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

BUDAGUMPA-1 (4D3A9E1c) MICROWATERSHED

Irakallagada 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.

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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 Budagumpa-1microwatershed 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
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PART-A

LAND RESOURCE INVENTORY

Contents

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The land resource inventory of Budagumpa-1microwatershed 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 363 ha in Koppaltaluk 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 about 83 per cent is covered by soils, 13 per cent by rock out crops, four per cent by water bodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 17 soil series and 21 soil phases (management units) and 6 land use classes.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- *Land suitability for growing 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 12 per cent of the soils are shallow (25-50 cm), 3 per centis moderately shallow (50-75 cm), 33per cent moderately deep (75- 100 cm) and 36 per cent has deep to very deep soils (100 ->150 cm).*
- *About 14per cent of the area is having sandy at the surface, 16 per cent loamy soils and 53 per cent has clayey soils at the surface.*
- *About 44per cent of the area has non-gravelly (<15%) soils and39per cent has gravelly soils (15-35 % gravel).*
- *With respect to available water capacity 21 per cent of the area has very low (<50mm/m), 32per cent of the area has low (51-100 mm/m), 14 per cent medium*

(101-150 mm/m), 6 per cent high (151-200mm/m) and 11 per cent area is very high (>200mm/m) in available water capacity.

- *An area of about 11 per cent has nearly level (0-1%) lands and 73 per cent has very gently sloping (1-3%) lands.*
- *An area of about 39 per cent is slightly eroded (e1) and 44 per cent is moderately eroded (e2) lands.*
- *An area of about <1 per cent has soils that are slightly acid (pH 6.0 to 6.5), 23 per cent neutral soils (pH 6.5 to 7.3), 22 per cent slightly alkaline (pH 7.3 to 7.8), 30 per cent moderately alkaline (pH 7.8 to 8.4) and 7 per cent soils strongly alkaline (pH 8.4 to 9.0).*
- *Electrical conductivity (EC) of the soils are dominantly < 2dsm^{-1}indicating that soils are non saline.*
- *Organic carbon is medium (0.5-0.75%) in 81 per cent and high (>0.75%) in 2 per cent area of the soils.*
- *Available phosphorus is medium (23-57 kg/ha) in 29per cent and high (>57 kg/ha) in 54 per cent area of the soils.*
- *Available potassium islow (<145 kg/ha) in <1 per cent, medium (145-337 kg/ha) in 45 per cent and high (>337 kg/ha) in 39 per cent of the soils.*
- *Available sulphur is low (<10 ppm) in 71per cent and medium (10-20 ppm) in 12 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in about 11 per cent and medium (0.5-1.0 ppm) in 73per cent area of the soils.*
- *Available iron is deficient in 35 per cent and sufficient (>4.5 ppm) in 48per cent of the area.*
- *Available zinc is deficient (<0.6 ppm) in 81 of the area and sufficient in 3 per cent of the area.*
- *Available manganese and copper are sufficient in the entire area.*
- *The land suitability for 28 major agricultural and horticultural crops grown in the microwatershed was assessed and the areas that are highly suitable (class S1) and moderately suitable (class 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	*63(17)*	*137(37)*		*Pomegranate*	*62(17)*	*145(40)*
Maize	*25(7)*	*174(48)*		*Guava*	*25(7)*	*135(37)*
Bajra	*107(30)*	*110(30)*		*Jackfruit*	*62(17)*	*98(27)*
Redgram	*62(17)*	*130(36)*		*Jamun*	*13(3)*	*186(51)*
Bengal gram	*38(11)*	*165(45)*		*Musambi*	*100(28)*	*107(30)*
Groundnut	*12(3)*	*171(47)*		*Lime*	*100 (28)*	*107(30)*
Sunflower	*100(28)*	*129 (35)*		*Cashew*	*10(3)*	*161(44)*
Cotton	*88(24)*	*112(31)*		*Custard apple*	*184(51)*	*77(21)*
Chilli	*107(30)*	*45 (12)*		*Amla*	*145(40)*	*115(32)*
Tomato	*107(30)*	*45(12)*		*Tamarind*	*13(3)*	*90(25)*
Drumstick	*64(18)*	*156(43)*		*Marigold*	*25(7)*	*174(48)*
Mulberry	*64(18)*	*187(51)*		*Chrysanthemum*	*25(7)*	*174(48)*
Mango	*13(3)*	*51(14)*		*Jasmine*	*25(7)*	*127(35)*
Sapota	*62(17)*	*98(27)*		*Crossandra*	*25(7)*	*130(36)*

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

- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment and drainage line treatment palnshave 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 in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

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

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

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

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

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

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

The land resource inventory aims to provide site specific database for Budagumpa-1 microwatershed in Koppal Taluk, Koppal District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery. Later, an attempt will be made to uplink this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological Units (LEUs) map.

The study was organized and executed by the ICAR- National Bureau of Soil Survey and Land Use Planning, Regional Centre, Bangalore under Generation of Land Resource Inventory Data Base Component-1 of the Sujala-III Project funded by the World Bank.

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Budagumpa-1 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig 2.1). It lies between $15^0$23' and $15^0$24' North latitudes and $76^0$17' and $76^0$19 East longitudes and covers an area of about 363 ha. It comprises parts of Balebavi, Amarapura, Budagumpa and Danakanadoddi. It is about 75 km southwest of Koppal town and is surrounded by Amarapura on the north, Danakanadoddi on the northwest, Budagumpa on the south and Balebavi on the northeastern side of the microwatershed.

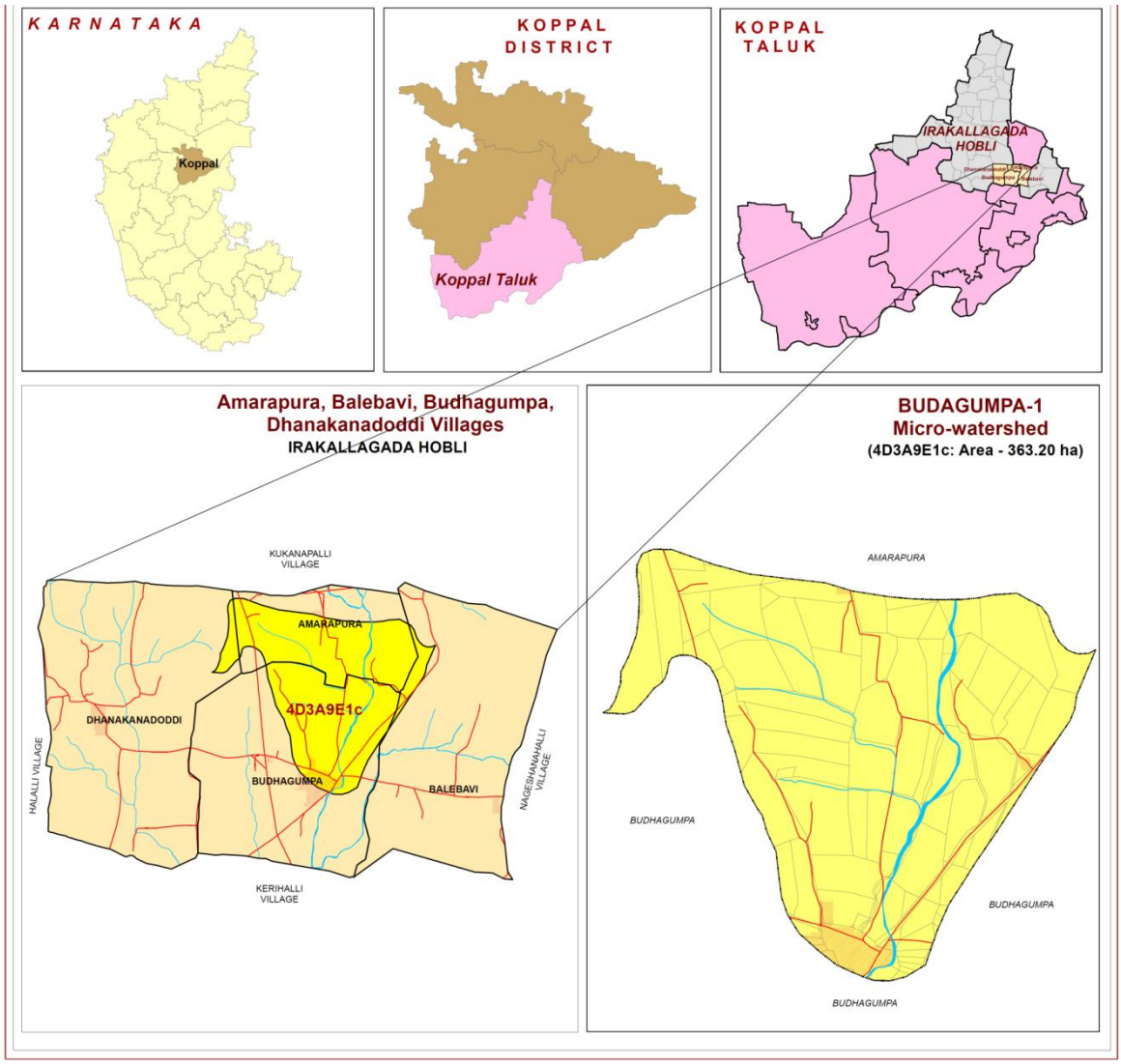


Fig.2.1 Location map of Budagumpa-1 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Figs.2.2 a and b). Granite gneisses are essentially pink to gray and are coarse to

medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Budagumpa-1 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 paleo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2 a 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 to 528 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 village. 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 is received 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 is 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 to 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

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

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

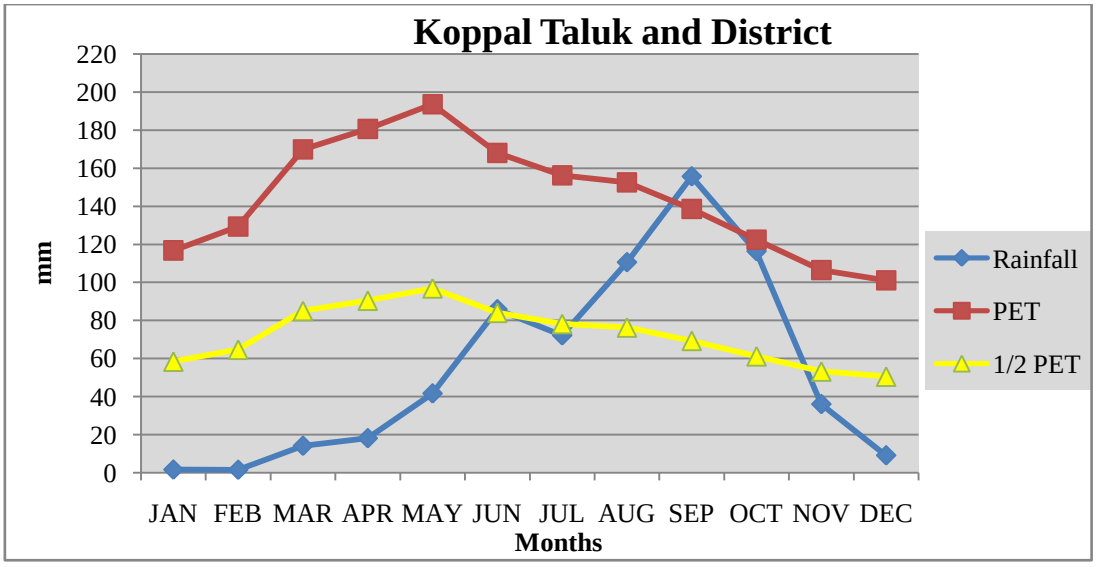


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

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

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

Fig 2.4 Natural vegetation of Budagumpa-1 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 boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5 a & b). 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 Budagumpa-1 microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells in Budagumpa-1 microwatershed is given in Fig 2.7.

Table 2.2 Land Utilization in Koppal District

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

Fig.2.5 (a) Different crops and cropping systems in Budagumpa-1 Microwatershed

Fig.2.5 (b) Different crops and cropping systems in Budagumpa-1 Microwatershed

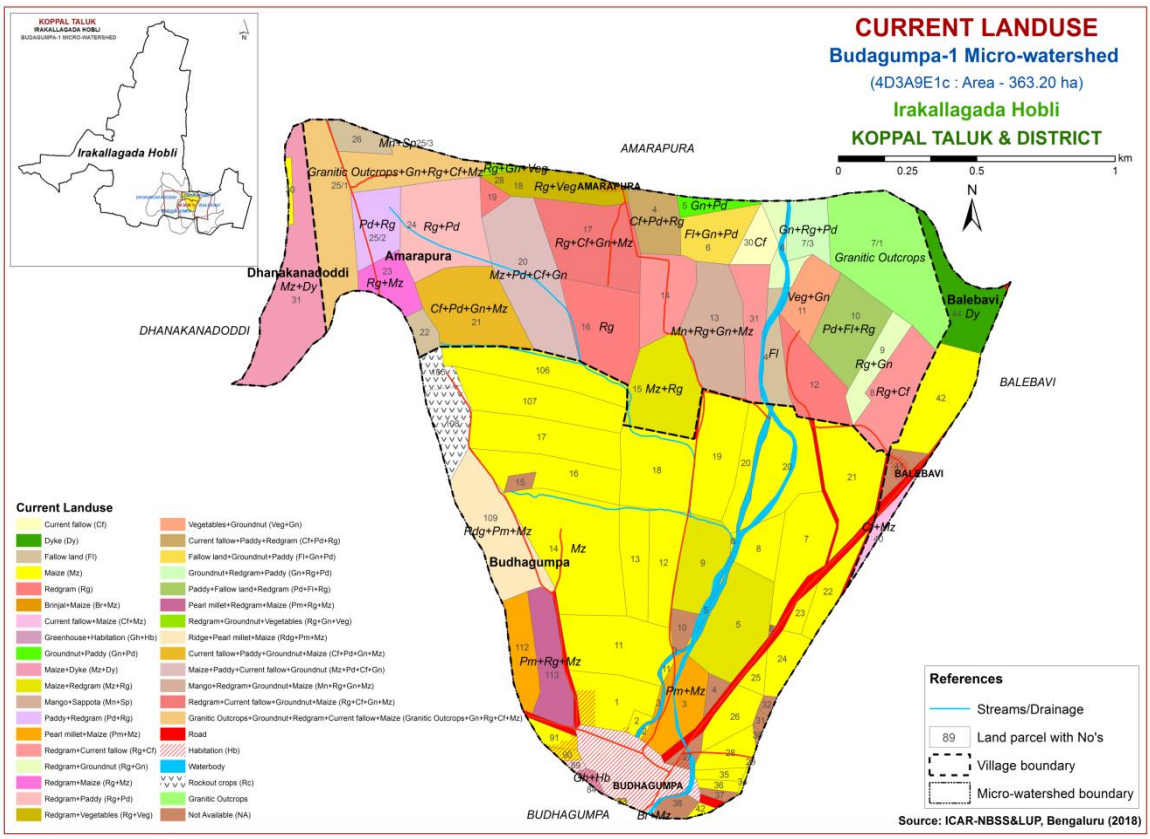


Fig.2.6 Current Land Use – Budagumpa-1 Microwatershed

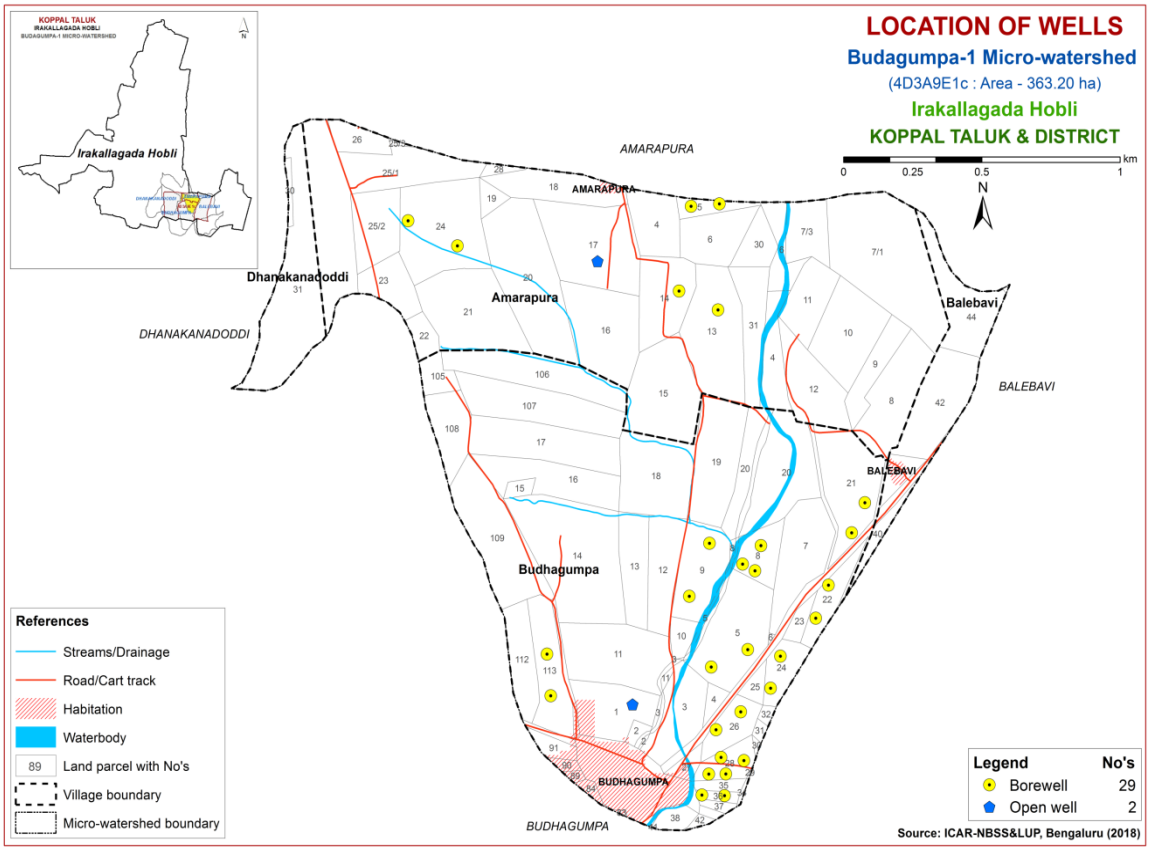


Fig. 2.6 Location of wells and conservation structures of Budagumpa-1 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Budagumpa-1 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope, 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 363 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 on 1:7290 scale covering the microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss and alluvial landscapes and is divided into landforms such as ridges, mounds and uplands, very gently sloping lands based on slope. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

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

DSe- Alluvial landscape

DSe 1 Summit

- DSe 11 Nearly level Summit with dark grey tone
- DSe 12 Nearly level Summit with medium grey tone
- DSe 13 Nearly level Summit with whitish grey tone
- DSe 14 Nearly level Summit with whitish tone (Calcareousness)
- DSe 15 Nearly level Summit with pinkish grey tone
- DSe 16 Nearly level Summit with medium pink tone
- DSe 17 Nearly level Summit with bluish white tone
- DSe 18 Nearly level Summit with greenish grey tone

DSe 2 Very genetly sloping

- DSe 21 Very gently sloping, whitish tone
- DSe 22 Very gently sloping, greyish pink tone
- DSe 23 Very gently sloping, whitish grey tone
- DSe 24 Very gently sloping, medium grey tone
- DSe 25 Very gently sloping, medium pink tone
- DSe 26 Very gently sloping, dark grey tone
- DSe 27 Very gently sloping, bluish grey tone
- DSe 28 Very gently sloping, greenish grey tone
- DSe 29 Very gently sloping, Pinkish grey

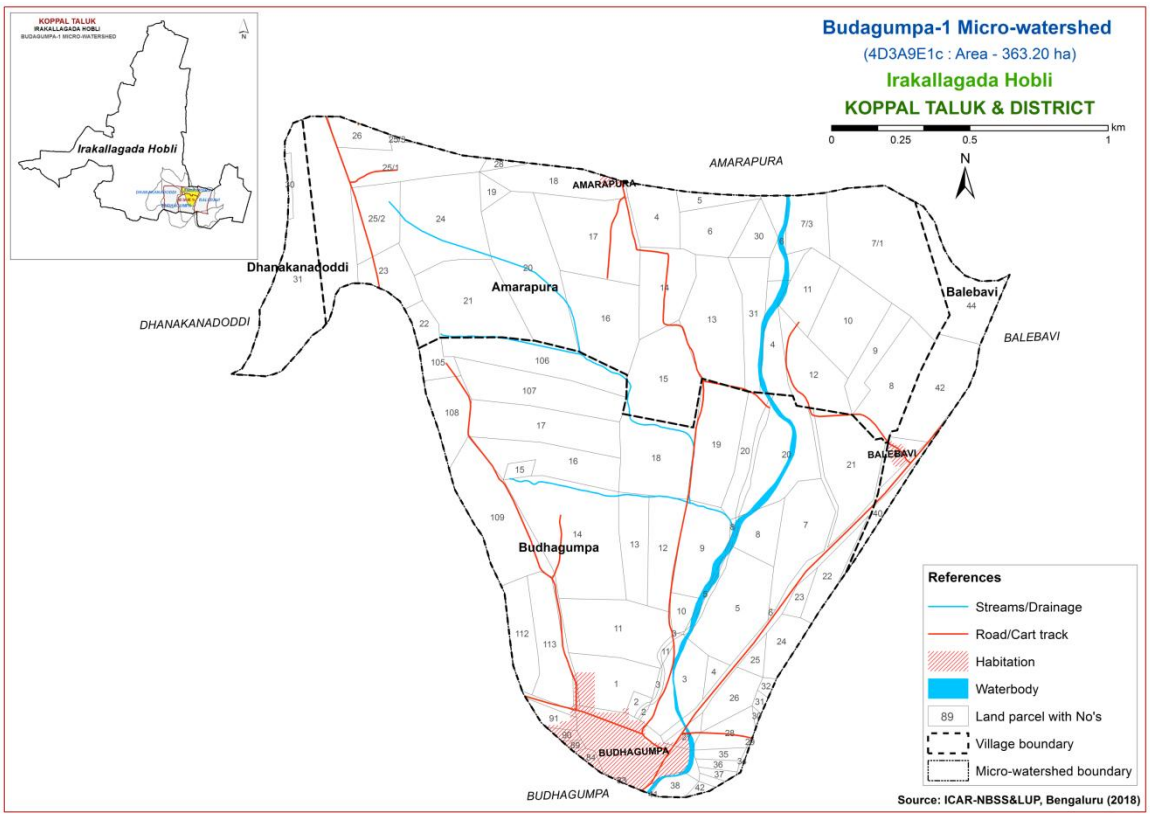


Fig 3.1 Scanned and Digitized Cadastral map of Budagumpa-1 Microwatershed

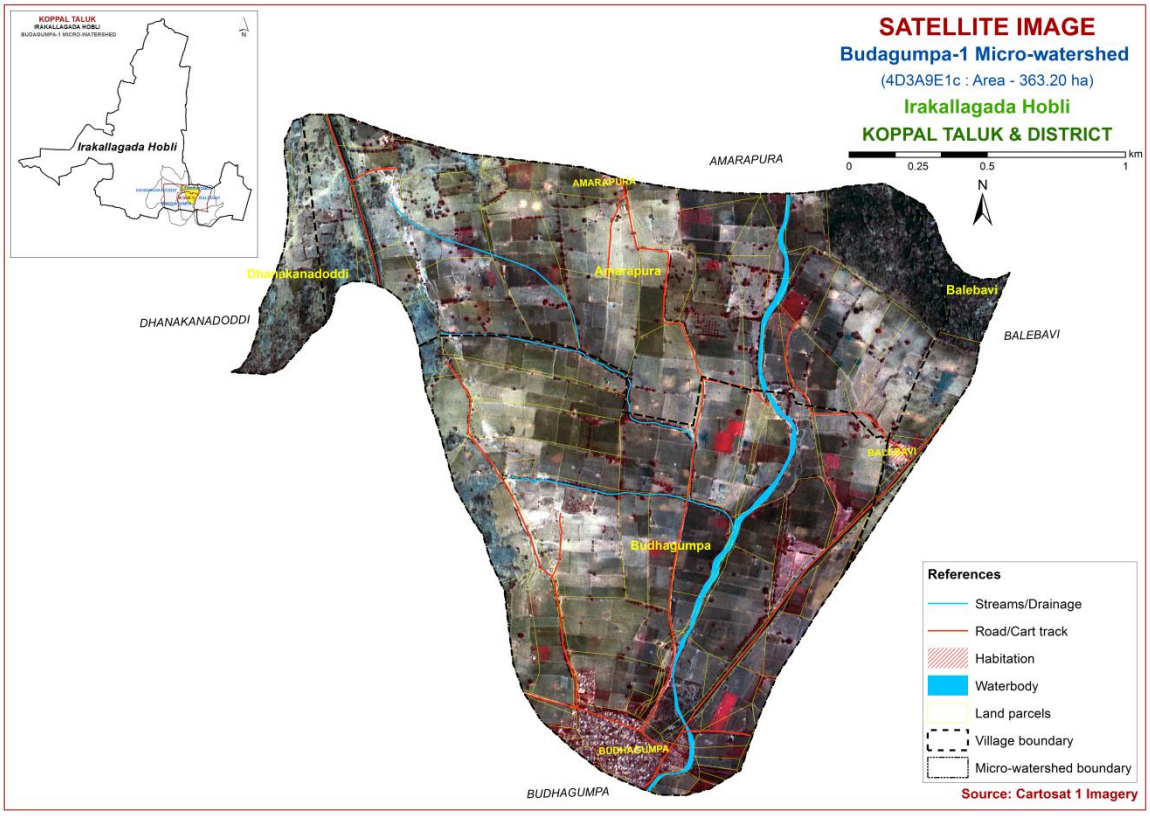


Fig.3.2 Satellite Image of Budagumpa-1 Microwatershed

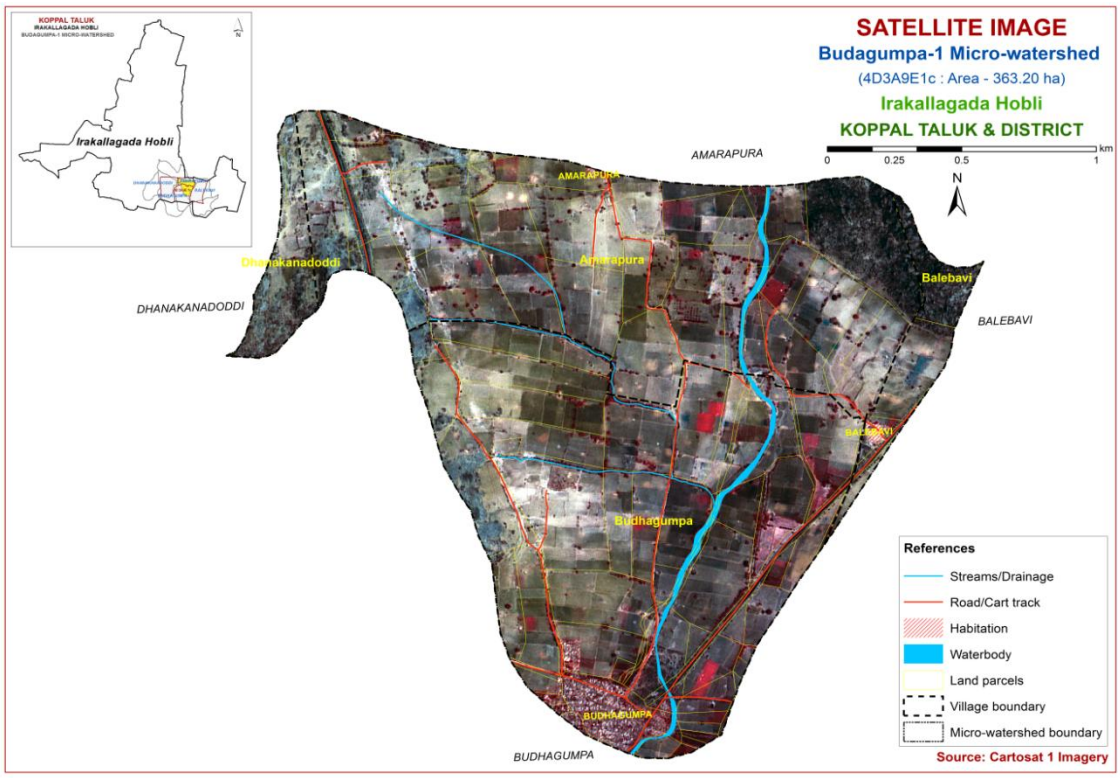


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Budagumpa-1 Microwatershed

3.3 Field Investigation

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

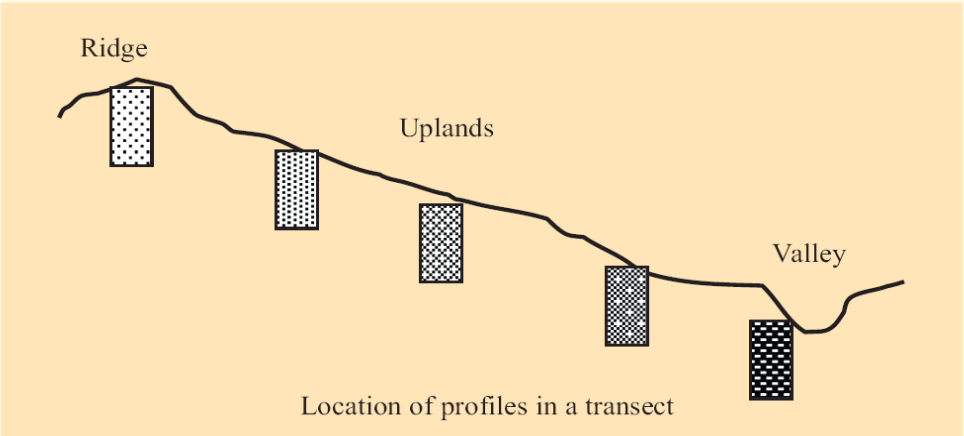


Fig: 3.4. Location of profiles in a transect

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 upto 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, soil profiles were also studied at random, almost like in a grid pattern, outside the transect areas to validate the soil map unit boundaries.

