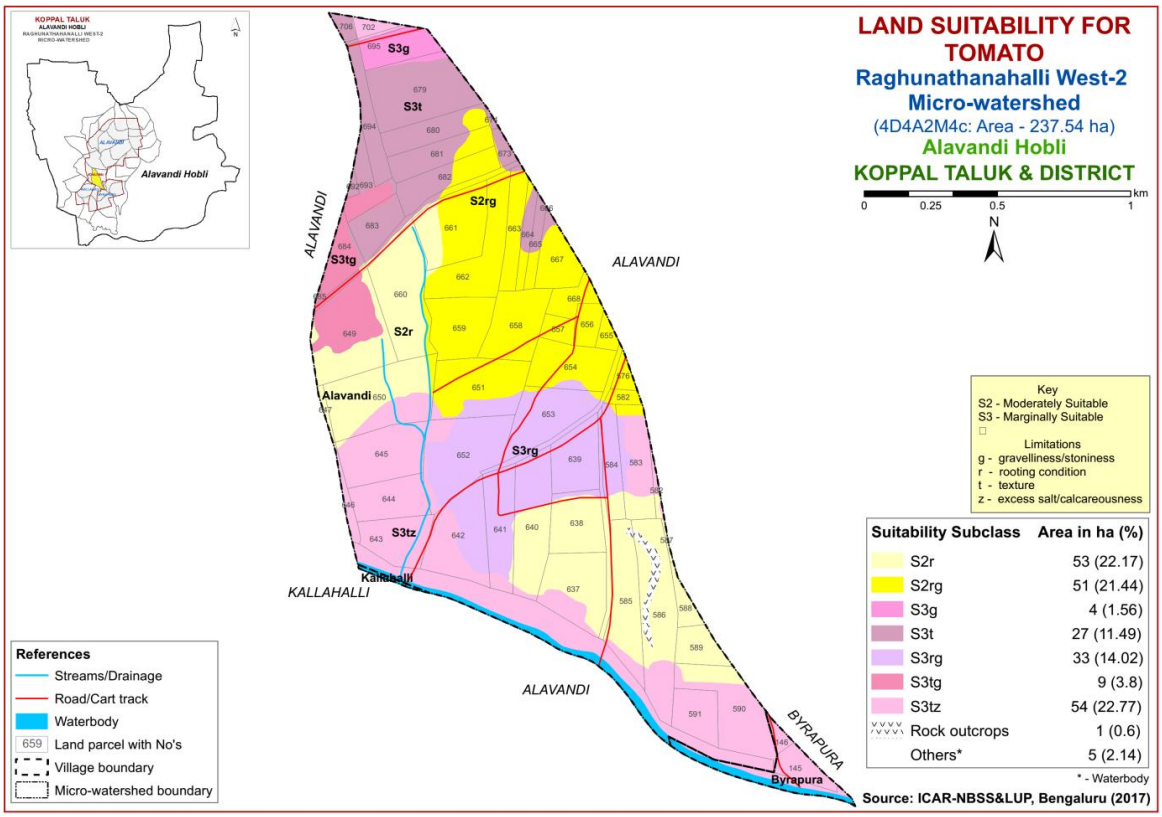


Fig. 7.10 Land Suitability map of Tomato

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

An area of 89 ha (38%) is moderately (Class S2) suitable for growing drumstick with minor limitations of gravelliness and calcareousness and distributed in the northern, western and southern part of the microwatershed. Major area of about 142 ha (60%) is marginally suitable (Class S3) for growing drumstick with moderate limitations of rooting depth, gravelliness and calcareousness and occur in the major part of the microwatershed.

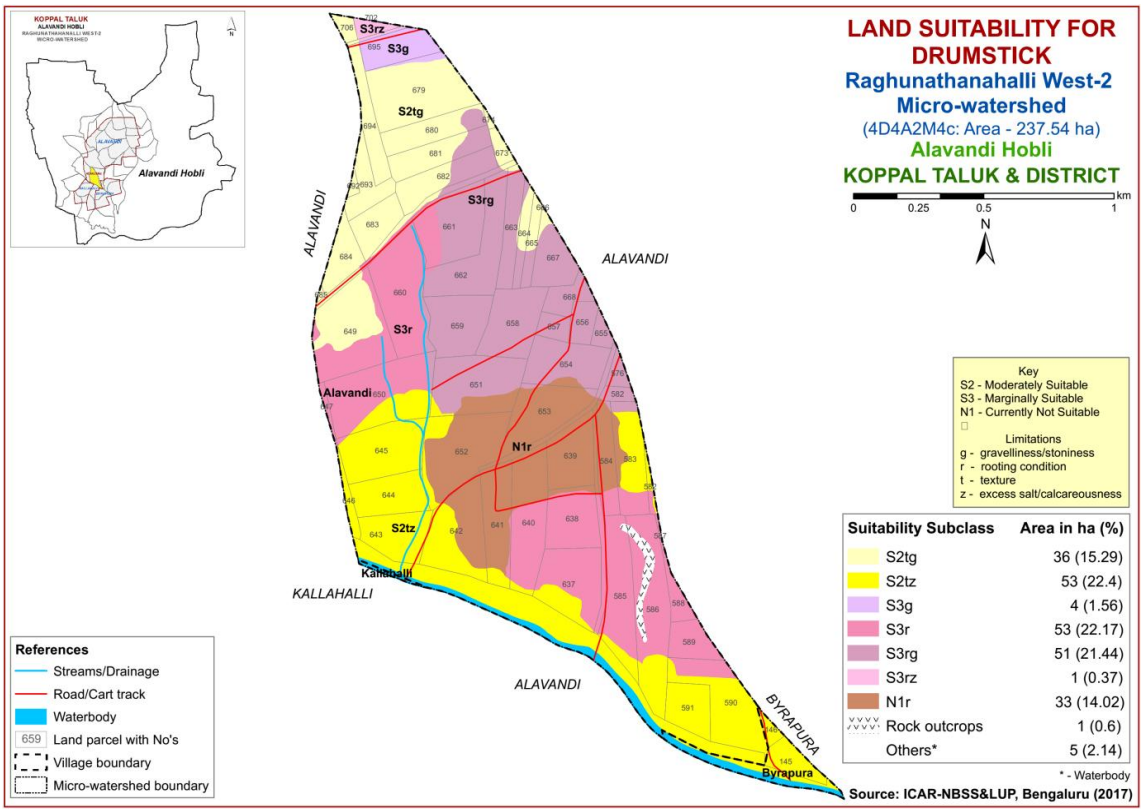


Fig. 7.11 Land Suitability map of Drumstick

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 7.13) 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.

Moderately suitable (Class S2) lands occupy an area of about 31 ha (13%) and occur in the northern part of the microwatershed. They have minor limitations of texture and gravelliness. Marginally suitable lands cover an area of about 167 ha (70%) and occur in the eastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness. An area of about 33 ha (14%) is currently not suitable (Class N1) for growing mulberry with severe limitations of rooting depth and occur in the central part of the microwatershed.

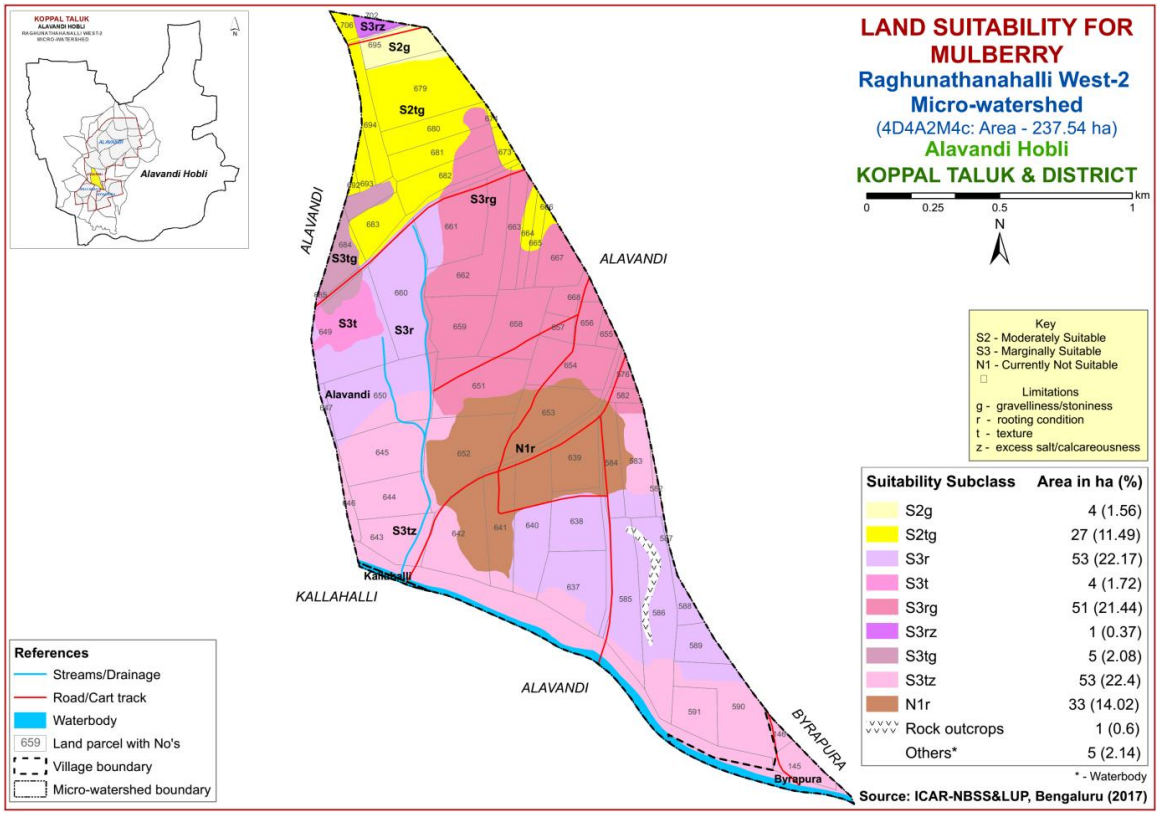


Fig. 7.12 Land Suitability map of Mulberry

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 7.14) 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.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing mango. Marginally suitable (Class S3) lands cover an area of about 93 ha (39%) and occur in the southern, western and northern part of the microwatershed. They have moderate limitations of texture and gravelliness and major area of about 138 ha (58%) is currently not suitable (Class N1) for growing mango and occur in the major parts of the microwatershed with severe limitations of calcareousness, gravelliness and rooting depth.

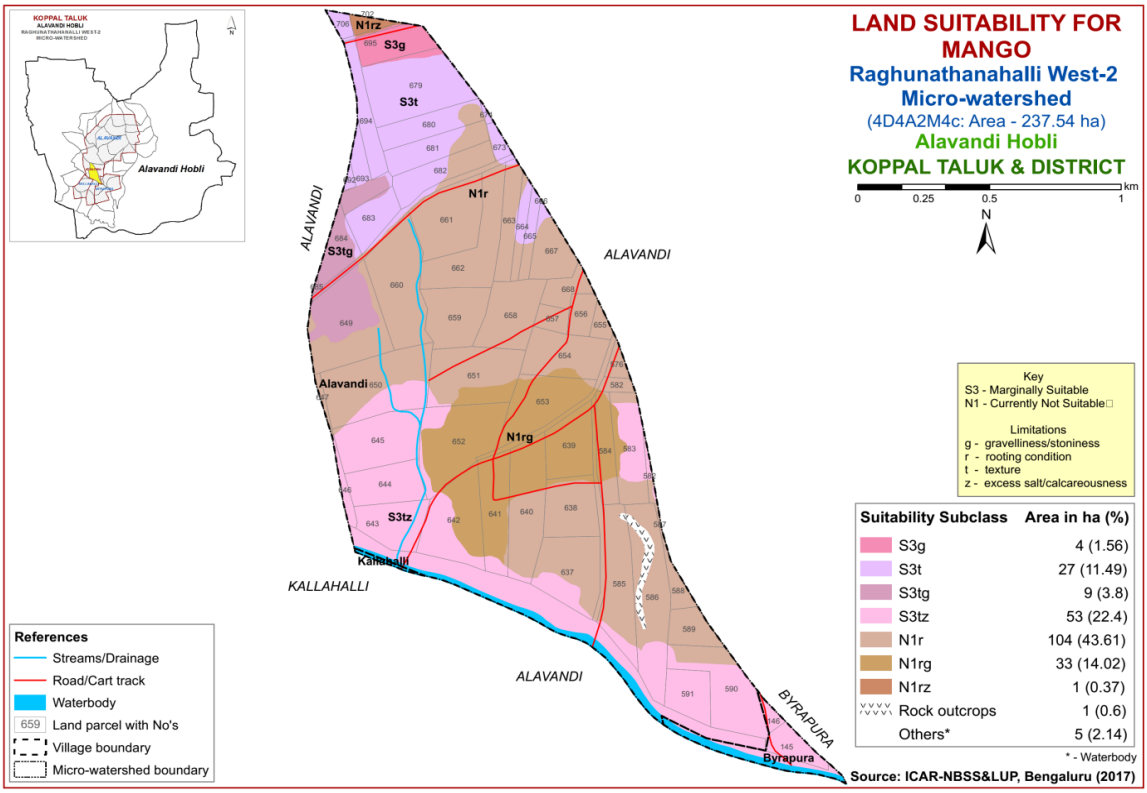


Fig. 7.13 Land Suitability map of Mango

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

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing sapota in the microwatershed Major area of about 198 ha (83%) is marginally (Class S3) suitable for growing sapota with moderate limitations of texture, rooting depth and calcareousness and occur in all parts of the microwatershed. An area of about 33 ha (14%) is not suitable (Class N1) for growing sapota with severe limitations of rooting depth, gravelliness and occur in the central part of the microwatershed.

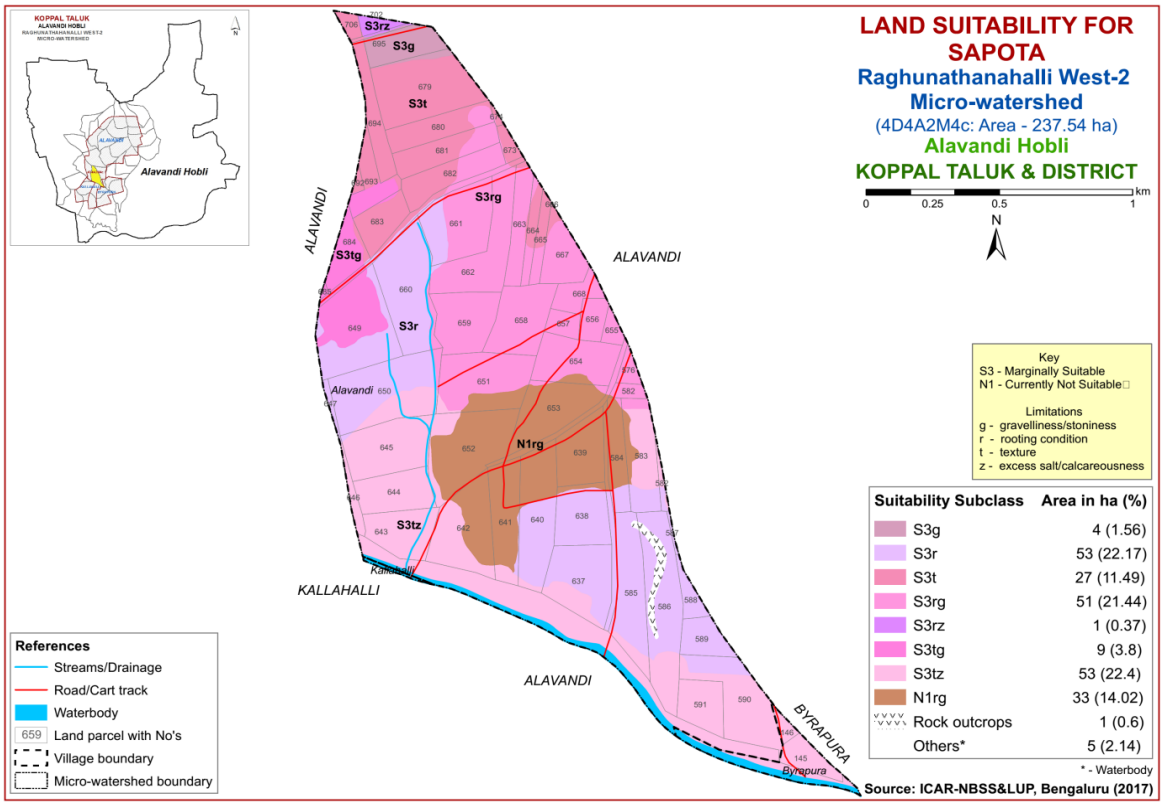


Fig. 7.14 Land Suitability map of Sapota

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 7.16) 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.

An area of about 89 ha (38%) is moderately (Class S2) suitable for growing pomegranate with minor limitations of texture, rooting depth, gravelliness and calcareousness and occur in the northern, eastern and southern part of the microwatershed. Marginally suitable (Class S3) lands cover an area of about 109 ha (46%) and occur in the eastern and southeastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. An area of about 33 ha (14%) is not suitable (Class N1) for growing pomegranate with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

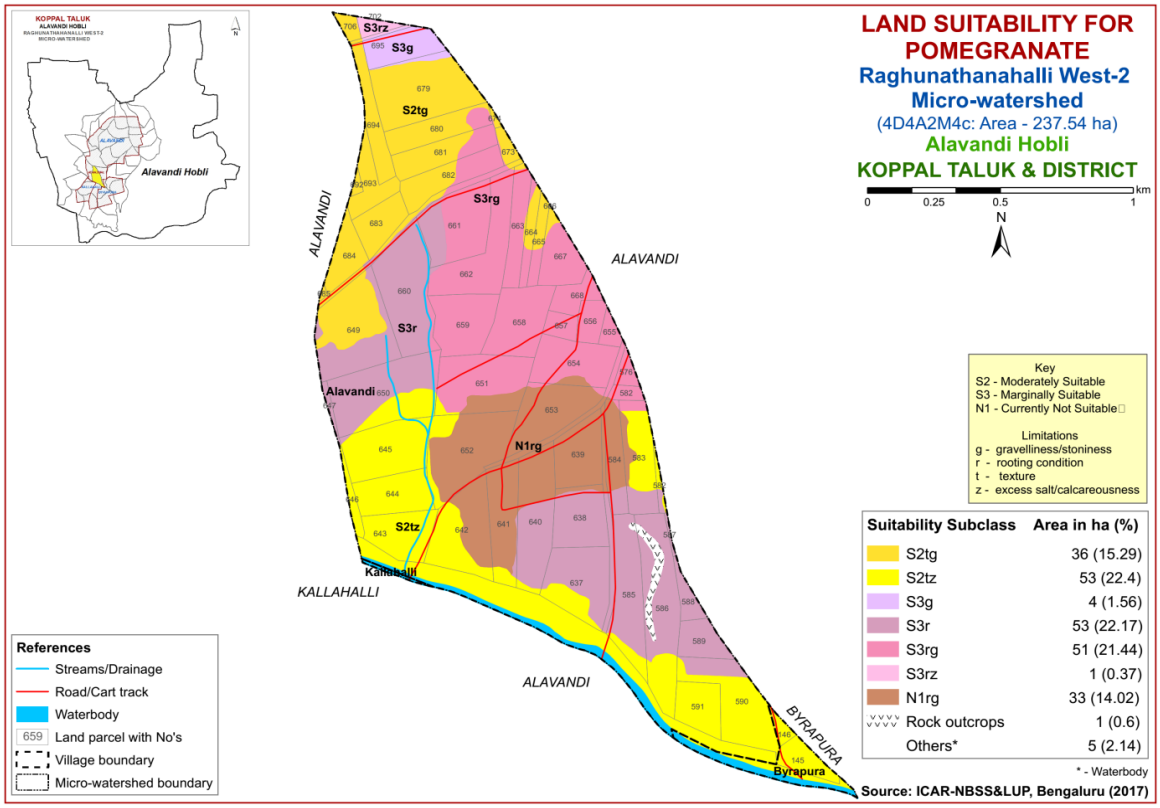


Fig. 7.15 Land Suitability map of Pomegranate

7.16 Land Suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 6558 ha in almost all the districts of the state. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (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.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing guava in the microwatershed. Major area of 198 ha (83%) is marginally (Class S3) suitable for growing guava with moderate limitations of texture, rooting depth, gravelliness and calcareousness and occur in the major parts of the microwatershed. An area of about 33 ha (14%) is currently not suitable (Class N1) for growing guava with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

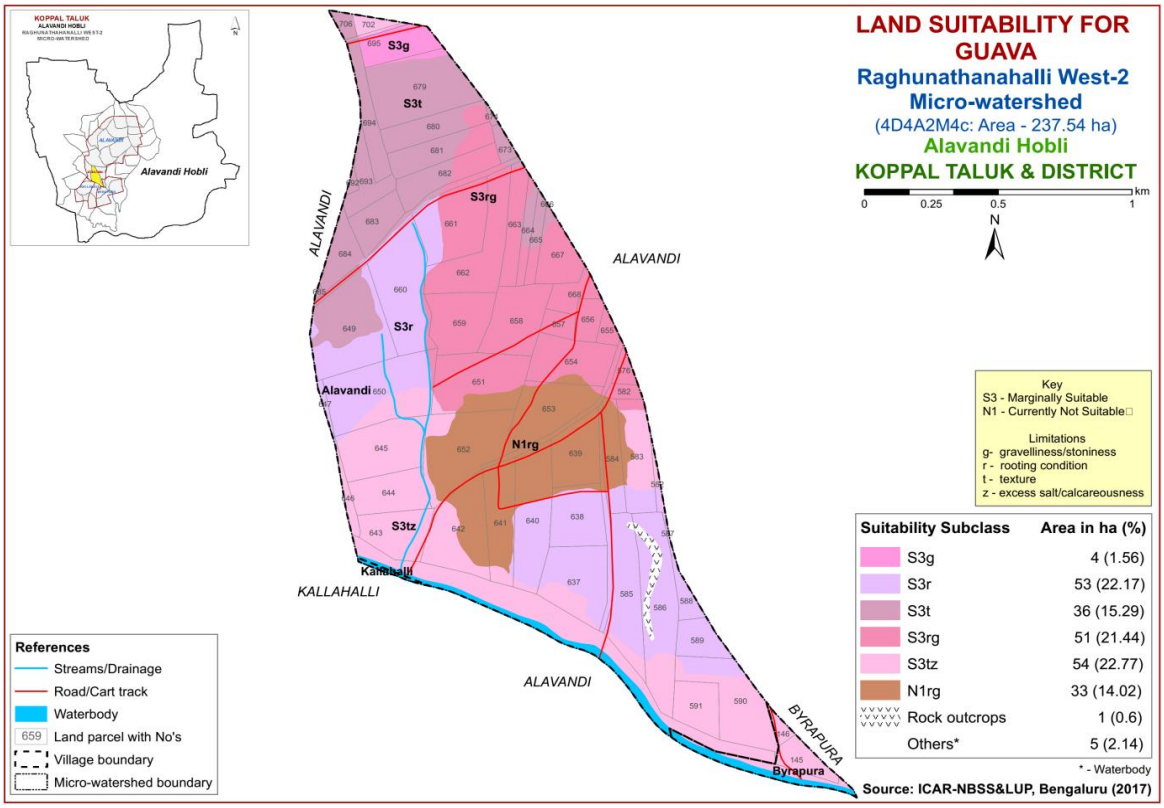


Fig. 7.16 Land Suitability map of Guava

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 (Table 7.18) for growing jackfruit 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.