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, 17 soil series were identified in Budagumpa-1 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcare o-usness**
1	Harve (HRV)	25-50	2.5YR 3/4,3/6 5YR 3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr-	-
2	Chikkasavanur (CSR)	25-50	7.5YR 3/2,3/3,3/4	scl	<15	Ap-Bw-Cr	-
3	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
4	Kutegoudanahundi (KGH)	50-75	7.5YR 3/2,3/3,3/4	scl	15-35	Ap-Bt-Cr	-
5	Bisarahalli (BSR)	75-100	5 YR 3/3, 3/4	gsc	15-35	Ap-Bt-Cr	-
6	Gollarahatti (GHT)	75-100	2.5YR 3/4,3/6,4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
7	Hooradhahalli (HDH)	75-100	2.5YR 2.5/4,3/4,3/6	gsc-gc	>35	Ap-Bt-Cr	-
8	Bidanagere (BDG)	75-100	5YR 3/3,3/4,4/3,5/4 2.5YR 3/4	gc	35-60	Ap-Bt-Cr	-
9	Jedigere (JDG)	100-150	5YR 4/6,3/4, 7.5YR 3/4, 4/6	sc-c	<15	Ap-Bt-BC-Cr	-
10	Kumchahalli (KMH)	100-150	2.5YR3/4, 3/6	sc	<15	Ap-Bt-Cr	-
11	Mornal (MNL)	100-150	5YR 3/4,	gsc	15-35	Ap-Bt-Cr	-

			2.5 YR 3/4, 4/6				
12	Vaddarahalli (VDH)	100-150	7.5YR3/2,3/3,3/4	sc-c	-	Ap-Bt-Cr	-
13	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
14	Hallikere (HLK)	>150	5YR 3/3,3/4 7.5YR 3/3,3/4	c	<15	Ap-Bt	-
	Soils of Alluvial Landscape						
15	Dambarahalli (DRL)	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bw-Ck	e-es
16	Gatareddihal (GRH)	100-150	10YR 2/1,3/1, 2.5 Y4/3,5/4	c	<15	Ap-Bw-BC-C	es
17	Kadagathur (KDT)	>150	10 YR3/1,3/2,3/3, 7.5YR 3/3, 3/4	sc-c	-	Ap-Bw	-

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey many profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 21 mapping units representing 17 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 21 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Land Use Classes

The 21 soil phases identified and mapped in the microwatershed were regrouped into 6 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Use Classes (LUC's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LUCs. For Budagumpa-1 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

3.5 Laboratory Characterization

Soil samples of 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 farmer's fields in Budagumpa-1 microwatershed (37 samples) for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Budagumpa-1 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	CSR	Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown, red sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**25 (6.98)**
37		CSRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	25 (6.98)
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay loam soils occurring on nearly level to gently sloping uplands under cultivation		**17 (4.66)**
31		HRViB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	17 (4.66)
	KGH	Kutegoudanahundi soils are moderately shallow (50-75 cm), well drained, have brown to dark brown gravelly red sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**7 (1.79)**
62		KGHbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7 (1.79)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**3 (0.95)**
53		LKRiB2	Sandy clay surface, slope 1-3%, moderate erosion	3 (0.95)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation		**15 (4.21)**
455		BDGcB2	Sandy loam surface, slope 1-3%, moderate erosion	15 (4.21)
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**81 (22.43)**
165		BSRiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	45 (12.5)
168		BSRiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	36 (9.93)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on nearly level to very gently sloping uplands under		**0.07 (0.02)**

		cultivation		
138		GHTcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	0.07 (0.02)
	HDH	Hooradhahalli soils are moderately deep (75-100 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation		**15 (4.09)**
103		HDHbB1	Loamy sand surface, slope 1-3%, slight erosion	15 (4.09)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**28 (7.65)**
216		BPRbB2	Loamy sand surface, slope 1-3%, moderate erosion	28 (7.64)
459		BPRmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	0.05(0.01)
	JDG	Jedigere soils are deep (100-150 cm), well drained, have dark brown to dark reddish brown red sandy clay to clay soils occurring on nearly level to very gently sloping uplands under cultivation		**37 (10.23)**
456		JDGcB2	Sandy loam surface, slope 1-3%, moderate erosion	17 (4.7)
458		JDGiB1	Sandy clay surface, slope 1-3%, slight erosion	20 (5.53)
	KMH	Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**2 (0.56)**
198		KMHhB1g1	Sandy clay loam surface, slight erosion, gravelly (15-35%)	2 (0.56)
	MNL	Mornal soils are deep (100-150 cm), well drained, have dark reddish brown to red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**5 (1.26)**
208		MNLiB2	Sandy clay surface, slope 1-3%, moderate erosion	5 (1.26)
	VDH	Vaddarahalli soils are deep (100-150 cm), moderately well drained, have dark brown sandy clay to clay soils occurring on nearly level to very gently sloping uplands under cultivation		**8 (2.09)**
247		VDHiB2	Sandy clay surface, slope 1-3%, moderate erosion	8 (2.09)
	HLK	Hallikere soils are very deep (>150 cm), well drained, have dark brown to dark reddish brown clayey soils occurring on nearly level to very gently sloping uplands under cultivation		**13 (3.44)**
273		HLKiB1	Sandy clay surface, slope 1-3%, slight erosion	13 (3.44)
Soils of Alluvial landscape				
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping alluvial plains under cultivation		**9 (2.4)**
349		DRLmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	9 (2.4)
	GRH	Gatareddihal soils are deep (100-150 cm), moderately well drained, have light olive brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping alluvial plains under cultivation		**36 (9.8)**

370		GRHmA1	Clay surface, slope 0-1%, slight erosion	36 (9.8)
	KDT	Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown, sandy clay to clay black soils occurring on nearly level to very gently sloping alluvialplains under cultivation		**3 (0.74)**
403		KDTmA1	Clay surface, slope 0-1%, slight erosion	3 (0.74)
999		Rock outcrops	Rock lands, both massive and bouldery	**46 (12.72)**
1000		Others	Habitation &waterbody	**14(3.97)**

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

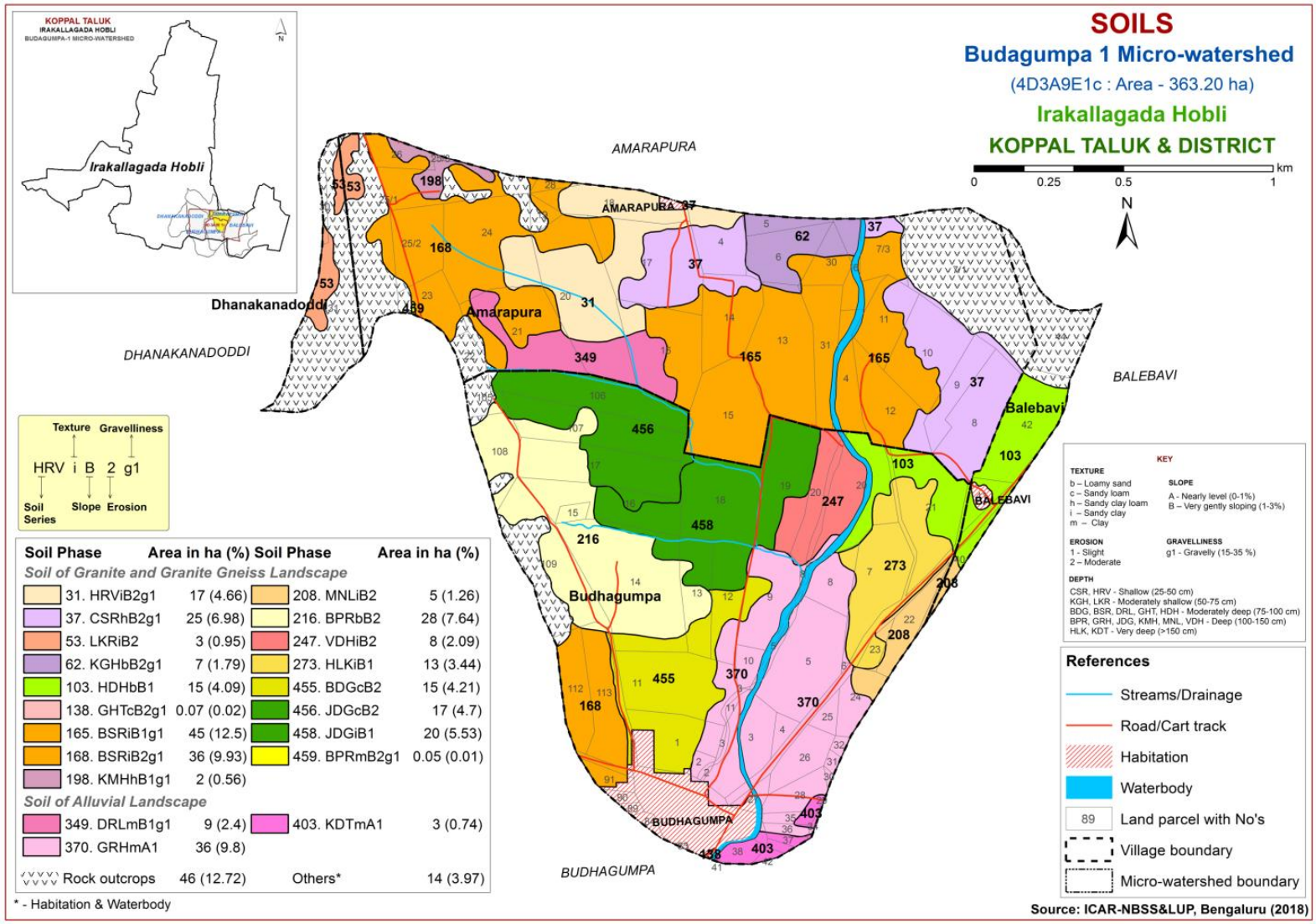


Fig 3.5 Soil Phase or Management Units- Budagumpa-1 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Budagumpa-1 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 17 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 17 soil series identified followed by 21 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified and their classification in Budagumpa-1 microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 14 soil series were identified and mapped. Of these series, Bisarahalli (BSR) series occupies maximum area of 81 ha (22%) followed by Jedigere (JDG) 37 ha (10%). The brief description of soil series along with the soil phases identified and mapped is given below.

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

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

Landscape and soil profile characteristics of Harve (HRV) Series

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

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

Landscape and soil profile characteristics of Chikkasavanur (CSR) Series

4.1.3 Lakkur (LKR) Series: Lakkur soils are moderately shallow (50-75cm), well drained, have reddish brown to dark red gravelly sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently and gently sloping uplands. The Lakkur series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Typic Rhodustalfs.

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

Landscape and soil profile characteristics of Lakkur (LKR) Series

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

The thickness of the solum ranges from 50 to 74 cm. The thickness of A horizon ranges from 12 to 22 cm. Its colour is in 7.5 YR and 10 YR hue with value and chroma 3 to 4. The texture varies from loamy sand to sandy loam with 15 to 30 per cent gravel. The thickness of B horizon ranges from 40 to 62 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. Its texture is sandy clay loam with gravel content of 15 to 35 per cent. The available water capacity is medium (100-150 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kutegoudanahundi (KGH) Series

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

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 11 to 19 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon varies from 65 to 83 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (50-100mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

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

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

Landscape and soil profile characteristics of Bisarahalli (BSR) Series

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

The thickness of the solum ranges from 78 to 98 cm. The thickness of A-horizon ranges from 12 to 18cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture varies from loamy sand to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 66 to 81cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay loam with 15 to 35 per cent gravel. The available water capacity is medium (100-150 mm/m). One soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Gollarahatti (GHT) Series

4.1.8 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 very low (<50 mm/m). One soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Bidanagere (BDG) Series

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

The thickness of the solum ranges from 102 to 147 cm. The thickness of A horizon ranges from 12 to 17 cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is medium (100-150 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Balapur (BPR) Series

4.1.10 Jedigere (JDG) Series: Jedigere soils are deep (100-150 cm) well drained, have yellowish red to strong brown sandy clay to clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands under cultivation.

The thickness of the solum ranges from 117 to 145 cm. The thickness of A horizon ranges from 13 to 21 cm. Its colour is in hue 5 YR and 7.5 YR with value 2 to 4 and chroma 2 to 6. Its texture is dominantly sandy clay and sand clay loam. The thickness of B horizon ranges from 104 to 124 cm. Its colour is in hue 10 YR and 7.5 YR with value 2 to 4 and chroma 3 to 6. Its texture is dominantly clay. The available water capacity is very high (>200mm/m).Two soil phases were identified and mapped.

Landscape and Soil Profile Characteristics of Jedigere (JDG) Series

4.1.11 Kumchahalli (KMH) Series: Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Kumchahalli series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Rhodustalfs.

The thickness of the solum ranges from 102 to 150 cm. The thickness of A horizon ranges from 11 to 23 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. The texture is dominantly sandy clay. The thickness of B horizon ranges from 95 to 132 cm. Its colour is in 2.5 YR hue with value 3 and chroma 4 to 6. Its texture is dominantly sandy clay loam to sandy clay. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kumchahalli (KMH) Series

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

The thickness of the solum ranges from 112 to 149 cm. The thickness of A-horizon ranges from 15 to 25 cm. Its colour is in 5 YR, 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture is sandy clay loam, sandy clay and clay with 15 to 30 per cent gravel. The thickness of B-horizon ranges from 103 to 131 cm. Its colour is in 2.5 YR and 5 YR hue with value 2.5 to 4 and chroma 3 to 6. Texture is sandy clay loam to sandy clay with 15 to 35 per cent gravel. The available water capacity is medium (101-150 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Mornal (MNL) Series.

4.1.13 Vaddarahalli (VDH) Series: Vaddarahalli soils are deep (100-150 cm), well drained, have dark reddish brown to dark brown sandy clay to clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Vaddarahalli series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 106 to 148 cm. The thickness of A horizon ranges from 13 to 23 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 and chroma 3 to 4. The texture varies from sandy loam to clay. The thickness of B horizon ranges from 95 to 132 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 2 to 4. Its texture is sandy clay to clay. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Vaddarahalli (VDH) Series

4.1.14 Hallikere (HLK) Series: Hallikere soils are very deep (>150 cm), well drained, have dark brown and dark reddish brown clayey soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Hallikere series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Paleaustalfs.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 11 to 14 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 3 to 4. The texture varies from sandy loam to sandy clay loam. The thickness of B horizon is more than 150 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 3 to 4. Its texture is clay. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Hallikere (HLK) Series

4.2 Soils of Alluvial Landscape

In this landscape, 3 soil series were identified and mapped. Of these series, Gatareddihal (GRH) series occupies maximum area of 36 ha (10 %). The brief description of soil series along with the soil phases identified and mapped is given below.

4.2.1 Dambarahalli (DRL) Series: Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have black and very dark gray to dark brown calcareous cracking clay soils. They have developed from alluvium and occur on very gently to gently sloping alluvial plains under cultivation.

The thickness of the solum ranges from 75 to 99 cm. The thickness of A horizon ranges from 13 to 24 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay. The thickness of B horizon ranges from 54 to 85 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Dambarahalli (DRL) Series

4.2.2 Gatareddihal (GRH) Series: Gatareddihal soils are deep (100-150 cm), moderately well drained, have black or dark grey to light olive brown, calcareous cracking clay soils. They are developed from alluvium and occur on nearly level to very gently sloping uplands under cultivation. The Gatareddihal series has been classified as a member of the fine, smectitic, isohyperthermic (calc) family of Vertic Haplustepts.

The thickness of the solum ranges from 102 to 149 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 7.5 YR, 10 YR hue with value 3 to 4 and chroma 1 to 6. The texture is sandy clay loam to clay. The thickness of B-horizon ranges from 86 to 117 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 and chroma 2 to 6. Texture is clay with less than 15 per cent gravel and is calcareous. The available water capacity is very high (>200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Gatareddihal (GRH) Series

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

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

Landscape and soil profile characteristics of Kadagathur (KDT) Series

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

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-21	Ap	74.00	8.34	17.66	9.62	11.57	15.76	23.13	13.92	20	sl	-	-
21-35	Bt1	54.37	10.48	35.14	16.33	8.64	9.69	11.59	8.11	40	sc	-	-
35-56	Bt2	48.37	13.46	38.17	10.96	7.69	9.17	11.28	9.27	60	sc	-	-

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

Contd.....

Soil Series: Gollarahatti (GHT), **Pedon:** RM-2
Location: $50^0$04'88.8"N, $75^0$37'65.2"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag district.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine loamy, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-26	Ap	83.22	5.74	11.05	9.71	11.73	16.68	27.10	16.58	30	ls	-	-
26-63	Bt1	55.91	13.36	30.73	13.05	9.66	11.10	14.29	7.81	20	scl	-	-
63-84	Bt2	57.17	11.38	31.45	10.53	10.11	12.28	13.83	10.42	20	scl	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaACO$_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-26	5.70	-	-	0.06	0.20	0.00	1.50	0.60	0.09	0.13	2.32	3.17	0.29	73.00	4.10
26-63	6.26	-	-	0.04	0.24	0.00	7.35	1.55	0.09	0.17	9.15	9.89	0.32	93.00	1.72
63-84	6.50	-	-	0.05	0.20	0.47	-	-	0.09	0.21	0.30	10.18	0.32	100.00	2.06

Contd…

Soil Series: Hooradhahalli (HDH), Pedon: RM-69
Location: $13^0$24'31"N, $76^0$33'41"E, (4D3D8G2d), Hesarahalli village, Chikkanayakanahalli taluk, Tumukur 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
0-18	Ap	72.56	15.17	12.27	4.57	8.33	17.38	23.88	18.39	35	sl	-	-
18-33	Bt1	56.29	10.75	32.96	7.88	10.24	13.41	14.43	10.34	55	scl	-	-
33-58	Bt2	46.66	10.79	42.55	10.79	9.87	8.43	9.04	8.53	55	sc	-	-
58-90	Bt3	43.09	13.63	43.27	9.90	8.25	7.32	8.76	8.87	45	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}							%	%
0-18	6.54	-	-	0.07	0.60	0.00	2.68	1.38	0.44	0.42	4.91	5.84	0.48	84.07	7.11
18-33	5.90	-	-	0.07	0.52	0.00	3.99	1.27	0.09	0.37	5.71	8.61	0.26	66.32	4.29
33-58	6.16	-	-	0.07	0.44	0.00	4.92	1.67	0.08	0.55	7.22	10.00	0.24	72.23	5.50
58-90	6.39	-	-	0.06	0.40	0.00	4.30	2.02	0.08	0.46	6.87	9.21	0.21	74.61	5.05

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: Kumchahalli (KMH), Pedon: RM- 9
Location: $15^0$20'05"N, $76^0$13'21"E, Basapura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine, mixed, isohyperthermic Typic Rhodustalfs

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-13	7.2	-	-	0.193	0.81	3.00	9.69	3.93	1.41	0.08	15.10	15.07	0.38	100	0.54
13-27	7.13	-	-	0.161	0.7	3.00	8.69	3.57	1.29	0.16	13.70	13.75	0.36	100	1.14
27-43	7.31	-	-	0.096	0.89	2.64	5.19	2.36	1.07	0.24	8.86	9.46	0.30	94	2.51
43-64	7.65	-	-	0.089	1.16	2.52	8.25	2.88	0.72	0.35	12.20	12.65	0.28	96	2.79
64-84	7.98	-	-	0.1	0.38	3.12	10.49	2.88	0.26	0.41	14.04	14.63	0.32	96	2.78
84-114	8.23	-	-	0.121	0.58	2.88	8.02	1.87	0.09	0.43	10.41	10.67	0.38	98	4.02

Contd…

Series Name: Mornal (MNL), Pedon: R-12
Location: $15^0$22'75"N, $76^0$05'16.1" Halageri village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic Typic Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	81.48	5.14	13.39	14.07	12.15	17.00	27.53	10.73	70	sl	9.64	4.93
17-31	Bt1	51.43	10.24	38.33	6.67	7.72	9.52	19.26	8.25	30	sc	23.97	11.70
31-56	Bt2	45.62	8.77	45.62	17.85	7.31	8.14	8.87	3.44	30	sc	25.94	12.45
56-104	Bt3	53.10	10.62	36.28	21.87	10.30	8.10	7.99	4.84	<30	sc	20.95	10.16
104-126	Bc	54.21	12.88	32.91	12.28	8.84	15.92	10.20	6.97	<30	scl	19.96	10.21

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	7.89	-	-	0.137	0.33	0.00	4.92	3.35	0.35	0.45	9.07	9.01	0.67	101	5.04
17-31	8.19	-	-	0.31	0.45	0.00	7.24	5.16	0.16	0.15	12.70	13.57	0.35	94	1.12
31-56	8.2	-	-	0.414	0.53	0.00	6.49	5.32	0.11	0.13	12.05	18.55	0.41	65	0.71
56-104	8.64	-	-	0.422	0.37	0.00	6.21	4.64	0.16	0.14	11.15	15.16	0.42	74	0.95
104-126	8.71	-	-	0.436	0.2	0.00	7.06	6.31	0.09	0.33	13.79	14.52	0.44	95	2.31

Contd…

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

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

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

Series Name: Gatareddihalla (GRH), Pedon: RM-2

Location: $15^0$24'01"N, $76^0$09'29"E, Chilavadagi village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine, smectitic, isohyperthermic (calc) Vertic 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
0-11	Ap	45.30	15.84	38.86	4.01	9.19	10.45	13.31	8.34	-	sc	25.72	17.55
11-35	Bw1	39.72	13.13	47.15	3.41	10.65	11.50	9.05	5.11	-	c	29.58	20.25
35-66	Bw2	34.69	17.29	48.02	3.32	4.93	12.63	8.14	5.67	-	c	35.93	18.05
66-86	Bw3	34.09	18.15	47.76	4.96	10.14	7.98	7.01	3.99	-	c	35.19	16.79
86-112	Bw4	42.55	16.46	40.98	5.53	11.91	9.68	10.21	5.21	-	c	44.70	16.06
112-125	Bc	56.02	14.48	29.50	11.41	17.07	12.36	10.26	4.92	-	scl	37.55	11.51

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-11	8.27	-	-	1.11	0.91	5.40	-	-	0.44	3.70	-	31.60	0.81	-	11.72
11-35	8.82	-	-	0.476	0.67	5.28	-	-	0.46	7.29	-	35.10	0.74	-	20.77
35-66	9.14	-	-	0.637	0.87	3.60	-	-	0.45	10.70	-	37.70	0.79	-	28.39
66-86	9.11	-	-	0.633	0.23	5.60	-	-	0.42	10.55	-	38.10	0.80	-	27.70
86-112	9.6	-	-	0.847	0.35	4.92	-	-	0.40	14.55	-	33.90	0.83	-	42.93
112-125	9.73	-	-	0.783	0.19	4.44	-	-	0.25	12.99	-	25.30	0.86	-	51.33

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

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

The 21 soil map units identified in the Budagumpa-1 microwatershed are grouped under two land capability classes and four land capability subclasses (Fig. 5.1).

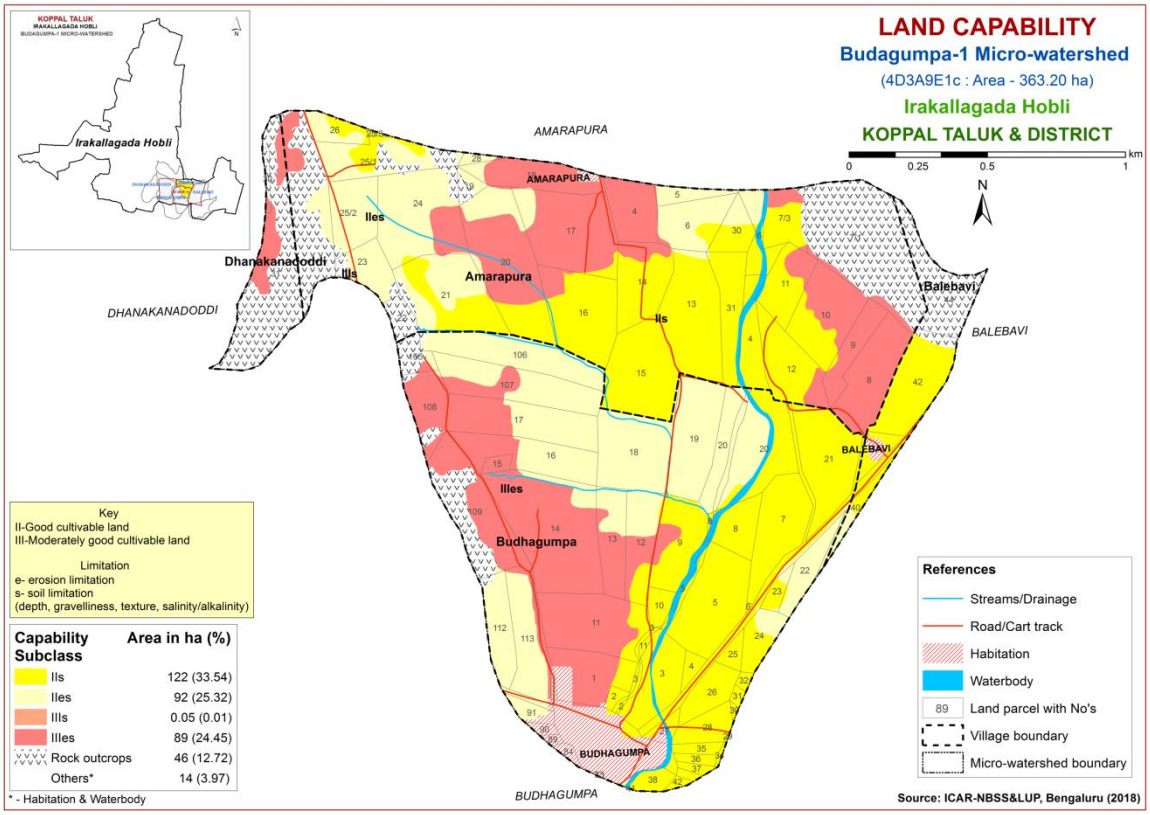


Fig. 5.1 Land Capability map of Budagumpa-1 Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good lands (Class II) cover an area of about 214 ha (59%) and distributed in the major part of the microwatershed. They have minor problems of soil and erosion. Moderately good lands (Class III) cover an area of about 89 ha (24%) and distributed in the western, northern and northeastern part with severe problems of erosion and soil.

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).

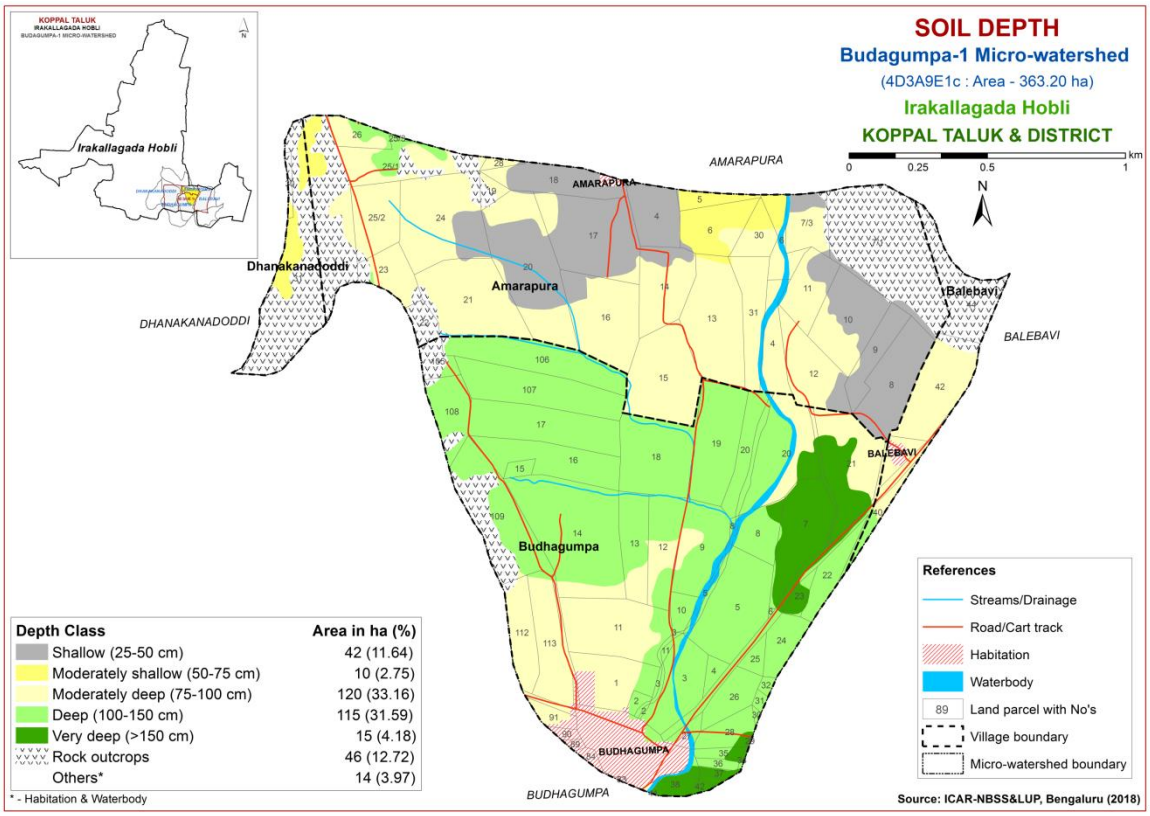


Fig. 5.2 Soil Depth map of Budagumpa-1 Microwatershed

Shallow (25-50 cm) soils occupy an area of about 42 ha (12 %) and are distributed in the northern part of the microwatershed. Moderately shallow (50-75cm) soils cover an area of about 10 ha (3%) and distributed in the northern part of the microwatershed. Moderately deep soils (75-100 cm) soils occupy an area of about 120 ha

(33 %) and occur in the northern, southwestern and eastern part of the microwatershed. Deep (100-150 cm) to very deep (>150 cm) soils occupy an area of about 130 ha (36 %) and distributed in the major part of the microwatershed.

The most productive lands cover about 130 ha (36%) where all climatically adapted long duration crops be grown. The problem lands cover about 42 ha (12%) where only short duration crops can be grown. The probability of crop failure is very high.

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 behavior, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Fig 5.3.

An area of about 49 ha (14%) is sandy at the surface and distributed in the western, eastern and southern part of the microwatershed. An area of about 59 ha (16 %) is loamy at the surface and distributed in the southern and central part of the microwatershed. Maximum area of about 194 ha (53%) is clayey at the surface and distributed in the major part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils (53 %) that have high potential for soil-water retention and availability and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other productive lands area loamy (16%) soils which also have high potential for soil- water retention and nutrient availability but have no drainage or other physical problems. The problem soils are sandy covering 14% area that have moisture and nutrient constraints.

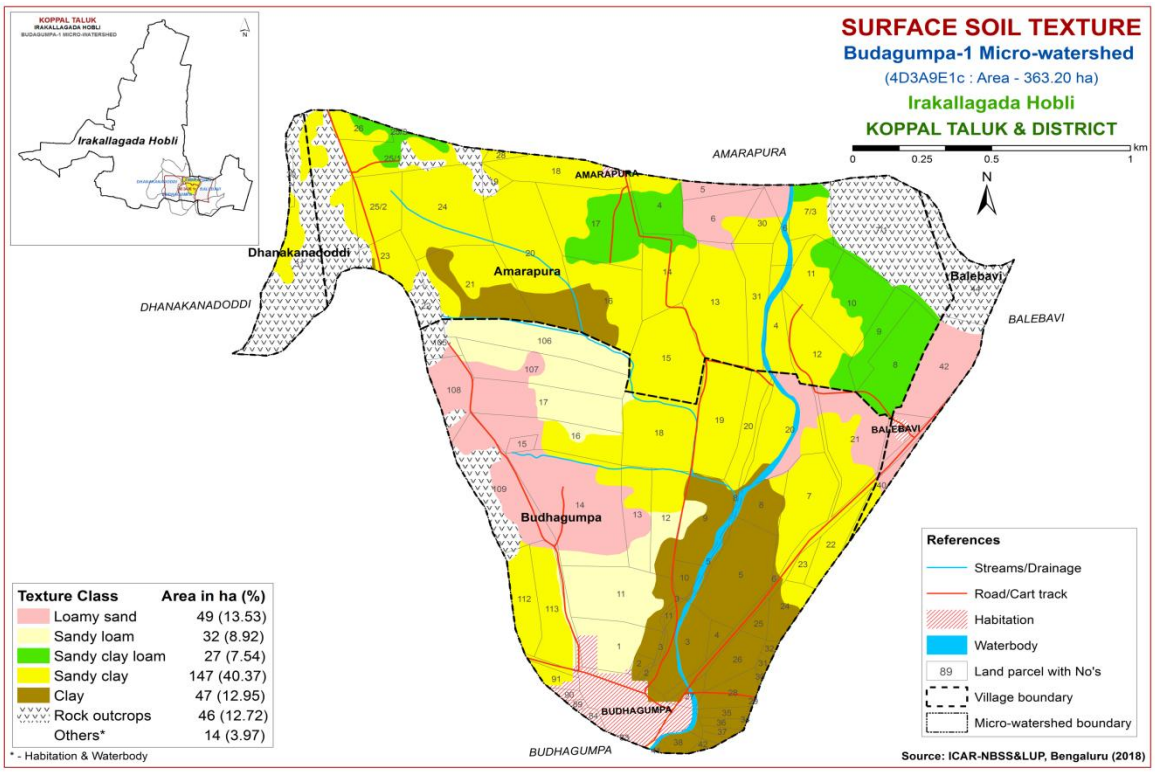


Fig. 5.3 Surface Soil Texture map of Budagumpa-1 Microwatershed

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover a maximum area of about 161 ha (44 %) and are distributed in the major part of the microwatershed. An area of 141 ha (39 %) is covered by gravelly (15-35% gravel) soils and are distributed in the western and northern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 44 per cent. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops.

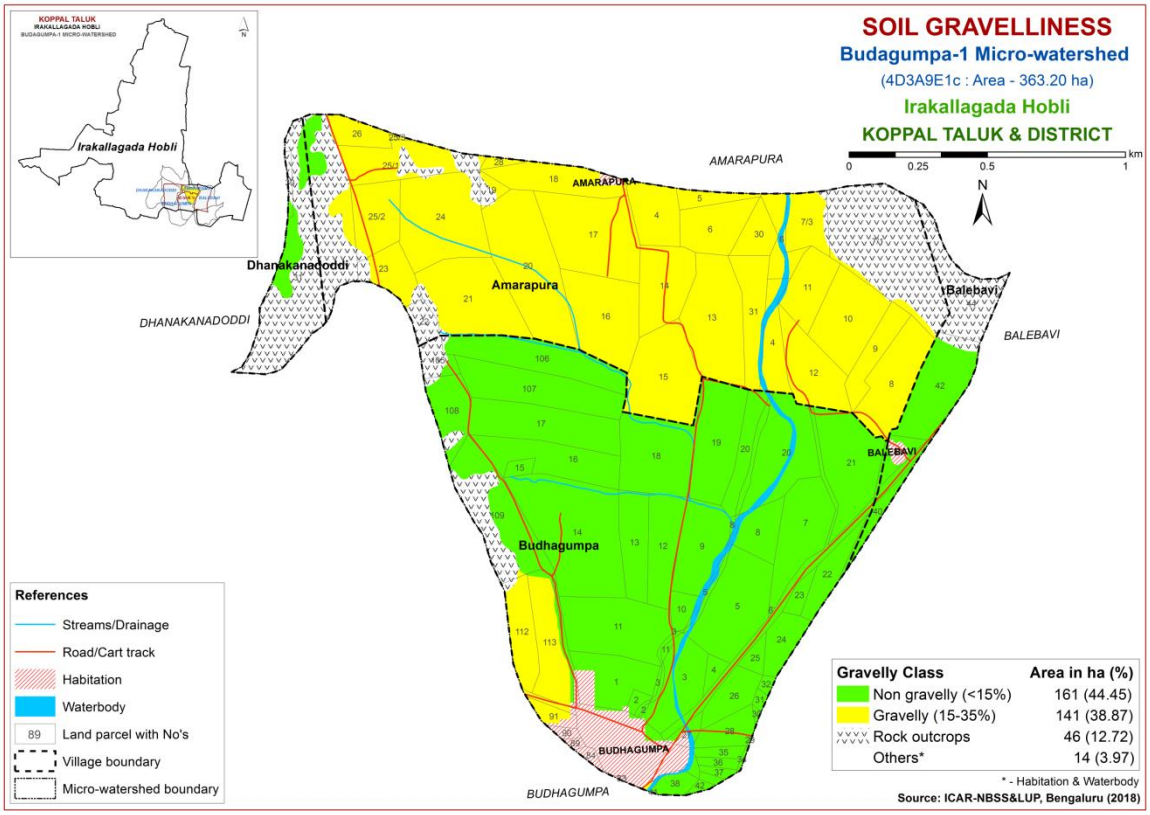


Fig. 5.4 Soil Gravelliness map of Budagumpa-1 Microwatershed

5.5 Available Water Capacity

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

An area of about 76 ha (21%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the southern and northeastern part of the microwatershed. Maximum area of about 116 ha (32 %) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 52 ha (14%) is medium (101-150 mm/m) in available water capacity and are distributed in the central and western part of the microwatershed. An area of about 58 ha (16%) is high to very high in available water capacity and distributed in the eastern and southern part of the microwatershed.

An area of about 76 ha (21%) 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 58 ha (16 %) has soils that have high potential (>200 mm/m) with

regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

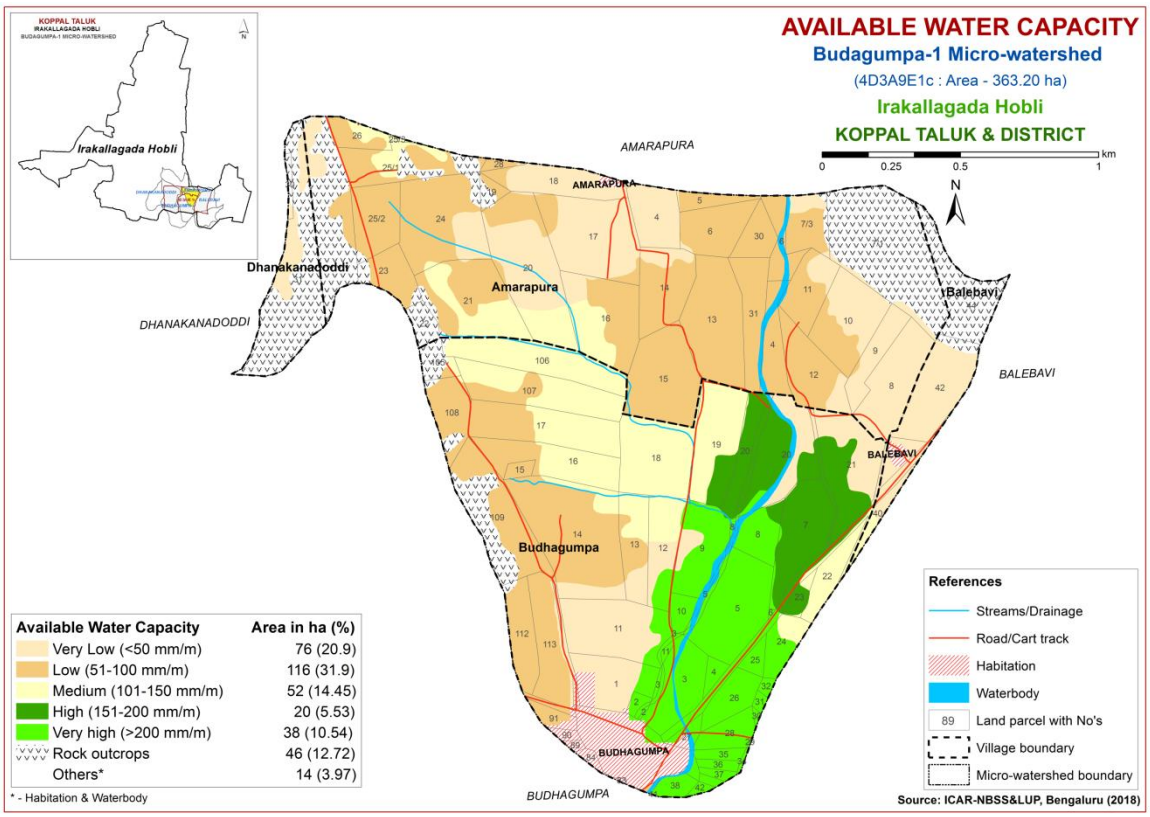


Fig. 5.5 Soil Available Water Capacity map of Budagumpa-1 Microwatershed

5.6 Soil Slope

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

Area falling under nearly level (0-1%) lands cover about 38 ha (11%) and distributed in the southeastern part of the microwatershed. Very gently sloping (1-3% slope) lands cover a maximum area of about 264 ha (73 %) and distributed in the major part of the microwatershed.

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.

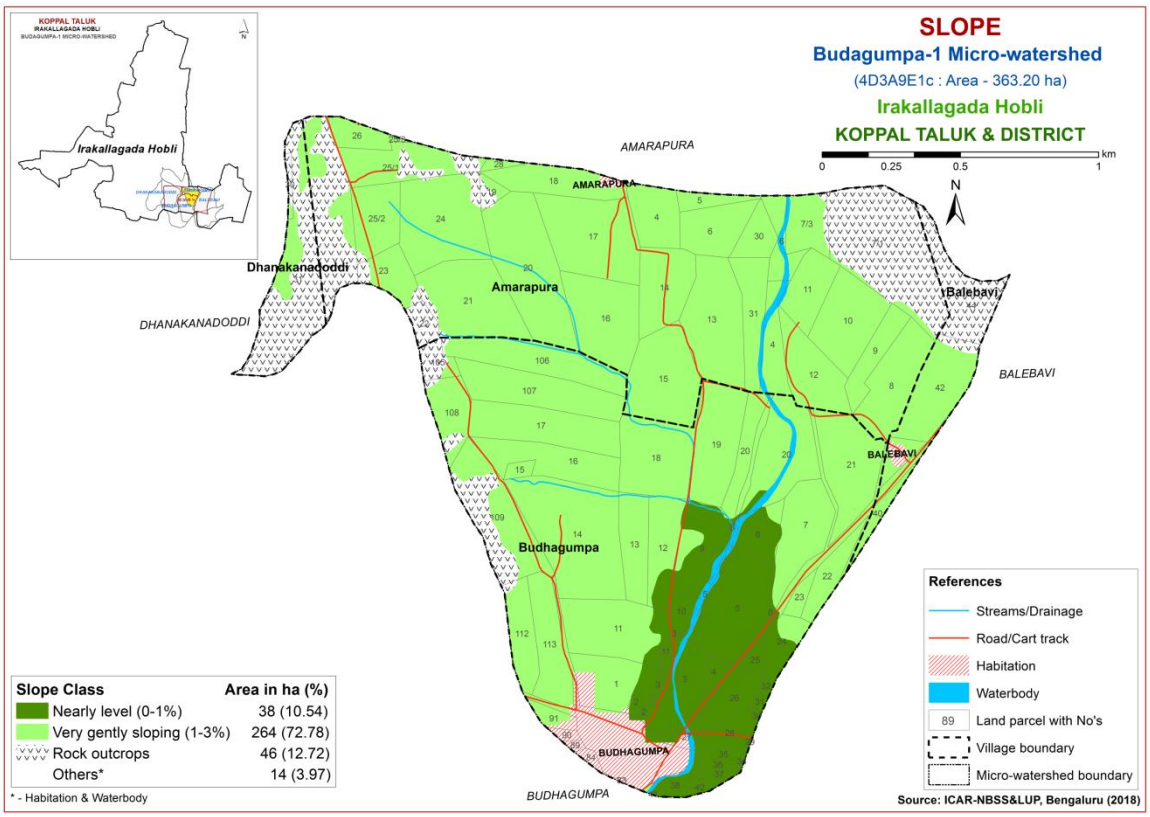


Fig. 5.6 Soil Slope map of Budagumpa-1 Microwatershed

5.7 Soil Erosion

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

Slightly eroded lands cover an area of about 142 ha (39%) and distributed in the northern, eastern and southern part of the microwatershed. Maximum area of about 161 ha (44%) has moderately eroded (e2 class) soils and are distributed in the major part of the microwatershed.

Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

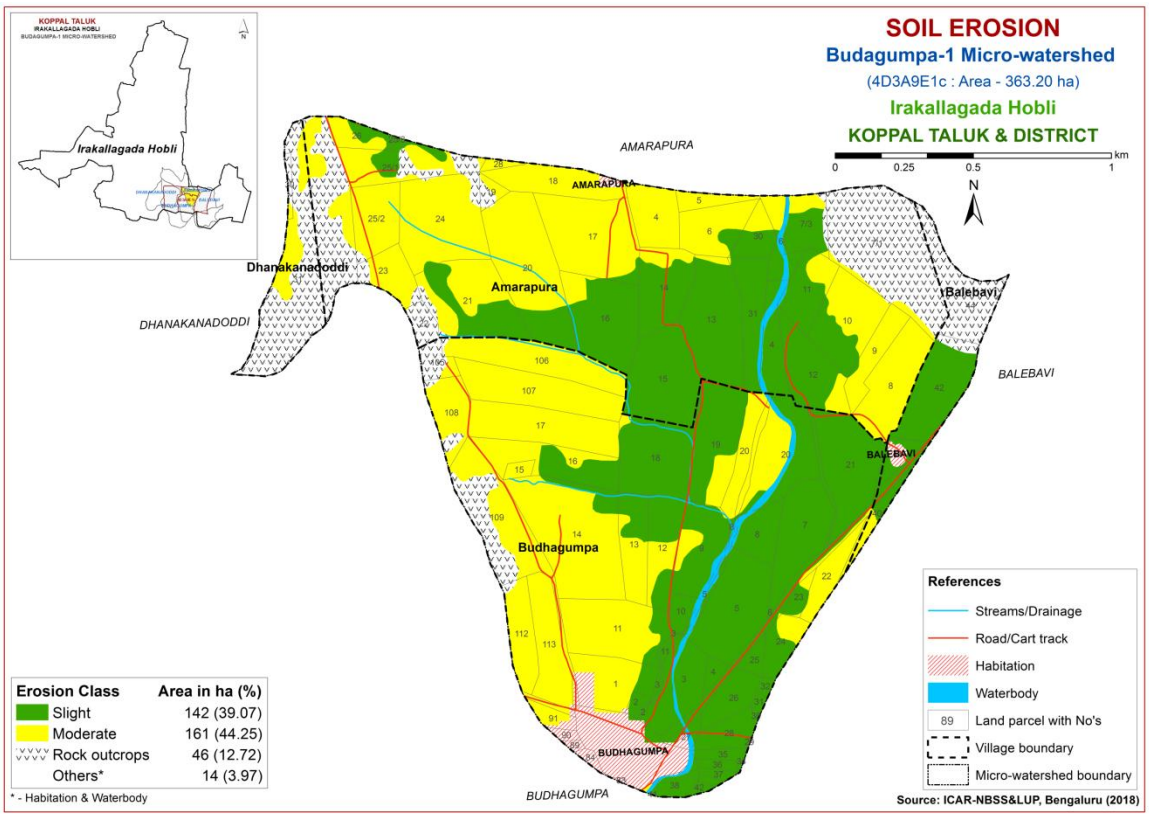


Fig. 5.7 Soil Erosion map of Budagumpa-1 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterized 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 analyzed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil analysis of the Budagumpa-1 microwatershed for soil reaction (pH) showed that a small area of about 1 ha (<1%) is slightly acid (pH 6.0 – 6.5) and distributed in the northeastern part of the microwatershed. An area of about 85 ha (23%) is neutral (pH 6.5– 7.3) in reaction and distributed in the eastern and northeastern part of the microwatershed. An area of about 81 ha (22%) is slightly alkaline (pH 7.3 – 7.8) in reaction and distributed in the northeastern, western and central part of the microwatershed. Moderately alkaline (pH 7.8 - 8.4) soils cover a maximum area of about 110 ha (30%) and are distributed in the major part of the microwatershed. An area of about 25 ha (7 %) is under strongly alkaline (pH 8.4-9.0) and is distributed in the eastern part of the microwatershed (Fig.6.1). Thus, major portion of soils in the microwatershed are alkaline in reaction.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity of the soils of the entire microwatershed area is non saline (<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 revealed that maximum area of about 294 ha (81 %) is medium (0.5-0.75%) in organic carbon and distributed in the major part of the microwatershed. An area of about 8 ha (2 %) is high (>0.75%) in organic carbon content and occur in the eastern part of the microwatershed (Fig.6.3).

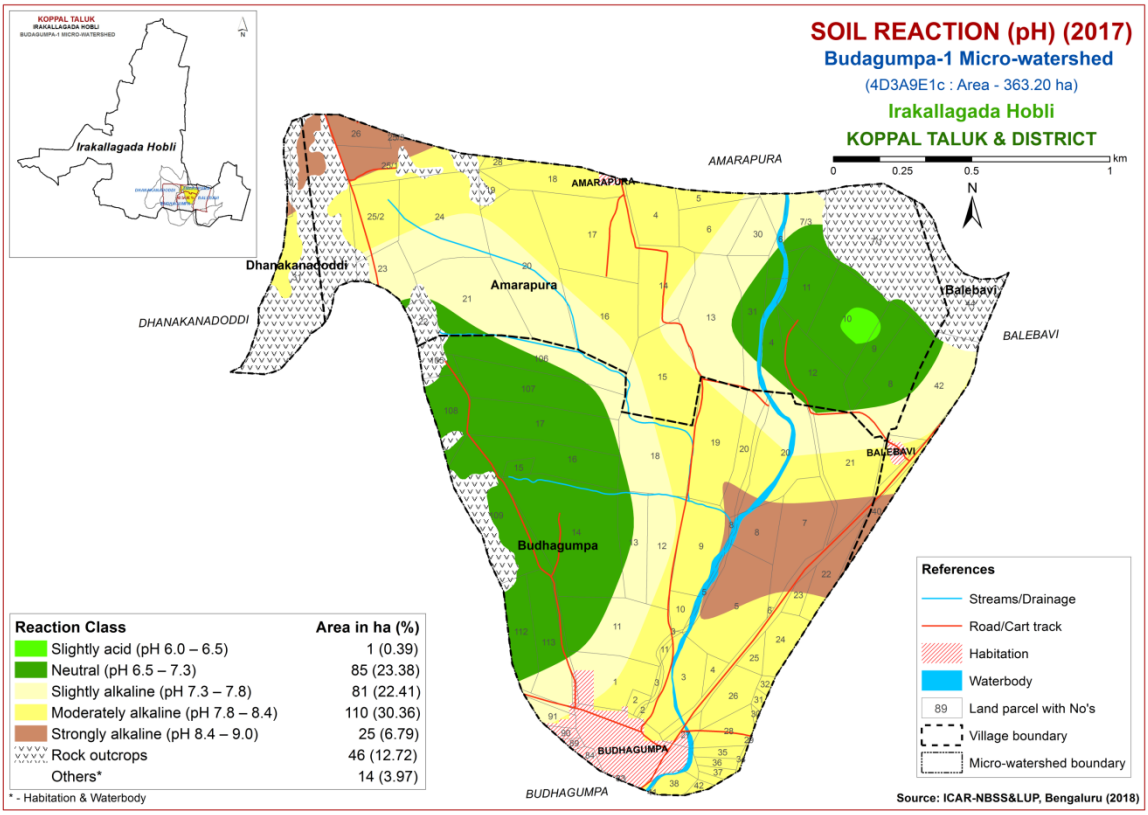


Fig.6.1 Soil Reaction (pH) map of Budagumpa-1 Microwatershed

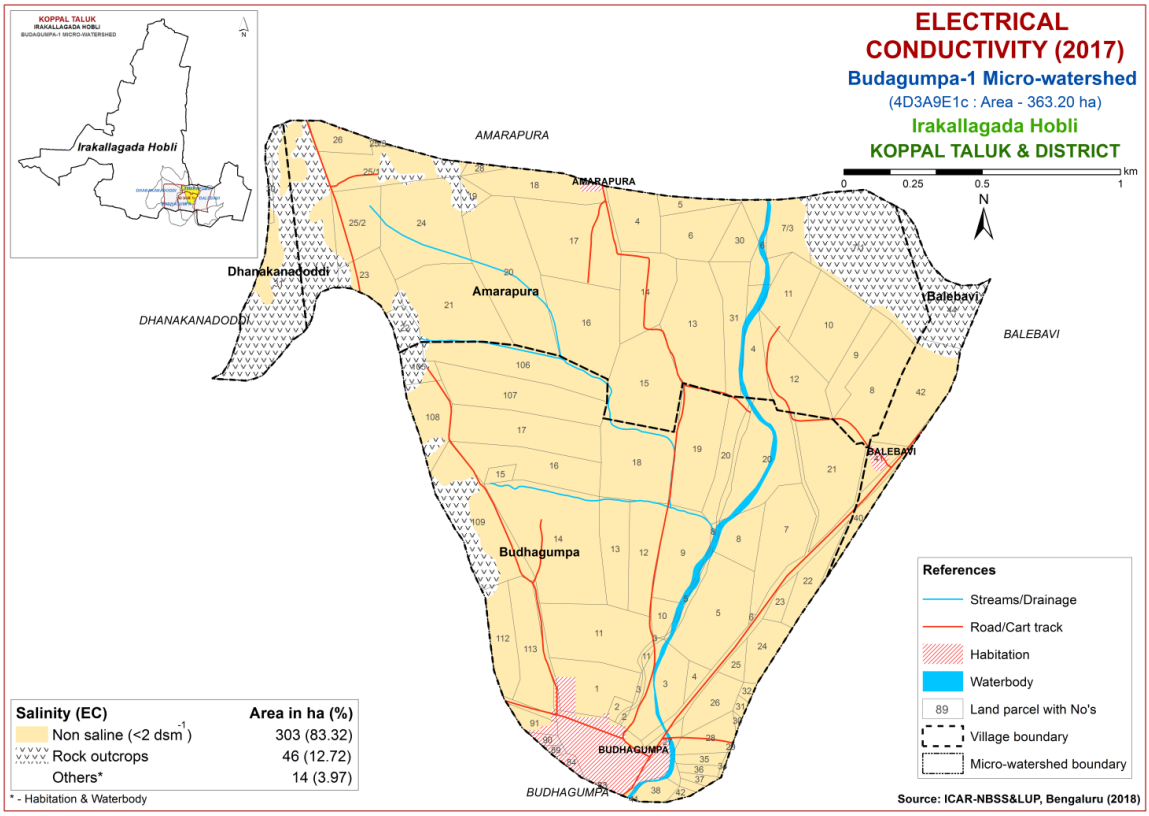


Fig.6.2 Electrical Conductivity (EC) map of Budagumpa-1 Microwatershed

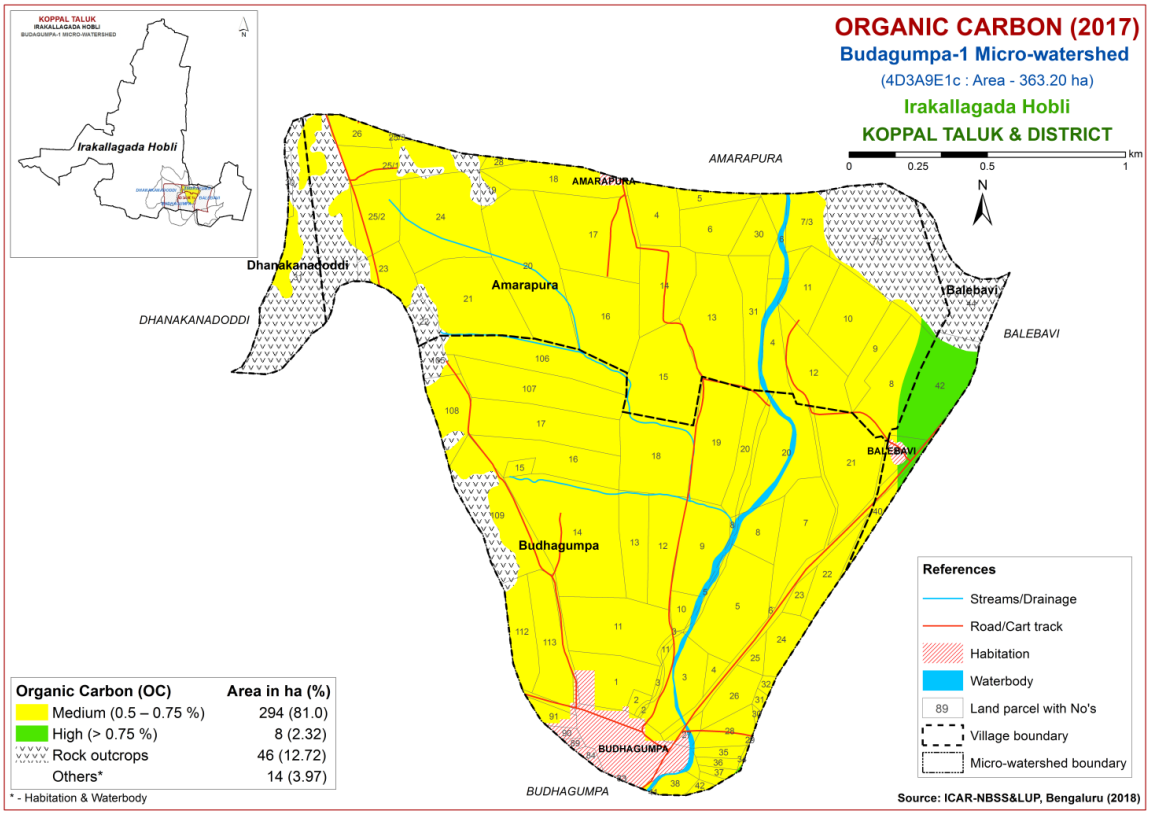


Fig.6.3 Soil Organic Carbon map of Budagumpa-1 Microwatershed

6.4 Available Phosphorus

An area of about 106 ha (29%) is medium (23-57 kg/ha) in available phosphorus and distributed in the northern, southern and central part of the microwatershed. Maximum area of about 197 ha (54%) is high (>57 kg/ha) in available phosphorus and distributed in the major part of the microwatershed (Fig 6.4). The areas with high phosphorus content may reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is medium (Fig 6.4).

6.5 Available Potassium

A small area of about <1 ha (< 1%) is low in available potassium and distributed in the northern part of the microwatershed. An area of about 162 ha (45%) is medium (145-337 kg/ha) in potassium content and distributed in the major part of the microwatershed. An area of about 141 ha (39 %) is high (>337 kg/ha) in available potassium and distributed in the southern, northern and central part of the microwatershed. The areas with high potassium content may reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium (Fig 6.5).

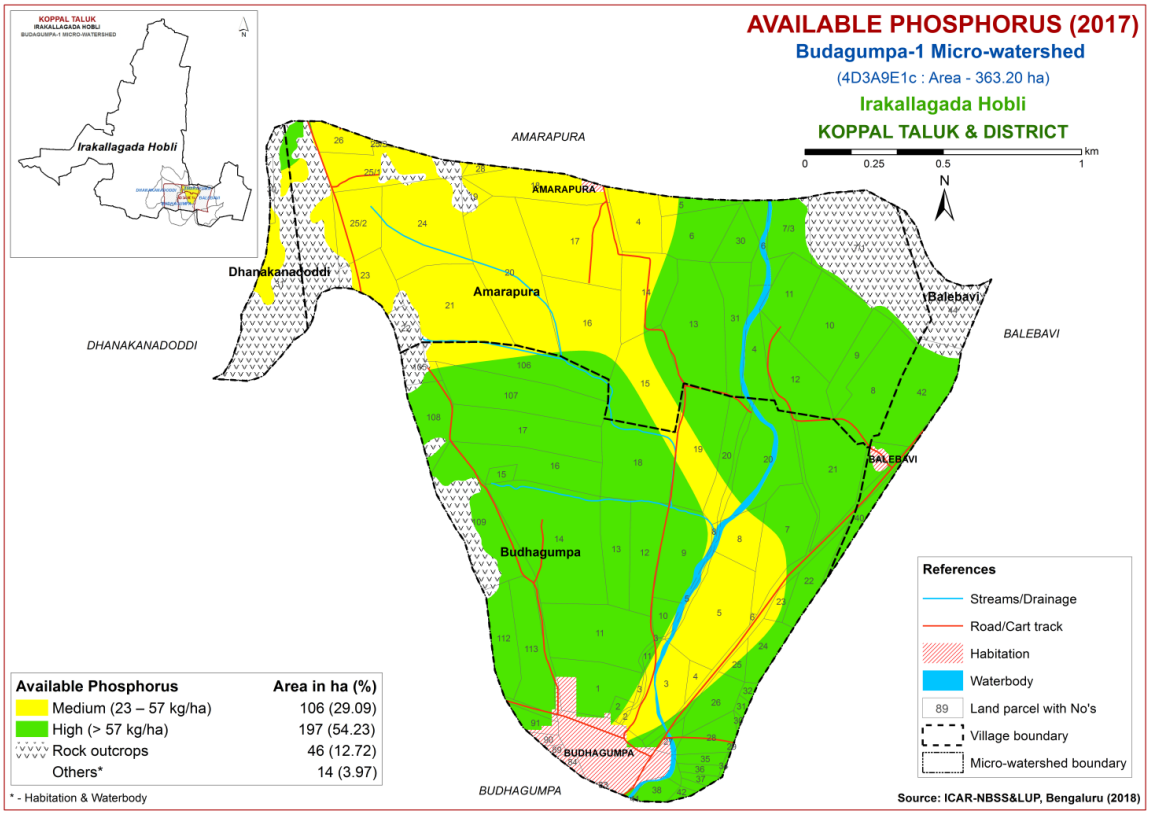


Fig.6.4 Soil Available Phosphorus map of Budagumpa-1 Microwatershed

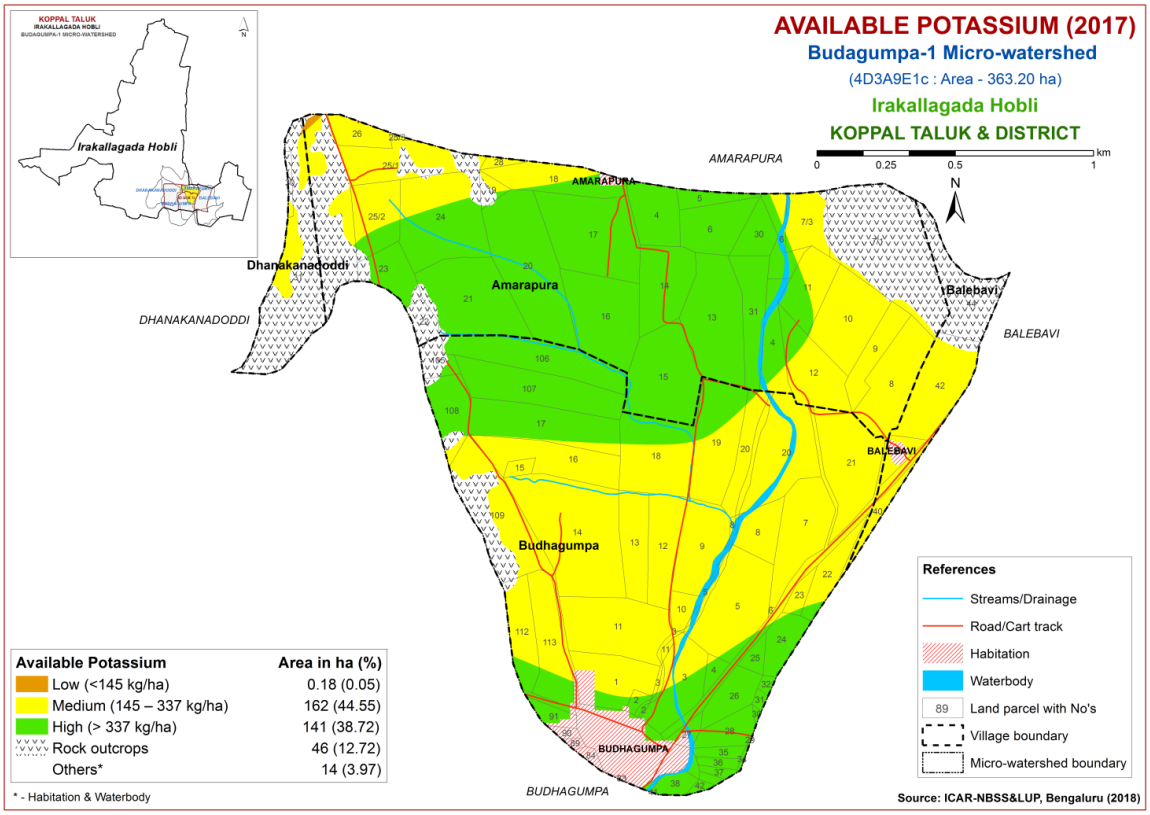


Fig.6.5 Soil Available Potassium map of Budagumpa-1 Microwatershed

6.6 Available Sulphur

Maximum area of about 259 ha (71%) is low (<10 ppm) in available sulphur and distributed in the major part of the microwatershed. An area of about 43 ha (12%) is medium in available sulphur and distributed in the northeastern part of the microwatershed (Fig.6.6). The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of about 38 ha (11 %) and distributed in the eastern part of the microwatershed. Maximum area of about 264 ha (73%) is medium (0.5-1.0 ppm) in available boron and distributed in the major part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content in the soils of the Budagumpa-1 microwatershed is deficient (<4.5 ppm) in an area of about 127 ha (35 %) and distributed in the northern, eastern, central and southern part. Maximum area of about 175 ha (48 %) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the major part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content in the soils of the Budagumpa-1 microwatershed is deficient (<0.6 ppm) in maximum area of about 293 ha (81 %) and distributed in the major part of the microwatershed. An area of about 10 ha (3 %) showed sufficiency (>4.5 ppm) with respect to zinc content and distributed in the southern part of the microwatershed (Fig 6.11).