There are no highly (Class S1) and moderately suitable (Class S2) lands for growing jackfruit in the microwatershed Major area of 198 ha (83%) is marginally (Class S3) suitable for growing jackfruit with moderate limitations of texture, rooting depth, gravelliness and calcareousness and occur in the major part of the microwatershed. An area of about 33 ha (14%) is currently not suitable (Class N1) for growing jackfruit with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

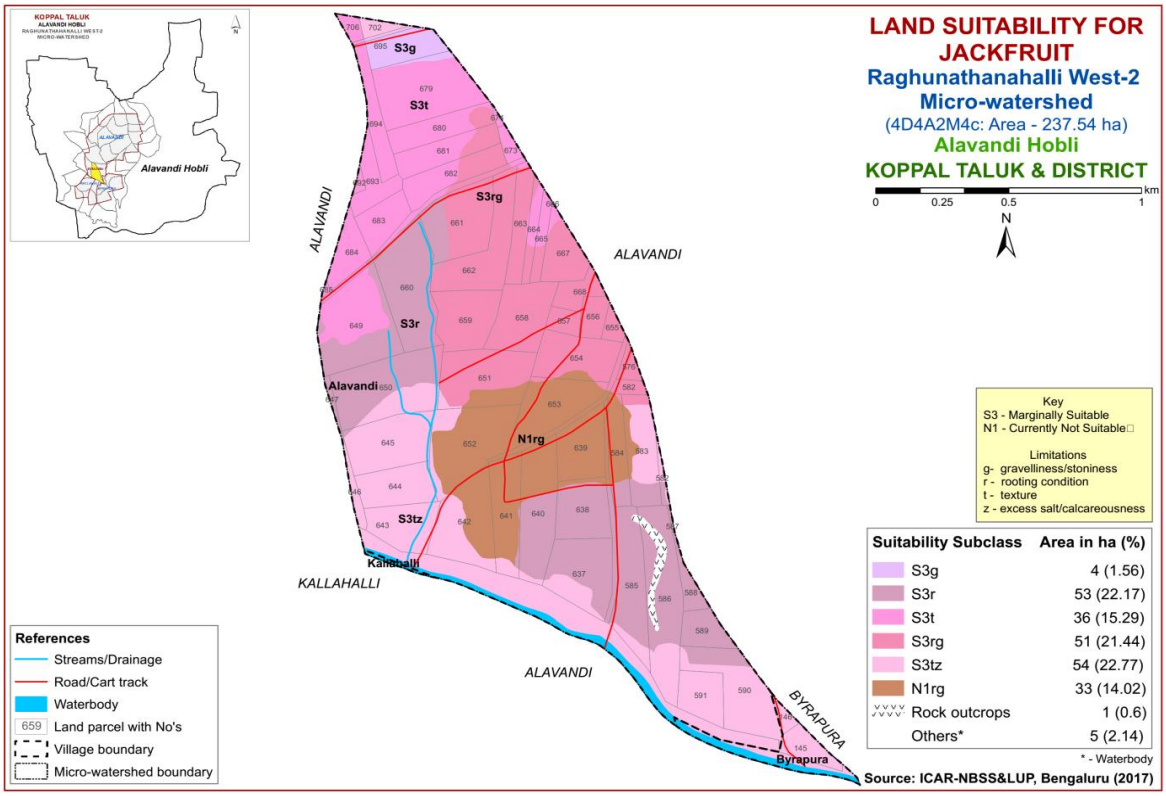


Fig. 7.17 Land Suitability map of Jackfruit

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 (Table 7.19) for growing jamun 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 89 ha (38%) is moderately suitable (Class S2) for growing jamun with minor limitations of texture, rooting depth and calcareousness and occur in the northern, western and southwestern part of the microwatershed. Marginally suitable (Class S3) lands cover a major area of about 109 ha (46%) and occur in all parts of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 33 ha (14%) is currently not suitable (Class N1) for growing jamun with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

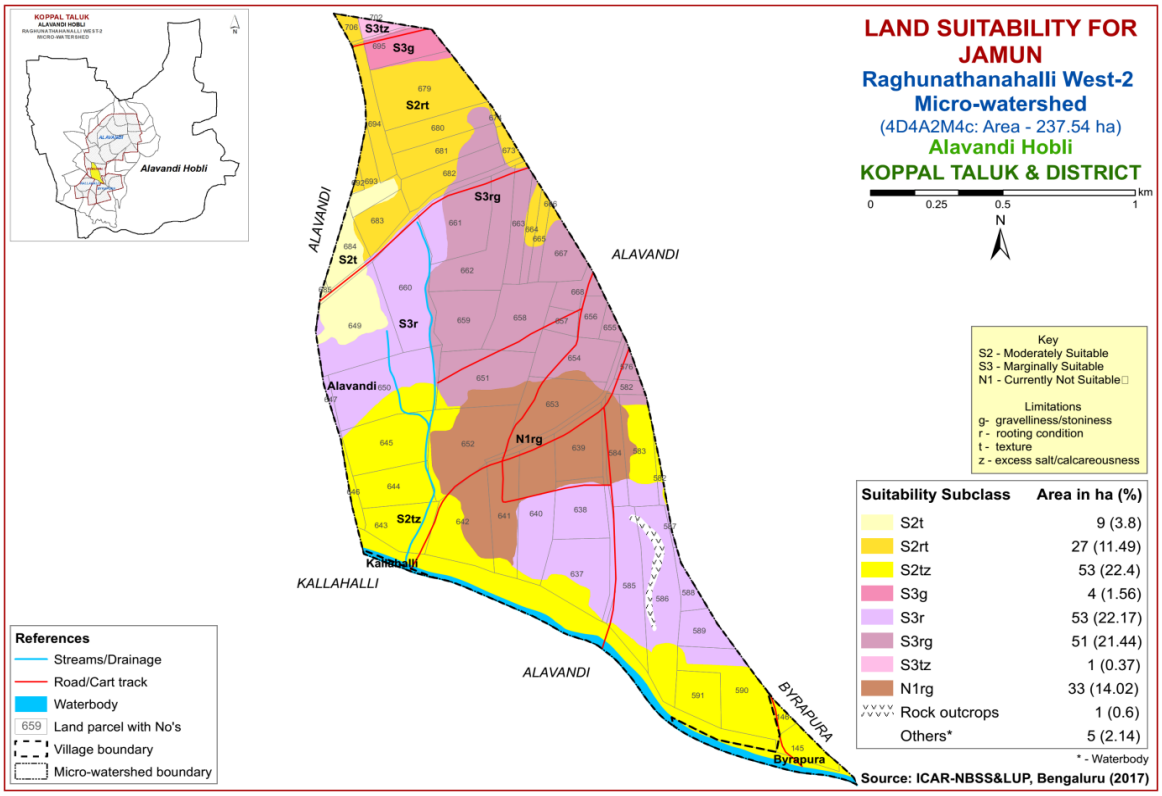


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements (Table 7.20) for growing musambi 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 7.16.

There are no highly suitable (Class S1) lands for growing musambi. About 89 ha (38%) is moderately suitable (Class S2) for growing musambi with minor limitations of gravelliness and calcareousness and occur in the northern, western and southern part of the microwatershed. Marginally suitable (Class S3) lands cover a major area of about 109 ha (46%) and occur in the eastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. About 33 ha (14%) is currently not suitable (Class N1) for growing musambi with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

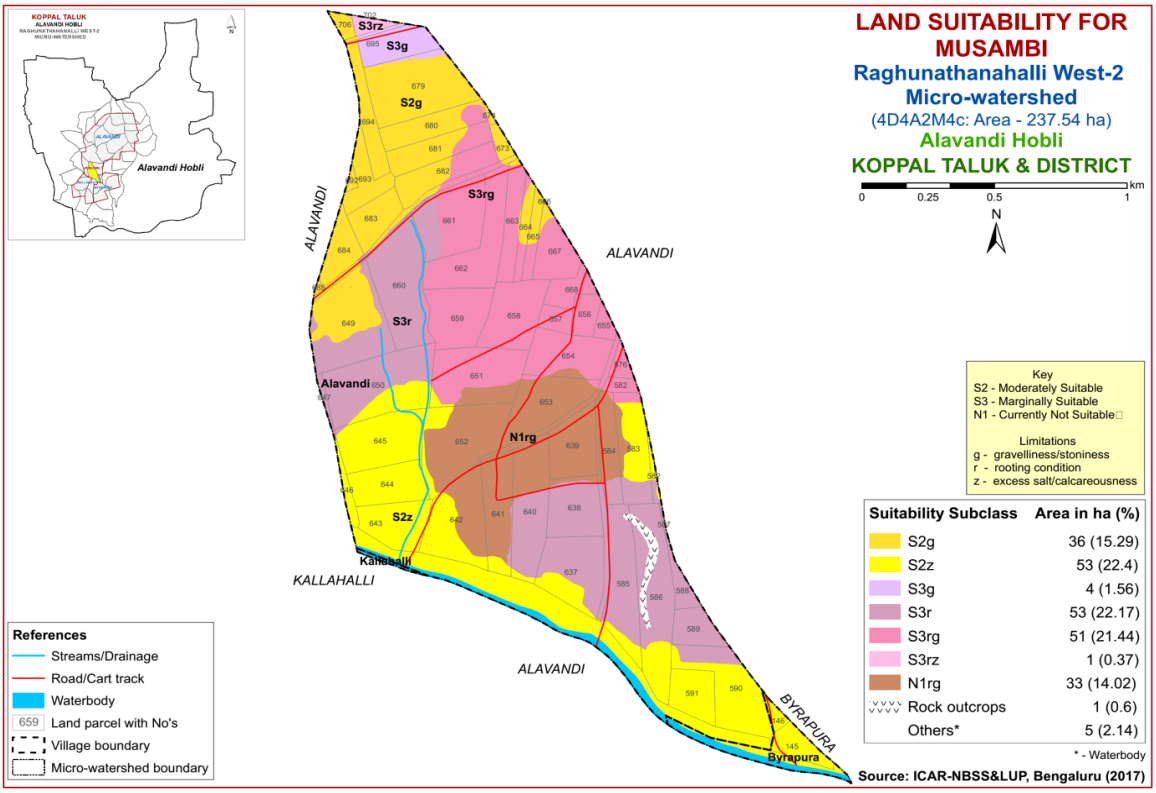


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements (Table 7.21) for growing lime (Table 7.15) 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 7.17.

There are no highly suitable (Class S1) lands for growing lime. About 89 ha (38%) is moderately suitable (Class S2) for growing lime with minor limitations of gravelliness and calcareousness and occur in the northern, western and southern part of the microwatershed. Marginally suitable (Class S3) lands cover a major area of about 109 ha (46%) and occur in the eastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness and about 33 ha (14%) is currently not suitable (Class N1) for growing lime with severe limitations of rooting depth and gravelliness and occur in the central part of the microwatershed.

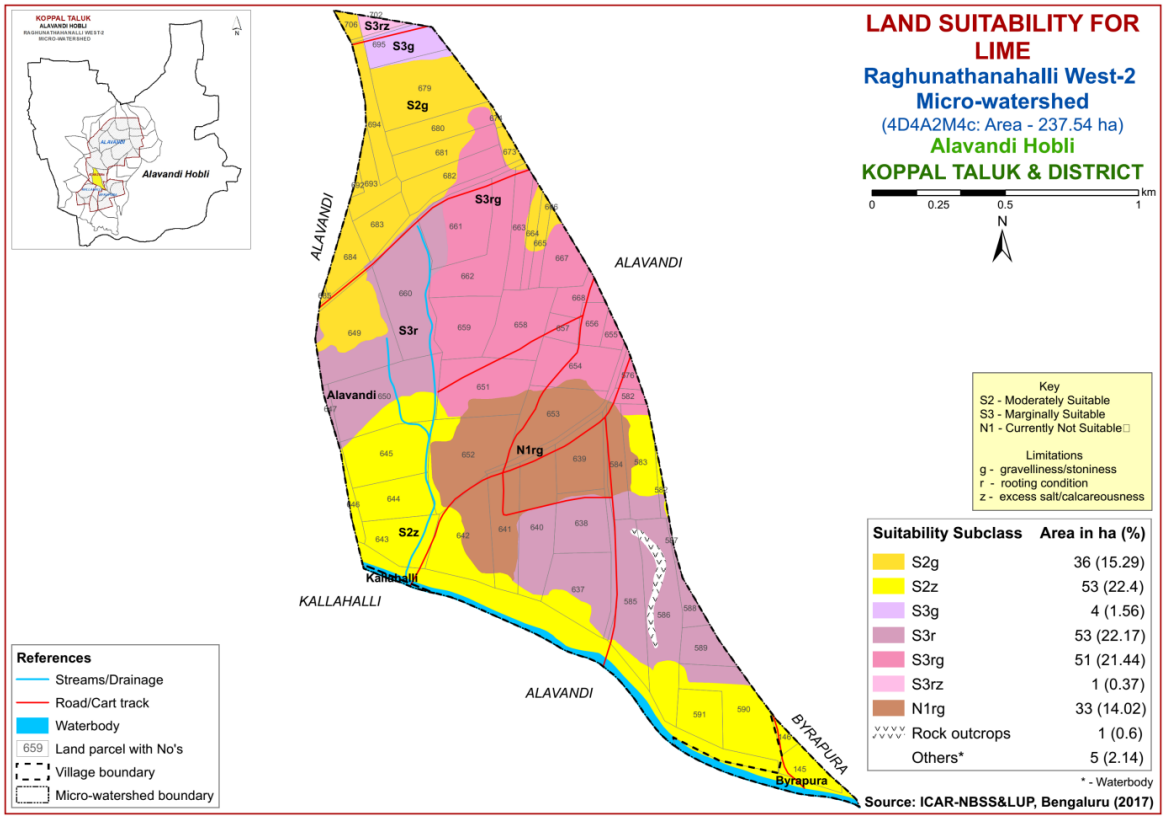


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements (Table 7.22) for growing cashew 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.

A very small area of about 4 ha (2%) is moderately suitable (Class S2) for growing cashew with minor limitations of rooting depth and gravelliness and occur in the northern part. About 104 ha (44%) area is marginally (Class S3) suitable for growing cashew with moderate limitations of rooting depth and gravelliness and occur in the eastern part of the microwatershed. Major area of about 123 ha (52%) is currently not suitable (Class N1) with very severe limitations of rooting depth, texture and calcareousness and occur in the northern, central and southern part of the microwatershed.

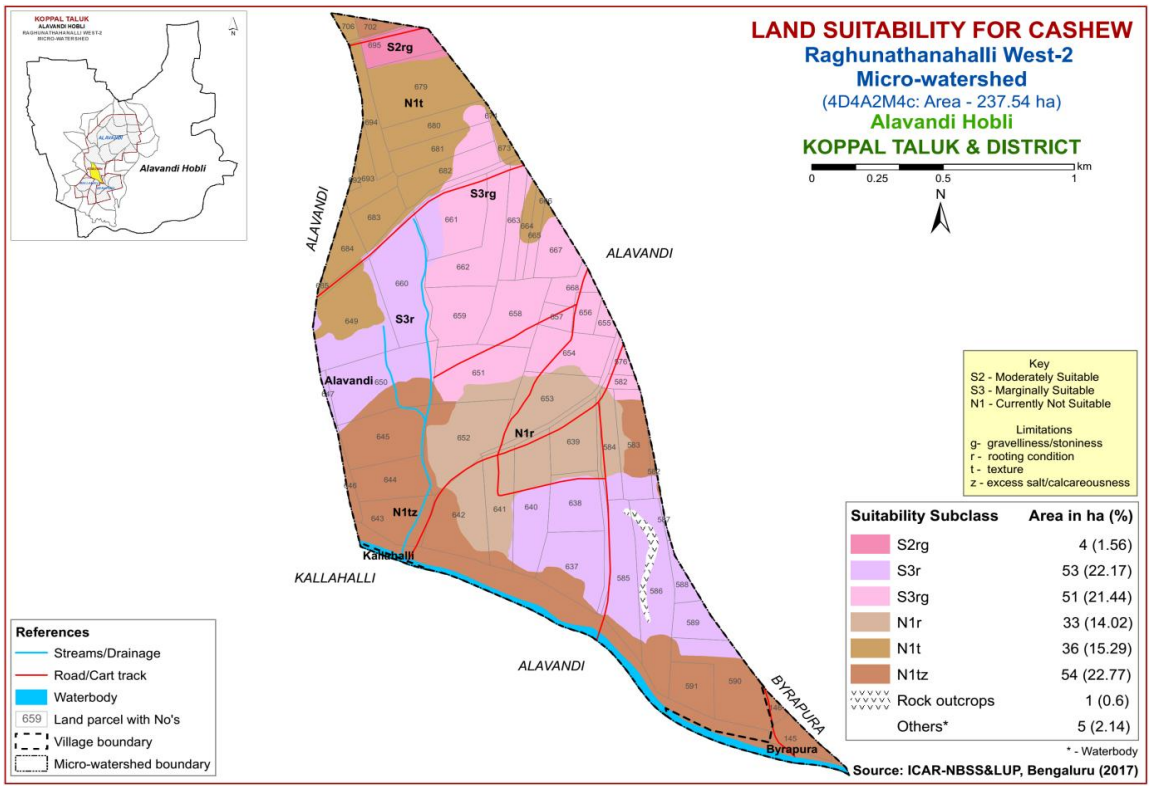


Fig. 7.21 Land Suitability map of Cashew

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements (Table 7.23) for growing custard apple 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 about 27 ha (11%) is highly suitable (Class S1) for growing custard apple and are distributed in the northern part of the microwatershed. Major area of about 171 ha (72%) is moderately suitable (Class S2) and occur in all parts of the microwatershed. They have minor limitations of gravelliness, calcareousness and rooting depth. An area of about 33 ha (14%) is marginally suitable for growing custard apple with moderate limitations of rooting depth and occur in the central part of the microwatershed.

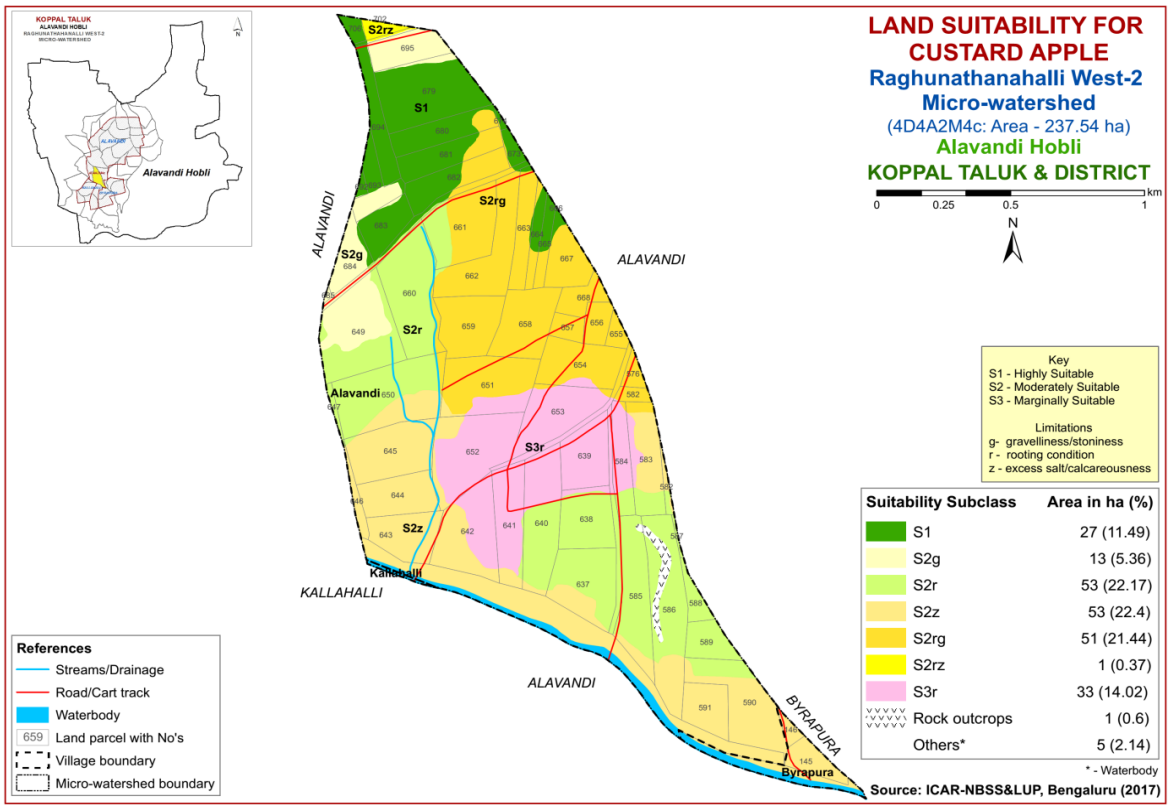


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements for (Table 7.24) growing amla 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.