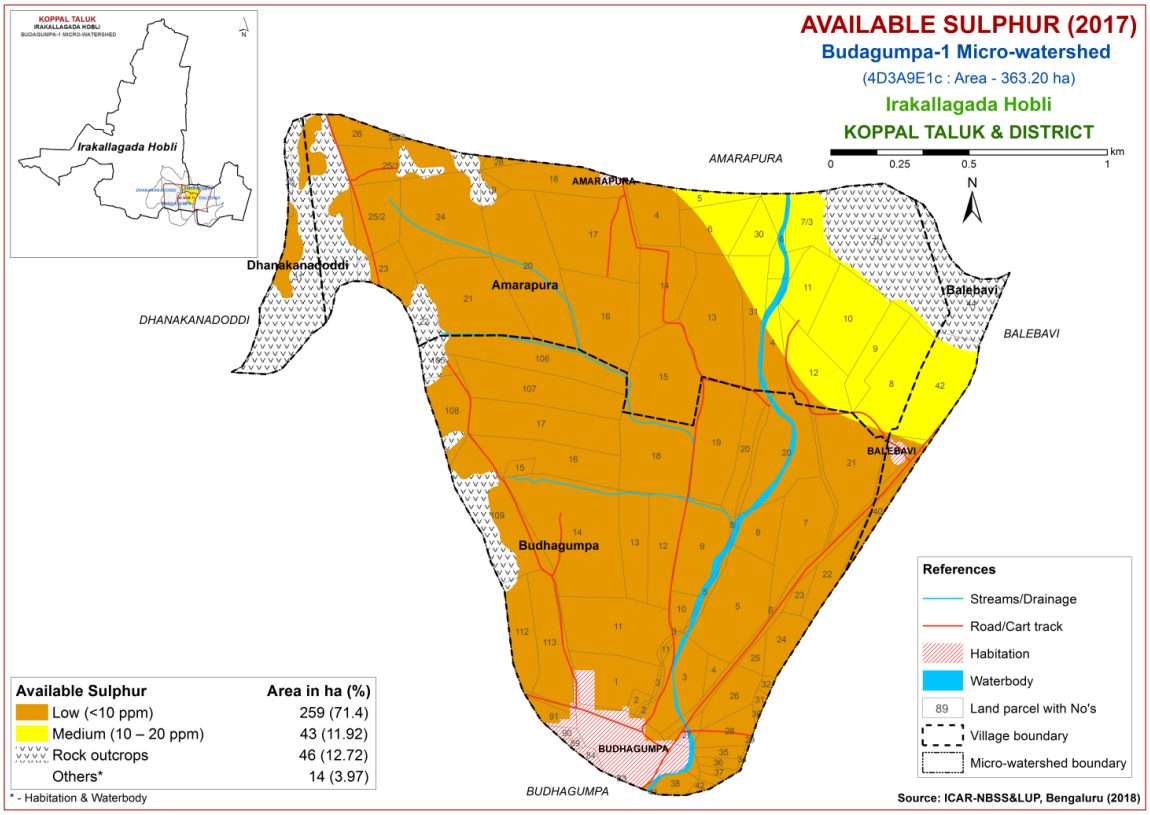


Fig.6.6 Soil Available Sulphur map of Budagumpa-1 Microwatershed

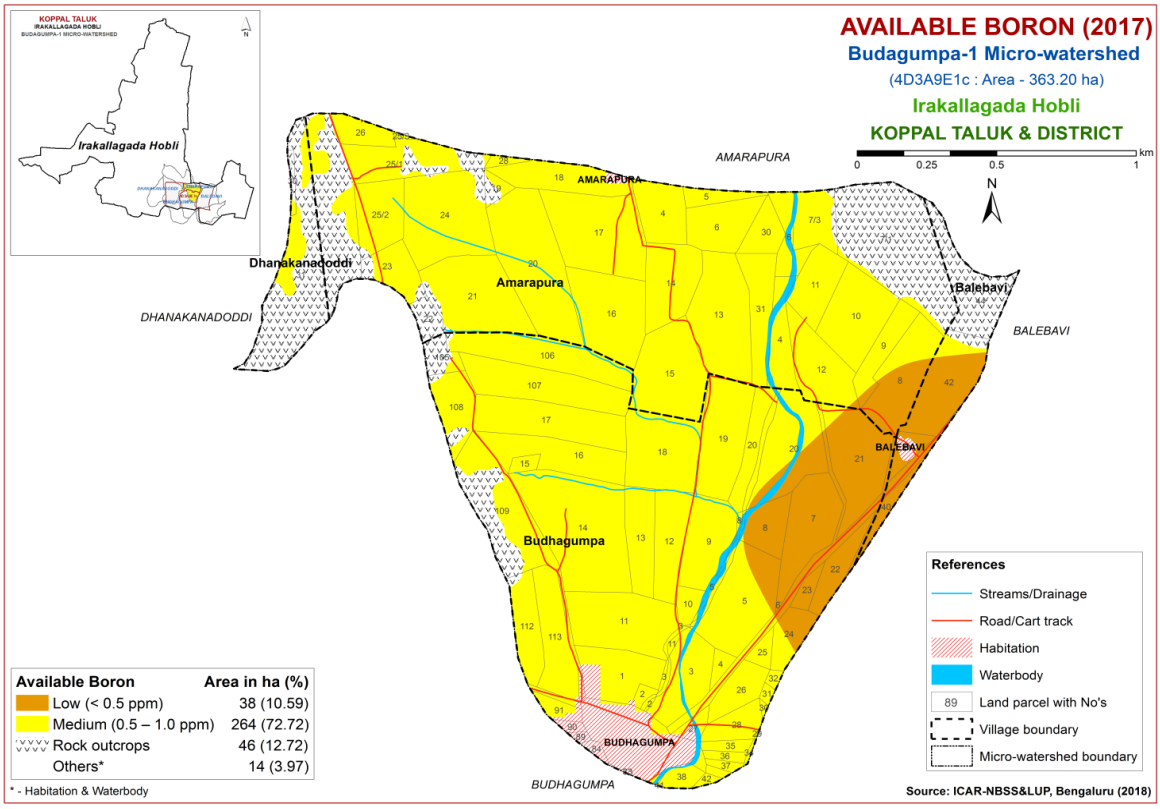


Fig.6.7 Soil Available Boron map of Budagumpa-1 Microwatershed

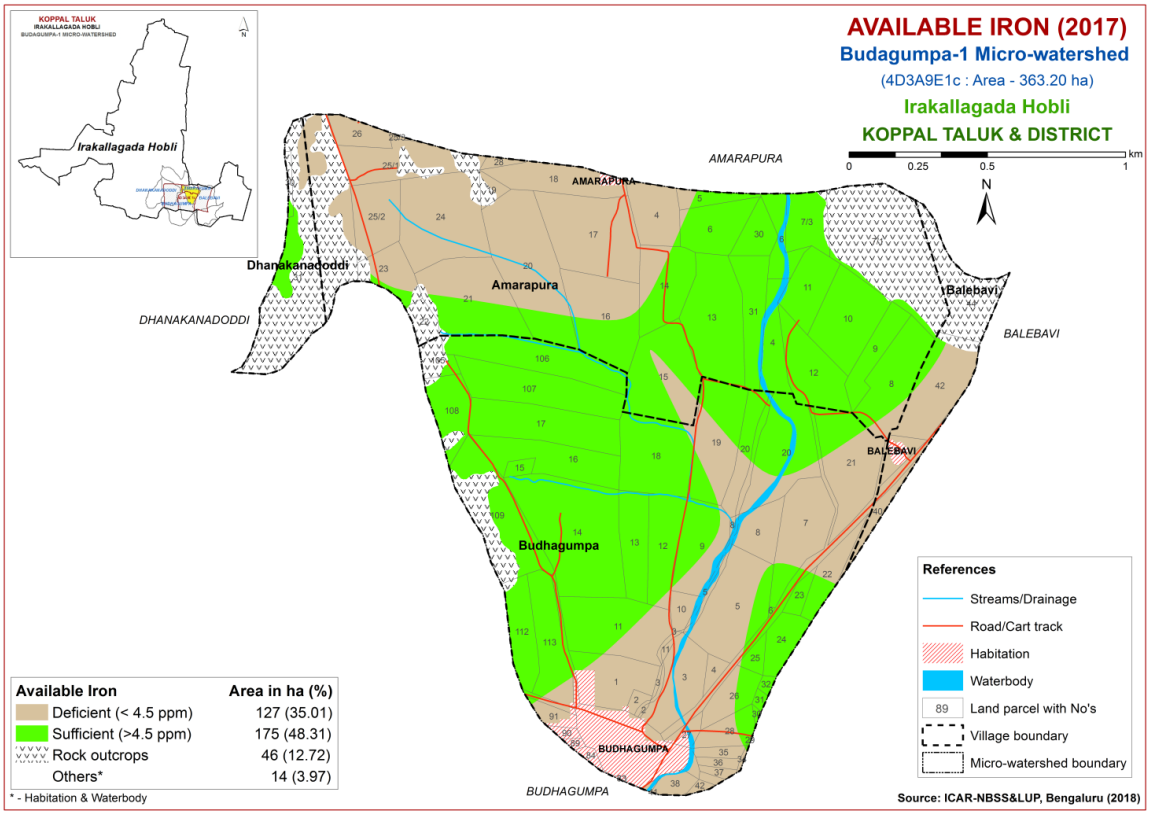


Fig.6.8 Soil Available Iron map of Budagumpa-1 Microwatershed

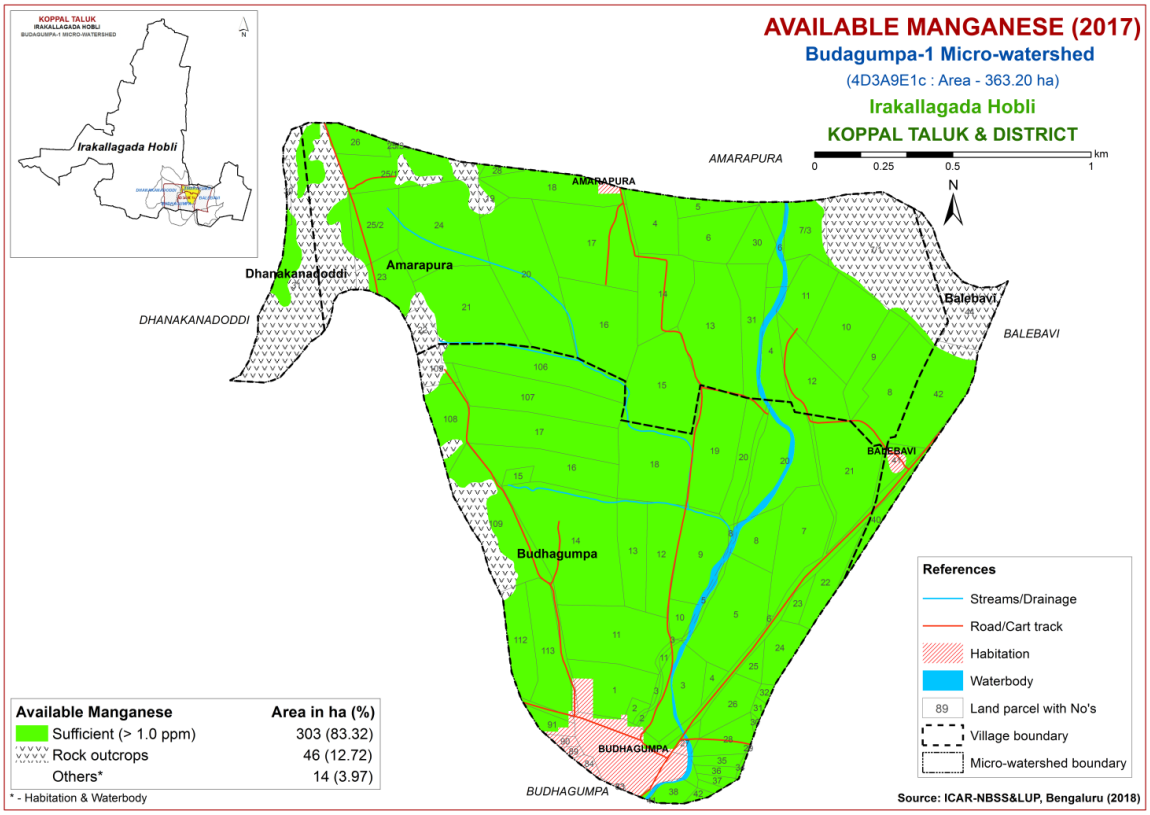


Fig.6.9 Soil Available Manganese map of Budagumpa-1 Microwatershed

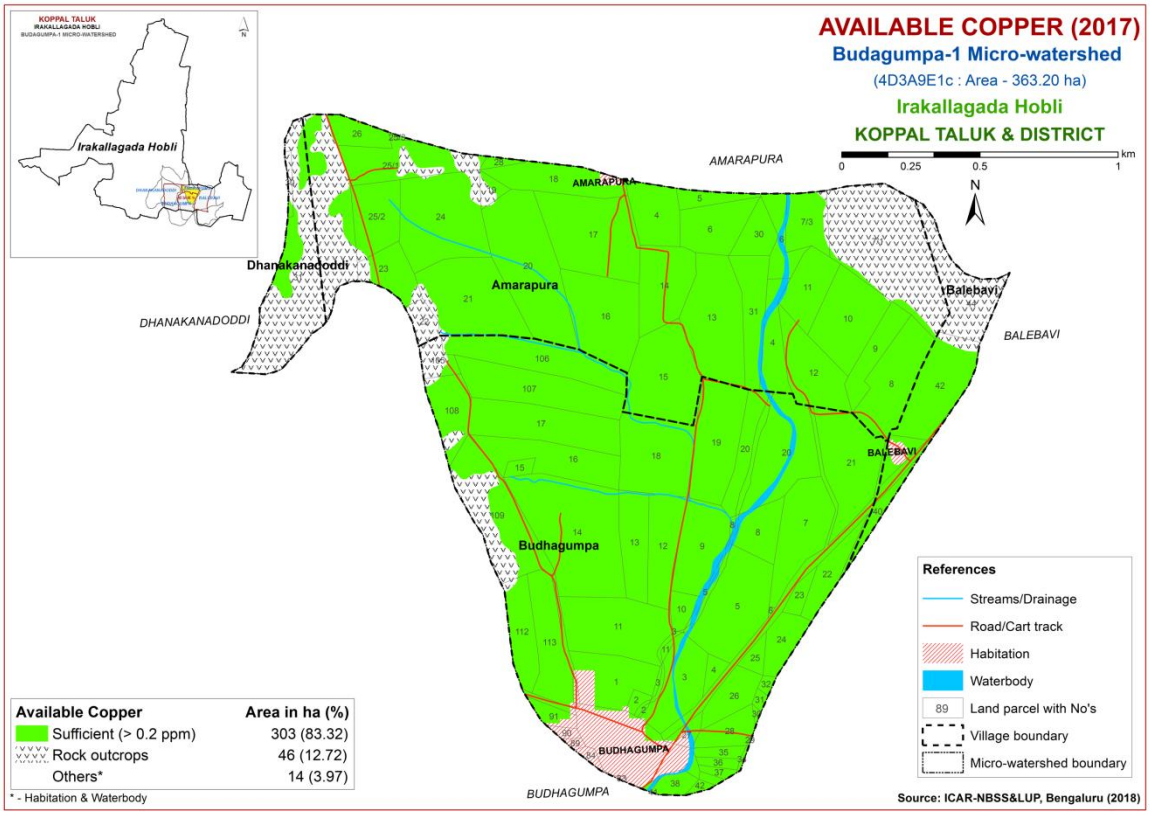


Fig.6.10 Soil Available Copper map of Budagumpa-1 Microwatershed

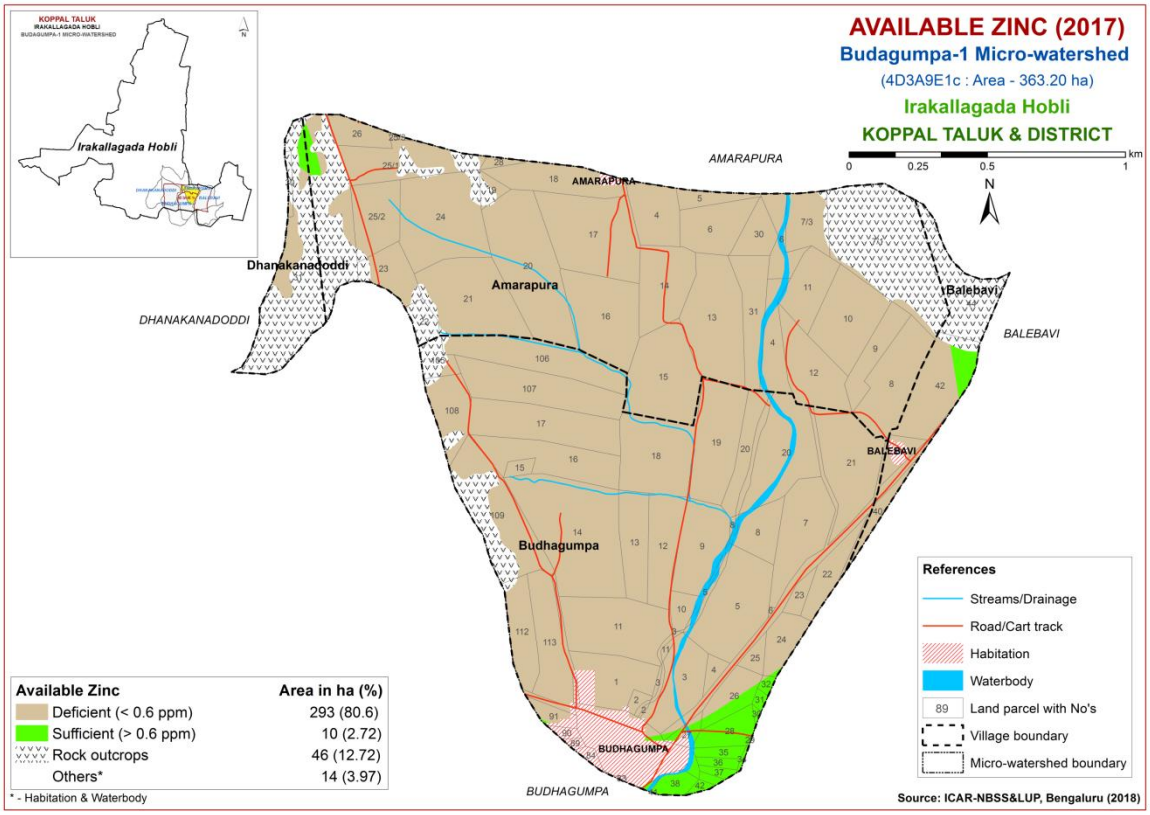


Fig.6.11 Soil Available Zinc map of Budagumpa-1 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Budagumpa-1 microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1- Highly Suitable, Class S2- Moderately Suitable and Class S3- Marginally Suitable. Order N has two Classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 and N1 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability,'s' for sodium '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 a land suitability map for growing sorghum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure. 7.1.

Highly suitable (Class S1) lands occupy an area of about 63 ha (17 %) for growing sorghum and occur in the southern and eastern part of the microwatershed. Maximum area of about 137 ha (37 %) is moderately suitable (Class S2) for growing sorghum and distributed in the major part of the microwatershed.

Table 7.1 Soil-Site Characteristics of Budagumpa-1 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 (%)
					Surf -ace	Sub-surface	Sur-face	Sub-surface								
CSRhB2g1	662	<90	WD	25-50	scl	scl	15-35	<15	50-100	1-3	moderate	-	-	-	-	-
HRViB2g1	662	<90	WD	25-50	sc	gscl	15-35	>35	<50	1-3	moderate	-	-	-	-	-
LKRiB2	662	<90	WD	50-75	sc	gsc	-	40-60	51-100	1-3	moderate	8.18	0.30	4.51	12.19	100
KGHbB2g1	662	<90	WD	50-75	ls	scl	15-35	15-35	101-150	1-3	moderate	-	-	-	-	-
HDHbB1	662	<90	WD	75-100	ls	gsc-gc	-	>35	51-100	1-3	slight	6.54	0.07	7.11	5.84	84.07
GHTcB2g1	662	<90	WD	75-100	sl	gscl	15-35	15-35	101-150	1-3	moderate	5.70	0.06	4.10	3.17	73.00
BSRiB1g1	662	<90	WD	75-100	sc	gsc	15-35	15-35	51-100	1-3	slight	-	-	-	-	-
BSRiB2g1	662	<90	WD	75-100	sc	gsc	15-35	15-35	51-100	1-3	moderate	-	-	-	-	-
BDGcB2	662	<90	WD	75-100	sl	gc	-	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	52.56
KMHhB1g1	662	<90	WD	100-150	scl	sc	15-35	<15	151-200	1-3	slight	7.2	0.19	0.54	15.07	100
MNLiB2	662	<90	WD	100-150	sc	gsc	-	15-35	101-150	1-3	moderate	7.89	0.13	5.04	9.01	101
JDGcB2	662	<90	WD	100-150	sl	sc-c	-	<15	>200	1-3	moderate	-	-	-	-	-
JDGiB1	662	<90	WD	100-150	sc	sc-c	-	<15	>200	1-3	slight	-	-	-	-	-
BPRbB2	662	<90	WD	100-150	ls	gsc-gc	-	>35	101-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
BPRmB2g1	662	<90	WD	100-150	c	gsc-gc	15-35	>35	101-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
VDHiB2	662	<90	MWD	100-150	sc	sc-c	-	-	151-200	1-3	moderate	-	-	-	-	-
HLKiB1	662	<90	WD	>150	sc	c	-	<15	151-200	1-3	slight	-		-	-	-
DRLmB1g1	662	<90	MWD	75-100	c	c	15-35	<15	151-200	1-3	slight	-	-	-	-	-
GRHmA1	662	<90	MWD	100-150	c	c	-	<15	>200	0-1	slight	8.27	1.11	11.72	31.60	-
KDTmA1	662	<90	MWD	>150	c	sc-c	-	-	>200	0-1	slight	-	-	-	-	-

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

They have minor limitations of rooting depth, nutrient availability, gravelliness, texture and calcareousness. An area of about 103 ha (29 %) is marginally suitable (Class S3) for growing sorghum and occur in the eastern, western and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.2 Crop suitability criteria for Sorghum

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

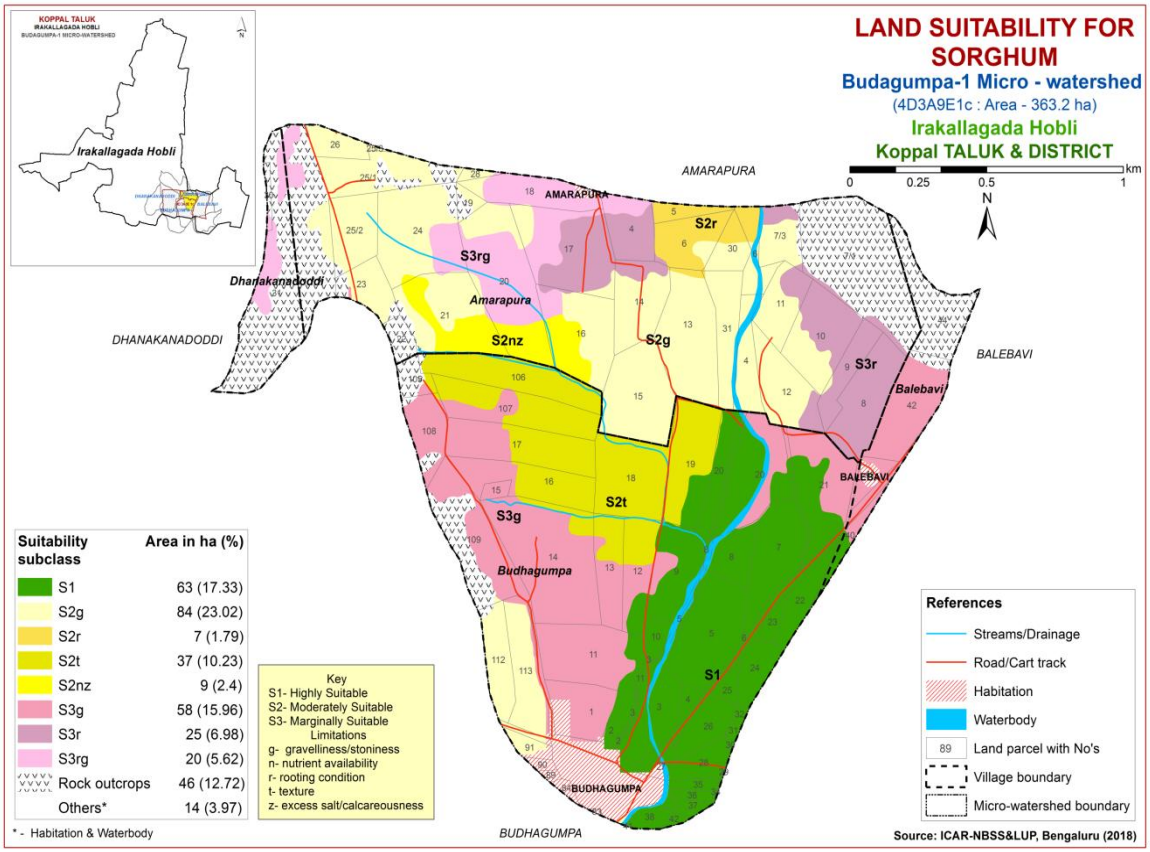


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Table 7.3 Crop suitability criteria for Maize

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

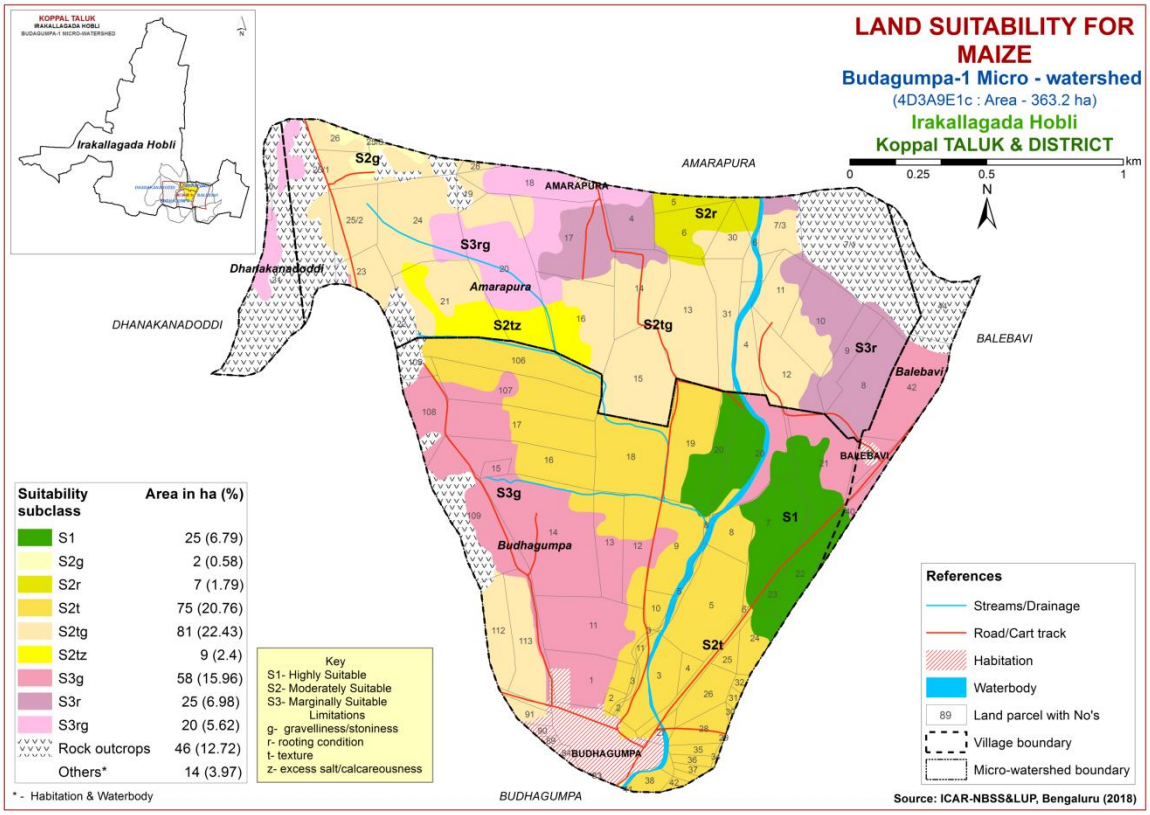


Fig. 7.2 Land Suitability map of Maize

Highly suitable lands for growing maize cover an area of about 25 ha (7%) and distributed in the eastern part of the microwatershed. Maximum area of about 174 ha (48%) is moderately suitable (Class S2) for maize and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 103 ha (29 %) and are distributed in the eastern, western and northern part of the microwatershed with moderate limitations of gravelliness and rooting depth.

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.

Highly suitable lands for growing bajra cover an area of about 107 ha (30%) and distributed in the eastern, central and northeastern part of the microwatershed. An area of about 110 ha (30%) is moderately suitable (Class S2) for bajra and are distributed in the southern, eastern and northern part of the microwatershed. They have minor limitations of gravelliness, texture, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy an area of about 85 ha (24%) and are distributed in the northern, northeastern and western part of the microwatershed with moderate limitations of gravelliness and rooting depth.

Table 7.4 Crop suitability criteria for Bajra

Crop requirement		**Rating**			
Soil –site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately suitable(S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	Class	Well to mod. Well drained	imperfect	Poorly/excessively	V.poorly
Soil reaction	pH	5.5-8.0	5.0-5.5,7.8-8.4	8.4-9.0	>9.0
Surface soil texture	Class	c(red), sicl, sc,sl,cl	l, c(black), scl,sil,sic	sl, ls	S, fragmental skeletal
Soil depth	cm	100-75	50-75	25-50	<25
Gravel content	% vol.	15-35	30-60	60-80	-
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

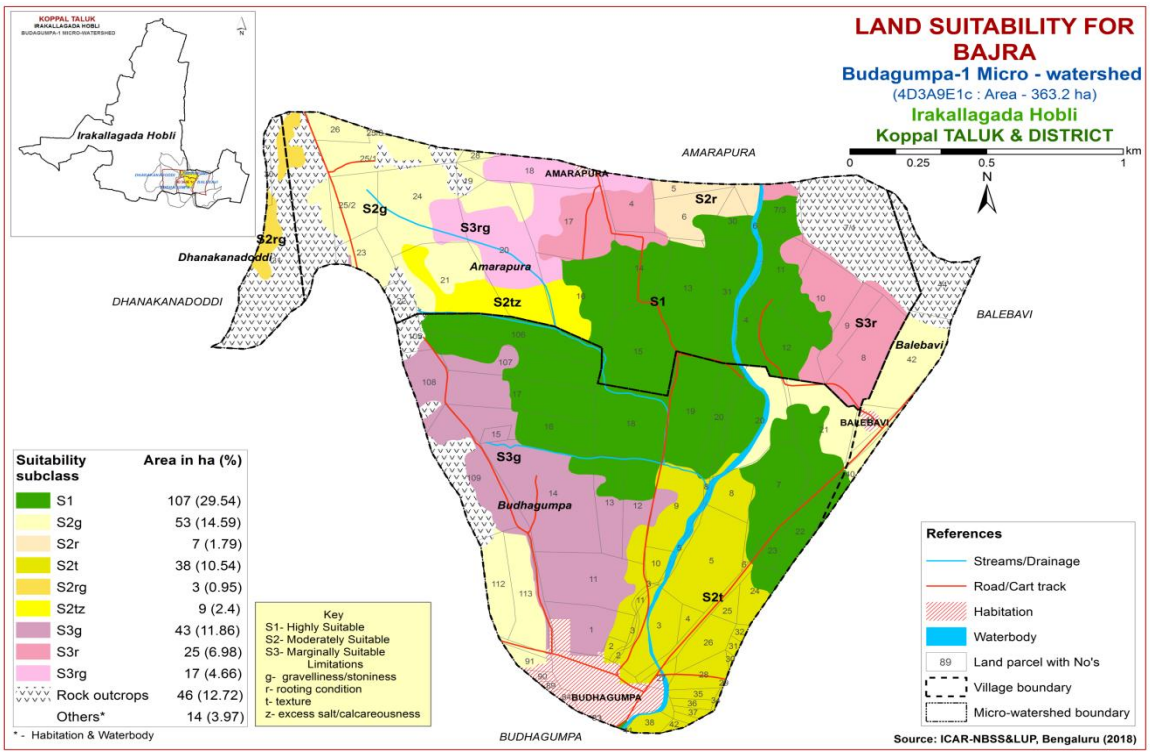


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Redgram (*Cajanus cajan*)

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.5) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.4.

Table 7.5 Land suitability criteria for Red gram

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

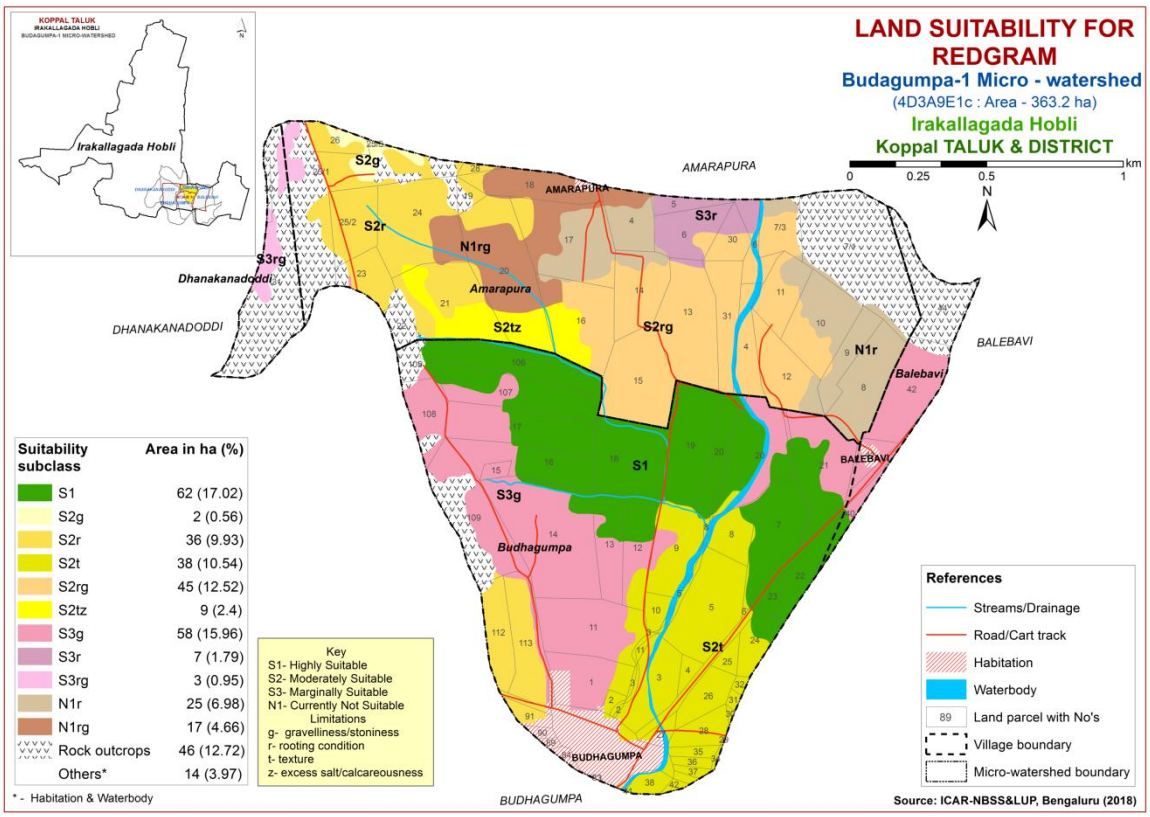


Fig. 7.4 Land Suitability map of redgram

Highly suitable land for growing red gram cover an area of about 62 ha (17%) and distributed in the eastern and central part of the microwatershed. Maximum area of about 130 ha (36 %) is moderately suitable (Class S2) for growing redgram and occur in the major part of the microwatershed. They have minor limitations of texture, gravelliness, rooting depth and calcareousness. Marginally suitable lands (Class S3) occupy an area of about 68 ha (19 %) and occur in the western, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12 %) is not suitable (Class N1) for growing redgram and occur in the northern part of the microwatersherd. They have severe limitations of gravelliness and rooting depth.

7.5 Land Suitability for Bengal gram (*Cicer arietinum*)

Bengal gram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing Bengal gram (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengal gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.5.

An area of about 38 ha (11 %) in the microwatershed has soils that are highly suitable (Class S1) for growing bengal gram and are distributed in the southeastern part of

the microwatershed. Maximum area of about 165 ha (45 %) is moderately suitable (Class S2) for growing bengalgram and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 100 ha (28%) and are distributed in the western, northern and northeastern part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth.

Table 7.6 Crop suitability criteria for Bengal gram

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>100	90-100	70-90	<70
Soil drainage	class	Well drained	Mod. to well drained; Imp.drained	Poorly drained; excessively drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.77.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	sl, c>60%	s,fragmental
Soil depth	cm	>75	51-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

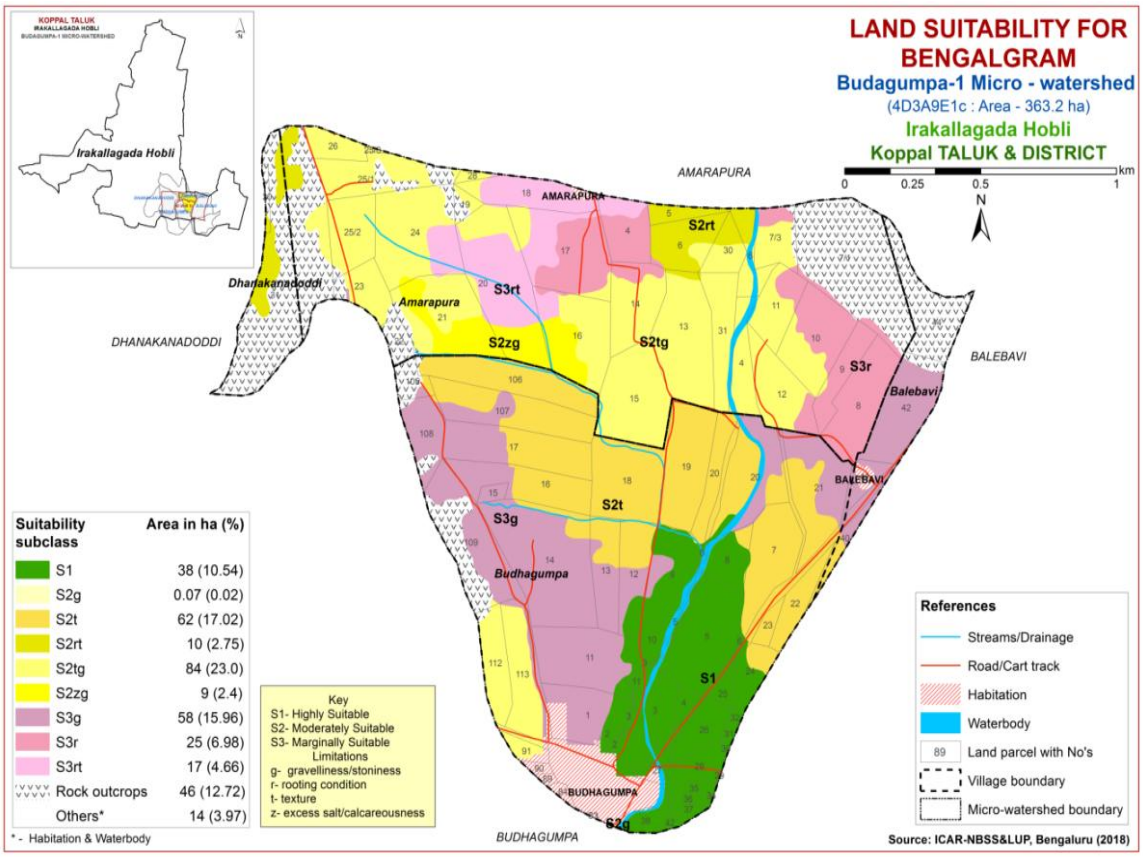


Fig. 7.5 Land Suitability map of bengalgram

7.6 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.7) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.6.

Table 7.7 Crop suitability criteria for Groundnut

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

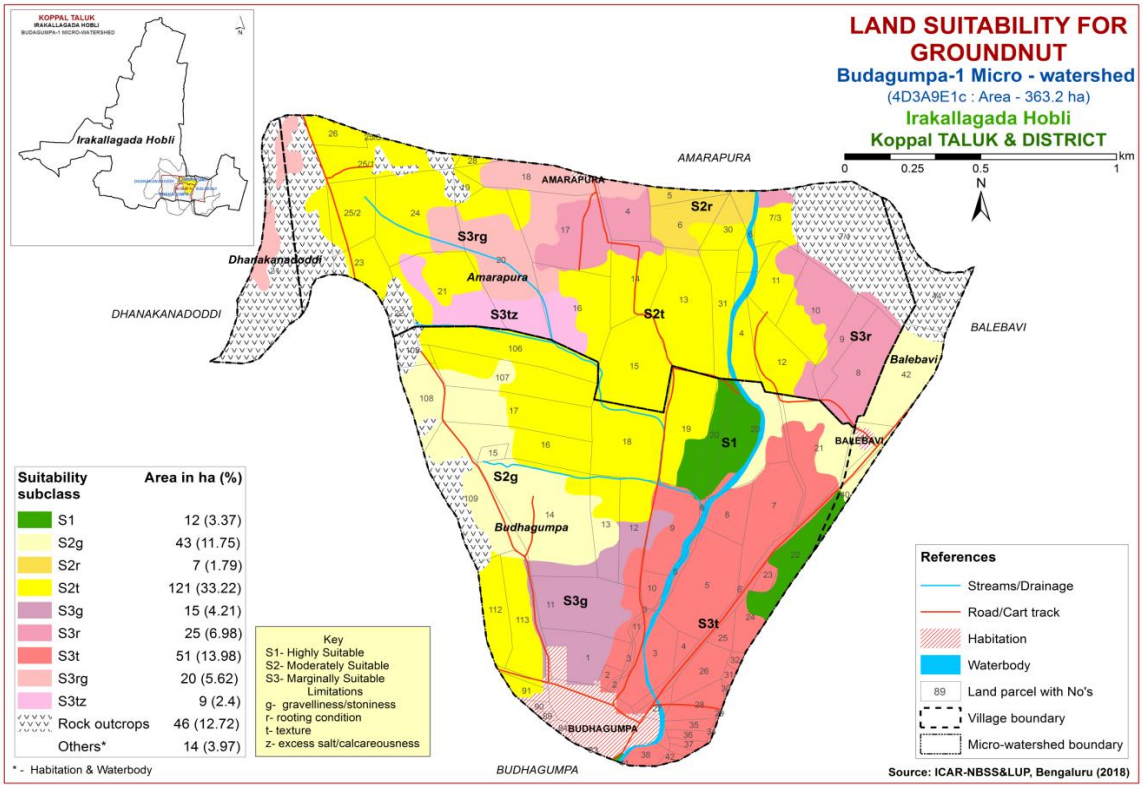


Fig. 7.6 Land Suitability map of Groundnut

An area of about 12 ha (3 %) in the microwatershed has soils that are highly suitable (Class S1) for growing groundnut and are distributed in the eastern part of the microwatershed. Maximum area of about 171 ha (47 %) is moderately suitable (Class S2) for groundnut and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands occupy an area of about 120 ha (33%) and are distributed in the northern, eastern and southern part of the microwatershed with moderate limitations of gravelliness, rooting depth, texture and calcareousness.

7.7 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.8) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

An area of about 100 ha (28%) is highly suitable (Class S1) for growing sunflower and are distributed in the central and eastern part of the microwatershed. An area of about 129 ha (35%) is moderately suitable (Class S2) and are distributed in the northern and western part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 68 ha (19 %) and are distributed in the western, eastern and northern part of the microwatershed with moderate limitations of rooting depth and gravelliness. An area of about 42 ha (12%) is not suitable (Class N1) for growing sunflower and occur in the northern and northeastern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.8 Crop suitability criteria for Sunflower

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>90	80-90	70-80	<70
Soil drainage	class	Well drained	mod. Well drained	imperfectly drained	Poorly drained
Soil reaction	pH	6.5-8.0	8.1-8.5:5.5-6.4	8.6-9.0;4.5-5.4	>9.0:<4.5
Surface soil texture	Class	l, cl, sil, sc	scl, sic, c,	c (>60%), sl	ls, s
Soil depth	Cm	>100	75-100	50-75	<50
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

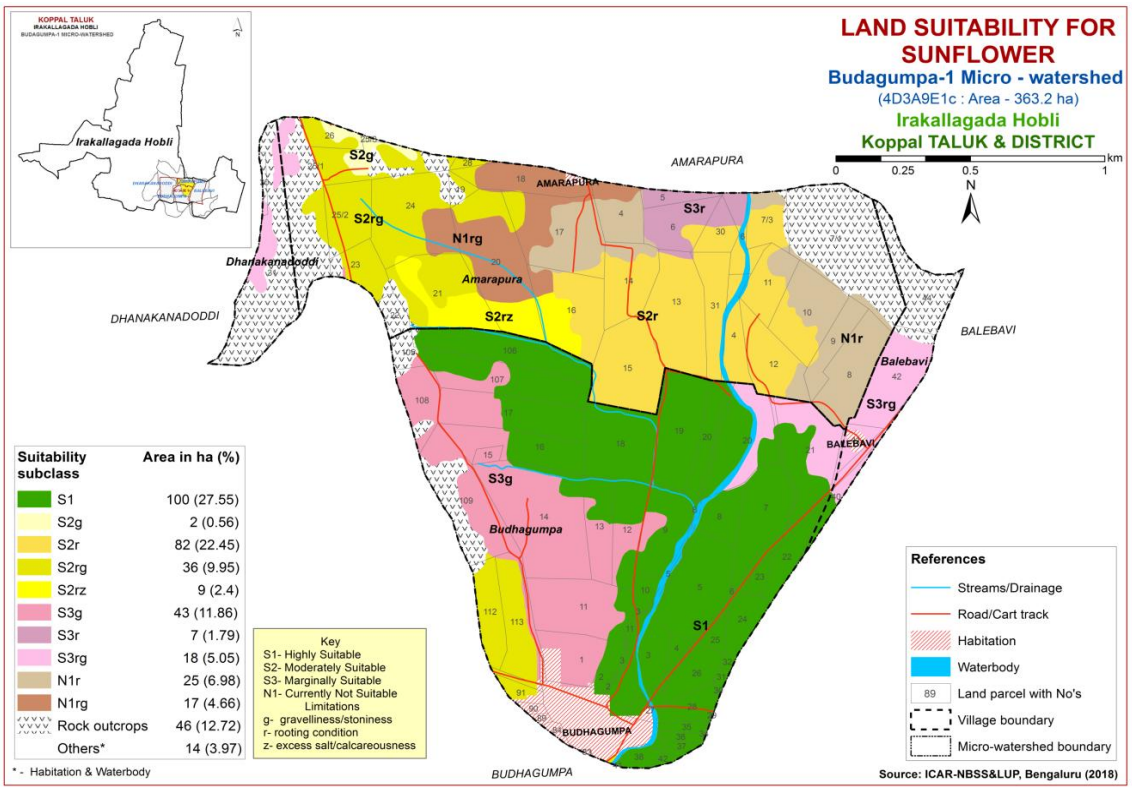


Fig. 7.7 Land Suitability map of Sunflower

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

Table 7.9 Crop suitability criteria for Cotton

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

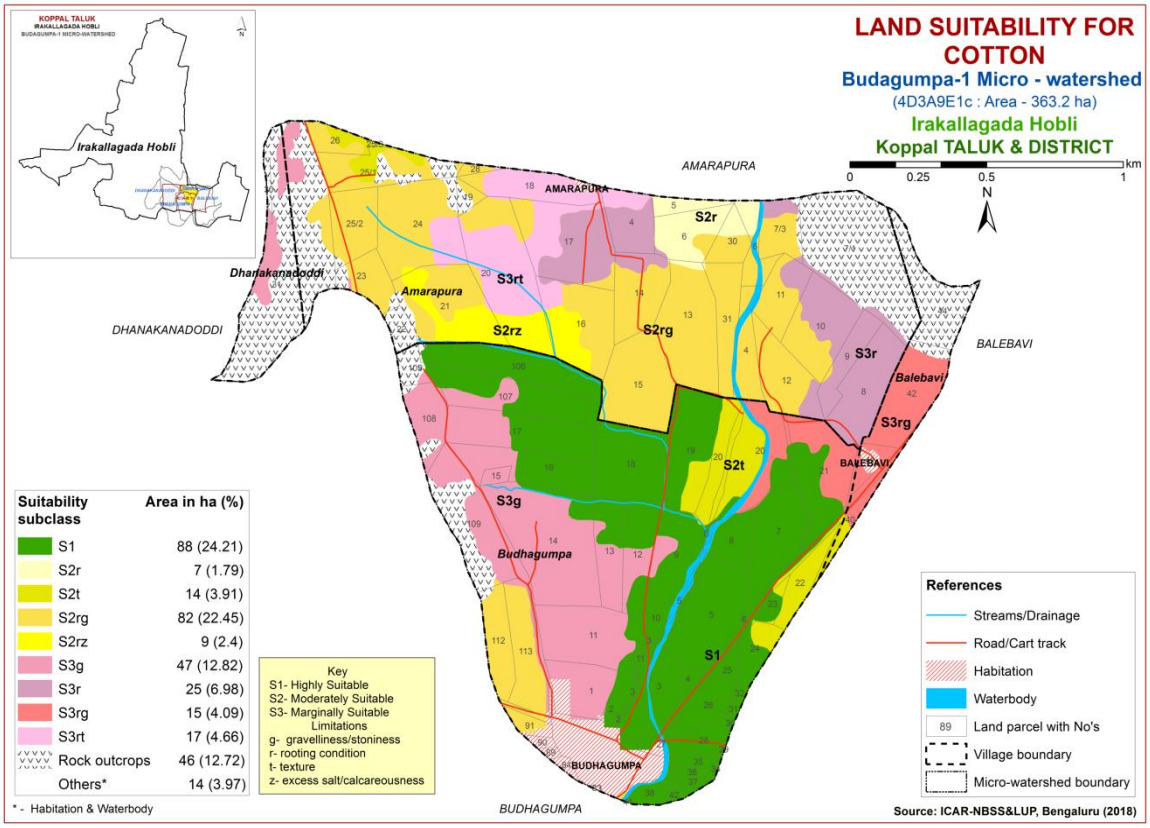


Fig. 7.8 Land Suitability map of Cotton

An area of about 88 ha (24 %) is highly suitable (Class S1) for growing cotton and are distributed in the eastern and central part of the microwatershed. Maximum area of about 112 ha (31%) is moderately suitable (Class S2) for cotton and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness, gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands cover an area of about 104 ha (29%) and occur in the western, northern and eastern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and texture.

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.

An area of about 107 ha (30 %) in the microwatershed has soils that are highly suitable (Class S1) for growing chilli and are distributed in the eastern, northern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 45 ha (12%) and distributed in the western and northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands

cover a maximum area of about 150 ha (41%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

Table 7.10 Crop suitability criteria for Chilli

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

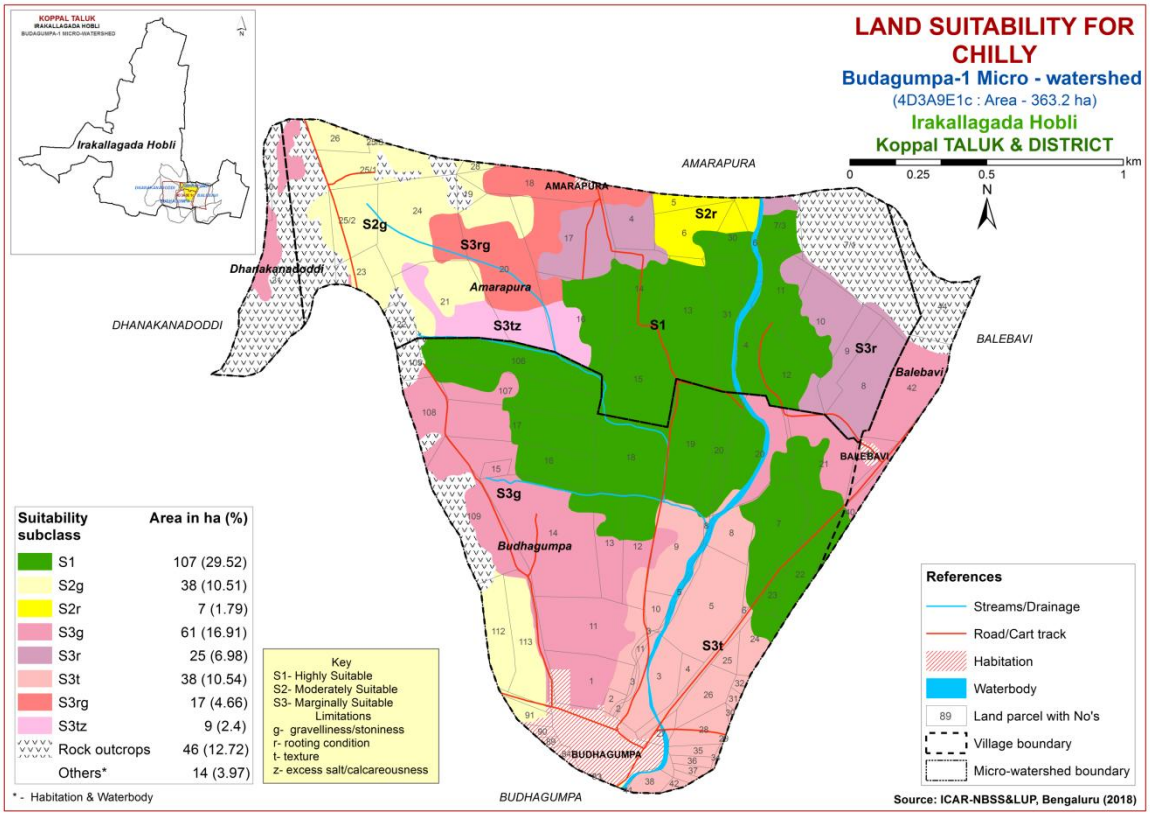


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable and fruit 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.

An area of about 107 ha (30 %) in the microwatershed has soils that are highly suitable (Class S1) for growing tomato and are distributed in the eastern, northern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 45 ha (12%) and distributed in the western and northern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 150 ha (41%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

Table 7.11 Crop suitability criteria for Tomato

Crop requirement			**Rating**			
Soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	25-28	29-32 20-24	15-19 33-36	<15 >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	Sic,sicl,sc,c(m/k)	C (ss)	ls, s
	pH	1:2.5	6.0-7.0	5.0-5.9:7.1-8.5	<5;>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slight	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

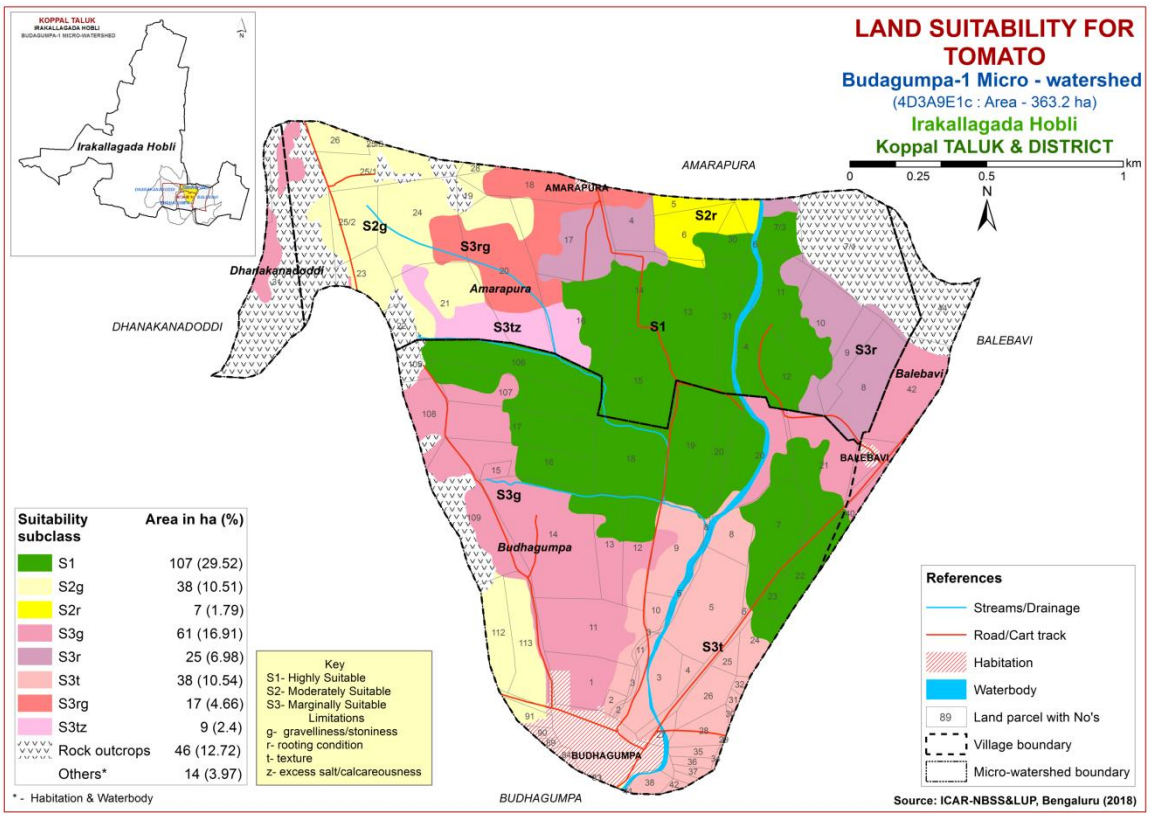


Fig. 7.7 Land Suitability map of Tomato

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.

Table 7.12 Land suitability criteria for Drumstick

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

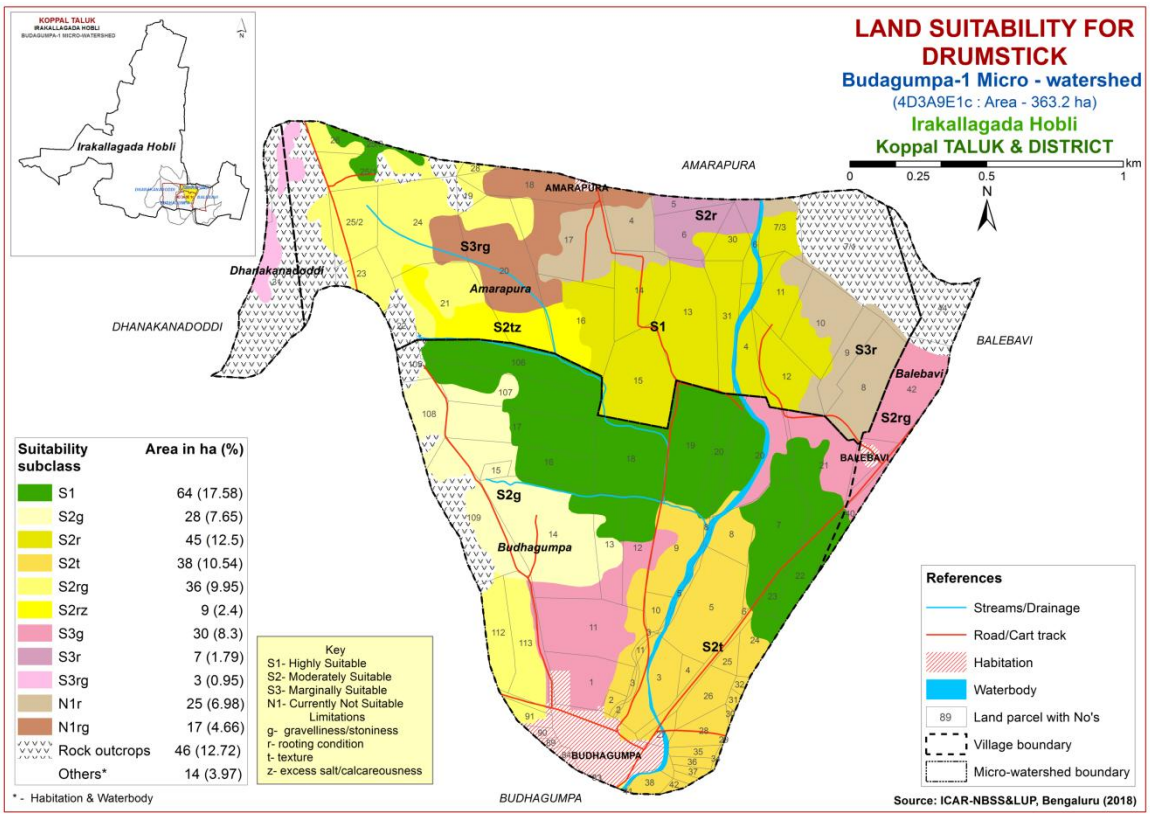


Fig. 7.11 Land Suitability map of Drumstick

An area of about 64 ha (18 %) in the microwatershed has soils that are highly suitable (Class S1) for growing drumstick and are distributed in the eastern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 156 ha (43%) and distributed in the major part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 40 ha (11%) and occur in the southern, eastern and northern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern part of the microwatershed and have severe limitations of rooting depth and gravelliness.

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is one of 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 mulbery (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.