Major area of about 198 ha (83%) is moderately suitable (Class S2) for growing amla with minor limitations of texture, calcareousness, gravelliness and rooting depth and occur in all parts of the microwatershed. and An area of about 33 ha (14%) is marginally suitable (Class S3) for growing amla with moderate limitations of rooting depth and occur in the central part of the microwatershed.

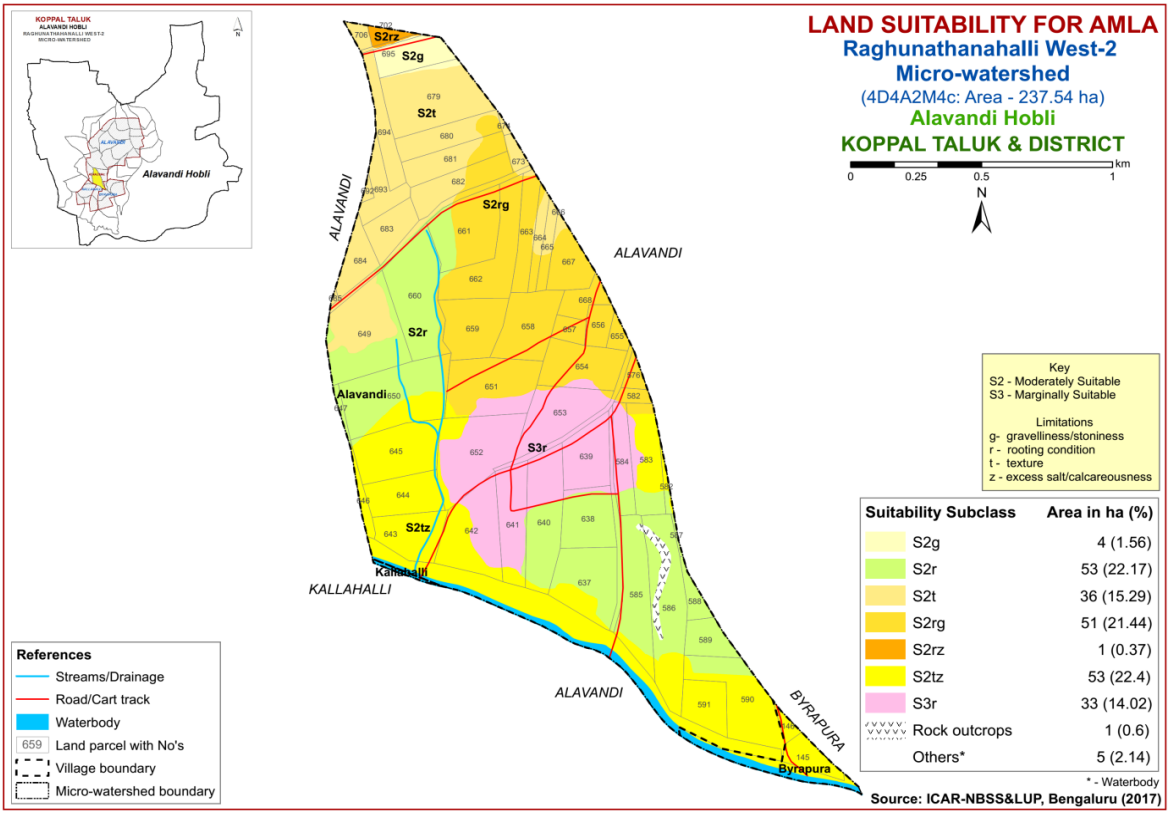


Fig. 7.23 Land Suitability map of Amla

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 (Table 7.25) for growing tamarind 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.

An area of about 89 ha (38%) is moderately suitable (Class S2) with minor limitations of rooting depth, gravelliness, texture and calcareousness and occur in the southern, northern and southwestern part of the microwatershed. Marginally suitable (Class S3) lands cover a very small area of 4 ha (2%) and occur in the northern part of the microwatershed. They have moderate limitations of gravelliness. Major area of about 138 ha (58%) is currently not suitable (Class N1) for growing tamarind and are distributed in the major part of the microwatershed. They have severe limitations of rooting depth, gravelliness and calcareousness.

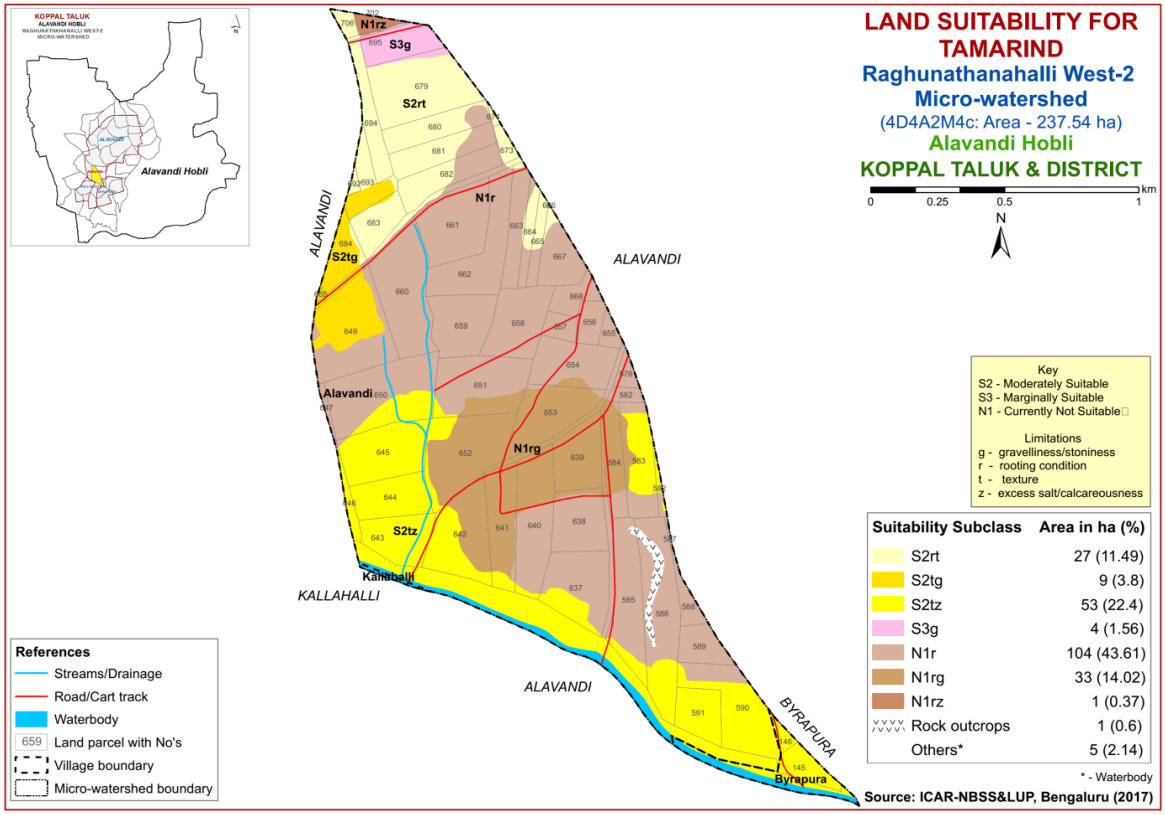


Fig. 7.24 Land Suitability map of Tamarind

7.25 Land Suitability for Marigold (*Tagetes erecta*)

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

Major area of about 194 ha (82%) is moderately suitable (Class S2) with minor limitations of rooting depth, gravelliness, texture and calcareousness and occur in all parts of the microwatershed. Marginally suitable (Class S3) lands cover an area of 37 ha (16%) and occur in the central part of the microwatershed. They have moderate limitations of rooting depth and gravelliness and are distributed in the central and northern part of the microwatershed.

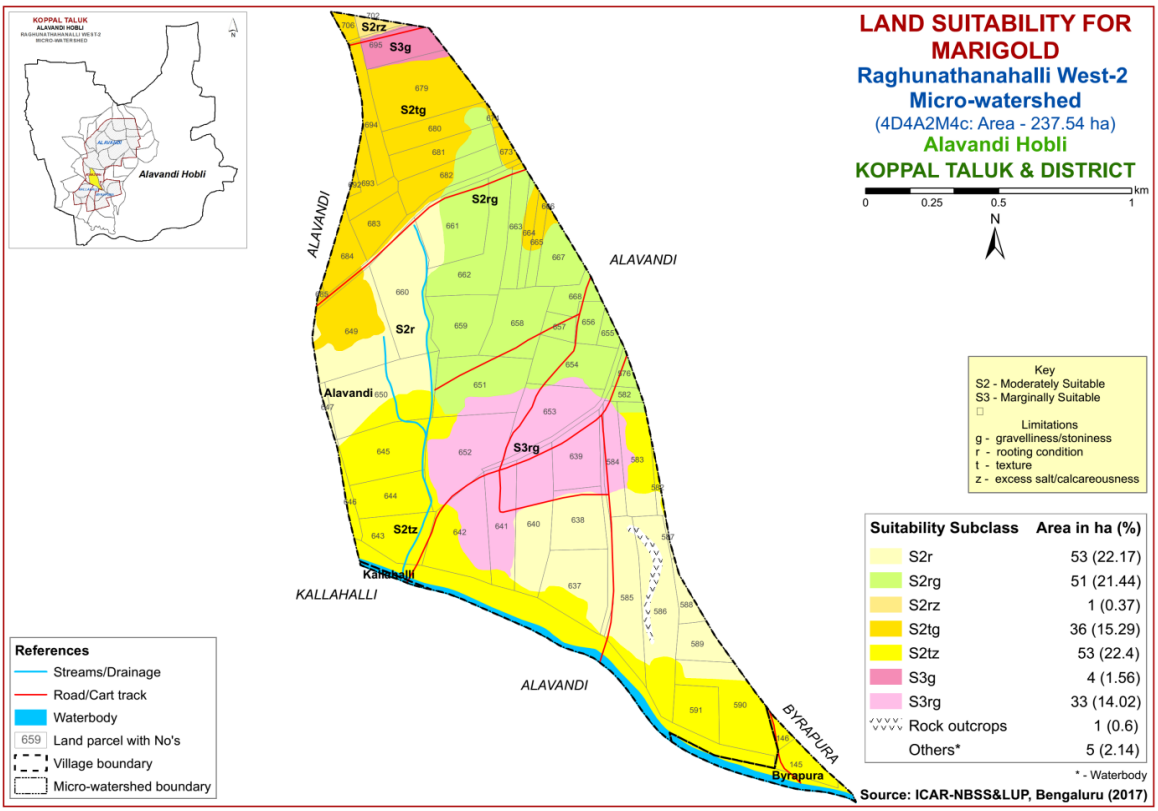


Fig. 7.25 Land Suitability map of Marigold

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

Major area of about 194 ha (82%) is moderately suitable (Class S2) with minor limitations of rooting depth, gravelliness, texture and calcareousness and occur in all parts of the microwatershed. Marginally suitable (Class S3) lands cover an area of 37 ha (16%) and occur in the central part of the microwatershed. They have moderate limitations of rooting depth and gravelliness and are distributed in the central and northern part of the microwatershed.

.

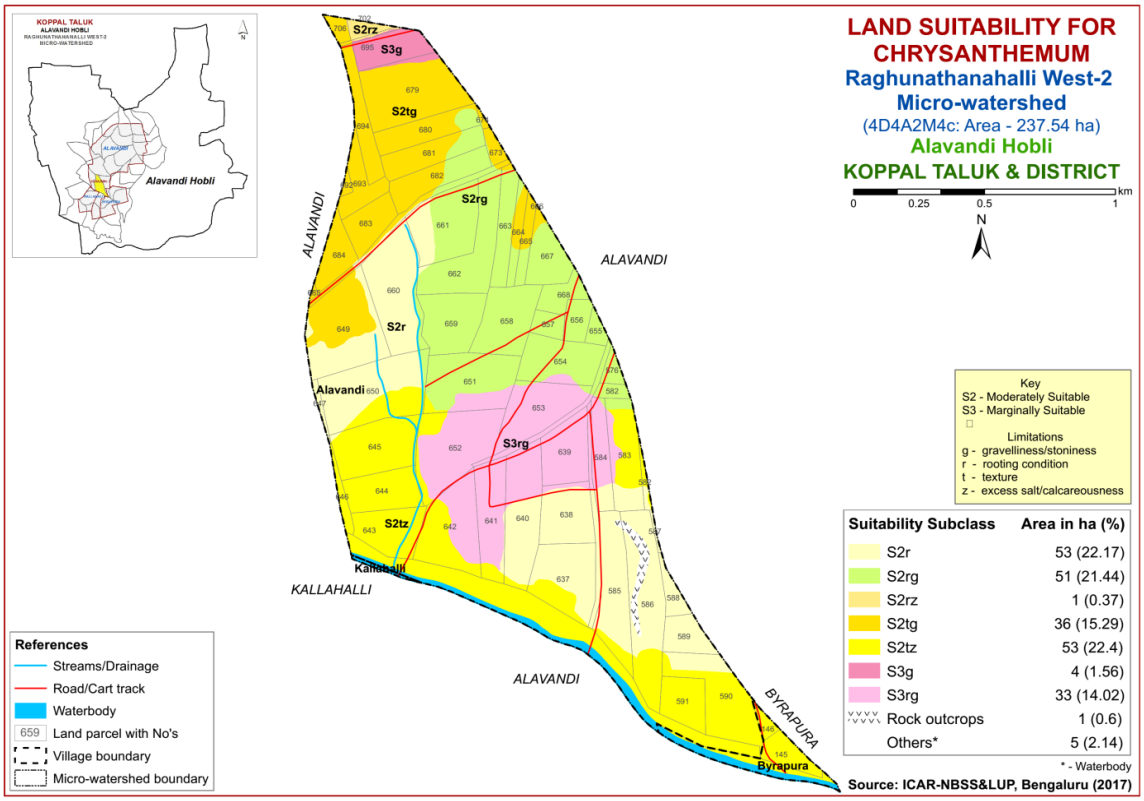


Fig. 7.26 Land Suitability map of Chrysanthemum

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

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.28) 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.

An area of about 105 ha (44) is moderately suitable (Class S2) for growing jasmine and occur in the eastern and western part of the microwatershed. They have minor limitations of calcareousness, gravelliness and rooting depth and major area of about 126 ha (53%) is marginally suitable (Class S3) for growing jasmine and occur in all parts of the microwatershed. They have moderate limitations of rooting depth, gravelliness, texture and calcareousness.

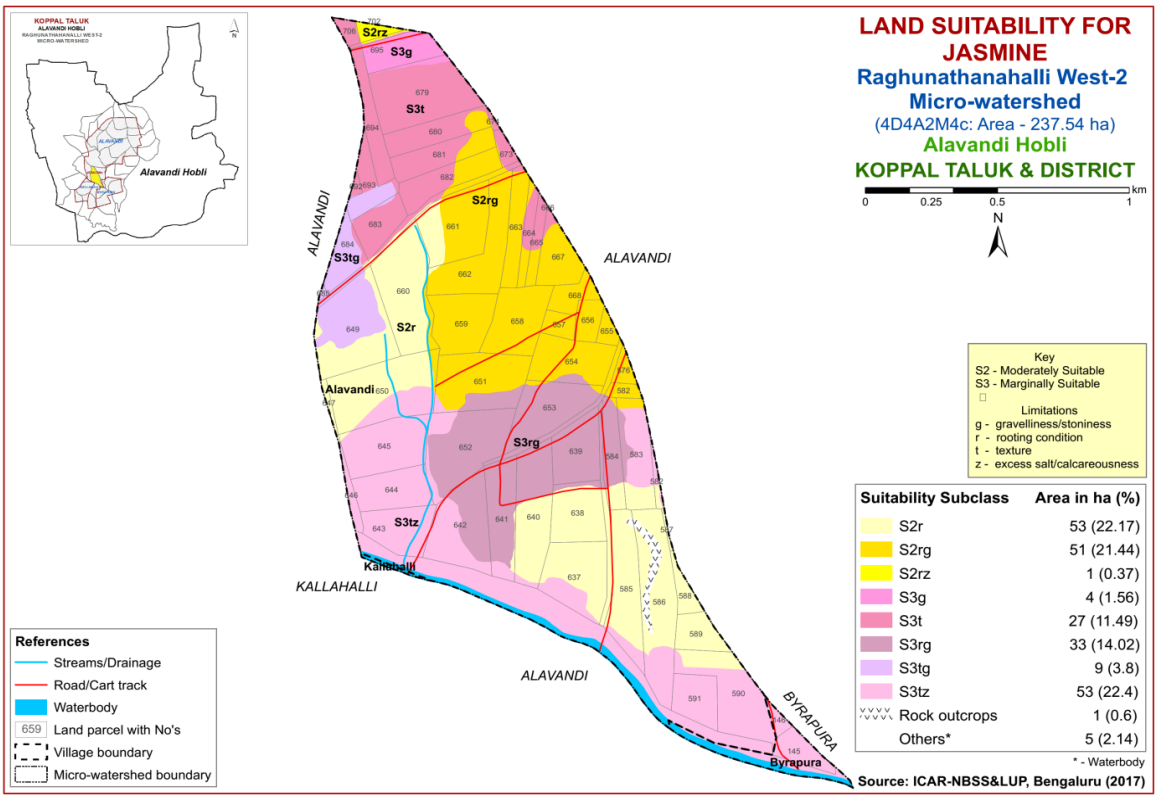


Fig. 7.27 Land Suitability map of Jasmine

7. 28 Land Suitability for Crossandra *(Crossandra infundibuliformis.)*

Crossandra is one of the most important flower crop grown in an all the districts of the state. The crop requirements (Table 7.29) for growing crossandra were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

An area of about 140 ha (59%) is moderately suitable (Class S2) for growing crossandra and occur in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness and texture. An area of about 91 ha (38%) is marginally suitable (Class S3) for growing crossandra and occur in the northern and southern part of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness and calcareousness.