An area of about 64 ha (18 %) in the microwatershed has soils that are highly suitable (Class S1) for growing mulberry and are distributed in the eastern and central part of the microwatershed. Moderately suitable (S2) lands cover a maximum area of about 187 ha (51%) and distributed in the major part of the microwatershed with minor

limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 10 ha (3%) and occur in the northern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.13 Land suitability criteria for Mulberry

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

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

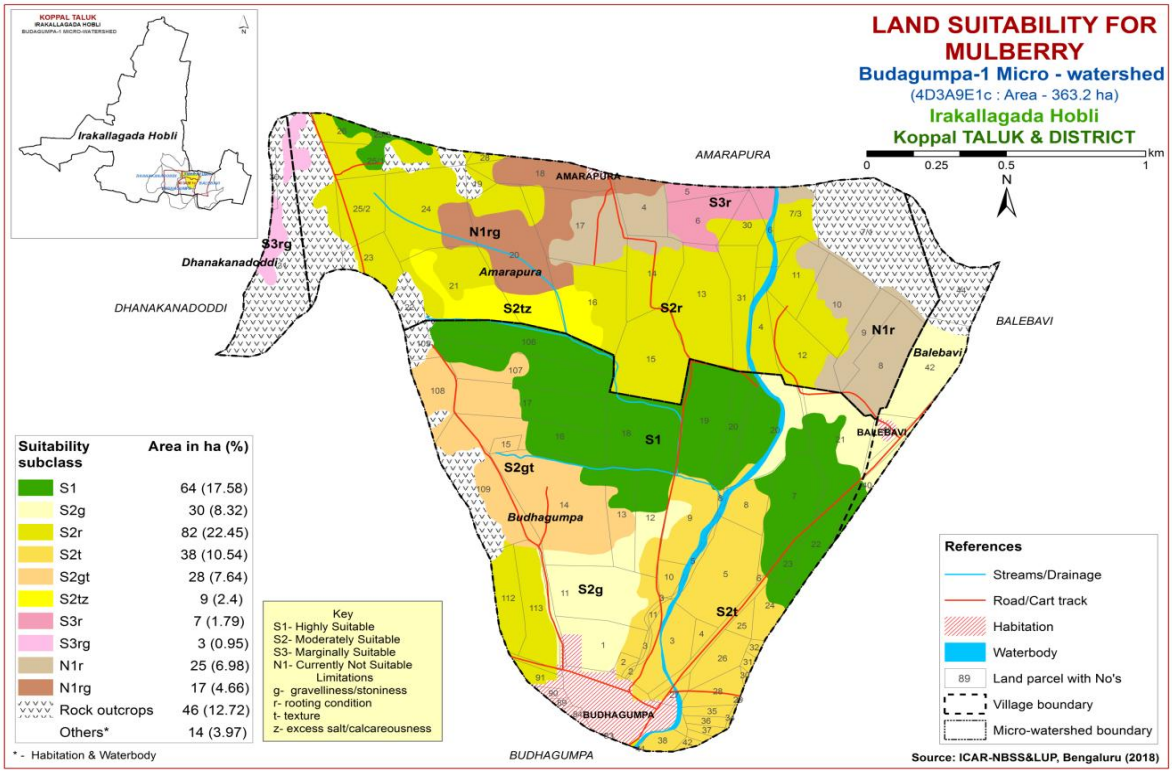


Fig. 7.12 Land Suitability map of Mulberry

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.

An area of about 13 ha (3%) in the microwatershed has soils that are highly suitable (Class S1) for growing mango and are distributed in the eastern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 51 ha (14%) and distributed in the central and eastern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 187 ha (51%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 52 ha (14.%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.14 Crop suitability criteria for Mango

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

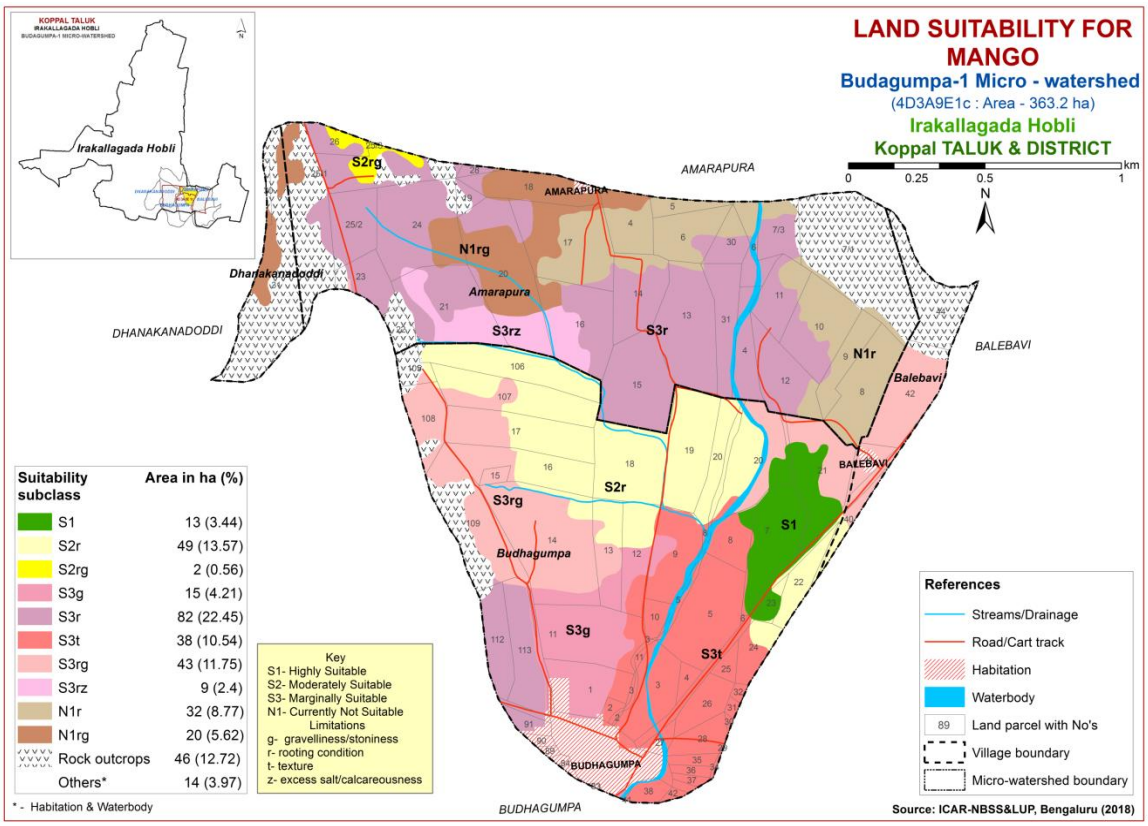


Fig. 7.13Land Suitability map of Mango

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.

An area of about 62 ha (17 %) in the microwatershed has soils that are highly suitable (Class S1) for growing sapota and are distributed in the eastern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 98 ha (27%) and distributed in the northeastern, northern and southwestern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 103 ha (28%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.15 Crop suitability criteria for Sapota

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

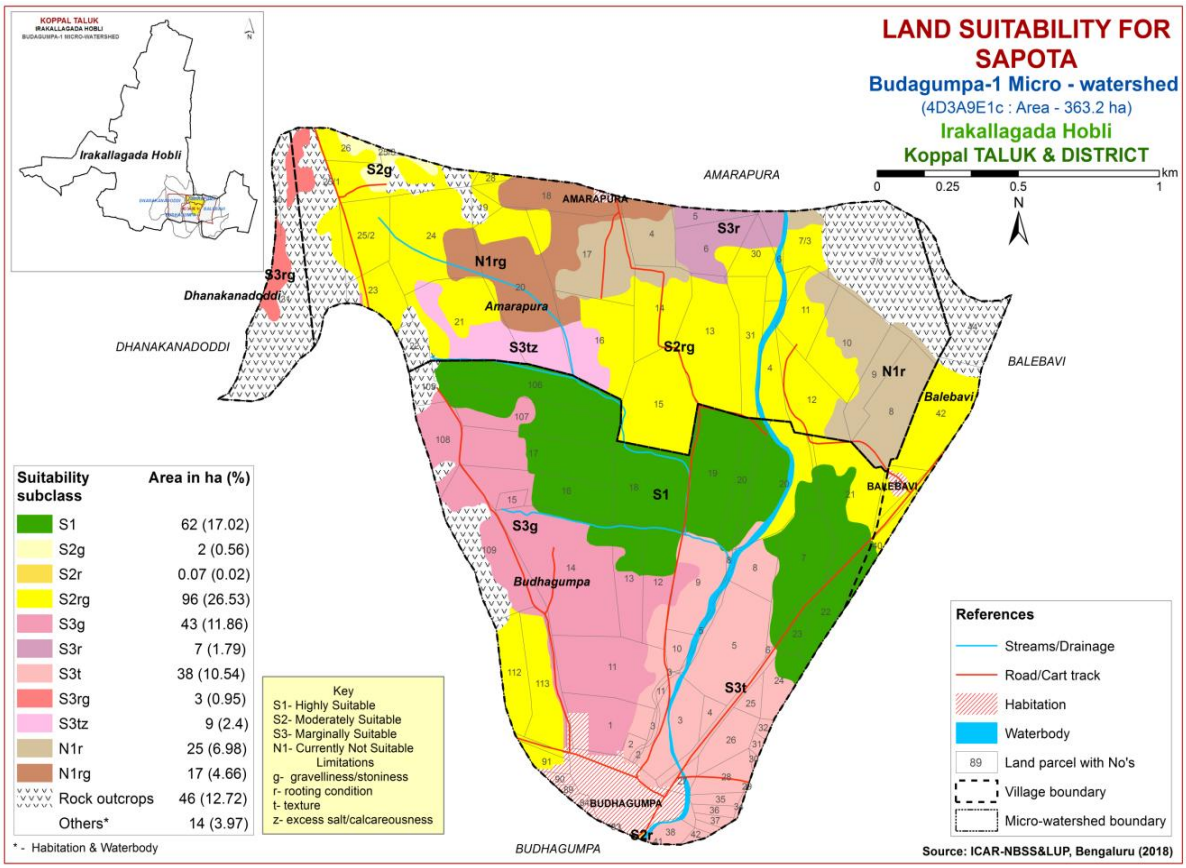


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the 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 62 ha (17 %) in the microwatershed has soils that are highly suitable (Class S1) for growing pomegranate and are distributed in the eastern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 145 ha (40%) and distributed in the major part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 53 ha (15%) and occur in the western and northern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.16 Crop suitability criteria for Pomegranate

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	30-34	35-38 25-29	39-40 15-24	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	imperfectly drained		
Nutrient availability	Texture	Class	sl, scl, l, cl	c, sic, sicl	cl, s, ls	s,fragmental
Rooting conditions	pH	1:2.5	5.5-7.5	7.6-8.5	8.6-9.0	
	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	%vol.	nil	15-35	35-60	>60
Soil toxicity	Salinity	dS/m	Nil	<9	>9	<50
	Sodicity	%	nil			
Erosion	Slope	%	<3	3-5	5-10	

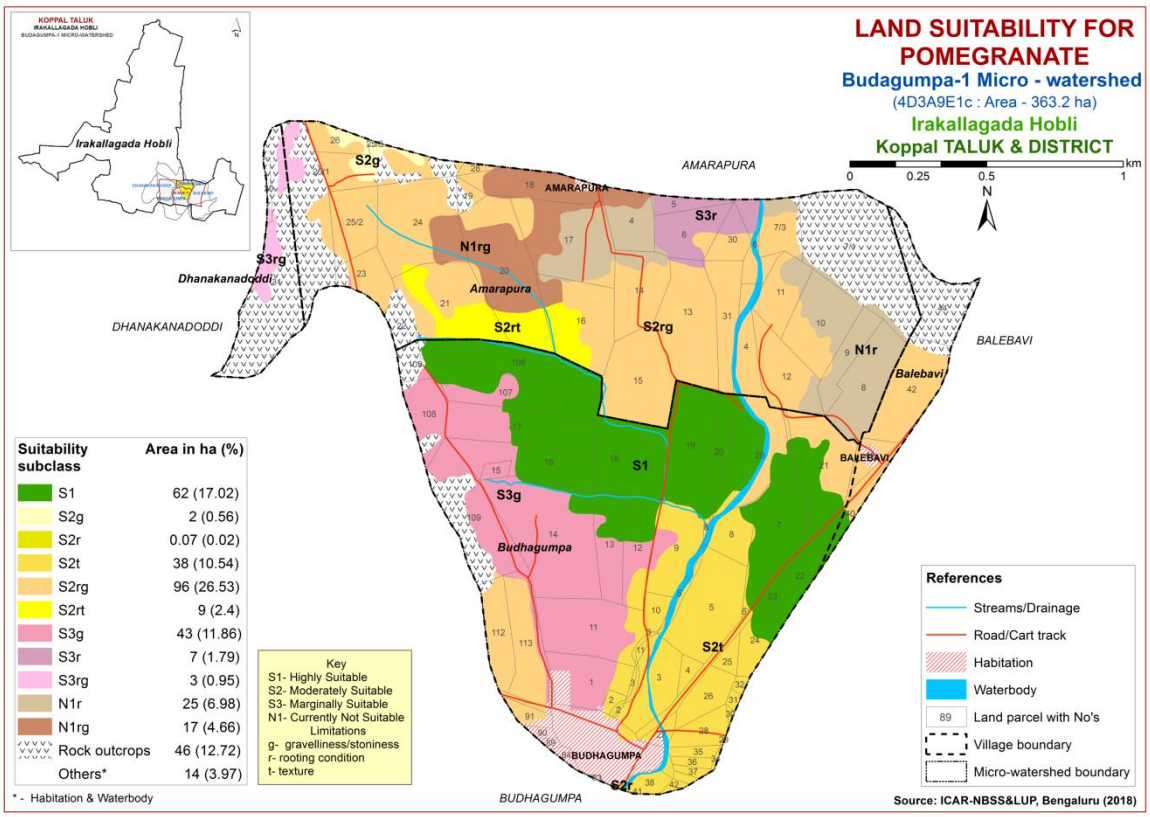


Fig. 7.15 Land Suitability map of Pomegranate

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 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.

An area of about 25 ha (7 %) in the microwatershed has soils that are highly suitable (Class S1) for growing guava and are distributed in the eastern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 135 ha (37%) and distributed in the major part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 100 ha (28%) and occur in the western, southern and northern part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.17 Crop suitability criteria for Guava

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

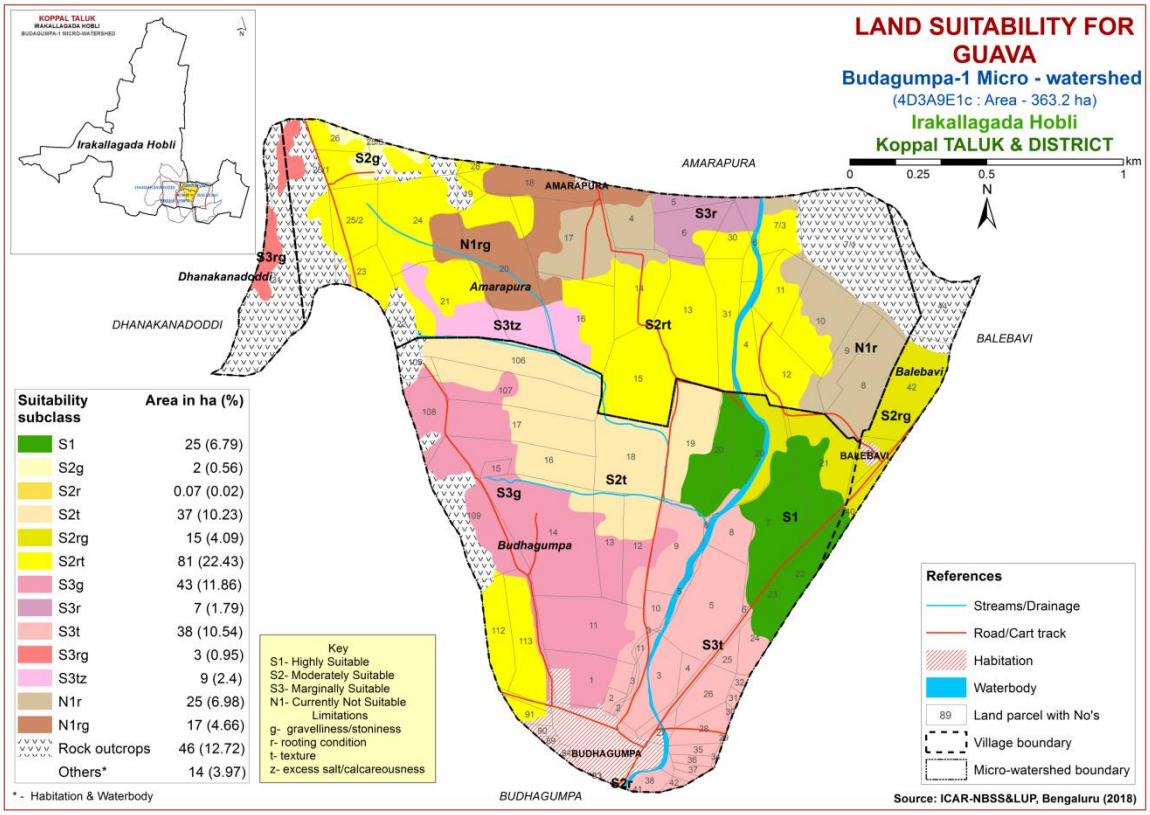


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the state. The crop requirements (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.

Table 7.18 Land suitability criteria for Jackfruit

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

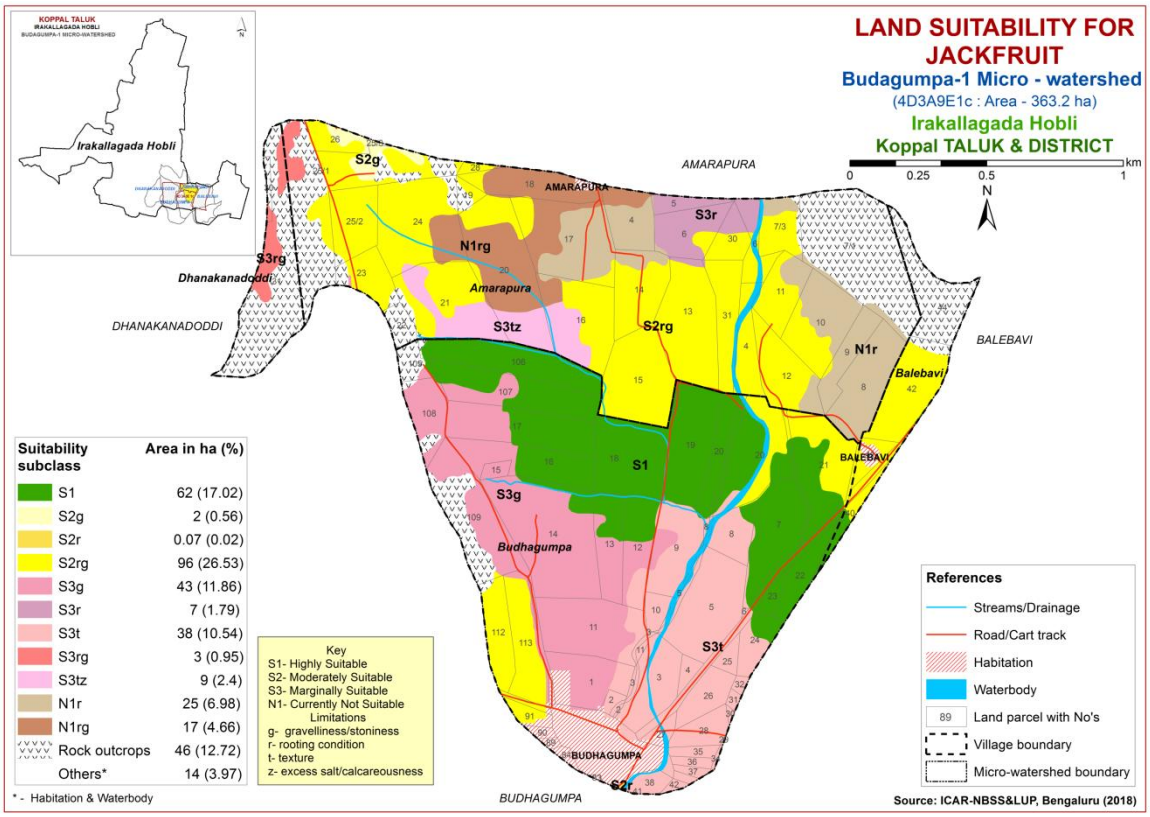


Fig. 7.17 Land Suitability map of Jackfruit

An area of about 62 ha (17 %) in the microwatershed has soils that are highly suitable (Class S1) for growing jackfruit and are distributed in the eastern and central part of the microwatershed. Moderately suitable (S2) lands cover an area of about 98 ha (27%)

and distributed in the southwestern, northern and northeastern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 100 ha (28%) and occur in the western, southern, central and northern part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

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 about 13 ha (3 %) in the microwatershed has soils that are highly suitable (Class S1) for growing jamun and are distributed in the eastern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 186 ha (51%) and distributed in the major part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 62 ha (17%) and occur in the western and northern part of the microwatershed. They have moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) and occur in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.19 Land suitability criteria for Jamun

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

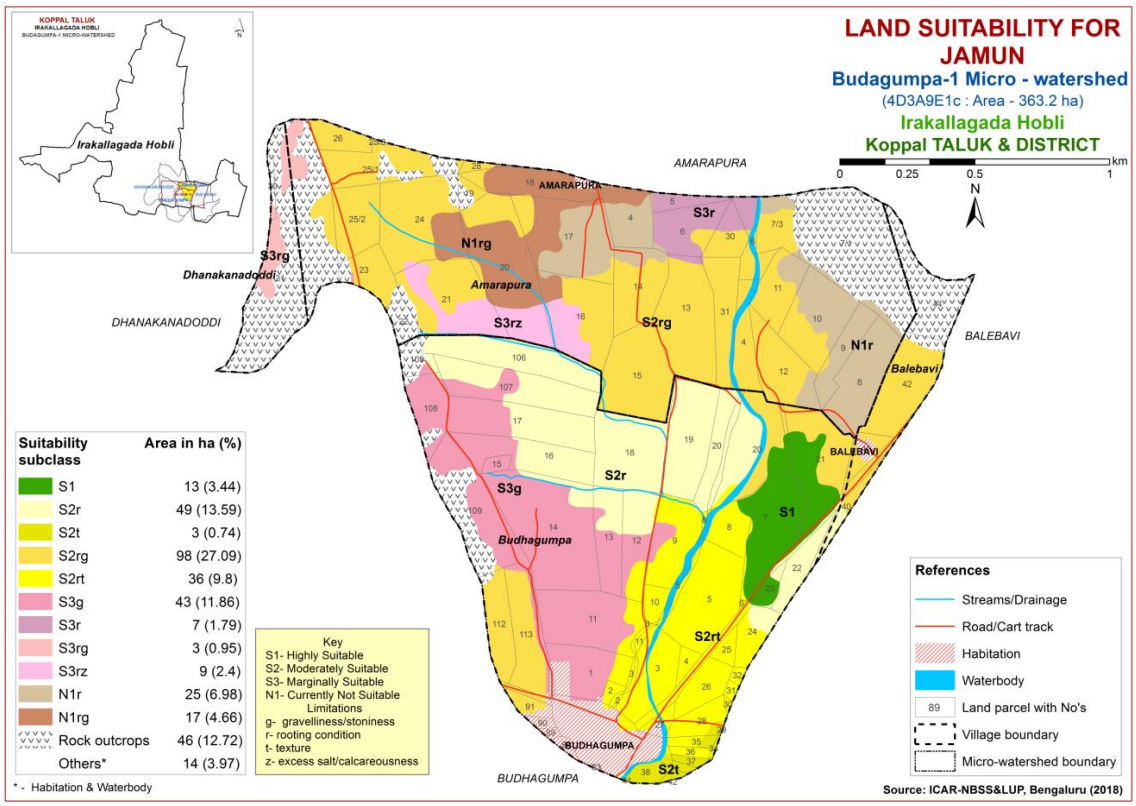


Fig. 7.18 Land Suitability map of Jamun

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 7.19.

An area of about 100 ha (28%) is highly suitable (Class S1) for growing musambi and are distributed in the southern, eastern and central part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 107 ha (30 %) and distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. An area of about 53 ha (15 %) is marginally suitable (Class S3) for growing musambi and distributed in the western and northern part of the microwatershed with moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) for growing musambi and are distributed in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.20 Crop suitability criteria for Musambi

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

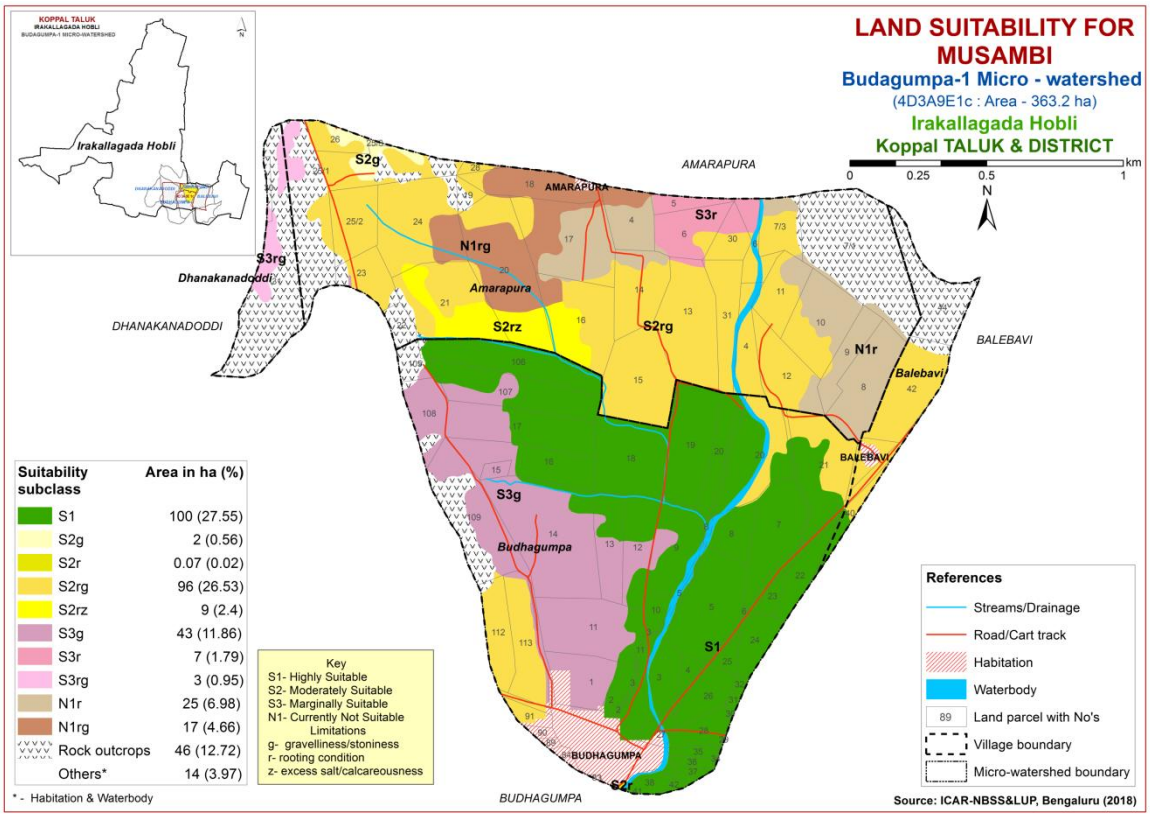


Fig. 7.16 Land Suitability map of Musambi

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 for growing lime (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

An area of about 100 ha (28%) is highly suitable (Class S1) for growing lime and are distributed in the southern, eastern and central part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 107 ha (30 %) and distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. An area of about 53 ha (15 %) is marginally suitable (Class S3) for growing lime and distributed in the western and northern part of the microwatershed with moderate limitations of gravelliness and rooting depth. An area of about 42 ha (12%) is not suitable (Class N1) for growing lime and are distributed in the northern and northeastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

Table 7.21 Crop suitability criteria for Lime

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

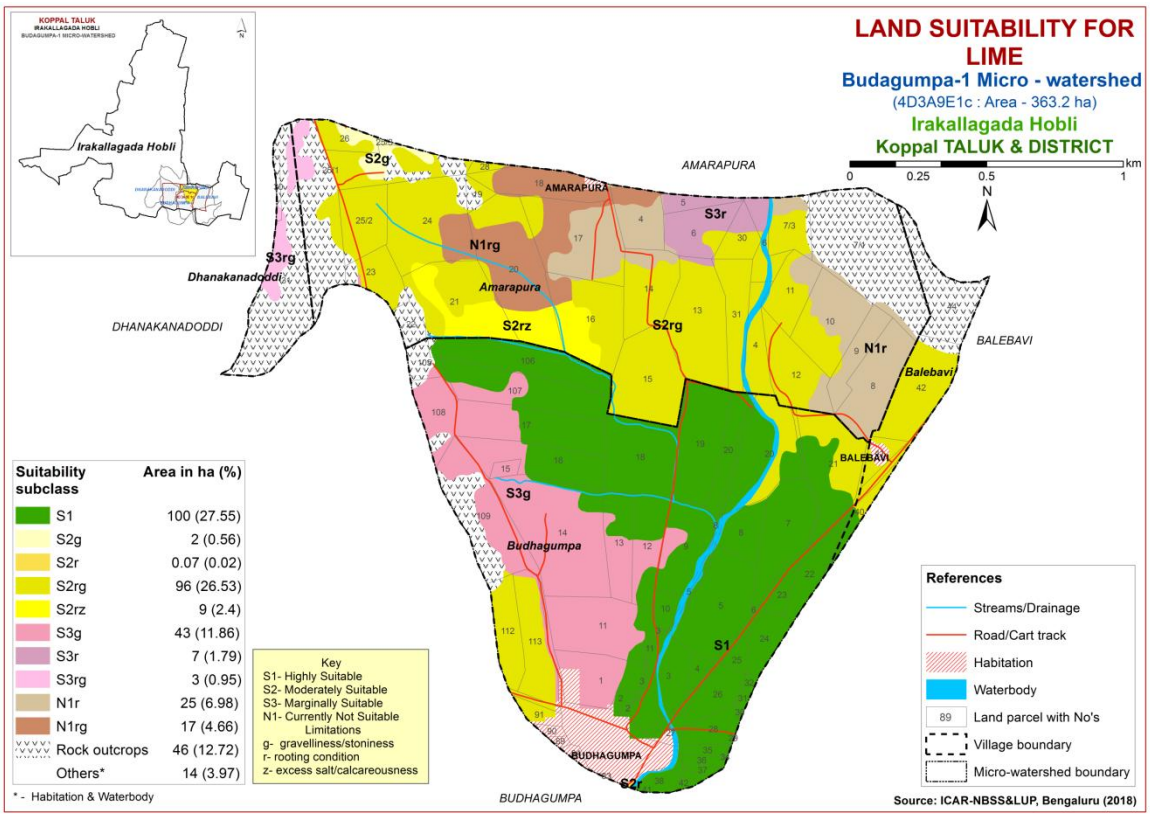


Fig. 7.17 Land Suitability map of Lime

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.