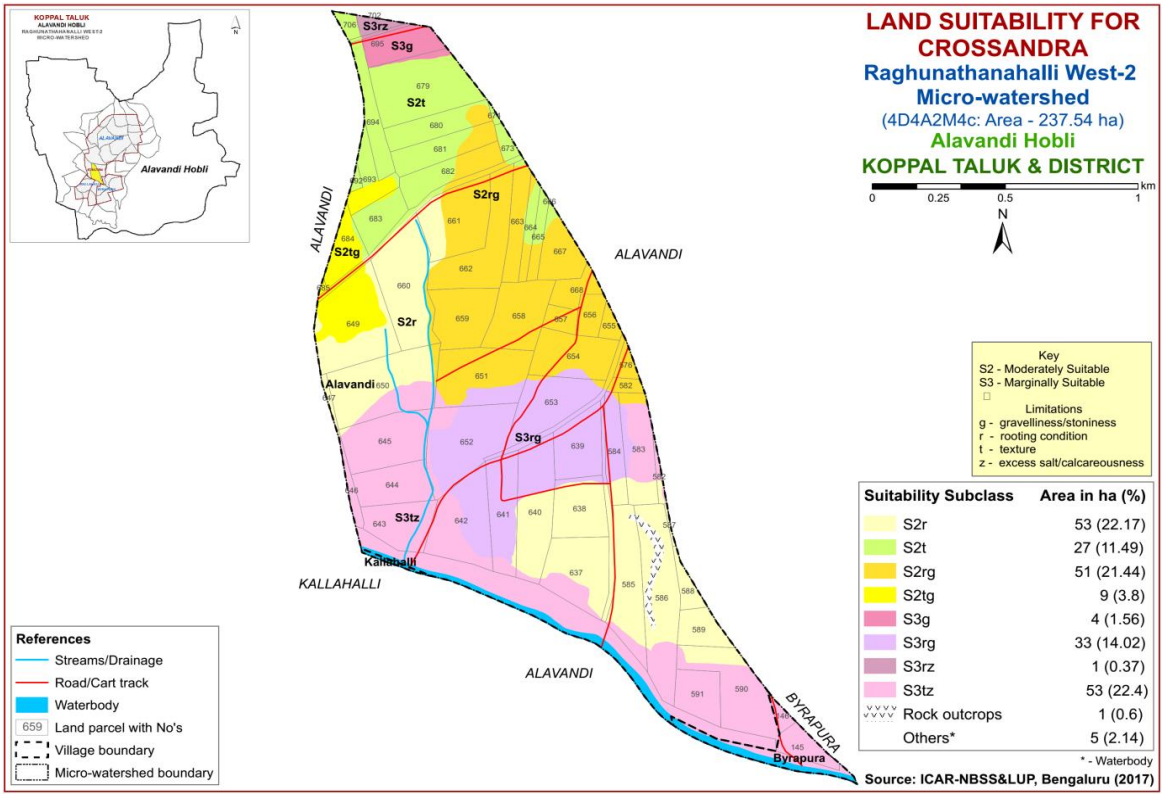


Fig. 7.28 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Raghunathanahalli West-2 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p+)kg-1]	BS (%)
					Surface	Subsurface	Surface	Subsurface								
KGPcB1g1	662	<90	WD	25-50	sl	scl-sc	15-35	15-35	<50	1-3	Slight					
KTPcB1g1	662	<90	WD	50-75	sl	sc	15-35	15-35	51-100	1-3	Slight	6.42	0.07	0.05	4.41	100.00
KTPiB1	662	<90	WD	50-75	sc	sc	-	15-35	51-100	1-3	Slight	6.42	0.07	0.05	4.41	100.00
MKHhB1	662	<90	WD	50-75	scl	scl	-	>35	<50	1-3	Slight	7.38	0.09	1.49	14.89	93
MKHhB1g1	662	<90	WD	50-75	scl	scl	15-35	>35	<50	1-3	Slight	7.38	0.09	1.49	14.89	93
MKHhB1g2	662	<90	WD	50-75	scl	scl	35-60	>35	<50	1-3	Slight	7.38	0.09	1.49	14.89	93
BDGiB1g2	662	<90	WD	75-100	sc	c	35-60	>35	51-100	1-3	Slight	6.24	0.06	0.35	3.76	52.56
RNKmB2g1	662	<90	MWD	50-75	c	c	15-35	<15	101-150	1-3	Moderate	8.86	0.48	16.94	37.0	8.86
HDLmA1g1	662	<90	MWD	100-150	c	c	15-35	-	>200	0-1	Slight	9.06	0.37	12.72	62.33	-
HDLmB1g1	662	<90	MWD	100-150	c	c	15-35	-	>200	1-3	Slight	9.06	0.37	12.72	62.33	-
MLRhB1g1	662	<90	MWD	>150	scl	c	15-35	10-20	>200	1-3	Slight	9.19	0.3	13.4	42.0	-
MLRmB2	662	<90	MWD	>150	c	c	-	10-20	>200	1-3	Moderate	9.19	0.3	13.4	42.0	-
AWDmA1	662	<90	MWD	>150	c	c	-	<15	>200	0-1	Slight	8.10	0.37	3.05	51.30	100.00
AWDmB2	662	<90	MWD	>150	c	c	-	<15	>200	1-3	Moderate	8.10	0.37	3.05	51.30	100.00
BDRmA1g1	662	<90	MWD	>150	c	c	15-35	<15	>200	0-1	slight	8.73	0.20	10.93	40.56	-
BDRmB1g1	662	<90	MWD	>150	c	c	15-35	<15	>200	1-3	Slight	8.73	0.20	10.93	40.56	-

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

Table 7.2 Land suitability criteria for Sorghum

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

Table 7.3 Land suitability criteria for Maize

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

Table 7.4 Land suitability criteria for Bajra

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

Table 7.5 Land suitability criteria for Groundnut

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

Table 7.6 Land suitability criteria for Sunflower

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

Table 7.7 Land suitability criteria for Cotton

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

Table 7.8 Land suitability criteria for Red gram

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

Table 7.9 Land suitability criteria for Bengal gram

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

Table 7.10 Land suitability criteria for Chilli

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

Table 7.11 Land suitability criteria for Tomato

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

Table 7.12 Land suitability criteria for Drumstick

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

Table 7.13 Land suitability criteria for Mulberry

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

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

Table 7.14 Land suitability criteria for Mango

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

Table 7.15 Land suitability criteria for Sapota

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

Table 7.16 Land suitability criteria for Pomegranate

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

Table 7.17 Land suitability criteria for Guava

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

Table 7.18 Land suitability criteria for Jackfruit

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

Table 7.19 Land suitability criteria for Jamun

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

Table 7.20 Land suitability criteria for Musambi

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

Table 7.21 Land suitability criteria for Lime

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

Table 7.22 Land suitability criteria for Cashew

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

Table 7.23 Land suitability criteria for Custard apple

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

Table 7.24 Land suitability criteria for Amla

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

Table 7.25 Land suitability criteria for Tamarind

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

Table 7.26 Land suitability criteria for Marigold

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

Table 7.27 Land suitability criteria for Chrysanthemum

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

Table 7.28 Land suitability criteria for Jasmine (irrigated)

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

7.29 Land suitability criteria for Crossandra

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

7.29 Land management units (LMUs)

The 17 soil map units identified in Raghunathanahalli West-2 microwatershed have been grouped into 6 Land management units (LMUs) 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 unit map (Fig.7.25) 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.

LMUs	Mapping unit	Soil and site characteristics
1	379. HDLmA1g1 381. HDLmB1g1 409.MLRhB1g1 418. MLRmB2 421. AWDmA1 424. AWDmB2 429. BDRmA1g1 431. BDRmB1g1	Deep to very deep, black calcareous clay soils with slopes of 0-3%, gravelly (15-35%)
2	193.BDGiB1g2	Moderately deep, red gravelly clay soils with slopes of 1-3%, slight erosion, very gravelly (35-60%)
3	337. RNKmB2g1	Moderately shallow, black calcareous clay soils with slopes of 1-3%, moderate erosion and gravelly (15-35%)
4	81.MKHhB1 82.MKHhB1g1 83.MKHhB1g2	Moderately shallow, red gravelly loamy soils with slopes of 1-3%, slight erosion and gravelly to very gravelly (15-60%)
5	71.KTPcB1g1 73.KTPiB1	Moderately shallow, red gravelly sandy clay soils with slopes of 1-3% and gravelly (15-35%)
6	14.KGPcB1g1	Shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-3%, slight erosion, and gravelly (15-35%)

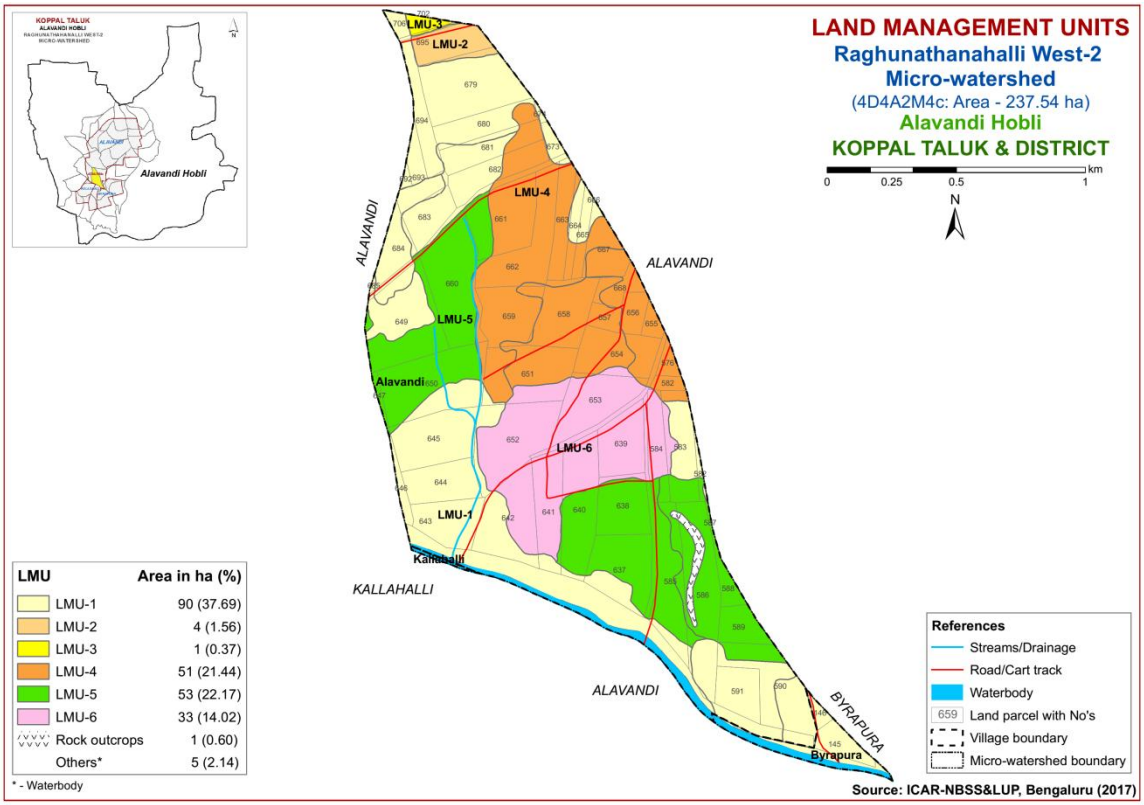


Fig 7.29 Land management units map of Raghunathanahalli West-2 microwatershed

7.30 Proposed Crop Plan for Raghunathanahalli West-2 Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the 6 identified LMUs 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 7.30 Proposed Crop Plan for Raghunathanahalli West-2 Microwatershed

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	379. HDLmA1g1 381. HDLmB1g1 409.MLRhB1g1 418. MLRmB2 421. AWDmA1 424. AWDmB2 429. BDRmA1g1 431. BDRmB1g1 (Deep to very deep, black calcareous clay soils)	**Alavandi:**583,590,591,643,644 ,645,646,664,665,666,673,674, 679,680,681,682,683,684,685,692, 693,694,706 **Byrapura:** 145,146	Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables:** Drumstick, Bhendi, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	193.BDGiB1g2 (Moderately deep, red gravelly clay soils)	**Alavandi:** 695	Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops:** Musambi, Lime, Jamun, Jackfruit Amla, Custard apple **Vegetables:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
3	337. RNKmB2g1 (Moderately shallow, black calcareous clay soils)	**Alavandi:** 702	Sorghum, Bajra, Bengal gram, Linseed, Safflower, Coriander	**Fruit crops:** Amla, Custard apple **Flowers:** Marigold, Jasmine Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
4	81.MKHhB1 82.MKHhB1g1 83.MKHhB1g2 (Moderately shallow, gravelly red loamy soils)	**Alavandi:**576,582,651,654,655,656, 657,658,659,661,662,663,667,668	Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Cashew, Custard apple	Dripirrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
5	71.KTPcB1g1 73.KTPiB1 (Moderately	**Alavandi:** 585,586,587,588,589,637, 638,640,647,649, 650,660	Maize, Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Custard apple **Flowers:** Marigold,	Drip irrigation, mulching, suitable soil and water conservation practices

	shallow, red gravelly sandy clay soils)			Chrysanthemum **Vegetables:** Drumstick	(Crescent Bunding with Catch Pit etc)
6	14.KGPcB1g1 (Shallow, red gravelly sandy clay to sandy clay loam soils)	**Alavandi:** 584,639,641,642,652, 653	Horse gram, 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 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 characterististics 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 Raghunathanahalli West-2 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Kethanapura (KTP) 53 ha (22%), Mukhadahalli (MKH) 50 ha (21%) and other series in small area.
- As per land capability classification, 109 ha (49%) area in the microwatershed falls under arable land category (Class II) with moderate limitations of soil and erosion, 122 ha (51%) area is under moderately good lands (Class III) with severe limitations of soil and erosion.

- ❖ On the basis of soil reaction, major area of 194 ha (81%) is under slightly alkaline (pH 7.3 - >9.0) to very strongly alkaline (pH >9.0) in reaction and neutral (6.5-7.3) in about 38 ha (16%).

Soil Health Management

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

Alkaline soils

(Slightly alkaline to very strongly alkaline soils cover major area of 194 ha in the microwatershed.

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers (Azospirullum, Azatobacter, Rhizobium).
3. Application of 25% extra N and P (125 % RDN&P).
4. Application of ZnSO4 – 12.5 kg/ha (once in three years).
5. Application of Boron – 5 kg/ha (once in three years).

Neutral soils

Neutral soils occur in about 38 ha area.

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. About 42 ha (18%) area is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

Any large scale implementation of soil health management requires that supporting information is made available widely, particularly through channels familiar to farmers and extension workers. Given the very high priority attached to soil health especially by the Central Government on issuing Soil-Health Cards to all the farmers,

media outlets like Regional, State and National Newspapers, Radio and Dooradarshan programs in local languages but also modern information and communication technologies such as Cellular phones and the Internet, which can be much more effective in reaching the younger farmers.

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning 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 Raghunathanahalli West-2 Microwatershed.
- **Organic Carbon:** The OC content is medium (0.5-0.75%) in an area of about 140 ha (<59%). These areas needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping and high (>0.75%) in 91 ha (38%) area.

- **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 140 ha 59% area where OC is medium (0.5-0.75%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Major area of 136 ha (57%) is low (<23 kg/ha) in available phosphorus and medium (23-57 kg/ha) in 95 ha (40%) area. Hence for all crops, 25% additional P-needs to be applied
- **Available Potassium:** Available potassium is high in an area of 181 ha (76%) and medium (145-337 kg/ha) in area of 50 ha (21%) in the microwatershed. For all crops, where P is medium 25 % more potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 62 ha (26%) area and medium in an area of about 99 ha (41%) 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. High (>20 ppm) in 70 ha (30%) area.
- **Available Boron:** An area of about 131 ha (55%) is low (<0.5 ppm) in available boron and an area of 94 ha (39%) is medium (05 -1.0 ppm) in available boron content. These areas need to be applied with sodium borate @ 10kg/ha as a soil application or 0.2% borax as foliar spray to correct the deficiency. High (>1.0 ppm) in 6 ha (3%) area.
- **Available Iron:** It is deficient (<4.5 ppm) in 171 ha (72%) area. For deficient areas, iron sulphate @ 25 kg/ha needs to be applied for 2-3 years to correct the deficiency and sufficient (>4.5 ppm) in 60 ha (25%).
- **Available Zinc:** It is deficient (<0.6 ppm) in 108 ha (45%) area. For these areas, application of zinc sulphate @ 25kg/ha is to be recommended. Sufficient (>0.6 ppm) in 123 ha (52%) area.
- **Soil Alkalinity:** Major area of 194 ha (81%) in the microwatershed has soils that are slightly alkaline to very strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

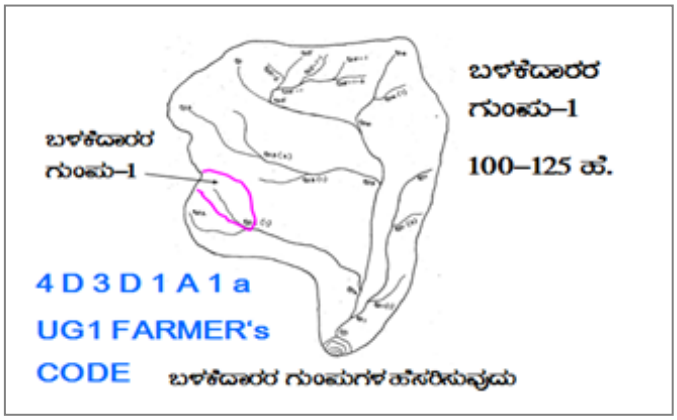
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase 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 Raghunathanahalli West-2 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 needs 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.

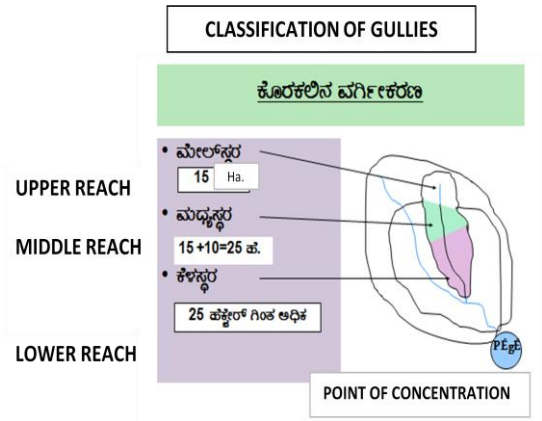
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

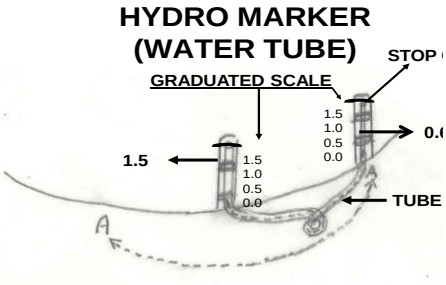
9.1.1 Arable Land Treatment

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 (bg0 .....b= loamy sand, g0 = <15% gravel). The recommended sections for different soils are given below.

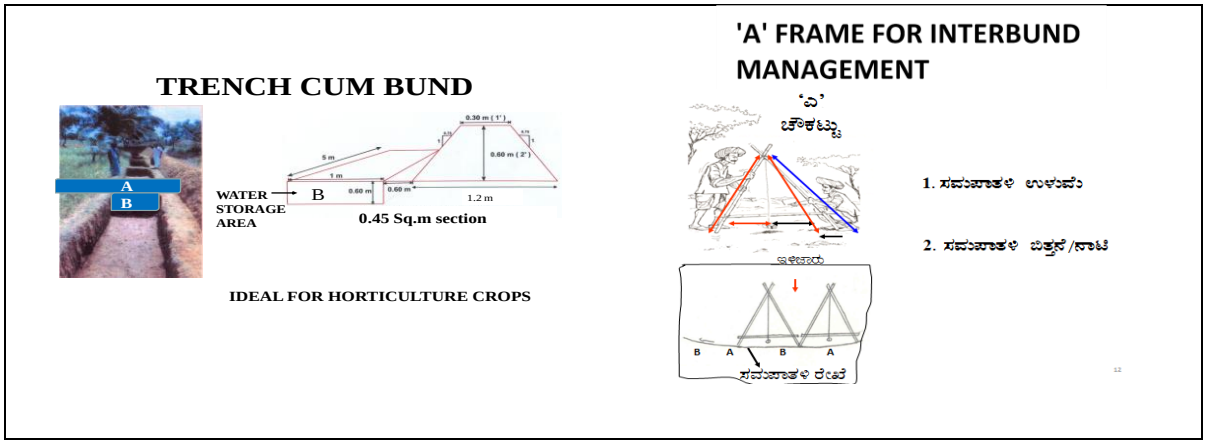
Recommended Bund Section

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
m2	m	m3	L(m)	W(m)	D(m)	Quantity (m3)	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 Bund.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. About 414 ha (94%) area is recommended for graded bunding and 17 ha (4%) area is strengthening of existing bunds/bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

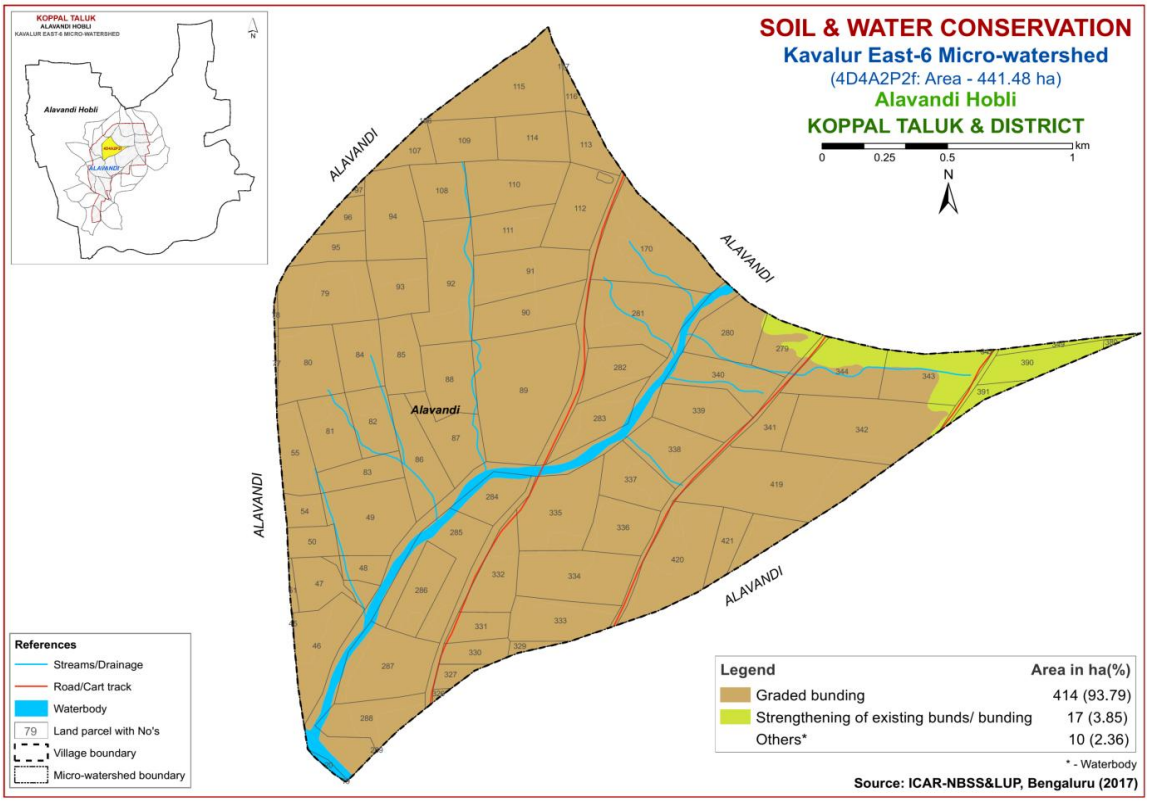


Fig. 9.1 Soil and Water Conservation Plan map of Raghunathanahalli West-2 Microwatershed

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; Research Gap and future needs. Fert. News 48 (4); 9-20.
5. Naidu, L.G.K., Ramamurthy, V., Challa, O., Hegde, R. and Krishnan, P. (2006) Manual Soil Site Suitability Criteria for Major Crops, NBSS Publ. No. 129, NBSS &LUP, Nagpur, 118 pp.
6. Natarajan, A. and Dipak Sarkar (2010) Field Guide for Soil Survey, National Bureau of Soil Survey and Land Use Planning (ICAR), Nagpur, India.
7. Natarajan, A., Rajendra Hegde, Raj, J.N. and Shivananda Murthy, H.G. (2015) Implementation Manual for Sujala-III Project, Watershed Development Department, Bengaluru, Karnataka.
8. Sarma, V.A.K., Krishnan, P. and Budihal, S.L. (1987) Laboratory Manual, Tech. Bull. 23, NBSS &LUP, Nagpur.
9. Sehgal, J.L. (1990) Soil Resource Mapping of Different States of India; Why and How?, National Bureau of Soil Survey and Land Use Planning, Nagpur, 49 pp.
10. Shivaprasad, C.R., R.S. Reddy, J. Sehgal and M. Velayuthum (1998) Soils of Karnataka for Optimizing 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

Raghunathanahalli West2 (2M4c)

Soil Phase Information

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Alavandi	576	0.78	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	582	1.19	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Bajra (Cf+Bj)	Not Available	IIIs	Trench cum bunding
Alavandi	583	4.86	MLRhB1g1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	1 Borewell	IIs	Graded bunding
Alavandi	584	2.85	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Pomegranate (Pg)	3 Borewell	IIIs	Trench cum bunding
Alavandi	585	6.12	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	1 Borewell	IIs	Trench cum bunding
Alavandi	586	8.94	KTPcB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Currentfallow+Groundnut+Bajra (Cf+Gn+Bj)	Not Available	IIs	Trench cum bunding
Alavandi	587	0.16	KTPcB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Trench cum bunding
Alavandi	588	1.2	KTPcB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut (Bj+Gn)	Not Available	IIs	Trench cum bunding
Alavandi	589	2.33	KTPcB1g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	Trench cum bunding
Alavandi	590	6.84	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bajra+Currentfallow+Sugarcane (Bj+Cf+Sc)	Not Available	IIs	Field bunds
Alavandi	591	3.06	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Fallow land (Fl)	Not Available	IIs	Field bunds
Alavandi	637	6.26	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+ Sugarcane (Cf+Sc)	1 Borewell	IIs	Trench cum bunding
Alavandi	638	4.57	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+ Sugarcane (Cf+Sc)	Not Available	IIs	Trench cum bunding
Alavandi	639	4.27	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	640	6.93	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Pomegranate+Groundnut+ Redgram (Pg+Gn+Rg)	1 Borewell	IIs	Trench cum bunding
Alavandi	641	4.82	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Bajra+Current fallow (Gn+Bj+Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	642	6.83	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow+ Sparse vegetation(Bj+Cf+Sv)	1 Borewell	IIIs	Trench cum bunding
Alavandi	643	4.13	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	2 Borewell	IIIe	Graded bunding
Alavandi	644	4.08	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Sunflower (Sc+Sf)	Not Available	IIIe	Graded bunding
Alavandi	645	6.16	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	1 Borewell	IIIe	Graded bunding
Alavandi	646	0.87	AWDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Maize+Mango +Sapota (Sc+Mz+Mn+Sp)	Not Available	IIIe	Graded bunding
Alavandi	647	0.37	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Fallow land (Mz+Fl)	Not Available	IIs	Trench cum bunding
Alavandi	649	9.03	KTPiB1	LMU-5	Moderately shallow	Sandy clay	Non gravelly	Low (51-100	Very gently	Slight	Current	Not	IIs	Trench cum

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
					(50-75 cm)		(<15%)	mm/m)	sloping (1-3%)		fallow+Bajra+Maize (Cf+Bj+Mz)	Available		bunding
Alavandi	650	9.26	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current fallow (Mz+Cf)	Not Available	IIs	Trench cum bunding
Alavandi	651	7.37	MKHhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIIs	Trench cum bunding
Alavandi	652	8.19	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Maize+Current fallow (Bj+Mz+Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	653	5.53	KGPcB1g1	LMU-6	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	2 Borewell	IIIs	Trench cum bunding
Alavandi	654	5.08	MKHhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Bajra (Gn+Bj)	Not Available	IIIs	Trench cum bunding
Alavandi	655	0.76	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut (Gn)	Not Available	IIIs	Trench cum bunding
Alavandi	656	1.52	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut (Gn)	Not Available	IIIs	Trench cum bunding
Alavandi	657	1.15	MKHhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	658	5.26	MKHhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Redgram (Bj+Rg)	Not Available	IIIs	Trench cum bunding
Alavandi	659	4.97	MKHhB1g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Bajra (Gn+Bj)	Not Available	IIIes	Trench cum bunding
Alavandi	660	8.02	KTPiB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Sparse vegetation (Sv)	Not Available	IIs	Trench cum bunding
Alavandi	661	6.44	MKHhB1g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow+ Groundnut (Bj+Cf+Gn)	Not Available	IIIes	Trench cum bunding
Alavandi	662	6.35	MKHhB1g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Groundnut (Bj+Gn)	Not Available	IIIes	Trench cum bunding
Alavandi	663	2.86	MKHhB1g2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Alavandi	664	1.44	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bajra (Bj)	Not Available	IIs	Field bunds
Alavandi	665	1.32	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Alavandi	666	0	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Current fallow (Mz+Cf)	Not Available	IIs	Field bunds
Alavandi	667	3.3	MKHhB1	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+Current fallow (Mz+Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	668	1.81	MKHhB1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Pomegranate+Current fallow (Pg+Cf)	Not Available	IIIs	Trench cum bunding
Alavandi	673	0.73	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow+Groundnut (Cf+Gn)	Not Available	IIs	Field bunds
Alavandi	674	0.17	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	679	8.45	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	680	3.65	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Alavandi	681	3.72	HDLmB1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	682	3.81	HDLmB1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	683	2.74	HDLmB1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Current fallow (Rg+Cf)	Not Available	IIs	Graded bunding
Alavandi	684	2.53	BDRmB1g1	LMU-1	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	685	0.1	BDRmA1g1	LMU-1	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	692	0.26	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	693	2.53	BDRmB1g1	LMU-1	Very deep (>150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	694	2.86	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	695	3.2	BDGiB1g2	LMU-2	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Currentfallow+Horsegram+Bajra (Cf+Hg+Bj)	Not Available	IIIes	Trench cum bunding
Alavandi	702	0.77	RNKmB2g1	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Subabulu+Sunflower (Su+Sf)	Not Available	IIes	Graded bunding
Alavandi	706	0.67	HDLmA1g1	LMU-1	Deep (100-150 cm)	Clay	Gravelly (15-35%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Byrapura	145	1.99	MLRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+ Greengram (Cf+Gg)	2 Borewell	IIes	Graded bunding
Byrapura	146	0.6	MLRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land +Bajra (Fl+Bj)	Not Available	IIes	Graded bunding
Kallahalli	RIVER	0.29	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Availavble	Not Available	Others	Others

Appendix II

Raghunathanahalli West2 (2M4c)

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	576	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	582	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	583	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	584	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	585	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	586	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	587	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	588	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	589	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	590	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	591	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)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	637	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	638	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	639	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	640	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	641	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	642	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	643	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	644	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	645	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	646	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	647	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	649	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	650	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)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	651	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	652	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	653	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	654	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	655	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	656	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	657	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	658	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	659	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	660	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	661	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	662	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	663	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	664	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	665	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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	666	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	667	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	668	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)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	673	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	674	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)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	679	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	680	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	681	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	682	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Sufficient (> 0.6 ppm)
Alavandi	683	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	684	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	685	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	692	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	693	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	694	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	695	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	702	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Alavandi	706	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 2.0 ppm)	Deficient (< 0.6 ppm)
Byrapura	145	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Byrapura	146	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 (> 2.0 ppm)	Deficient (< 0.6 ppm)
Kallahalli	RIVER	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Appendix IV

Raghunathanahalli West2 (2M4c)

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Alavandi	576	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
Alavandi	582	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
Alavandi	583	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	584	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	585	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
Alavandi	586	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
Alavandi	587	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
Alavandi	588	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
Alavandi	589	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
Alavandi	590	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Alavandi	591	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S3tz
Alavandi	637	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
Alavandi	638	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
Alavandi	639	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	640	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
Alavandi	641	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	642	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	643	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	644	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	645	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	646	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	647	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
Alavandi	649	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
Alavandi	650	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
Alavandi	651	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
Alavandi	652	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	653	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1r	N1r
Alavandi	654	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
Alavandi	655	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
Alavandi	656	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

Village	Survey Number	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Alavandi	657	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
Alavandi	658	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
Alavandi	659	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
Alavandi	660	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
Alavandi	661	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
Alavandi	662	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
Alavandi	663	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
Alavandi	664	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	665	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	666	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	667	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
Alavandi	668	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
Alavandi	673	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	674	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	679	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	680	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	681	S3t	S3t	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3t	S3t	S2t	S2tg	S2tg
Alavandi	682	S3t	S3t	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3t	S3t	S2t	S2tg	S2tg
Alavandi	683	S3t	S3t	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3t	S3t	S2t	S2tg	S2tg
Alavandi	684	S3tg	S3tg	S3tg	S2g	S3t	S2g	S2tg	S2g	S2g	S2g	S2tg	S2t	S3t	S2g	N1t	S2t	S2g	S3tg	S3tg	S3tg	S2tg	S2tg	S2tg	S3tg	S3tg	S2tg	S2tg	S3tg
Alavandi	685	S3tg	S3tg	S3tg	S2g	S3t	S2g	S2tg	S2g	S2g	S2g	S2tg	S2t	S3t	S2g	N1t	S2t	S2g	S3tg	S3tg	S3tg	S2tg	S2tg	S2tg	S3tg	S3tg	S2tg	S2tg	S3t
Alavandi	692	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	693	S3tg	S3tg	S3tg	S2g	S3t	S2g	S2tg	S2g	S2g	S2g	S2tg	S2t	S3t	S2g	N1t	S2t	S2g	S3tg	S3tg	S3tg	S2tg	S2tg	S2tg	S3tg	S3tg	S2tg	S2tg	S3tg
Alavandi	694	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Alavandi	695	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Alavandi	702	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	706	S3t	S3tg	S3t	S2g	S3t	S1	S2rt	S2g	S1	S2g	S2t	S2t	S3t	S1	N1t	S2rt	S2g	S3t	S3t	S3t	S2tg	S2tg	S2tg	S3tg	S3t	S2t	S2tg	S2tg
Byrapura	145	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Byrapura	146	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Kallahalli	RIVER	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

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 105 (58.99%) men and 73 (41.01%) women among the sampled households.*
- *The average family size of marginal farmers' was 5.2, small farmers' was 5.15, semi medium farmers' was 4.6, medium farmers' was 10 and large farmers' was 3.*
- *The data indicated that, 23 (12.92%) people were in 0-15 years of age, 75 (42.13%) were in 16-35 years of age, 64 (35.96%) were in 36-60 years of age and 16 (8.99%) were above 61 years*
- *The results indicated that Raghunathanahalli West-2 had 22.47 per cent illiterates, 34.83 per cent of them had primary school education, 5.62 per cent of them had middle school education, 19.10 per cent of them had high school education, 4.49 per cent of them had PUC education, 1.69 per cent had diploma and masters, 0.56 per cent did ITI and 5.06 per cent of them had degree education.*
- *The results indicate that, 94.29 per cent of household heads were practicing agriculture, and 2.86 per cent of the household heads were agricultural laborers and private service.*
- *The results indicate that agriculture was the major occupation for 66.29 per cent of the household members, 8.99 per cent were agricultural laborers, 1.12 per cent were in general labour and government service, 0.56 per cent were in artisans, trade and business and housewives, 3.93 per cent were in private service, 15.17 per cent were student and 1.69 per cent were children.*
- *The results show that, 100 per cent of the population in the micro watershed has not participated in any local institutions.*
- *The results indicate that 5.71 per cent of the households possess thatched house, 71.43 per cent of the households possess katcha house and 11.43 per cent of them possess pucca/RCC house and semi pacca house.*
- *The results show that 77.14 per cent of the households possess TV, 2.86 per cent of them possess DVD/VCD player, refrigerator, land line and computer/ laptop, 68.57 per cent of them possess mixer/grinder, 57.14 per cent of them possess bicycle, 51.43 per cent of them possess motor cycle, 5.71 per cent of them possess auto and 97.14 per cent of the households possess mobile phones.*
- *The results show that the average value of television was Rs. 3151, DVD/VCD player was Rs.1300, mixer grinder was Rs. 1383, refrigerator was Rs.12000, bicycle was Rs.1033, motor cycle was Rs. 28,485, auto was Rs. 21,000, land line was Rs. 1,200, mobile phone was Rs. 802 and computer/laptop was Rs. 30,000.*
- *About 14.29 per cent of the households possess bullock cart, plough and tractor, 2.86 per cent possess seed/ fertilizer drill, 28.57 per cent of them possess sprayer,*

88.57 per cent of them possess weeder 11.43 per cent possess chaff cutter and 5.71 per cent possess earth remover/ duster.

- *The results show that the average value of bullock cart was Rs. 12,800, plough was Rs. 2,360, seed/ fertilizer drill was Rs. 35,000, tractor was Rs. 240,000, sprayer was Rs. 2,650, weeder was Rs.62, Chaff cutter was Rs. 1,650 and the average value of earth remover/ duster was Rs.10,000.*
- *The results indicate that, 5.71 per cent of the households possess bullocks, 20.00 per cent of the households possess local cow, 8.57 per cent possess buffalo and 2.86 per cent of the households possess goat.*
- *The results indicate that, average own labour men available in the micro watershed was 2.11, average own labour (women) available was 1.60, average hired labour (men) available was 11.11 and average hired labour (women) available was 10.26. The results indicate that, 888.57 per cent of the households opined that the hired labour was adequate and 11.43 per cent of the households opined that the hired labour was inadequate.*
- *The results indicate that, households of the Raghunathanahalli West-2 micro-watershed possess 82.57 ha (92.87%) of dry land and 6.34 ha (7.13%) of irrigated land. Marginal farmers possess 7.60 ha (100%) of dry land. Small farmers possess 17.50 ha (96.93%) of dry land and 0.55 ha (3.07%) of irrigated land. Semi medium farmers possess 22.67 ha (88.79%) of dry land and 2.86 ha (11.21%) of irrigated land. Medium farmers possess 2.92 ha (100%) of irrigated land. Large farmers possess 34.80 ha (100%) of dry land.*
- *The results indicate that, the average value of dry land was Rs. 108,954.57 and the average value of irrigated land was Rs. 378,544.07. In case of marginal famers, the average land value was Rs. 328,982.42 for dry land. In case of small famers, the average land value was Rs. 191,362.16 for dry land and Rs. 360,583.94 for irrigated land. In case of semi medium famers, the average land value was Rs. 121,251.34 for dry land and Rs. 489,108.92 for irrigated land. In case of medium farmers, the average land value was Rs. 273,684.22 for irrigated land. In case of large farmers it was Rs. 11,488.37 for dry land.*
- *The results indicate that, there were 1 functioning and 1 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 2.86 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 2.61 meters.*
- *The results indicate that semi medium farmers had an irrigated area of 2.49 ha respectively.*
- *The results indicate that, farmers have grown bajra (7.27 ha), bengal gram (12.96 ha), green gram (4.59 ha), groundnut (2.83 ha), maize (5.57 ha), navane (0.55 ha), red gram (2.43 ha), sorghum (11.91 ha) and sunflower (18.61 ha). Marginal*

farmers have grown bajra groundnut, red gram, sorghum and sunflower. While small farmers have grown bajra, Bengal gram, navane, sorghum, sunflower and maize. Semi medium farmers have grown bajra, Bengal gram, green gram, groundnut, maize, red gram, sorghum and sunflower. Medium farmers have grown sunflower and Bengal gram. Large farmers have grown Bengal gram and sorghum.

- *The results indicate that, the cropping intensity in Raghunathanahalli West-2 micro-watershed was found to be 75.10 per cent.*
- *The results indicate that, 34.29 per cent of the households have bank account and savings.*
- *The results indicate that, 34.29 per cent of the households have availed credit from different sources.*
- *The results indicate that, the total cost of cultivation for bajra was Rs. 20534.76. The gross income realized by the farmers was Rs. 24896.58. The net income from bajra cultivation was Rs. 4361.83. Thus the benefit cost ratio was found to be 1:1.21.*
- *The results indicate that, the total cost of cultivation for Bengal gram was Rs. 29001.41. The gross income realized by the farmers was Rs. 43669.40. The net income from Bengal gram cultivation was Rs. 14668.00. Thus the benefit cost ratio was found to be 1:1.51.*
- *The results indicate that, the total cost of cultivation for green gram was Rs. 17450.25. The gross income realized by the farmers was Rs. 30372.61. The net income from green gram cultivation was Rs. 12922.36. Thus the benefit cost ratio was found to be 1:1.74.*
- *The results indicate that, the total cost of cultivation for groundnut was Rs. 35453.60. The gross income realized by the farmers was Rs. 41303.89. The net income from groundnut cultivation was Rs. 5850.29. Thus the benefit cost ratio was found to be 1:1.17.*
- *The results indicate that, the total cost of cultivation for jowar was Rs. 18725.82. The gross income realized by the farmers was Rs. 27559.83. The net income from jowar cultivation was Rs. 8834.00. Thus the benefit cost ratio was found to be 1:1.47.*
- *The results indicate that, the total cost of cultivation for maize was Rs. 31548.18. The gross income realized by the farmers was Rs. 48720.69. The net income from maize cultivation was Rs. 17172.51. Thus the benefit cost ratio was found to be 1:1.54.*
- *The results indicate that, the total cost of cultivation for navane was Rs. 30370.30. The gross income realized by the farmers was Rs. 56251.09. The net income from navane cultivation was Rs. 25880.80. Thus the benefit cost ratio was found to be 1:1.85.*

- *The results indicate that, the total cost of cultivation for red gram was Rs. 20232.19. The gross income realized by the farmers was Rs. 28960.75. The net income from red gram cultivation was Rs. 8728.56. Thus the benefit cost ratio was found to be 1:1.43.*
- *The results indicate that, the total cost of cultivation for sorghum was Rs. 20948.98. The gross income realized by the farmers was Rs. 23650.01. The net income from sorghum cultivation was Rs. 2701.03. Thus the benefit cost ratio was found to be 1:1.13.*
- *The results indicate that, the total cost of cultivation for sunflower was Rs. 23157.86. The gross income realized by the farmers was Rs. 35766.20. The net income from sunflower cultivation was Rs. 12608.34. Thus the benefit cost ratio was found to be 1:1.54.*
- *The results indicate that, 14.29 per cent of the households opined that dry fodder was adequate and green fodder was adequate for 25.71 per cent of the households.*
- *The results indicate that the annual gross income for marginal farmers it was Rs. 98,350, for small farmers it was Rs. 92,320.77, for semi medium farmers it was Rs. 132,700, for medium farmers it was Rs. 488,000 and for large farmers it was Rs115,000.*
- *The results indicate that the average annual expenditure is Rs. 16,211.77. For marginal farmers it was Rs. 3,363.33, for small farmers it was Rs. 8,565.02, for semi medium farmers it was Rs. 152,433.33, for medium farmers it was Rs. 170,000 and for large farmers it was Rs. 100,000.*
- *The results indicate that, sampled households have grown 44 coconut trees in their field.*
- *The results indicate that, households have planted 6 yeak, 44 neem and 15 tamarind trees in their field.*
- *The results indicated that, bajra was sold to the extent of 96.3 per cent, Bengal gram, green gram, groundnut, jowar, maize, red gram and sunflower was sold to the extent 100 per cent, Navane was sold to the extent of 83.33 per cent and sorghum was sold to the extent of 98.25 per cent.*
- *The results indicated that, about 34.29 per cent of the farmers sold their produce to agent/traders, 80 per cent of the farmers sold their produce to local/village merchants and 20 per cent of them sold their produce through contract marketing arrangement.*
- *The results indicated that, 14 per cent of the households used cart and 120 per cent of the households used tractor as a mode of transportation for their agricultural produce.*
- *The results indicated that, 28.57 per cent of the households have experienced soil and water erosion problems in the farm.*

- *The results indicated that, 54.29 per cent have shown interest in soil test.*
- *The results indicated that, 74.29 per cent of the households used firewood and 28.57 per cent of the household used LPG as a source of fuel.*
- *The results indicated that, piped supply was the major source of drinking water for 48.57 per cent of the households, bore well was the source of drinking water for 40 per cent, open well and lake/tank was the major source of drinking water for 2.86 per cent of the households in micro watershed.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 34.29 per cent of the households possess sanitary toilet facility.*
- *The results indicated that, 2.86 per cent of the sampled households possessed APL, 88.57 per cent of the sampled households possessed BPL card and 8.57 per cent of the households did not possess PDS card.*
- *The results indicated that, 28.57 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 94.29 per cent of the households, pulses were adequate for 65.71 per cent, oilseeds were adequate for 34.29 per cent, vegetables were adequate for 68.57 per cent, milk was adequate for 62.86 per cent and meat were adequate for 2.86.*
- *The results indicated that, cereals were inadequate for 2.86 per cent of the households, pulses were inadequate for 31.43 per cent, oilseeds were inadequate for 45.71 per cent, vegetables were inadequate for 17.14 per cent, fruits were inadequate for 51.43 per cent, milk was inadequate for 31.43 per cent, eggs were inadequate for 65.71 per cent and meat was inadequate for 57.14 per cent of the households.*
- *The results indicated that, oilseeds were market surplus for 17.14 per cent of the households and vegetables was market surplus for 11.43 per cent of the households.*
- *The results indicated that, lower fertility status of the soil was the constraint experienced by 57.14 per cent of the households, wild animal menace on farm field (71.43%), frequent incidence of pest and diseases (88.57%), inadequacy of irrigation water (22.86%), high cost of fertilizers and plant protection chemicals (74.29%), high rate of interest on credit (62.86%), low price for the agricultural commodities (60%), lack of marketing facilities in the area (65.71%), inadequate extension services (2.86%), lack of transport for safe transport of the agricultural produce to the market (54.29%) , less rainfall (45.71%) and source of agri-technology information (22.86%)*

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. 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

Raghunathanahalli West-2 micro-watershed in Murlapura sub-watershed (Koppal taluk and district) is located in between $15^0$13’52.804’’ to 15^0 12’8.54” North latitudes and 75^0 59’7.069’’ to $75^0$57’59.838’’ East longitudes, covering an area of about 237.67 ha, bounded by Alavandi, Ragunathanahalli and Byrapura villages

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyse the data. About 35 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

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

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Raghunathanahalli West-2 micro-watershed is presented in Table 1 and it indicated that 34 farmers were sampled in Raghunathanahalli West-2 micro-watershed among them 10 (28.57%) were marginal farmers, 13 (37.14%) were small farmers, 10 (28.57%) were semi medium farmers and 1 (2.86%) were medium farmers and large farmers.