Table 7.22 Land suitability criteria for Cashew

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

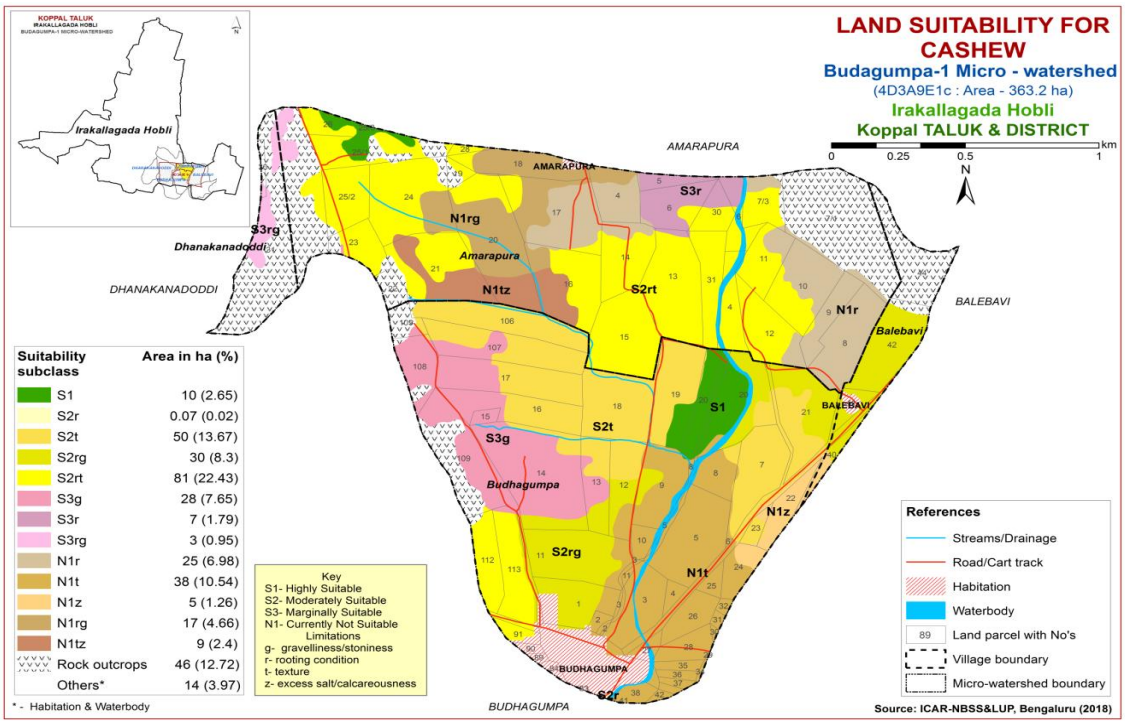


Fig. 7.21 Land Suitability map of Cashew

An area of about 10 ha (3%) is highly suitable (Class S1) for growing cashew and are distributed in the central part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 161 ha (44 %) and distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture. An area of about 38 ha (10 %) is marginally suitable (Class S3) for growing cashew and distributed in the western and northern part of the microwatershed with moderate limitations of gravelliness and rooting depth. An area of about 94 ha (26%) is not suitable (Class N1) for growing cashew and are distributed in the southern, northern and northeastern part of the microwatershed with severe limitations of rooting depth, texture, calcareousness and gravelliness.

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.

Maximum area of about 184 ha (51%) is highly suitable (Class S1) for growing custard apple and are distributed in the major part of the microwatershed. An area of about 77 ha (21%) is moderately suitable (Class S2) and occur in the eastern, western and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 42 ha (12%) is marginally suitable

(Class S3) for growing custard apple and are distributed in the northern and northeastern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

Table 7.23 Land suitability criteria for Custard apple

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

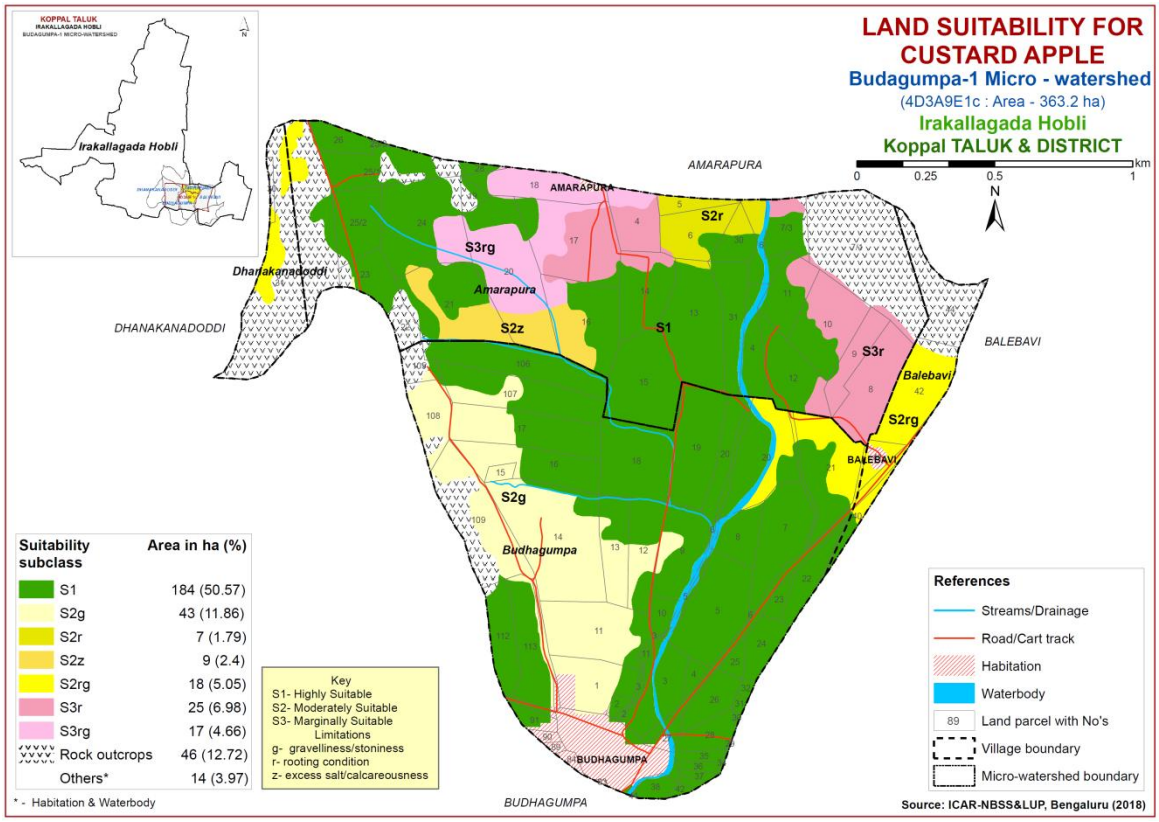


Fig. 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for 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 (Table 7.24) for 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.

Highly suitable lands for growing amla cover a maximum area of about 145 ha (40 %) and distributed in the major part of the microwatershed. An area of about 115 ha (32 %) has soils that are moderately suitable (Class S2) and are distributed in the southern, western and eastern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 42 ha (12 %) and occur in the northern and northeastern part of the microwatershed with moderate problems of rooting depth and gravelliness.

Table 7.24 Land suitability criteria for Amla

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

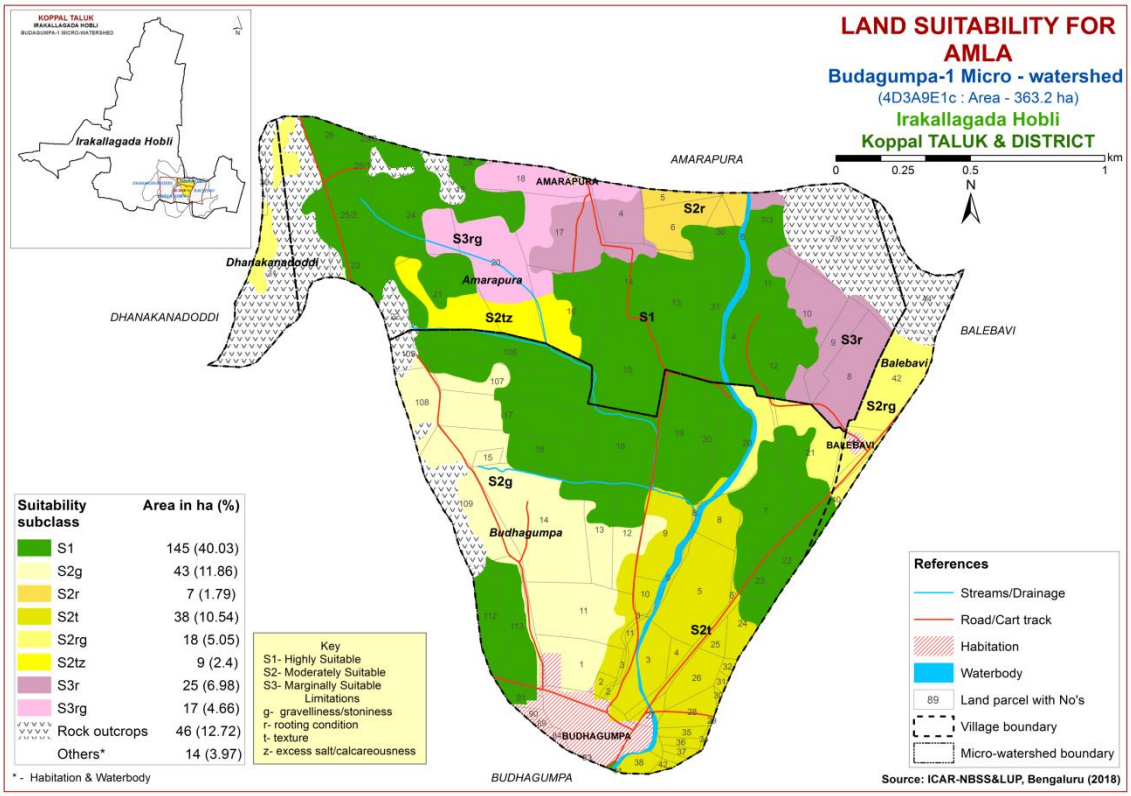


Fig. 7.23 Land Suitability map of Amla

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 are given in Figure 7.24.

Table 7.25 Land suitability criteria for Tamarind

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

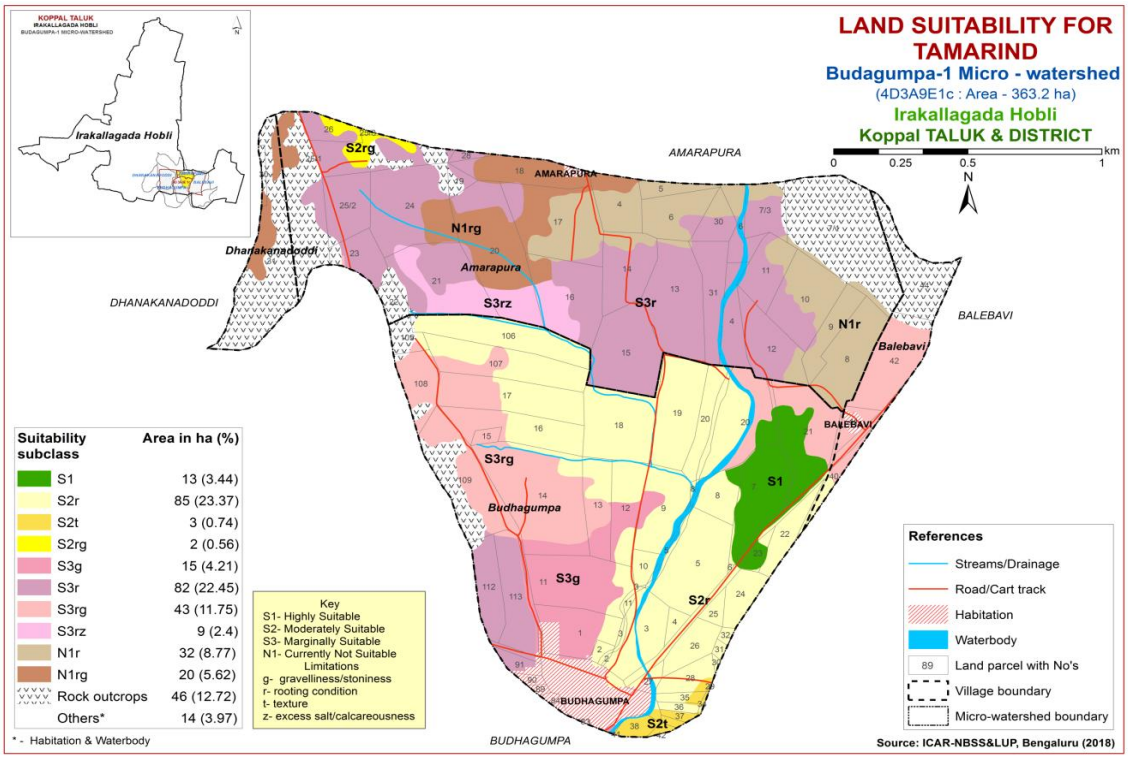


Fig. 7.24 Land Suitability map of Tamarind

Highly suitable lands (Class S1) for growing tamarind cover an area of about 13 ha (3 %) and distributed in the northeastern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 90 ha (25%) and distributed in the southern, eastern and central part of the microwatershed. They have minor limitations of texture, gravelliness and rooting depth. Maximum area of about 149 ha (41 %) is

marginally suitable (Class S3) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. Area not suitable (Class N1) for growing tamarind is about 52 ha (14 %) and are distributed in the northeastern and northern part of the microwatershed. They have severe limitations of rooting depth and gravelliness.

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.

An area of about 25 ha (7%) is highly suitable for growing marigold and distributed in the eastern part of the microwatershed. Maximum area of about 174 ha (48 %) is moderately suitable (Class S2) for growing marigold and occur in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. An area of about 103 ha (29%) is marginally suitable (Class S3) for growing marigold and occur in the western, northern and northeastern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Table 7.26 Land suitability criteria for Marigold

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

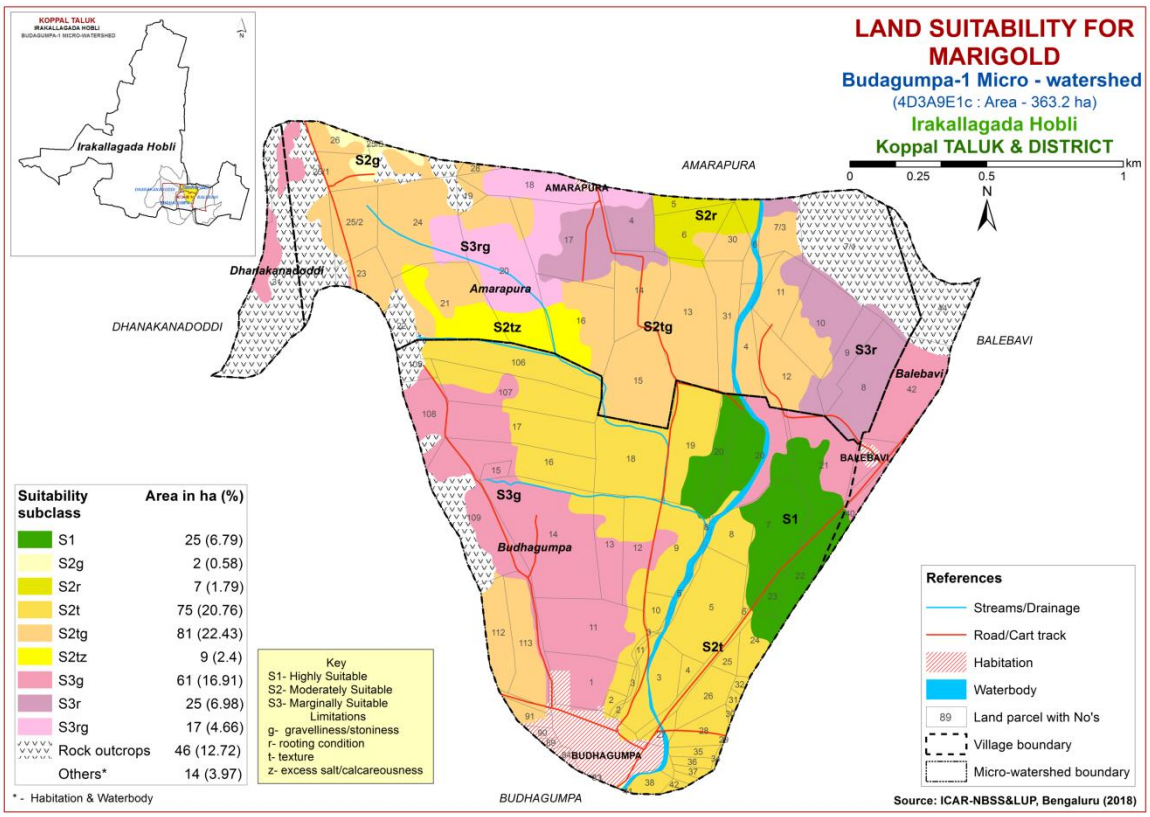


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*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.

Table 7.27 Land suitability criteria for Chrysanthemum

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable (N)
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l,sl, scl, cl, sil	sicl, sc, sic, c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	

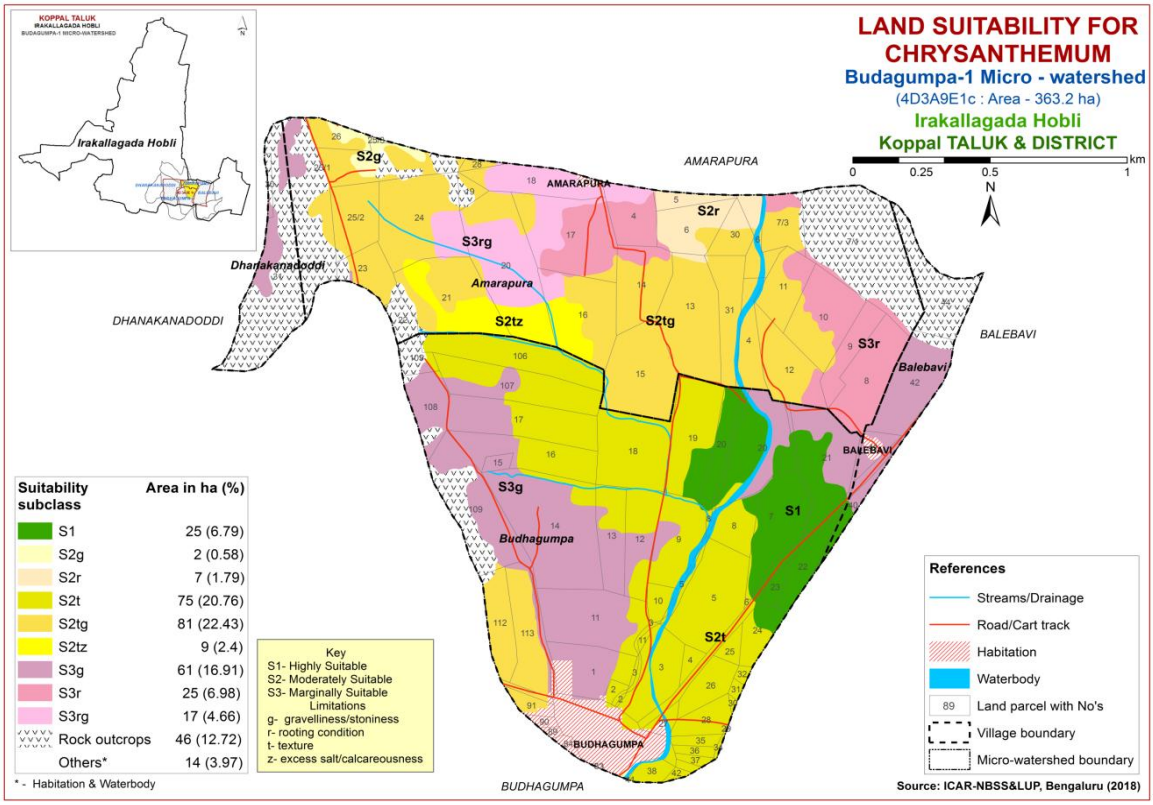


Fig. 7.26 Land Suitability map of Chrysanthemum

An area of about 25 ha (7%) is highly suitable for growing chrysanthemum and distributed in the eastern part of the microwatershed. Maximum area of about 174 ha (48 %) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. An area of about 103 ha (29%) is marginally suitable (Class S3) for growing chrysanthemum and occur in the western, northern and northeastern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

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 25 ha (7%) is highly suitable for growing jasmine and distributed in the eastern part of the microwatershed. An area of about 127 ha (35 %) is moderately suitable (Class S2) for growing jasmine and are distributed in the northern, central and western part of the microwatershed. They have minor limitations of rooting depth, gravelliness and texture. Maximum area of about 150 ha (41 %) is marginally suitable

(Class S3) for growing jasmine and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

Table 7.28 Land suitability criteria for jasmine (irrigated)

Crop requirement			Rating			
Soil-site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season		18-23	17-15 24-35	35-40 10-14	
Soil aeration	Soil drainage	Class	Well drained	Moderately drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	Scl,l,scl,cl,sil	sicl,sc,sic,c(m/k)	C(ss),	ls, s
	pH	1:2.5	6.0-7.5	5.5-5.9:7.6-8.5	<5: >8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strong calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	Slight	Strongly	
	Sodicity	%	Non sodic	Slight	Strongly	
Erosion	Slope	%	1-3	3-5	5-10	

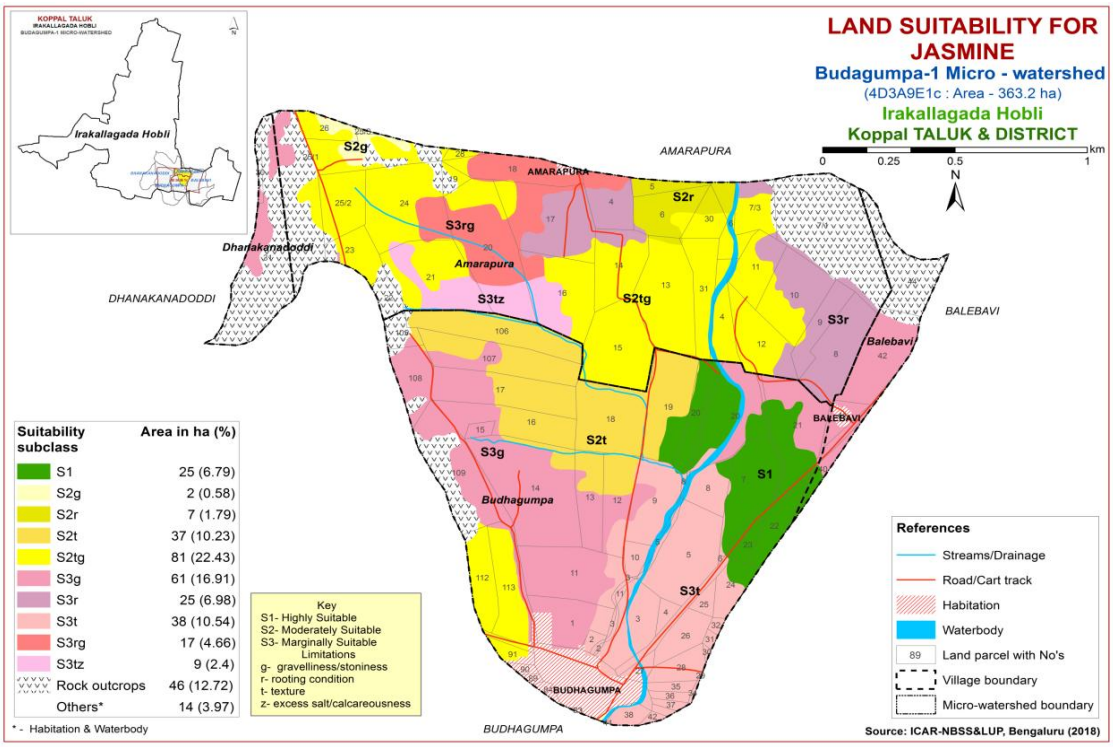


Fig. 7.27 Land Suitability map of Jasmine

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

Crossandra is one of the most important flower crop grown in almost all the districts of the State. The crop requirements for growing crossandra were matched with

the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was given. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

An area of about 25 ha (7 %) is highly suitable for growing crossandra and distributed in the eastern part of the microwatershed. Moderately suitable (Class S2) lands for growing crossandra cover an area of about 130 ha (36%) and distributed in the western, central and northern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and texture. An area of about 148 ha (41 %) is marginally suitable (Class S3) for growing crossandra and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

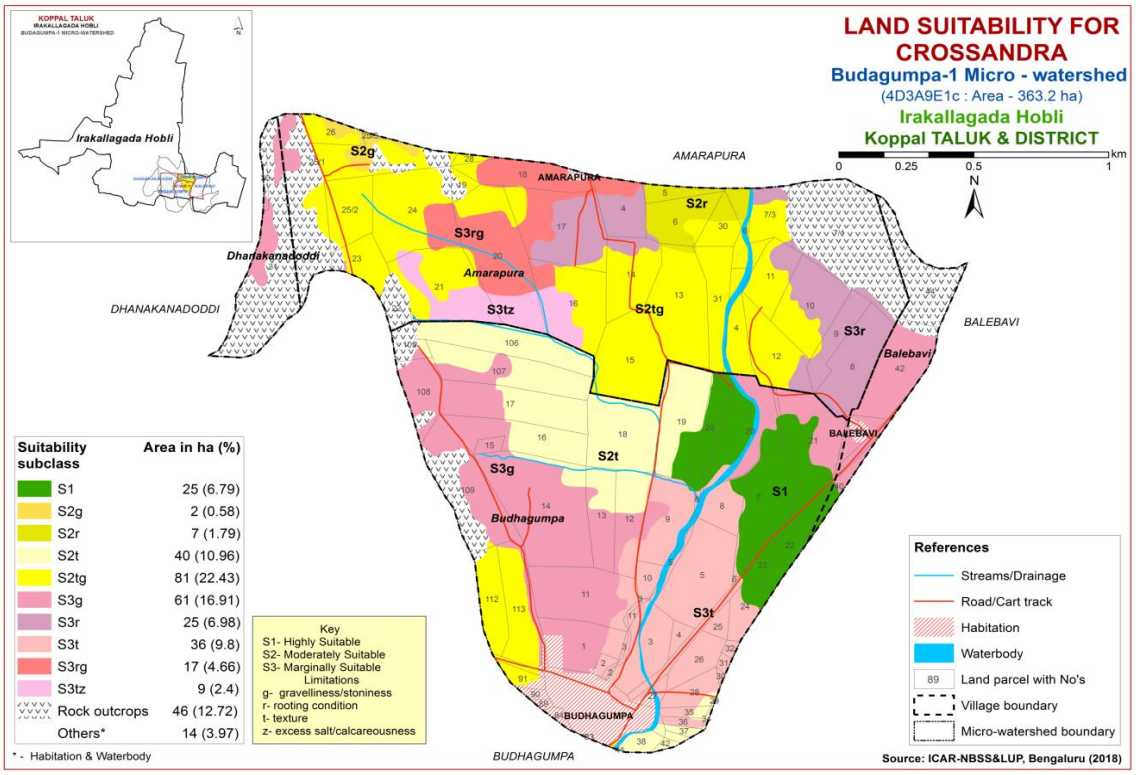


Fig. 7.28 Land Suitability map of Crossandra

7.29 Land Management Units (LMU)

The 21 soil map units identified in Budagumpa-1 microwatershed have been grouped into six Land Management Units (LMU) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig.7.25) 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.

LMU	Mapping unit	Soil and site characteristics
1	BSRiB1g1, BSRiB2g1, GHTcB2g1, HLKiB1 JDGcB2, JDGiB1, KMHhB1g1, MNLiB2 VDHiB2	Moderately deep to very deep, red sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
2	DRLmB1g1, GRHmA1, KDTmA1	Moderately deep to very deep, calcareous to non calcareous black sandy clay to clay soils with slopes of 0-3%, slight erosion, gravely (15-35%)
3	BDGcB2 ,BPRbB2 BPRmB2g1, HDHbB1	Moderately deep to deep, gravelly red sandy clay to clay soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
4	KGHbB2g1	Moderately shallow, red loamy soils with slopes of 1-3% moderate erosion, gravelly (15-35%)
5	LKRiB2	Moderately shallow, red gravelly sandy clay soils with slopes of 1-3%, moderate erosion
6	CSRhB2g1, HRViB2g1	Shallow, red gravelly loamy soils with slopes of 1-3%, moderate erosion, gravelly (15-35%)

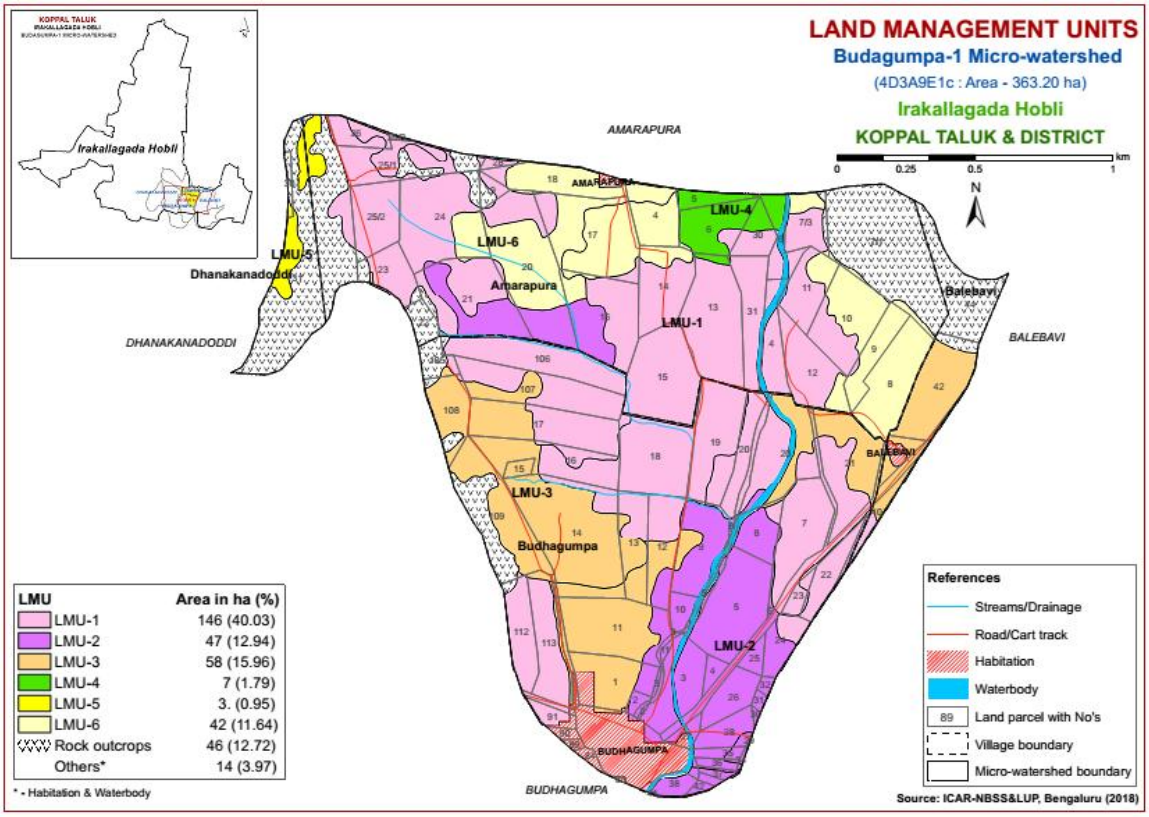


Fig 7.29 Land Management Units map of Budagumpa-1 microwatershed

7.30 Proposed Crop Plan for Budagumpa-1 Microwatershed

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

Table 7.29 Proposed Crop Plan for Budagumpa-1 Microwatershed

Proposed LUC	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	165.BSRiB1g1 168.BSRiB2g1 138.GHTcB2g1 273.HLKiB1 456.JDGcB2 458.JDGiB1 198.KMHhB1g1 208.MNLiB2 247.VDHiB2 (Moderately deep to very deep , red sandy clay to sandy clay loam soils)	**Amarapura:**,7/3,11,12,13,14,15, 16,19,21,23,24,25/2,25/3,26,28,30 ,31 **Budhagumpa:**7,12,13,16,17,18,1 9, 20,22,23,91,106,107,112, 113	Maize, Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Pomegranate, Guava, Sapota, Mango, Jackfruit, Jamun, Tamarind, Lime, Musambi, Amla, Custard apple **Vegetable crops:** Drumstick, Tomato, Chilli, Brinjal **Flower crops:** Jasmine, Marigold, Chrysanthemum	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
2	349.DRLmB1g1 370.GRHmA1 403.KDTmA1 (Moderately deep to very deep, calcareous to non calcareous black sandy clay to clay soils)	**Budhagumpa:**2,3,4,5,6,8,9,10,24, 25,26,27,28,29,30,31,32,34,35,36, 37,38,41,42	Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum, Jasmine, Crossandra	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
3	455.BDGcB2 216.BPRbB2 459.BPRmB2g1 103.HDHbB1	**Balebavi:** 40,41,42 **Budhagumpa :**1,11,14,15,21,108, 109	Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops:** Lime, Musambi**,** Jackfruit, Jamun, Amla, Cashew, Custard apple	Drip irrigation, mulching, suitable soil and water conservation

	(Moderately deep to deep, gravelly red sandy clay to clay soils)			**Vegetable crops:** Drumstick	practices (Crescent Bunding with Catch Pit etc)
4	62.KGHbB2g1 (Moderately shallow, red loamy soils)	**Amarapura :** 5,6	Groundnut, Bajra, Horsegram	**Fruit crops:** Lime, Musambi, Amla, Custard apple **Flower crops:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, Mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
5	53.LKRiB2 (Moderately shallow, red gravelly sandy clay soils)	**Amarapura :** 25/1 **Dhanakanadoddi:** 30,31	Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Cashew, Custard apple	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
6	37.CSRhB2g1 31.HRViB2g1 (Shallow, red gravelly loamy soils)	**Amarapura :** 4,8,9,10,17,18,20	Horsegram	**Agri-Silvi-Pasture:** Custard apple, Amla**, Hybrid Napier,** Styloxanthes hamata, Glyricidia, Styloxanthes scabra	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Budagumpa-1 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of BSR (81 ha), JDG (37 ha), GRH (36 ha), BPR (28 ha), CSR (25 ha), HRV (17 ha), BDG (15 ha), HDH (15 ha), HLK (13 ha), DRL (9 ha) VDH (8 ha), KGH (7 ha), MNL (5 ha), LKR (3 ha), KDT (3 ha), KMH (2 ha) and GHT (<1ha).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, an area of about 1 ha (<1%) is slightly acid (pH 6.0-6.5), 85 ha (23%) is neutral (pH 6.5-7.3), 81 ha (22%) is slightly alkaline (pH 7.3-7.8), 110 ha

(30%) is moderately alkaline (pH 7.8-8.4) and 25 ha (7%) under strongly alkaline (pH 8.4-9.0) in reaction.. Thus, major portion of the soils are alkaline in reaction.