Table 1: Households sampled for socio economic survey in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	10	28.57	13	37.14	10	28.57	1	2.86	1	2.86	35	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Raghunathanahalli West-2 micro-watershed is presented in Table 2. The data indicated that there were 105 (58.99%) men and 73 (41.01%) women among the sampled households. The average family size of marginal farmers' was 5.2, small farmers' was 5.15, semi medium farmers' was 4.6, medium farmers' was 10 and large farmers' was 3.

Table 2: Population characteristics of Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (52)		SF (67)		SMF (46)		MDF (10)		LF (3)		All (178)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	29	55.77	39	58.21	29	63.04	6	60.00	2	66.67	105	58.99
2	Women	23	44.23	28	41.79	17	36.96	4	40.00	1	33.33	73	41.01
Total		52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00
Average		5.2		5.15		4.6		10		3		5.08	

Age wise classification of population: The age wise classification of household members in Raghunathanahalli West-2 micro-watershed is presented in Table 3. The data indicated that, 23 (12.92%) people were in 0-15 years of age, 75 (42.13%) were in 16-35 years of age, 64 (35.96%) were in 36-60 years of age and 16 (8.99%) were above 61 years of age.

Table 3: Age wise classification of household members in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (52)		SF (67)		SMF (46)		MDF (10)		LF (3)		All (178)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	11	21.15	8	11.94	4	8.70	0	0.00	0	0.00	23	12.92
2	16-35 years of age	19	36.54	29	43.28	19	41.30	7	70.00	1	33.33	75	42.13
3	36-60 years of age	15	28.85	29	43.28	16	34.78	2	20.00	2	66.67	64	35.96
4	> 61 years	7	13.46	1	1.49	7	15.22	1	10.00	0	0.00	16	8.99
Total		52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00

Education level of household members: Education level of household members in Raghunathanahalli West-2 micro-watershed is presented in Table 4. The results indicated that Raghunathanahalli West-2 had 22.47 per cent illiterates, 34.83 per cent of them had primary school education, 5.62 per cent of them had middle school education, 19.10 per cent of them had high school education, 4.49 per cent of them had PUC education, 1.69 per cent had diploma and masters, 0.56 per cent did ITI and 5.06 per cent of them had degree education.

Table 4. Education level of household members in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (52)		SF (67)		SMF (46)		MDF (10)		LF (3)		All (178)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	16	30.77	13	19.40	9	19.57	2	20.00	0	0.00	40	22.47
3	Primary School	15	28.85	26	38.81	14	30.43	6	60.00	1	33.33	62	34.83
4	Middle School	5	9.62	3	4.48	1	2.17	0	0.00	1	33.33	10	5.62
5	High School	7	13.46	19	28.36	7	15.22	1	10.00	0	0.00	34	19.10
6	PUC	1	1.92	5	7.46	1	2.17	0	0.00	1	33.33	8	4.49
7	Diploma	1	1.92	0	0.00	2	4.35	0	0.00	0	0.00	3	1.69
8	ITI	0	0.00	1	1.49	0	0.00	0	0.00	0	0.00	1	0.56
9	Degree	3	5.77	0	0.00	5	10.87	1	10.00	0	0.00	9	5.06
10	Masters	1	1.92	0	0.00	2	4.35	0	0.00	0	0.00	3	1.69
12	Others	3	5.77	0	0.00	5	10.87	0	0.00	0	0.00	8	4.49
Total		52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Raghunathanahalli West-2 micro-watershed is presented in Table 5. The results indicate that, 94.29 per cent of household heads were practicing agriculture, and 2.86 per cent of the household heads were agricultural labourers and private service.

Table 5: Occupation of household heads in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	9	90.00	12	92.31	10	100.00	1	100.00	1	100.00	33	94.29
2	Agricultural Labour	1	10.00	0	0.00	0	0.00	0	0.00	0	0.00	1	2.86
7	Private Service	0	0.00	1	7.69	0	0.00	0	0.00	0	0.00	1	2.86
Total		10	100.00	13	100.00	10	100.00	1	100.00	1	100.00	35	100.00

Occupation of the household members: The data regarding the occupation of the household members in Raghunathanahalli West-2 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 66.29 per cent of the household members, 8.99 per cent were agricultural labourers, 1.12 per cent were in general labour and government service, 0.56 per cent were in artisans, trade and business and housewives, 3.93 per cent were in private service, 15.17 per cent were student and 1.69 per cent were children.

Table 6: Occupation of family members in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (52)		SF (67)		SMF (46)		MDF (10)		LF (3)		All (178)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	32	61.54	50	74.63	23	50.00	10	100.00	3	100.00	118	66.29
2	Agricultural Labour	6	11.54	0	0.00	10	21.74	0	0.00	0	0.00	16	8.99
3	General Labour	1	1.92	1	1.49	0	0.00	0	0.00	0	0.00	2	1.12
5	Artisans	0	0.00	0	0.00	1	2.17	0	0.00	0	0.00	1	0.56
6	Government Service	0	0.00	0	0.00	2	4.35	0	0.00	0	0.00	2	1.12
7	Private Service	2	3.85	2	2.99	3	6.52	0	0.00	0	0.00	7	3.93
8	Trade & Business	0	0.00	0	0.00	1	2.17	0	0.00	0	0.00	1	0.56
9	Student	8	15.38	13	19.40	6	13.04	0	0.00	0	0.00	27	15.17
10	Housewife	0	0.00	1	1.49	0	0.00	0	0.00	0	0.00	1	0.56
11	Children	3	5.77	0	0.00	0	0.00	0	0.00	0	0.00	3	1.69
Total		52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00

Institutional participation of the household members: The data regarding the institutional participation of the household members in Raghunathanahalli West-2 micro-watershed is presented in Table 7. The results show that, 100 per cent of the population in the micro watershed has not participated in any local institutions.

Table 7. Institutional Participation of household members in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (52)		SF (67)		SMF (46)		MDF (10)		LF (3)		All (178)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00
Total		52	100.00	67	100.00	46	100.00	10	100.00	3	100.00	178	100.00

Type of house owned: The data regarding the type of house owned by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 8. The results indicate that 5.71 per cent of the households possess thatched house, 71.43 per cent of the households possess katcha house and 11.43 per cent of them possess pucca/RCC house and semi pacca house.

Table 8. Type of house owned by households in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0.00	2	15.38	0	0.00	0	0.00	0	0.00	2	5.71
2	Katcha	9	90.00	10	76.92	5	50.00	1	100.00	0	0.00	25	71.43
3	Pucca/RCC	1	10.00	1	7.69	2	20.00	0	0.00	0	0.00	4	11.43
4	Semi pacca	0	0.00	0	0.00	3	30.00	0	0.00	1	100.00	4	11.43
Total		10	100.00	13	100.00	10	100.00	1	100.00	1	100.00	35	100.00

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 9. The results show that 77.14 per cent of the households possess TV, 2.86 per cent of them possess DVD/VCD player, refrigerator, land line and computer/ laptop, 68.57 per cent of them possess mixer/grinder, 57.14 per cent of them possess bicycle, 51.43 per cent of them possess motor cycle, 5.71 per cent of them possess auto and 97.14 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	4	40	12	92.31	9	90	1	100	1	100	27	77.14
2	DVD/VCD Player	0	0	0	0	0	0	1	100	0	0	1	2.86
3	Mixer/Grinder	4	40	11	84.62	7	70	1	100	1	100	24	68.57
4	Refrigerator	1	10	0	0	0	0	0	0	0	0	1	2.86
5	Bicycle	3	30	10	76.92	6	60	1	100	0	0	20	57.14
6	Motor Cycle	3	30	7	53.85	6	60	1	100	1	100	18	51.43
7	Auto	0	0	0	0	1	10	1	100	0	0	2	5.71
8	Landline Phone	1	10	0	0	0	0	0	0	0	0	1	2.86
9	Mobile Phone	10	100	12	92.31	10	100	1	100	1	100	34	97.14
10	Computer/Laptop	0	0	0	0	1	10	0	0	0	0	1	2.86
11	Blank	0	0	1	7.69	0	0	0	0	0	0	1	2.86

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 10. The results show that the average value of television was Rs. 3151, DVD/VCD player was Rs.1300, mixer grinder was Rs. 1383, refrigerator was Rs.12000, bicycle was Rs.1033, motor cycle was Rs. 28,485, auto was Rs.21,000, land line was Rs. 1,200, mobile phone was Rs. 802 and computer/laptop was Rs. 30,000.

Table 10. Average value of durable assets owned by households in Raghunathanahalli West-2 micro-watershed

Average value (Rs.)

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Television	4,450	2,250	3,588	2,000	6,000	3,151
2	DVD/VCD Player	0	0	0	1,300	0	1,300
3	Mixer/Grinder	1,500	936	1,800	800	3,500	1,383
4	Refrigerator	12,000	0	0	0	0	12,000
5	Bicycle	700	930	1,616	300	0	1,033
6	Motor Cycle	35,333	27,750	33,500	350	40,000	28,485
7	Auto	0	0	35,000	14,000	0	21,000
8	Landline Phone	1,200	0	0	0	0	1,200
9	Mobile Phone	1,178	453	976	200	2,000	802
10	Computer/Laptop	0	0	30,000	0	0	30,000

Farm Implements owned: The data regarding the farm implements owned by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 11. About 14.29 per cent of the households possess bullock cart, plough and tractor, 2.86 per cent possess seed/ fertilizer drill, 28.57 per cent of them possess sprayer, 88.57 per cent of them possess weeder 11.43 per cent possess chaff cutter and 5.71 per cent possess earth remover/ duster.

Table 11. Farm Implements owned by households in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0.00	2	15.38	2	20.00	1	100.00	0	0.00	5	14.29
2	Plough	0	0.00	2	15.38	2	20.00	1	100.00	0	0.00	5	14.29
3	Seed/Fertilizer Drill	0	0.00	0	0.00	1	10.00	0	0.00	0	0.00	1	2.86
4	Tractor	0	0.00	2	15.38	2	20.00	1	100.00	0	0.00	5	14.29
5	Sprayer	0	0.00	3	23.08	6	60.00	1	100.00	0	0.00	10	28.57
6	Weeder	9	90.00	12	92.31	9	90.00	1	100.00	0	0.00	31	88.57
7	Chaff Cutter	0	0.00	2	15.38	1	10.00	1	100.00	0	0.00	4	11.43
8	Blank	1	10.00	0	0.00	1	10.00	0	0.00	1	100.00	3	8.57
9	Earth remover/Duster	0	0.00	0	0.00	1	10.00	1	100.00	0	0.00	2	5.71

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 12,800, plough was Rs. 2,360, seed/ fertilizer drill was Rs. 35,000, tractor was Rs. 240,000, sprayer was Rs. 2,650, weeder was Rs.62, Chaff cutter was Rs. 1,650 and the average value of earth remover/ duster was Rs. 10,000.

Table 12. Average value of farm implements owned by households in Raghunathanahalli West-2 micro-watershed Average Value (Rs.)

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	All (35)
1	Bullock Cart	0.00	12,000.00	14,000.00	12,000.00	12,800.00
2	Plough	0.00	2,400.00	2,000.00	3,000.00	2,360.00
3	Seed/Fertilizer Drill	0.00	0.00	35,000.00	0.00	35,000.00
4	Tractor	0.00	200,000.00	300,000.00	200,000.00	240,000.00
5	Sprayer	0.00	2,200.00	3,016.00	1,800.00	2,650.00
6	Weeder	63.00	41.00	97.00	25.00	62.00
7	Chaff Cutter	0.00	1,800.00	1,800.00	1,200.00	1,650.00
9	Earth remover/Duster	0.00	0.00	12,000.00	8,000.00	10,000.00

Livestock possession by the households: The data regarding the Livestock possession by the households in Raghunathanahalli West-2 micro-watershed is presented in Table 13. The results indicate that, 5.71 per cent of the households possess bullocks, 20.00 per cent of the households possess local cow, 8.57 per cent possess buffalo and 2.86 per cent of the households possess goat.

Table 13. Livestock possession by households in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	1	7.69	1	10.00	0	0.00	0	0.00	2	5.71
2	Local cow	1	10.00	1	7.69	4	40.00	1	100.00	0	0.00	7	20.00
4	Buffalo	1	10.00	1	7.69	1	10.00	0	0.00	0	0.00	3	8.57
6	Goat	0	0.00	1	7.69	0	0.00	0	0.00	0	0.00	1	2.86
9	blank	8	80.00	9	69.23	6	60.00	0	0.00	1	100.00	24	68.57

Average Labour availability: The data regarding the average labour availability in Raghunathanahalli West-2 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 2.11, average own labour (women) available was 1.60, average hired labour (men) available was 11.11 and average hired labour (women) available was 10.26.

In case of marginal farmers, average own labour men available was 2, average own labour (women) was 1.60, average hired labour (men) and average hired labour (women) available was 7. In case of small farmers, average own labour men available was 2.15, average own labour (women) was 1.69, average hired labour (men) was 12.46 and average hired labour (women) available was 12.15. In case of semi medium farmers, average own labour men available was 1.90, average own labour (women) was 1.30, average hired labour (men) was 11.40 and average hired labour (women) available was 8.90. In case of medium farmers, average own labour men available was 6, average own labour (women) was 4, average hired labour (men) and average hired labour (women) available was 40. In case of large farmers, average own labour men and average own labour (women) was 1, average hired labour (men) was 2 and average hired labour (women) available was 3.

Table 14. Average Labour availability in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Hired labour Female	7.00	12.15	8.90	40.00	2.00	10.26
2	Own Labour Female	1.60	1.69	1.30	4.00	1.00	1.60
3	Own labour Male	2.00	2.15	1.90	6.00	1.00	2.11
4	Hired labour Male	7.00	12.46	11.40	40.00	3.00	11.11

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Raghunathanahalli West-2 micro-watershed is presented in Table 15. The results indicate that, 888.57 per cent of the households opined that the hired labour was adequate and 11.43 per cent of the households opined that the hired labour was inadequate.

Table 15. Adequacy of Hired Labour in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	9	90.00	13	100.00	7	70.00	1	100.00	1	100.00	31	88.57
2	Inadequate	1	10.00	0	0.00	3	30.00	0	0.00	0	0.00	4	11.43

Distribution of land (ha): The data regarding the distribution of land (ha) in Raghunathanahalli West-2 micro-watershed is presented in Table 16. The results indicate that, households of the Raghunathanahalli West-2 micro-watershed possess 82.57 ha (92.87%) of dry land and 6.34 ha (7.13%) of irrigated land. Marginal farmers possess 7.60 ha (100%) of dry land. Small farmers possess 17.50 ha (96.93%) of dry land and 0.55 ha (3.07%) of irrigated land. Semi medium farmers possess 22.67 ha (88.79%) of dry land and 2.86 ha (11.21%) of irrigated land. Medium farmers possess 2.92 ha (100%) of irrigated land. Large farmers possess 34.80 ha (100%) of dry land.

Table 16. Distribution of land (Ha) in Raghunathanahalli West-2 micro-watershed

Sl. No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	7.60	100.00	17.50	96.93	22.67	88.79	0.00	0.00	34.80	100.00	82.57	92.87
2	Irrigated	0.00	0.00	0.55	3.07	2.86	11.21	2.92	100.00	0.00	0.00	6.34	7.13
Total		7.60	100.00	18.05	100.00	25.53	100.00	2.92	100.00	34.80	100.00	88.91	100.00

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Raghunathanahalli West-2 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 108,954.57 and the average value of irrigated land was Rs. 378,544.07. In case of marginal famers, the average land value was Rs. 328,982.42 for dry land. In case of small famers, the average land value was Rs. 191,362.16 for dry land and Rs. 360,583.94 for irrigated land. In case of semi medium famers, the average land value was Rs. 121,251.34 for dry land and Rs. 489,108.92 for irrigated land. In case of medium farmers, the average land value was Rs. 273,684.22 for irrigated land. In case of large farmers it was Rs. 11,488.37 for dry land.

Table 17. Average land value (Rs./ha) in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Dry	328,982.42	191,362.16	121,251.34	0.00	11,488.37	108,954.57
2	Irrigated	0.00	360,583.94	489,108.92	273,684.22	0.00	378,544.07

Status of bore wells: The data regarding the status of bore wells in Raghunathanahalli West-2 micro-watershed is presented in Table 18. The results indicate that, there were 1 functioning and 1 de-functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	De-functioning	0	0	1	0	0	1
2	Functioning	0	0	1	0	0	1

Source of irrigation: The data regarding the source of irrigation in Raghunathanahalli West-2 micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 2.86 per cent of the farmers.

Table 19. Source of irrigation in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	0	0.00	1	10.00	0	0.00	0	0.00	1	2.86

Depth of water (Avg in meters): The data regarding the depth of water in Raghunathanahalli West-2 micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 2.61 meters.

Table 20. Depth of water (Avg in meters) in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Bore Well	0.00	0.00	9.14	0.00	0.00	2.61

Irrigated Area (ha): The data regarding the irrigated area (ha) in Raghunathanahalli West-2 micro-watershed is presented in Table 21. The results indicate that semi medium farmers had an irrigated area of 2.49 ha respectively.

Table 21. Irrigated Area (ha) in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Kharif	0.00	0.00	1.24	0.00	0.00	1.24
2	Rabi	0.00	0.00	1.24	0.00	0.00	1.24
Total		0.00	0.00	2.49	0.00	0.00	2.49

Cropping pattern: The data regarding the cropping pattern in Raghunathanahalli West-2 micro-watershed is presented in Table 22. The results indicate that, farmers have grown bajra (7.27 ha), bengal gram (12.96 ha), green gram (4.59 ha), groundnut (2.83 ha), maize (5.57 ha), navane (0.55 ha), red gram (2.43 ha), sorghum (11.91 ha) and sunflower (18.61 ha). Marginal farmers have grown bajra groundnut, red gram, sorghum and sunflower. while small farmers have grown bajra, Bengal gram, navane, sorghum, sunflower and maize. Semi medium farmers have grown bajra, Bengal gram, green gram, groundnut, maize, red gram, sorghum and sunflower. Medium farmers have grown sunflower and Bengal gram. Large farmers have grown Bengal gram and sorghum.

Table 22. Cropping pattern in Raghunathanahalli West-2 micro-watershed

(Area in ha)

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Kharif - Bajra	1.43	4.63	1.21	0.00	0.00	7.27
2	Kharif - Bengal gram	0.00	1.30	3.77	0.00	2.83	7.89
3	Kharif - Greengram	0.00	0.00	4.59	0.00	0.00	4.59
4	Kharif - Groundnut	1.62	0.00	1.21	0.00	0.00	2.83
5	Kharif - Maize	0.00	0.00	2.15	0.00	0.00	2.15
6	Kharif - Navane	0.00	0.55	0.00	0.00	0.00	0.55
7	Kharif - Red gram	0.81	0.00	1.62	0.00	0.00	2.43
8	Kharif - Sorghum	1.35	3.26	0.00	0.00	3.24	7.84
9	Kharif - Sunflower	1.44	5.62	4.86	2.92	0.00	14.84
10	Rabi - Bengal gram	0.00	0.00	2.15	2.92	0.00	5.07
11	Rabi - Maize	0.00	0.55	2.86	0.00	0.00	3.42
12	Rabi - Sorghum	0.96	0.00	3.12	0.00	0.00	4.07
13	Rabi - Sunflower	0.00	1.21	2.55	0.00	0.00	3.77
Total		7.60	17.12	33.43	5.85	6.07	70.07

Cropping intensity: The data regarding the cropping intensity in Raghunathanahalli West-2 micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Raghunathanahalli West-2 micro-watershed was found to be 75.10 per cent.

Table 23. Cropping intensity (%) in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Cropping Intensity	100.00	100.00	66.60	100.00	48.43	75.10

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Raghunathanahalli West-2 micro-watershed is presented in Table 24. The results indicate that, 34.29 per cent of the households have bank account and savings.

Table 24. Possession of Bank account and savings in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	5	50.00	7	53.85	0	0.00	0	0.00	0	0.00	12	34.29

Borrowing status: The data regarding the borrowing status in Raghunathanahalli West-2 micro-watershed is presented in Table 25. The results indicate that, 34.29 per cent of the households have availed credit from different sources.

Table 25. Borrowing status in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	5	50.00	7	53.85	0	0.00	0	0.00	0	0.00	12	34.29

Cost of cultivation of Bajra: The data regarding the cost of cultivation of bajra in Raghunathanahalli West-2 micro-watershed is presented in Table 26. The results indicate that, the total cost of cultivation for bajra was Rs. 20534.76. The gross income realized by the farmers was Rs. 24896.58. The net income from bajra cultivation was Rs. 4361.83. Thus the benefit cost ratio was found to be 1:1.21.

Table 26. Cost of Cultivation of bajra in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	36.66	5822.62	28.35
2	Bullock		Pairs/day	2.36	1205.82	5.87
3	Tractor		Hours	1.68	1315.14	6.40
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.81	891.82	4.34
7	FYM		Quintal	1.40	741.77	3.61
8	Fertilizer + micronutrients		Quintal	3.36	2562.63	12.48
9	Pesticides (PPC)		Kgs / ltes	1.15	923.36	4.50
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	6.52	0.03
14	Land revenue and Taxes			0.00	5.35	0.03
II	**Cost B1**					
16	Interest on working capital				614.57	2.99
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				14089.61	68.61
III	**Cost B2**					
18	Rental Value of Land				366.67	1.79
19	**Cost B2 = (Cost B1 + Rental value)**				14456.28	70.40
IV	**Cost C1**					
20	Family Human Labour			20.27	4209.85	20.50
21	**Cost C1 = (Cost B2 + Family Labour)**				18666.13	90.90
V	**Cost C2**					
22	Risk Premium				1.83	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				18667.96	90.91
VI	**Cost C3**					
24	Managerial Cost				1866.80	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				20534.76	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		18.29	24845.29	
		b) Main Crop Sales Price (Rs.)			1358.33	
	By Product	e) Main Product (q)		0.38	51.30	
		f) Main Crop Sales Price (Rs.)			133.33	
b.	Gross Income (Rs.)				24896.58	
c.	Net Income (Rs.)				4361.83	
d.	Cost per Quintal (Rs./q.)				1122.67	
e.	Benefit Cost Ratio (BC Ratio)				1:1.21	

Cost of cultivation of Bengal gram: The data regarding the cost of cultivation of Bengal gram in Raghunathanahalli West-2 micro-watershed is presented in Table 27. The results indicate that, the total cost of cultivation for Bengal gram was Rs. 29001.41. The gross income realized by the farmers was Rs. 43669.40. The net income from Bengal gram cultivation was Rs. 14668.00. Thus the benefit cost ratio was found to be 1:1.51.

Table 27. Cost of Cultivation of bengal gram in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	28.55	4287.23	14.78
2	Bullock		Pairs/day	0.49	301.00	1.04
3	Tractor		Hours	2.00	1629.13	5.62
4	Machinery		Hours	0.62	588.85	2.03
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	44.70	4619.52	15.93
7	FYM		Quintal	1.34	1892.72	6.53
8	Fertilizer + micronutrients		Quintal	6.58	6065.81	20.92
9	Pesticides (PPC)		Kgs / liters	0.50	477.76	1.65
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	1385.70	4.78
14	Land revenue and Taxes			0.00	3.29	0.01
II	**Cost B1**					
16	Interest on working capital				1567.02	5.40
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				22818.03	78.68
III	**Cost B2**					
18	Rental Value of Land				677.78	2.34
19	**Cost B2 = (Cost B1 + Rental value)**				23495.81	81.02
IV	**Cost C1**					
20	Family Human Labour			13.20	2866.44	9.88
21	**Cost C1 = (Cost B2 + Family Labour)**				26362.25	90.90
V	**Cost C2**					
22	Risk Premium				2.67	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				26364.91	90.91
VI	**Cost C3**					
24	Managerial Cost				2636.49	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				29001.41	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.65	43583.64	
		b) Main Crop Sales Price (Rs.)			4091.67	
	By Product	e) Main Product (q)		0.13	85.76	
		f) Main Crop Sales Price (Rs.)			666.67	
b.	Gross Income (Rs.)				43669.40	
c.	Net Income (Rs.)				14668.00	
d.	Cost per Quintal (Rs./q.)				2722.67	
e.	Benefit Cost Ratio (BC Ratio)				1:1.51	

Cost of cultivation of Green gram: The data regarding the cost of cultivation of greenl gram in Raghunathanahalli West-2 micro-watershed is presented in Table 28. The results indicate that, the total cost of cultivation for green gram was Rs. 17450.25. The gross income realized by the farmers was Rs. 30372.61. The net income from green gram cultivation was Rs. 12922.36. Thus the benefit cost ratio was found to be 1:1.74.

Table 28. Cost of Cultivation of green gram in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	29.25	4751.83	27.23
2	Bullock		Pairs/day	0.54	325.58	1.87
3	Tractor		Hours	2.37	1819.17	10.42
4	Machinery		Hours	0.42	415.74	2.38
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	7.23	710.25	4.07
7	FYM		Quintal	1.27	1703.04	9.76
8	Fertilizer + micronutrients		Quintal	2.48	2783.22	15.95
9	Pesticides (PPC)		Kgs / liters	0.70	590.63	3.38
10	Irrigation		Number	2.41	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	18.88	0.11
14	Land revenue and Taxes			0.00	4.67	0.03
II	**Cost B1**					
16	Interest on working capital				694.98	3.98
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				13817.98	79.18
III	**Cost B2**					
18	Rental Value of Land				311.11	1.78
19	**Cost B2 = (Cost B1 + Rental value)**				14129.09	80.97
IV	**Cost C1**					
20	Family Human Labour			8.08	1730.44	9.92
21	**Cost C1 = (Cost B2 + Family Labour)**				15859.53	90.88
V	**Cost C2**					
22	Risk Premium				4.33	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				15863.86	90.91
VI	**Cost C3**					
24	Managerial Cost				1586.39	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				17450.25	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		7.41	30372.61	
		b) Main Crop Sales Price (Rs.)			4100.00	
b.	Gross Income (Rs.)				30372.61	
c.	Net Income (Rs.)				12922.36	
d.	Cost per Quintal (Rs./q.)				2355.61	
e.	Benefit Cost Ratio (BC Ratio)				1:1.74	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation of green gram in Raghunathanahalli West-2 micro-watershed is presented in Table 29. The results indicate that, the total cost of cultivation for groundnut was Rs. 35453.60. The gross income realized by the farmers was Rs. 41303.89. The net income from groundnut cultivation was Rs. 5850.29. Thus the benefit cost ratio was found to be 1:1.17.

Table 29. Cost of Cultivation of groundnut in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	39.79	6518.06	18.38
2	Bullock		Pairs/day	1.10	576.33	1.63
3	Tractor		Hours	3.57	2511.17	7.08
4	Machinery		Hours	0.55	658.67	1.86
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	89.19	9262.50	26.13
7	FYM		Quintal	0.82	1646.67	4.64
8	Fertilizer + micronutrients		Quintal	4.39	3828.50	10.80
9	Pesticides (PPC)		Kgs / liters	1.10	1042.89	2.94
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	6.59	0.02
14	Land revenue and Taxes			0.00	4.39	0.01
II	**Cost B1**					
16	Interest on working capital				1893.75	5.34
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				27949.50	78.83
III	**Cost B2**					
18	Rental Value of Land				377.78	1.07
19	**Cost B2 = (Cost B1 + Rental value)**				28327.28	79.90
IV	**Cost C1**					
20	Family Human Labour			18.94	3902.60	11.01
21	**Cost C1 = (Cost B2 + Family Labour)**				32229.88	90.91
V	**Cost C2**					
22	Risk Premium				0.67	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				32230.55	90.91
VI	**Cost C3**					
24	Managerial Cost				3223.05	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				35453.60	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.33	41212.41	
		b) Main Crop Sales Price (Rs.)			4416.67	
	By Product	e) Main Product (q)		0.27	91.48	
		f) Main Crop Sales Price (Rs.)			333.33	
b.	Gross Income (Rs.)				41303.89	
c.	Net Income (Rs.)				5850.29	
d.	Cost per Quintal (Rs./q.)				3799.50	
e.	Benefit Cost Ratio (BC Ratio)				1:1.17	

Cost of cultivation of Jowar: The data regarding the cost of cultivation of jowar in Raghunathanahalli West-2 micro-watershed is presented in Table 30. The results indicate that, the total cost of cultivation for jowar was Rs. 18725.82. The gross income realized by the farmers was Rs. 27559.83. The net income from jowar cultivation was Rs. 8834.00. Thus the benefit cost ratio was found to be 1:1.47.

Table 30. Cost of Cultivation of jowar in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	32.14	5066.71	27.06
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	2.25	2072.03	11.07
4	Machinery		Hours	0.39	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	5.52	827.86	4.42
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	2.40	2023.60	10.81
8	Fertilizer + micronutrients		Quintal	1.88	2629.66	14.04
9	Pesticides (PPC)		Kgs / ltrs	0.47	469.58	2.51
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	1565.83	8.36
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				714.68	3.82
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15369.96	82.08
III	**Cost B2**					
18	Rental Value of Land				266.67	1.42
19	**Cost B2 = (Cost B1 + Rental value)**				15636.63	83.50
IV	**Cost C1**					
20	Family Human Labour			7.21	1381.85	7.38
21	**Cost C1 = (Cost B2 + Family Labour)**				17018.47	90.88
V	**Cost C2**					
22	Risk Premium				5.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				17023.47	90.91
VI	**Cost C3**					
24	Managerial Cost				1702.35	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				18725.82	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.48	25687.96	
		b) Main Crop Sales Price (Rs.)			2450.00	
	By Product	e) Main Product (q)		1.56	1871.87	
		f) Main Crop Sales Price (Rs.)			1200.00	
b.	Gross Income (Rs.)				27559.83	
c.	Net Income (Rs.)				8834.00	
d.	Cost per Quintal (Rs./q.)				1785.98	
e.	Benefit Cost Ratio (BC Ratio)				1:1.47	

Cost of cultivation of Maize: The data regarding the cost of cultivation of maize in Raghunathanahalli West-2 micro-watershed is presented in Table 31. The results indicate that, the total cost of cultivation for maize was Rs. 31548.18. The gross income realized by the farmers was Rs. 48720.69. The net income from maize cultivation was Rs. 17172.51. Thus the benefit cost ratio was found to be 1:1.54.

Table 31. Cost of Cultivation of maize in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	45.35	6961.55	22.07
2	Bullock		Pairs/day	0.65	346.05	1.10
3	Tractor		Hours	3.02	1846.42	5.85
4	Machinery		Hours	0.57	340.21	1.08
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	17.52	2767.81	8.77
7	FYM		Quintal	8.53	1061.20	3.36
8	Fertilizer + micronutrients		Quintal	2.71	2619.11	8.30
9	Pesticides (PPC)		Kgs / ltrs	0.96	961.86	3.05
10	Irrigation		Number	0.62	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	3761.15	11.92
14	Land revenue and Taxes			0.00	3.09	0.01
II	**Cost B1**					
16	Interest on working capital				889.56	2.82
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				21558.01	68.33
III	**Cost B2**					
18	Rental Value of Land				216.67	0.69
19	**Cost B2 = (Cost B1 + Rental value)**				21774.67	69.02
IV	**Cost C1**					
20	Family Human Labour			31.15	6902.49	21.88
21	**Cost C1 = (Cost B2 + Family Labour)**				28677.17	90.90
V	**Cost C2**					
22	Risk Premium				3.00	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				28680.17	90.91
VI	**Cost C3**					
24	Managerial Cost				2868.02	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				31548.18	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		28.01	44107.98	
		b) Main Crop Sales Price (Rs.)			1575.00	
	By Product	e) Main Product (q)		6.83	4612.71	
		f) Main Crop Sales Price (Rs.)			675.00	
b.	Gross Income (Rs.)				48720.69	
c.	Net Income (Rs.)				17172.51	
d.	Cost per Quintal (Rs./q.)				1126.52	
e.	Benefit Cost Ratio (BC Ratio)				1:1.54	

Cost of Cultivation of Navane: The data regarding the cost of cultivation of Navane in Raghunathanahalli West-2 micro-watershed is presented in Table 32. The results indicate that, the total cost of cultivation for navane was Rs. 30370.30. The gross income realized by the farmers was Rs. 56251.09. The net income from navane cultivation was Rs. 25880.80. Thus the benefit cost ratio was found to be 1:1.85.

Table 32. Cost of Cultivation of Navane in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	77.53	9591.53	31.58
2	Bullock		Pairs/day	12.62	7572.26	24.93
3	Tractor		Hours	0.00	0.00	0.00
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	7.21	324.53	1.07
7	FYM		Quintal	3.61	1442.34	4.75
8	Fertilizer + micronutrients		Quintal	1.80	2433.94	8.01
9	Pesticides (PPC)		Kgs / liters	0.00	0.00	0.00
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	1000.00	3.29
13	Depreciation charges			0.00	564.67	1.86
14	Land revenue and Taxes			0.00	4.12	0.01
II	**Cost B1**					
16	Interest on working capital				504.10	1.66
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				23437.49	77.17
III	**Cost B2**					
18	Rental Value of Land				133.33	0.44
19	**Cost B2 = (Cost B1 + Rental value)**				23570.82	77.61
IV	**Cost C1**					
20	Family Human Labour			25.24	4038.54	13.30
21	**Cost C1 = (Cost B2 + Family Labour)**				27609.36	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				27609.36	90.91
VI	**Cost C3**					
24	Managerial Cost				2760.94	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				30370.30	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		21.64	56251.09	
		b) Main Crop Sales Price (Rs.)			2600.00	
b.	Gross Income (Rs.)				56251.09	
c.	Net Income (Rs.)				25880.80	
d.	Cost per Quintal (Rs./q.)				1403.76	
e.	Benefit Cost Ratio (BC Ratio)				1:1.85	

Cost of cultivation of Redgram: The data regarding the cost of cultivation of red gram in Raghunathanahalli West-2 micro-watershed is presented in Table 33. The results indicate that, the total cost of cultivation for red gram was Rs. 20232.19. The gross income realized by the farmers was Rs. 28960.75. The net income from red gram cultivation was Rs. 8728.56. Thus the benefit cost ratio was found to be 1:1.43.

Table 33. Cost of Cultivation of red gram in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	38.59	6344.81	31.36
2	Bullock	Pairs/day	0.93	509.44	2.52
3	Tractor	Hours	2.16	1620.94	8.01
4	Machinery	Hours	0.31	185.25	0.92
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	9.26	957.13	4.73
7	FYM	Quintal	3.09	617.50	3.05
8	Fertilizer + micronutrients	Quintal	1.85	2593.50	12.82
9	Pesticides (PPC)	Kgs /ltrs	1.24	1235.00	6.10
10	Irrigation	Number	0.00	0.00	0.00
11	Repairs		0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	1.24	0.01
14	Land revenue and Taxes		0.00	0.00	0.00
II	**Cost B1**				
16	Interest on working capital			649.57	3.21
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			14714.38	72.73
III	**Cost B2**				
18	Rental Value of Land			133.33	0.66
19	**Cost B2 = (Cost B1 + Rental value)**			14847.71	73.39
IV	**Cost C1**				
20	Family Human Labour		16.36	3535.19	17.47
21	**Cost C1 = (Cost B2 + Family Labour)**			18382.90	90.86
V	**Cost C2**				
22	Risk Premium			10.00	0.05
23	**Cost C2 = (Cost C1 + Risk Premium)**			18392.90	90.91
VI	**Cost C3**				
24	Managerial Cost			1839.29	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			20232.19	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	8.65	28960.75	
		b) Main Crop Sales Price (Rs.)		3350.00	
b.	Gross Income (Rs.)			28960.75	
c.	Net Income (Rs.)			8728.56	
d.	Cost per Quintal (Rs./q.)			2340.33	
e.	Benefit Cost Ratio (BC Ratio)			1:1.43	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Raghunathanahalli West-2 micro-watershed is presented in Table 34. The results indicate that, the total cost of cultivation for sorghum was Rs. 20948.98. The gross income realized by the farmers was Rs. 23650.01. The net income from sorghum cultivation was Rs. 2701.03. Thus the benefit cost ratio was found to be 1:1.13.

Table 34. Cost of Cultivation of sorghum in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	28.70	4509.75	21.53
2	Bullock		Pairs/day	1.24	637.13	3.04
3	Tractor		Hours	2.78	2336.21	11.15
4	Machinery		Hours	0.40	454.16	2.17
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	6.76	660.52	3.15
7	FYM		Quintal	2.86	2700.43	12.89
8	Fertilizer + micronutrients		Quintal	2.60	2621.92	12.52
9	Pesticides (PPC)		Kgs / liters	1.08	1082.95	5.17
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	11.20	0.05
14	Land revenue and Taxes			0.00	3.71	0.02
II	**Cost B1**					
16	Interest on working capital				848.00	4.05
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15865.97	75.74
III	**Cost B2**					
18	Rental Value of Land				333.33	1.59
19	**Cost B2 = (Cost B1 + Rental value)**				16199.30	77.33
IV	**Cost C1**					
20	Family Human Labour			14.60	2844.35	13.58
21	**Cost C1 = (Cost B2 + Family Labour)**				19043.65	90.90
V	**Cost C2**					
22	Risk Premium				0.88	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				19044.53	90.91
VI	**Cost C3**					
24	Managerial Cost				1904.45	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				20948.98	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.82	23434.78	
		b) Main Crop Sales Price (Rs.)			2387.50	
	By Product	e) Main Product (q)		0.48	215.23	
		f) Main Crop Sales Price (Rs.)			445.00	
b.	Gross Income (Rs.)				23650.01	
c.	Net Income (Rs.)				2701.03	
d.	Cost per Quintal (Rs./q.)				2134.25	
e.	Benefit Cost Ratio (BC Ratio)				1:1.13	

Cost of cultivation of Sunflower: The data regarding the cost of cultivation of sunflower in Raghunathanahalli West-2 micro-watershed is presented in Table 35. The results indicate that, the total cost of cultivation for sunflower was Rs. 23157.86. The gross income realized by the farmers was Rs. 35766.20. The net income from sunflower cultivation was Rs. 12608.34. Thus the benefit cost ratio was found to be 1:1.54.

Table 35. Cost of Cultivation of sunflower in Raghunathanahalli West-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	29.37	4566.18	19.72
2	Bullock		Pairs/day	1.07	603.36	2.61
3	Tractor		Hours	2.62	1998.57	8.63
4	Machinery		Hours	0.25	242.88	1.05
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	5.44	2456.73	10.61
7	FYM		Quintal	5.13	1646.10	7.11
8	Fertilizer + micronutrients		Quintal	3.49	3217.09	13.89
9	Pesticides (PPC)		Kgs / liters	0.82	815.29	3.52
10	Irrigation		Number	3.71	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	491.47	2.12
14	Land revenue and Taxes			0.00	4.25	0.02
II	**Cost B1**					
16	Interest on working capital				976.31	4.22
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17018.24	73.49
III	**Cost B2**					
18	Rental Value of Land				444.44	1.92
19	**Cost B2 = (Cost B1 + Rental value)**				17462.69	75.41
IV	**Cost C1**					
20	Family Human Labour			16.94	3589.25	15.50
21	**Cost C1 = (Cost B2 + Family Labour)**				21051.93	90.91
V	**Cost C2**					
22	Risk Premium				0.67	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				21052.60	90.91
VI	**Cost C3**					
24	Managerial Cost				2105.26	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				23157.86	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.51	35766.20	
		b) Main Crop Sales Price (Rs.)			3762.50	
b.	Gross Income (Rs.)				35766.20	
c.	Net Income (Rs.)				12608.34	
d.	Cost per Quintal (Rs./q.)				2436.14	
e.	Benefit Cost Ratio (BC Ratio)				1:1.54	

Adequacy of fodder: The data regarding the adequacy of fodder in Raghunathanahalli West-2 micro-watershed is presented in Table 36. The results indicate that, 14.29 per cent of the households opined that dry fodder was adequate and green fodder was adequate for 25.71 per cent of the households.

Table 36. Adequacy of fodder in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	2	20.00	0	0.00	3	30.00	0	0.00	0	0.00	5	14.29
2	Adequate-Green Fodder	2	20.00	2	15.38	4	40.00	1	100.00	0	0.00	9	25.71

Annual gross income: The data regarding the annual gross income in Raghunathanahalli West-2 micro-watershed is presented in Table 37. The results indicate that the annual gross income for marginal farmers it was Rs. 98,350, for small farmers it was Rs. 92,320.77, for semi medium farmers it was Rs. 132,700, for medium farmers it was Rs. 488,000 and for large farmers it was Rs115,000.

Table 37. Annual gross income in Raghunathanahalli West-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Service/salary	47,000.00	0.00	17,600.00	0.00	0.00	18,457.14
2	Business	0.00	12,307.69	15,000.00	60,000.00	0.00	10,571.43
3	Wage	20,200.00	27,000.00	3,300.00	0.00	15,000.00	17,171.43
4	Agriculture	31,150.00	49,357.69	94,400.00	428,000.00	100,000.00	69,290.00
5	Non-Farm income	0.00	1,846.15	1,800.00	0.00	0.00	1,200.00
6	Dairy Farm	0.00	1,809.23	600.00	0.00	0.00	843.43
Income(Rs.)		98,350.00	92,320.77	132,700.00	488,000.00	115,000.00	117,533.43

Average annual expenditure: The data regarding the average annual expenditure in Raghunathanahalli West-2 micro-watershed is presented in Table 38. The results indicate that the average annual expenditure is Rs. 16,211.77. For marginal farmers it was Rs. 3,363.33, for small farmers it was Rs. 8,565.02, for semi medium farmers it was Rs. 152,433.33, for medium farmers it was Rs. 170,000 and for large farmers it was Rs. 100,000.

Table 38. Average annual expenditure in Raghunathanahalli West-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	MF (10)	SF (13)	SMF (10)	MDF (1)	LF (1)	All (35)
1	Service/salary	12,500.00	0.00	37,500.00	0.00	0.00	2,857.14
2	Business	0.00	47,500.00	50,000.00	35,000.00	0.00	5,142.86
3	Wage	1,333.33	21,428.57	6,333.33	0.00	10,000.00	5,342.86
4	Agriculture	19,800.00	28,416.67	57,600.00	135,000.00	90,000.00	38,285.71
7	Dairy Farm	0.00	14,000.00	1,000.00	0.00	0.00	457.14
Total		33,633.33	111,345.24	152,433.33	170,000.00	100,000.00	567,411.90
Average		3,363.33	8,565.02	15,243.33	170,000.00	100,000.00	16,211.77

Horticulture species grown: The data regarding horticulture species grown in Raghunathanahalli West-2 micro-watershed is presented in Table 39. The results indicate that, sampled households have grown 44 coconut trees in their field.

Table 39. Horticulture species grown in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	4	0	0	0	40	0	0	0	44	0

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

Forest species grown: The data regarding forest species grown in Raghunathanahalli West-2 micro-watershed is presented in Table 40. The results indicate that, households have planted 6 yeak, 44 neem and 15 tamarind trees in their field.

Table 40: Forest species grown in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	0	1	0	5	0	0	0	6	0
2	Neem	2	0	22	0	19	0	0	0	1	0	44	0
3	Tamarind	0	0	0	0	0	0	15	0	0	0	15	0

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

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Raghunathanahalli West-2 micro-watershed is presented in Table 41. The results indicated that, bajra was sold to the extent of 96.3 per cent, Bengal gram, green gram, groundnut, jowar, maize, red gram and sunflower was sold to the extent 100 per cent, Navane was sold to the extent of 83.33 per cent and sorghum was sold to the extent of 98.25 per cent.

Table 41. Marketing of the agricultural produce in Raghunathanahalli West-2 micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	135.0	5.0	130.0	96.3	1358.33
2	Bengalgram	146.0	0.0	146.0	100.0	4091.67
3	Greengram	35.0	0.0	35.0	100.0	4100.0
4	Groundnut	26.0	0.0	26.0	100.0	4416.67
5	Jowar	35.0	0.0	35.0	100.0	2450.0
6	Maize	127.0	0.0	127.0	100.0	1575.0
7	Navane	12.0	2.0	10.0	83.33	2600.0
8	Redgram	20.0	0.0	20.0	100.0	3350.0
9	Sorghum	114.0	2.0	112.0	98.25	2387.5
10	Sunflower	181.0	0.0	181.0	100.0	3762.5

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Raghunathanahalli West-2

micro-watershed is presented in Table 42. The results indicated that, about 34.29 per cent of the farmers sold their produce to agent/traders, 80 per cent of the farmers sold their produce to local/village merchants and 20 per cent of them sold their produce through contract marketing arrangement.

Table 42. Marketing Channels used for sale of agricultural produce in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	1	10.00	3	23.08	6	60.00	0	0.00	2	200.00	12	34.29
2	Local/village Merchant	8	80.00	11	84.62	7	70.00	2	200.00	0	0.00	28	80.00
3	Regulated Market	1	10.00	0	0.00	6	60.00	0	0.00	0	0.00	7	20.00

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Raghunathanahalli West-2 micro-watershed is presented in Table 43. The results indicated that, 14 per cent of the households used cart and 120 per cent of the households used tractor as a mode of transportation for their agricultural produce.

Table 43. Mode of transport of agricultural produce in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	1	10.00	2	15.38	2	20.00	0	0.00	0	0.00	5	14.29
2	Tractor	9	90.00	12	92.31	17	170.00	2	200.00	2	200.00	42	120.00

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Raghunathanahalli West-2 micro-watershed is presented in Table 44. The results indicated that, 28.57 per cent of the households have experienced soil and water erosion problems in the farm.

Table 44. Incidence of soil and water erosion problems in Raghunathanahalli West-2 micro-watershed

Sl. No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	5	50.00	5	38.46	0	0.00	0	0.00	10	28.57

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Raghunathanahalli West-2 micro-watershed is presented in Table 45. The results indicated that, 54.29 per cent have shown interest in soil test.

Table 45. Interest shown towards soil testing in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	7	70.00	10	76.92	1	10.00	1	100.00	0	0.00	19	54.29

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Raghunathanahalli West-2 micro-watershed is presented in Table 46. The results indicated that, 74.29 per cent of the households used firewood and 28.57 per cent of the household used LPG as a source of fuel.

Table 46. Usage pattern of fuel for domestic use in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	8	80.00	7	53.85	9	90.00	1	100.00	1	100.00	26	74.29
2	LPG	2	20.00	6	46.15	2	20.00	0	0.00	0	0.00	10	28.57

Source of drinking water: The data regarding source of drinking water in Raghunathanahalli West-2 micro-watershed is presented in Table 47. The results indicated that, piped supply was the major source of drinking water for 48.57 per cent of the households, bore well was the source of drinking water for 40 per cent, open well and lake/tank was the major source of drinking water for 2.86 per cent of the households in micro watershed.

Table 47. Source of drinking water in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	6	60.00	10	76.92	0	0.00	1	100.00	0	0.00	17	48.57
2	Bore Well	2	20.00	2	15.38	9	90.00	0	0.00	1	100.00	14	40.00
3	Open well	1	10.00	0	0.00	0	0.00	0	0.00	0	0.00	1	2.86
4	Lake/ Tank	1	10.00	0	0.00	0	0.00	0	0.00	0	0.00	1	2.86

Source of light: The data regarding source of light in Raghunathanahalli West-2 micro-watershed is presented in Table 48. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 48. Source of light in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	10	100.00	13	100.00	10	100.00	1	100.00	1	100.00	35	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Raghunathanahalli West-2 micro-watershed is presented in Table 49. The results indicated that, 34.29 per cent of the households possess sanitary toilet facility.

Table 49. Existence of Sanitary toilet facility in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	4	40.00	4	30.77	2	20.00	1	100.00	1	100.00	12	34.29

Possession of PDS card: The data regarding possession of PDS card in Raghunathanahalli West-2 micro-watershed is presented in Table 50. The results indicated that, 2.86 per cent of the sampled households possessed APL, 88.57 per cent of the sampled households possessed BPL card and 8.57 per cent of the households did not possess PDS card.

Table 50. Possession of PDS card in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0.00	0	0.00	1	10.00	0	0.00	0	0.00	1	2.86
2	BPL	9	90.00	13	100.00	7	70.00	1	100.00	1	100.00	31	88.57
3	Not Possessed	1	10.00	0	0.00	2	20.00	0	0.00	0	0.00	3	8.57

Participation in NREGA program: The data regarding participation in NREGA programme in Raghunathanahalli West-2 micro-watershed is presented in Table 51. The results indicated that, 28.57 per cent of the households participated in NREGA programme.

Table 51. Participation in NREGA programme in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	3	30	1	7.69	4	40	1	100	1	100	10	28.57

Adequacy of food items: The data regarding adequacy of food items in Raghunathanahalli West-2 micro-watershed is presented in Table 52. The results indicated that, cereals were adequate for 94.29 per cent of the households, pulses were adequate for 65.71 per cent, oilseeds were adequate for 34.29 per cent, vegetables were adequate for 68.57 per cent, milk was adequate for 62.86 per cent and meat were adequate for 2.86 per cent.

Table 52. Adequacy of food items in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	8	80.00	13	100.00	10	100.00	1	100.00	1	100.00	33	94.29
2	Pulses	6	60.00	11	84.62	5	50.00	0	0.00	1	100.00	23	65.71
3	Oilseed	1	10.00	5	38.46	5	50.00	0	0.00	1	100.00	12	34.29
4	Vegetables	8	80.00	10	76.92	5	50.00	0	0.00	1	100.00	24	68.57
5	Milk	7	70.00	8	61.54	6	60.00	0	0.00	1	100.00	22	62.86
6	Meat	1	10.00	0	0.00	0	0.00	0	0.00	0	0.00	1	2.86

Response on Inadequacy of food items: The data regarding inadequacy of food items in Raghunathanahalli West-2 micro-watershed is presented in Table 53. The results indicated that, cereals were inadequate for 2.86 per cent of the households, pulses were

inadequate for 31.43 per cent, oilseeds were inadequate for 45.71 per cent, vegetables were inadequate for 17.14 per cent, fruits were inadequate for 51.43 per cent, milk was inadequate for 31.43 per cent, eggs were inadequate for 65.71 per cent and meat was inadequate for 57.14 per cent of the households.

Table 53. Response on Inadequacy of food items in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Cereals	1	10.00	0	0.00	0	0.00	0	0.00	1	2.86
2	Pulses	3	30.00	2	15.38	5	50.00	1	100.00	11	31.43
3	Oilseed	6	60.00	7	53.85	2	20.00	1	100.00	16	45.71
4	Vegetables	0	0.00	3	23.08	2	20.00	1	100.00	6	17.14
5	Fruits	6	60.00	10	76.92	1	10.00	1	100.00	18	51.43
6	Milk	2	20.00	4	30.77	4	40.00	1	100.00	11	31.43
7	Egg	8	80.00	10	76.92	4	40.00	1	100.00	23	65.71
8	Meat	6	60.00	11	84.62	2	20.00	1	100.00	20	57.14

Response on Market surplus of food items: The data regarding market surplus of food items in Raghunathanahalli West-2 micro-watershed is presented in Table 54. The results indicated that, oilseeds were market surplus for 17.14 per cent of the households and vegetables was market surplus for 11.43 per cent of the households.

Table 54. Response on Market surplus of food items in Raghunathanahalli West-2 micro-watershed

Sl.No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	2	20.00	1	7.69	3	30.00	0	0.00	0	0.00	6	17.14
2	Vegetables	1	10.00	0	0.00	3	30.00	0	0.00	0	0.00	4	11.43

Farming constraints: The data regarding farming constraints experienced by households in Raghunathanahalli West-2 micro-watershed is presented in Table 55. The results indicated that, lower fertility status of the soil was the constraint experienced by 57.14 per cent of the households, wild animal menace on farm field (71.43%), frequent incidence of pest and diseases (88.57%), inadequacy of irrigation water (22.86%), high cost of fertilizers and plant protection chemicals (74.29%), high rate of interest on credit (62.86%), low price for the agricultural commodities (60%), lack of marketing facilities in the area (65.71%), inadequate extension services (2.86%), lack of transport for safe transport of the agricultural produce to the market (54.29%) , less rainfall (45.71%) and source of Agri-technology information (22.86%)

Table 55. Farming constraints Experienced in Raghunathanahalli West-2 micro-watershed

Sl. No.	Particulars	MF (10)		SF (13)		SMF (10)		MDF (1)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	7	70	11	84.62	1	10	1	100	0	0	20	57.14
2	Wild animal menace on farm field	8	80	11	84.62	4	40	1	100	1	100	25	71.43
3	Frequent incidence of pest and diseases	9	90	12	92.31	8	80	1	100	1	100	31	88.57
4	Inadequacy of irrigation water	2	20	5	38.46	1	10	0	0	0	0	8	22.86
5	High cost of Fertilizers and plant protection chemicals	8	80	15	115.38	2	20	1	100	0	0	26	74.29
6	High rate of interest on credit	8	80	10	76.92	3	30	1	100	0	0	22	62.86
7	Low price for the agricultural commodities	8	80	10	76.92	2	20	1	100	0	0	21	60
8	Lack of marketing facilities in the area	8	80	11	84.62	4	40	0	0	0	0	23	65.71
9	Inadequate extension services	0	0	1	7.69	0	0	0	0	0	0	1	2.86
10	Lack of transport for safe transport of the Agril produce to the market.	4	40	9	69.23	4	40	1	100	1	100	19	54.29
11	Less rainfall	3	30	3	23.08	9	90	0	0	1	100	16	45.71
12	Source of Agri-technology information	2	20	1	7.69	5	50	0	0	0	0	8	22.86

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 analyse the data. About 35 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 105 (58.99%) men and 73 (41.01%) women among the sampled households. The average family size of marginal farmers' was 5.2, small farmers' was 5.15, semi medium farmers' was 4.6, medium farmers' was 10 and large farmers' was 3. . The data indicated that, 23 (12.92%) people were in 0-15 years of age, 75 (42.13%) were in 16-35 years of age, 64 (35.96%) were in 36-60 years of age and 16 (8.99%) were above 61 years

The results indicated that Raghunathanahalli West-2 had 22.47 per cent illiterates, 34.83 per cent of them had primary school education, 5.62 per cent of them had middle school education, 19.10 per cent of them had high school education, 4.49 per cent of them had PUC education, 1.69 per cent had diploma and masters, 0.56 per cent did ITI and 5.06 per cent of them had degree education.

The results indicate that, 94.29 per cent of household heads were practicing agriculture, and 2.86 per cent of the household heads were agricultural labourers and private service. The results indicate that agriculture was the major occupation for 66.29 per cent of the household members, 8.99 per cent were agricultural labourers, 1.12 per cent were in general labour and government service, 0.56 per cent were in artisans, trade and business and housewives, 3.93 per cent were in private service, 15.17 per cent were student and 1.69 per cent were children.

The results show that, 100 per cent of the population in the micro watershed has not participated in any local institutions. The results indicate that 5.71 per cent of the households possess thatched house, 71.43 per cent of the households possess katcha house and 11.43 per cent of them possess pucca/RCC house and semi pacca house.

The results show that 77.14 per cent of the households possess TV, 2.86 per cent of them possess DVD/VCD player, refrigerator, land line and computer/ laptop, 68.57 per cent of them possess mixer/grinder, 57.14 per cent of them possess bicycle, 51.43 per cent of them possess motor cycle, 5.71 per cent of them possess auto and 97.14 per cent of the households possess mobile phones. The results show that the average value of television was Rs. 3151, DVD/VCD player was Rs.1300, mixer grinder was Rs. 1383, refrigerator

was Rs.12000, bicycle was Rs.1033, motor cycle was Rs. 28,485, auto was Rs. 21,000, land line was Rs. 1,200, mobile phone was Rs. 802 and computer/laptop was Rs. 30,000.

About 14.29 per cent of the households possess bullock cart, plough and tractor, 2.86 per cent possess seed/ fertilizer drill, 28.57 per cent of them possess sprayer, 88.57 per cent of them possess weeder 11.43 per cent possess chaff cutter and 5.71 per cent possess earth remover/ duster. The results show that the average value of bullock cart was Rs. 12,800, plough was Rs. 2,360, seed/ fertilizer drill was Rs. 35,000, tractor was Rs. 240,000, sprayer was Rs. 2,650, weeder was Rs.62, Chaff cutter was Rs. 1,650 and the average value of earth remover/ duster was Rs. 10,000.

The results indicate that, 5.71 per cent of the households possess bullocks, 20.00 per cent of the households possess local cow, 8.57 per cent possess buffalo and 2.86 per cent of the households possess goat

The results indicate that, average own labour men available in the micro watershed was 2.11, average own labour (women) available was 1.60, average hired labour (men) available was 11.11 and average hired labour (women) available was 10.26. The results indicate that, 888.57 per cent of the households opined that the hired labour was adequate and 11.43 per cent of the households opined that the hired labour was inadequate.

The results indicate that, households of the Raghunathanahalli West-2 micro-watershed possess 82.57 ha (92.87%) of dry land and 6.34 ha (7.13%) of irrigated land. Marginal farmers possess 7.60 ha (100%) of dry land. Small farmers possess 17.50 ha (96.93%) of dry land and 0.55 ha (3.07%) of irrigated land. Semi medium farmers possess 22.67 ha (88.79%) of dry land and 2.86 ha (11.21%) of irrigated land. Medium farmers possess 2.92 ha (100%) of irrigated land. Large farmers possess 34.80 ha (100%) of dry land.

The results indicate that, the average value of dry land was Rs. 108,954.57 and the average value of irrigated land was Rs. 378,544.07. In case of marginal famers, the average land value was Rs. 328,982.42 for dry land. In case of small famers, the average land value was Rs. 191,362.16 for dry land and Rs. 360,583.94 for irrigated land. In case of semi medium famers, the average land value was Rs. 121,251.34 for dry land and Rs. 489,108.92 for irrigated land. In case of medium farmers, the average land value was Rs. 273,684.22 for irrigated land. In case of large farmers it was Rs. 11,488.37 for dry land.

The results indicate that, there were 1 functioning and 1 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 2.86 per cent of the farmers. The results indicate that, the depth of bore well was found to be 2.61 meters.

The results indicate that semi medium farmers had an irrigated area of 2.49 ha respectively. The results indicate that, farmers have grown bajra (7.27 ha), Bengal gram

(12.96 ha), green gram (4.59 ha), groundnut (2.83 ha), maize (5.57 ha), navane (0.55 ha), red gram (2.43 ha), sorghum (11.91 ha) and sunflower (18.61 ha). Marginal farmers have grown bajra groundnut, red gram, sorghum and sunflower. while small farmers have grown bajra, Bengal gram, navane, sorghum, sunflower and maize. Semi medium farmers have grown bajra, Bengal gram, green gram, groundnut, maize, red gram, sorghum and sunflower. Medium farmers have grown sunflower and Bengal gram. Large farmers have grown Bengal gram and sorghum. The results indicate that, the cropping intensity in Raghunathanahalli West-2 micro-watershed was found to be 75.10 per cent.

The results indicate that, 34.29 per cent of the households have bank account and savings. The results indicate that, 34.29 per cent of the households have availed credit from different sources.

The results indicate that, the total cost of cultivation for bajra was Rs. 20534.76. The gross income realized by the farmers was Rs. 24896.58. The net income from bajra cultivation was Rs. 4361.83. Thus the benefit cost ratio was found to be 1:1.21. The results indicate that, the total cost of cultivation for Bengal gram was Rs. 29001.41. The gross income realized by the farmers was Rs. 43669.40. The net income from Bengal gram cultivation was Rs. 14668.00. Thus the benefit cost ratio was found to be 1:1.51. The results indicate that, the total cost of cultivation for green gram was Rs. 17450.25. The gross income realized by the farmers was Rs. 30372.61. The net income from green gram cultivation was Rs. 12922.36. Thus the benefit cost ratio was found to be 1:1.74. The results indicate that, the total cost of cultivation for groundnut was Rs. 35453.60. The gross income realized by the farmers was Rs. 41303.89. The net income from groundnut cultivation was Rs. 5850.29. Thus the benefit cost ratio was found to be 1:1.17. The results indicate that, the total cost of cultivation for jowar was Rs. 18725.82. The gross income realized by the farmers was Rs. 27559.83. The net income from jowar cultivation was Rs. 8834.00. Thus the benefit cost ratio was found to be 1:1.47. The results indicate that, the total cost of cultivation for maize was Rs. 31548.18. The gross income realized by the farmers was Rs. 48720.69. The net income from maize cultivation was Rs. 17172.51. Thus the benefit cost ratio was found to be 1:1.54. The results indicate that, the total cost of cultivation for navane was Rs. 30370.30. The gross income realized by the farmers was Rs. 56251.09. The net income from navane cultivation was Rs. 25880.80. Thus the benefit cost ratio was found to be 1:1.85. The results indicate that, the total cost of cultivation for red gram was Rs. 20232.19. The gross income realized by the farmers was Rs. 28960.75. The net income from red gram cultivation was Rs. 8728.56. Thus the benefit cost ratio was found to be 1:1.43. The results indicate that, the total cost of cultivation for sorghum was Rs. 20948.98. The gross income realized by the farmers was Rs. 23650.01. The net income from sorghum cultivation was Rs. 2701.03. Thus the benefit cost ratio was found to be 1:1.13. The results indicate that, the total cost of cultivation for sunflower was Rs. 23157.86. The gross income realized by the farmers

was Rs. 35766.20. The net income from sunflower cultivation was Rs. 12608.34. Thus the benefit cost ratio was found to be 1:1.54.

The results indicate that, 14.29 per cent of the households opined that dry fodder was adequate and green fodder was adequate for 25.71 per cent of the households.

The results indicate that the annual gross income for marginal farmers it was Rs. 98,350, for small farmers it was Rs. 92,320.77, for semi medium farmers it was Rs. 132,700, for medium farmers it was Rs. 488,000 and for large farmers it was Rs115,000. The results indicate that the average annual expenditure is Rs. 16,211.77. For marginal farmers it was Rs. 3,363.33, for small farmers it was Rs. 8,565.02, for semi medium farmers it was Rs. 152,433.33, for medium farmers it was Rs. 170,000 and for large farmers it was Rs. 100,000.

The results indicate that, sampled households have grown 44 coconut trees in their field. The results indicate that, households have planted 6 yeak, 44 neem and 15 tamarind trees in their field.

The results indicated that, bajra was sold to the extent of 96.3 per cent, Bengal gram, green gram, groundnut, jowar, maize, red gram and sunflower was sold to the extent 100 per cent, Navane was sold to the extent of 83.33 per cent and sorghum was sold to the extent of 98.25 per cent.

The results indicated that, about 34.29 per cent of the farmers sold their produce to agent/traders, 80 per cent of the farmers sold their produce to local/village merchants and 20 per cent of them sold their produce through contract marketing arrangement.

The results indicated that, 14 per cent of the households used cart and 120 per cent of the households used tractor as a mode of transportation for their agricultural produce.

The results indicated that, 28.57 per cent of the households have experienced soil and water erosion problems in the farm. The results indicated that, 54.29 per cent have shown interest in soil test.

The results indicated that, 74.29 per cent of the households used firewood and 28.57 per cent of the household used LPG as a source of fuel. The results indicated that, piped supply was the major source of drinking water for 48.57 per cent of the households, bore well was the source of drinking water for 40 per cent, open well and lake/tank was the major source of drinking water for 2.86 per cent of the households in micro watershed.

Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 34.29 per cent of the households possess sanitary toilet facility. The results indicated that, 2.86 per cent of the sampled households possessed APL, 88.57 per cent of the sampled households possessed BPL card and 8.57

per cent of the households did not possess PDS card. The results indicated that, 28.57 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 94.29 per cent of the households, pulses were adequate for 65.71 per cent, oilseeds were adequate for 34.29 per cent, vegetables were adequate for 68.57 per cent, milk was adequate for 62.86 per cent and meat were adequate for 2.86 The results indicated that, cereals were inadequate for 2.86 per cent of the households, pulses were inadequate for 31.43 per cent, oilseeds were inadequate for 45.71 per cent, vegetables were inadequate for 17.14 per cent, fruits were inadequate for 51.43 per cent, milk was inadequate for 31.43 per cent, eggs were inadequate for 65.71 per cent and meat was inadequate for 57.14 per cent of the households.

The results indicated that, oilseeds were market surplus for 17.14 per cent of the households and vegetables was market surplus for 11.43 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 57.14 per cent of the households, wild animal menace on farm field (71.43%), frequent incidence of pest and diseases (88.57%), inadequacy of irrigation water (22.86%), high cost of fertilizers and plant protection chemicals (74.29%), high rate of interest on credit (62.86%), low price for the agricultural commodities (60%), lack of marketing facilities in the area (65.71%), inadequate extension services (2.86%), lack of transport for safe transport of the agricultural produce to the market (54.29%) , less rainfall (45.71%) and source of Agri-technology information (22.86%)