Soil Health Management

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

Acid soils

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

Liming materials:

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

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

Alkaline soils

(Slightly alkaline to strongly alkaline soils)

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area 161 ha (44 %) 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, radish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dry land Agriculture, Vijayapura, Karnataka can be adopted.
- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number.

Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Budagumpa-1 microwatershed.

- **Organic Carbon:** An area of about 294 ha (81%) is medium (0.5-0.75%) and 8 ha (2 %) is high (>0.75%) in organic carbon content. The areas that are medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 294 ha (81 %) area where OC is less than 0.75%. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Available phosphorus is medium (23-57 kg/ha) in 106 ha (29 %) and high (>57 kg/ha) in 197 ha (54%) of the soils. The areas where phosphorus content is high reduce 25 % from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is medium.
- **Available Potassium:** Available potassium is low (<145 kg/ha) <1 ha (<1%), medium (145-337 kg/ha) in 162 ha (45 %) and high (>337 kg/ha) in 141 ha (39 %) area of the microwatershed. The areas where potassium content is high reduce 25 % from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low or medium**.**
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 259 ha (71%) area and medium (10-20 ppm) in 43 ha (12%) area of the microwatershed. The areas with low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available iron:** It is deficient (<4.5 ppm) in 127 ha (35%) and sufficient (>4.5ppm) in 175 ha (48%) area of the microwatershed. To manage iron deficiency iron sulphate @25 kg/ha needs to be applied for 2-3 years.
- **Available Manganese:** It is sufficient in the entire area of the microwatershed.
- **Available Copper:** It is sufficient in the entire area of the microwatershed.
- **Available Zinc:** It is deficient (<0.6 ppm) in 293 ha (81%) and sufficient (>0.6 ppm) in 10 ha (3%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low (<0.5 ppm) in 38 ha (11 %) and medium (0.5-1.0 ppm) in 264 ha (73 %) area of the microwatershed. The areas with low and medium need to be applied with sodium borate @ 10 kg/ha as a soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Soil acidity:** The microwatershed has 1 ha (<1%) area with soils that are slightly acid. These area needs application of lime (Calcium Carbonate).

- **Soil alkalinity:** The area of about 216 ha (60%) in the microwatershed has soils that are slightly to strongly 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.

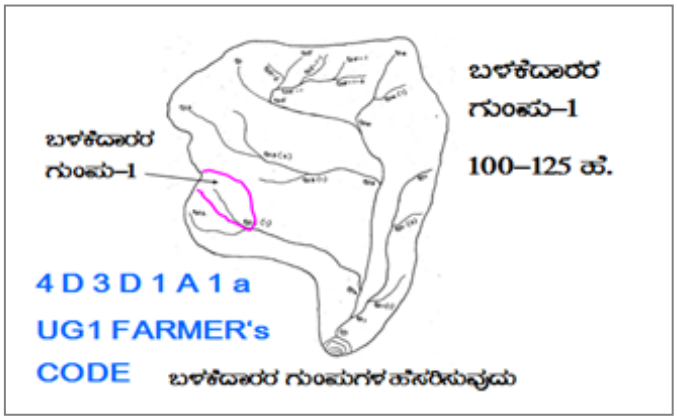
  Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, 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 Budagumpa-1 microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

- Soil depth
- Surface soil texture
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability 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.

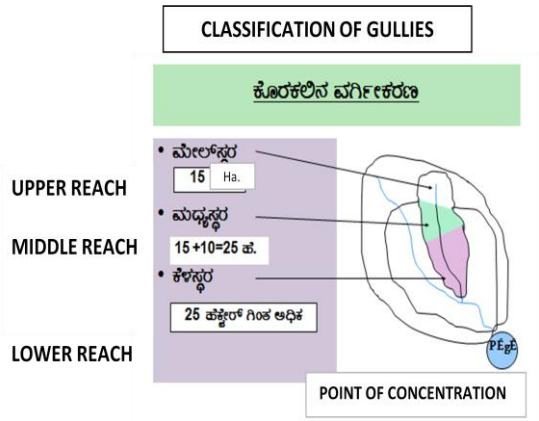
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

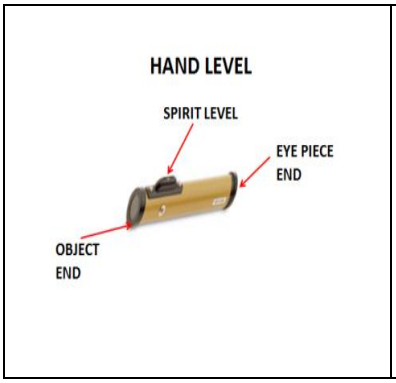
9.1.1 Arable Land Treatment

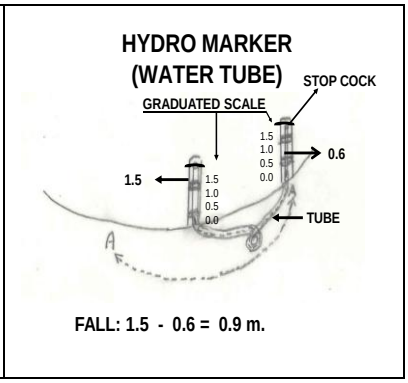
A. BUNDING

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.





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

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

Note: i) The above intervals are maximum.

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

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

Section of the Bund

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

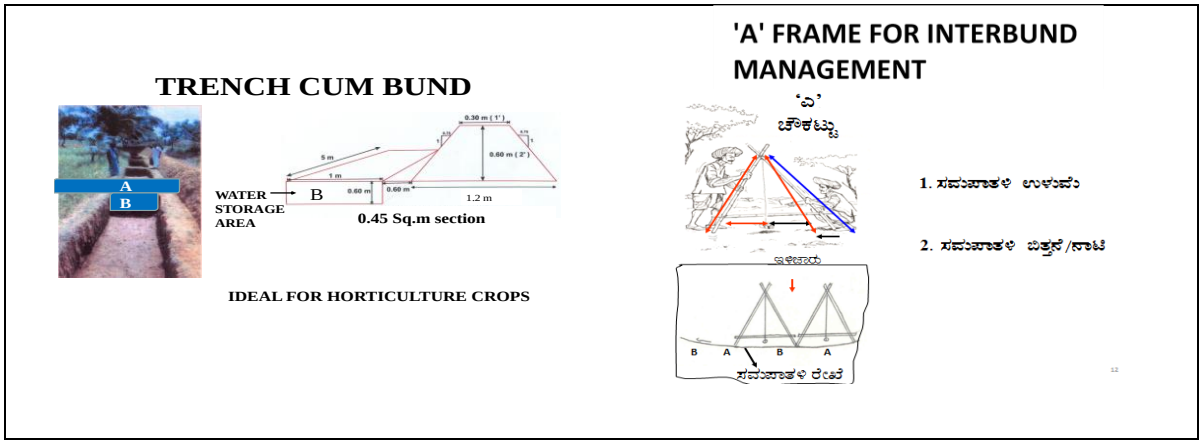
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

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

B. 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 (Fig. 9.1).

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

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

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

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

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

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

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

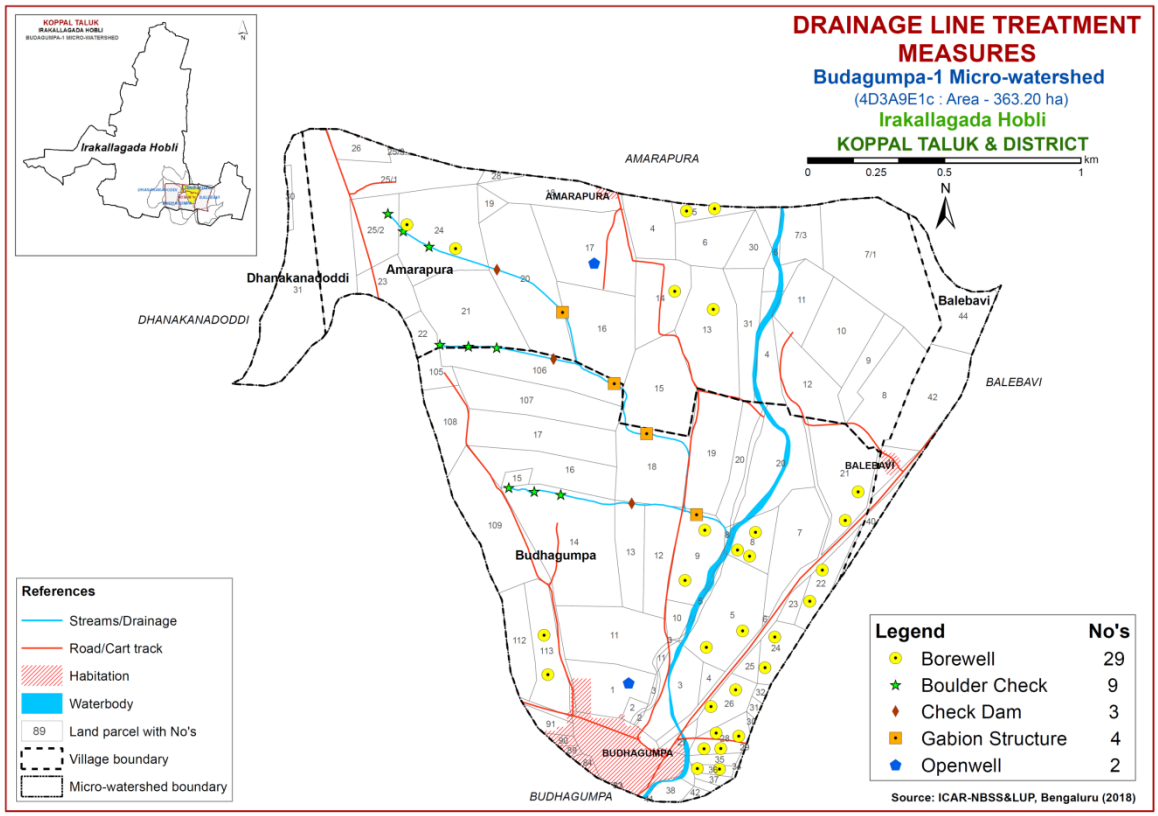


Fig. 9.1 Drainage line treatment measures map of Danakkanadoddi-1 Microwatershed

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.2) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. Maximum area of about 256 ha (70%) needs trench cum bunding, an area of about 9 ha (2%) needs graded bunding and an area of about 38 ha (11%) requires 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.

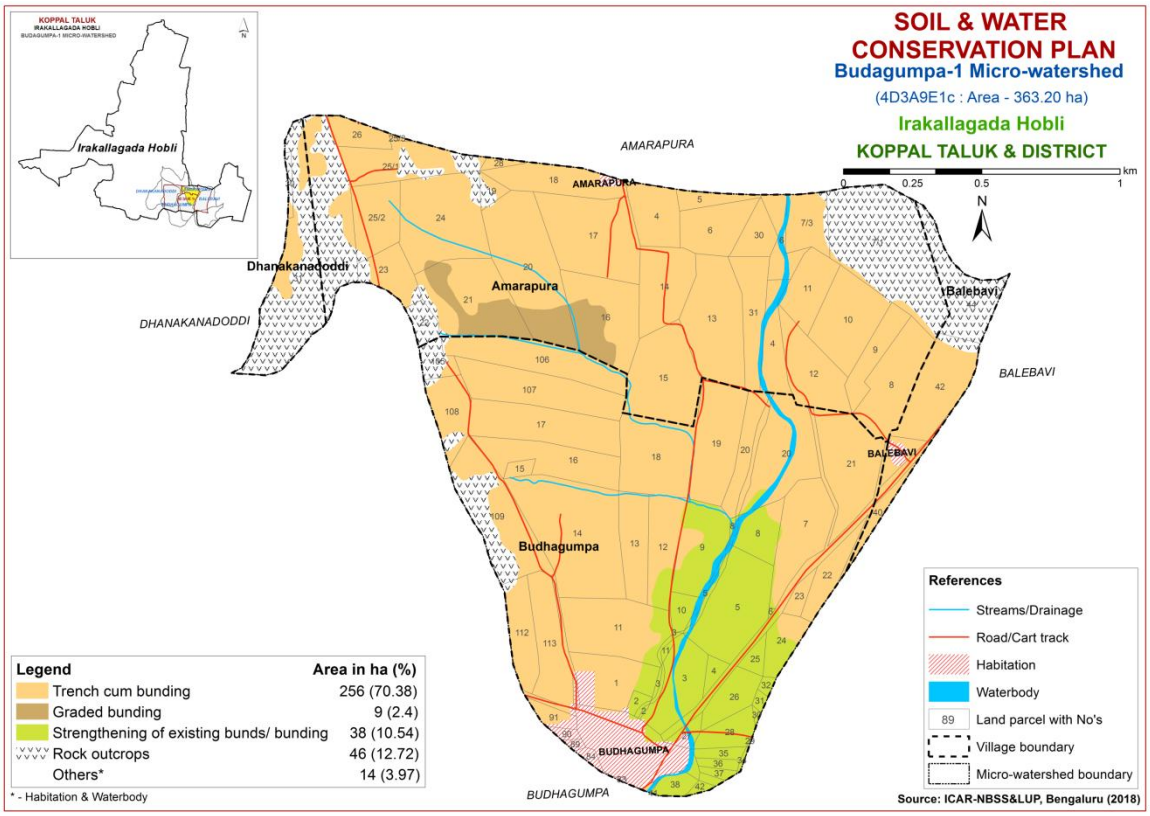


Fig. 9.2 Soil and Water Conservation Plan map of Budagumpa-1 Microwatershed

9.3 Greening of Microwatershed

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

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like 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

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Appendix I

Budhagumpa-1 Microwatershed

Soil Phase Information

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Amarapura	4	6.76	CSRhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Paddy+Redgram (Cf+Pd+Rg)	Not Available	IIIes	Trench cum bunding
Amarapura	5	1.26	KGHbB2g1	LMU-4	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy (Gn+Pd)	2 Bore well	IIes	Trench cum bunding
Amarapura	6	6.32	KGHbB2g1	LMU-4	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Groundnut+Paddy (Fl+Gn+Pd)	Not Available	IIes	Trench cum bunding
Amarapura	7/1	14.43	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Granitic Outcrops	Not Available	Rock outcrops	Rock outcrops
Amarapura	7/3	3.16	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Redgram+Paddy (Gn+Rg+Pd)	Not Available	IIs	Trench cum bunding
Amarapura	8	6.19	CSRhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Current fallow (Rg+Cf)	Not Available	IIIes	Trench cum bunding
Amarapura	9	2.85	CSRhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	Trench cum bunding
Amarapura	10	6.40	CSRhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Fallow land+Redgram (Pd+Fl+Rg)	Not Available	IIIes	Trench cum bunding
Amarapura	11	3.68	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Vegetables+Groundnut (Veg+Gn)	Not Available	IIs	Trench cum bunding
Amarapura	12	5.17	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Trench cum bunding
Amarapura	13	8.46	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Redgram+Groundnut+Maize (Mn+Rg+Gn+Mz)	1 Bore well	IIs	Trench cum bunding
Amarapura	14	5.30	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Current fallow (Rg+Cf)	1 Bore well	IIs	Trench cum bunding
Amarapura	15	7.69	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIs	Trench cum bunding
Amarapura	16	7.50	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Trench cum bunding
Amarapura	17	9.27	CSRhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Current fallow+ Groundnut+Maize (Rg+Cf+Gn+Mz)	1 Open well	IIIes	Trench cum bunding
Amarapura	18	4.52	HRViB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Vegetables (Rg+Veg)	Not Available	IIIes	Trench cum bunding
Amarapura	19	0.81	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Amarapura	20	10.92	HRViB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy+Current fallow+Groundnut (Mz+Pd+Cf+Gn)	Not Available	IIIes	Trench cum bunding
Amarapura	21	8.59	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Paddy+Groundnut +Maize (Cf+Pd+Gn+Mz)	Not Available	IIes	Trench cum bunding
Amarapura	22	1.24	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Fallow land (Fl)	Not Available	Rock outcrops	Rock outcrops
Amarapura	23	2.98	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize (Rg+Mz)	Not Available	IIes	Trench cum bunding

Amarapura	24	9.50	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Paddy (Rg+Pd)	2 Bore well	IIes	Trench cum bunding
Amarapura	25/1	14.09	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Not Available	Rock outcrops	Rock outcrops
Amarapura	25/2	4.22	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Redgram (Pd+Rg)	Not Available	IIes	Trench cum bunding
Amarapura	25/3	0.11	KMHhB1g1	LMU-1	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Mango+Sapota (Mn+Sp)	Not Available	IIs	Trench cum bunding
Amarapura	26	1.86	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Trench cum bunding
Amarapura	28	0.42	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Vegetables (Rg+Gn+Veg)	Not Available	IIes	Trench cum bunding
Amarapura	30	2.05	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Trench cum bunding
Amarapura	31	4.07	BSRiB1g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Current fallow (Rg+Cf)	Not Available	IIs	Trench cum bunding
Balebavi	40	1.12	HDHbB1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Maize (Cf+Mz)	Not Available	IIs	Trench cum bunding
Balebavi	41	1.34	HDHbB1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Trench cum bunding
Balebavi	42	6.43	HDHbB1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Balebavi	44	5.54	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Dyke (Dy)	Not Available	Rock outcrops	Rock outcrops
Budhagumpa	1	4.85	BDGcB2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	1 Open well	IIIes	Trench cum bunding
Budhagumpa	2	0.49	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Budhagumpa	3	4.82	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Pearl millet+Maize (Pm+Mz)	Not Available	IIs	Field bunds
Budhagumpa	4	0.67	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	5	7.98	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Redgram (Mz+Rg)	2 Bore well	IIs	Field bunds
Budhagumpa	6	0.05	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	7	5.94	HLKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Budhagumpa	8	2.91	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	3 Bore well	IIs	Field bunds
Budhagumpa	9	5.18	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Redgram (Mz+Rg)	2 Bore well	IIs	Field bunds
Budhagumpa	10	1.08	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	11	7.80	BDGcB2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Budhagumpa	12	4.34	JDGiB1	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIes	Trench cum bunding

Budhagumpa	13	3.84	JDGiB1	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	14	13.14	BPRbB2	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	Trench cum bunding
Budhagumpa	15	0.56	BPRbB2	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Trench cum bunding
Budhagumpa	16	5.61	JDGiB1	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	17	7.07	JDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	18	7.09	JDGiB1	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	19	6.84	JDGiB1	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	20	9.75	VDHiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	21	7.10	HDHbB1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	2 Bore well	IIs	Trench cum bunding
Budhagumpa	22	2.42	MNLiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 Bore well	IIes	Trench cum bunding
Budhagumpa	23	0.86	HLKiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Trench cum bunding
Budhagumpa	24	2.32	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	2 Bore well	IIs	Field bunds
Budhagumpa	25	0.79	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Budhagumpa	26	2.53	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	2 Bore well	IIs	Field bunds
Budhagumpa	27	0.82	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	28	2.12	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	4 Bore well	IIs	Field bunds
Budhagumpa	29	0.03	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	30	0.12	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	31	0.27	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	32	0.29	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	34	0.12	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Budhagumpa	35	0.72	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Budhagumpa	36	0.53	GRHmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	2 Bore well	IIs	Field bunds
Budhagumpa	37	0.39	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds

Budhagumpa	38	1.06	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIs	Field bunds
Budhagumpa	41	0.02	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Brinjal+Maize (Br+Mz)	Not Available	IIs	Field bunds
Budhagumpa	42	0.27	KDTmA1	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Field bunds
Budhagumpa	83	0.06	Habitation	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Budhagumpa	84	0.39	Habitation	Others	Others	Others	Others	Others	Others	Others	Greenhouse+Habitation (Gh+Hb)	Not Available	Others	Others
Budhagumpa	89	0.23	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation (Hb)	Not Available	Others	Others
Budhagumpa	90	0.36	Habitation	Others	Others	Others	Others	Others	Others	Others	Others	Not Available	Others	Others
Budhagumpa	91	1.01	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	105	1.45	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rockout crops (Rc)	Not Available	Rock outcrops	Rock outcrops
Budhagumpa	106	6.65	JDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	107	7.03	JDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	108	3.47	BPRbB2	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Trench cum bunding
Budhagumpa	109	8.66	BPRbB2	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Ridge+Pearl millet+Maize (Rdg+Pm+Mz)	Not Available	IIIes	Trench cum bunding
Budhagumpa	112	3.54	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet+Maize (Pm+Mz)	Not Available	IIes	Trench cum bunding
Budhagumpa	113	4.90	BSRiB2g1	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Pearl millet+Redgram+Maize (Pm+Rg+Mz)	2 Bore well	IIes	Trench cum bunding
Dhanakanad oddi	30	0.43	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rockout crops	Not Available	Rock outcrops	Rock outcrops
Dhanakanad oddi	31	11.80	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rockout crops	Not Available	Rock outcrops	Rock outcrops

Appendix II

Budhagumpa-1 Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Amarapura	4	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	5	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	6	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	7/1	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Amarapura	7/3	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	8	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	9	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	10	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	11	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	12	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	13	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	14	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	16	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	17	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	18	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	19	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Rock outcrops	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	20	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	21	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	22	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Amarapura	23	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	24	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	25/1	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Amarapura	25/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	25/3	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	26	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	28	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	30	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Amarapura	31	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Balebavi	40	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Balebavi	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Balebavi	42	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Balebavi	44	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Budhagumpa	1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	3	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	4	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 (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	5	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	7	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	8	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	9	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	10	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	11	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	12	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	13	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	14	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	15	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Budhagumpa	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	18	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	19	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	22	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	23	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	24	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	26	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	27	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	28	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	29	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	30	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	31	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	34	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	36	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	37	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	38	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	42	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Budhagumpa	83	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Budhagumpa	84	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Budhagumpa	89	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Budhagumpa	90	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Budhagumpa	91	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	105	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Budhagumpa	106	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	107	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	108	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	109	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	112	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Budhagumpa	113	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakanadoddi	30	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakanadoddi	31	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops

Appendix III

Budhagumpa-1 Microwatershed

Soil Suitability Information

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drum stick	Mulberry
Amarapura	4	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Amarapura	5	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Amarapura	6	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S3r	S3r
Amarapura	7/1	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Amarapura	7/3	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	8	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Amarapura	9	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Amarapura	10	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Amarapura	11	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	12	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	13	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	14	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	15	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	16	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	17	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	N1r	N1r
Amarapura	18	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Amarapura	19	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	20	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Amarapura	21	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	22	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Amarapura	23	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	24	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	25/1	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Amarapura	25/2	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	25/3	S2rg	S2g	S2g	S2g	S2g	S2t	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	S1	S2rg	S2g	S2t	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S2g	S1	S1

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drum stick	Mulberry
Amarapura	26	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	28	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Amarapura	30	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Amarapura	31	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2r	S2rg	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S1	S1	S2tg	S2tg	S2rg	S1	S2tg	S2tg	S2r	S2r
Balebavi	40	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Balebavi	41	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Balebavi	42	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Balebavi	44	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Budhagumpa	1	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	S3g	S2g
Budhagumpa	2	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	3	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	4	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	5	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	6	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	7	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Budhagumpa	8	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	9	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	10	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	11	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
Budhagumpa	12	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	13	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	14	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Budhagumpa	15	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Budhagumpa	16	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	17	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	18	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	19	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	20	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drum stick	Mulberry
Budhagumpa	21	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S2g
Budhagumpa	22	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Budhagumpa	23	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S2t	S1	S1	S3t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Budhagumpa	24	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	25	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	26	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	27	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	28	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	29	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	30	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	31	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	32	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	34	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	35	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	36	S3t	S2t	S3t	S1	S3t	S1	S2r	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S3t	S2t	S2t
Budhagumpa	37	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	38	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	41	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	42	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t
Budhagumpa	83	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
Budhagumpa	84	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
Budhagumpa	89	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
Budhagumpa	90	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Budhagumpa	91	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Budhagumpa	105	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Budhagumpa	106	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1
Budhagumpa	107	S2r	S2t	S1	S2t	S2t	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S2t	S2t	S1	S1	S2t	S2t	S1	S1

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crossandra	Drum stick	Mulberry
Budhagumpa	108	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Budhagumpa	109	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Budhagumpa	112	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Budhagumpa	113	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2tg	S2rg	S2r	S1	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2g	S2g	S2tg	S2tg	S2rg	S2g	S2tg	S2tg	S2rg	S2r
Dhanakana doddi	30	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
Dhanakana doddi	31	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC

*ROC- Rock OutCrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE STUDY

- *The data indicated that 35 farmers were sampled in Budagumpa-1 micro watershed among them 8 (22.86%) were marginal farmers, 7 (20 %) were small farmers, 7 (20 %) were semi medium farmers, 6 (17.14%) were medium farmers, 2(5.71%) were large farmers and 5 (14.29%) landless farmers were also interviewed for the survey.*
- *The data indicated that there were 157 population households were there in the studied micro watershed. Among them 89 (56.69%) men and 68 (43.31 %) were women. The average family size of landless was 5, marginal, small and semi medium farmers were 7 and medium and large farmers were 6. On an average the family size was 4.*
- *The data indicated that 20 (12.74%) people were in 0-15 years of age, 76 (48.41 %) were in 16-35 years of age, 47 (29.94 %) were in 36-60 years of age and 14 (8.92%) were above 61 years of age.*
- *The results indicated that the Budagumpa-1had 42.04 per cent illiterates, 1.27 per cent functional literates, 22.93 per cent of them had primary school education, 8.92 per cent of them had middle school, 12.74 per cent them had high school education, 5.10 per cent of them had PUC education and 6.37 per cent of them had degree education.*
- *The results indicated that, 77.14 per cent of households practicing agriculture, 8.57 per cent of the household heads were agricultural labour and 14.29 per cent of the household heads were general labour.*
- *The results indicated that agriculture was the major occupation for 40.76 per cent of the household members, 23.57 per cent were agricultural labourers, 11.46 per cent were general labours and 0.64 per cent were in private sector, were in trade and business, housewives and children's and 21.02 per cent of them were students. In case of landless farmers 70.83 per cent of them were general labours and 29.17 per cent of them were students.*
- *In case of marginal farmers 42.86 per cent of them were doing agriculture, 17.86 per cent of them were agriculture labour, 3.57 per cent of them were general labour and 35.71 per cent of them were students. In small farmers 61.29 per cent of them were doing agriculture, 16.13 per cent of them were agriculture labour, 3.23 per cent of them were in private service and 3.23 per cent of them were doing trade& business and housewives. In case of semi medium farmers 50 per cent of them were agriculturist, 34.62 per cent of them were agriculture labour and 11.54 per cent of them were students. In medium farmers 37.84 per cent of them were agriculturist, 35.14 per cent of them were agricultural labour and 21.62 per cent of them were students. Similarly in case of large farmers 54.55 per cent of them were agriculturist and 45.45 per cent of them were agricultural labour.*

- *The results showed that 0.64 per cent of them participated in cooperative bank and 99.36 per cent of them have not participated in any local institutions. Landless, marginal, semi medium, medium and large farmers were found to have no participation in any local institutions. Small farmers were found to participate in one or the other local institutions.*
- *The results indicated that 65.71 per cent of the households possess thatched house, 25.71 per cent of the households possess Katcha house and 8.57 per cent of the households possess Pacca house.*
- *The results showed that, 74.29 per cent of the households possess TV, 48.57 per cent of the households possess mixer/grinder, 17.14 per cent of the households possess bicycle, 31.43 per cent of the households possess motor cycle and 100 per cent of the households possess mobile phones.*
- *The results showed that the average value of television was Rs. 8269, mixer/grinder was Rs. 1676, bicycle was Rs.2166, motor cycle was Rs.29583 and mobile phone was Rs.2303.*
- *The result showed that about 17.14 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 8.57 per cent of the households possess power tiller, 11.43 per cent of the households possess tractor, 17.14 per cent of the households possess sprayer, 91.43 per cent of the households possess weeder, 5.71 43 per cent of the households possess harvester, 2.86 per cent of the households possess thresher and 5.71 per cent of the households possess chaff cutter.*
- *The results showed that the average value of bullock cart was Rs.18333; the average value of plough was Rs. 1250, the average value of power tiller was Rs. 25000, the average value of tractor was Rs. 475000, the average value of sprayer was Rs. 10666, the average value of weeder was Rs. 80, the average value of harvester was Rs.35000, the average value of thresher was Rs. 37000 and the average value of chaff cutter was Rs. 3000.*
- *The results indicated that, 31.43 per cent of the households possess bullocks, 17.14 per cent of the households possess local cow, 5.71 per cent of the households possess buffalo and 2.86 per cent of the households possess sheep.*
- *The data indicated that in case of marginal farmers, 25 per cent of the households possess local cow and 12.50 per cent of the households possess local cow, buffalo and sheep respectively. In case of small farmers, 14.29 per cent of households possess bullock and 28.57 per cent possess local cow. In case of semi medium farmers, 28.57 per cent of the households possess bullock and 14.29 per cent of the households possess local cow and buffalo. 66.67 medium farmers possess bullock and 16.67 farmers possess local cow and 100 per cent of the large farmers possess bullock and 50 per cent of them possess local cow.*

- *The results indicated that, average own labour men available in the micro watershed was 2, average own labour (women) available was 1.61, average hired labour (men) available was 8.80 and average hired labour (women) available was 7.38.*
- *The data showed that in case of marginal farmers, average own labour men available was 1.25, average own labour (women) was also 1.11, average hired labour (men) was 7.67 and average hired labour (women) available was 7. In case of small farmers, average own labour men available was 1.71, average own labour (women) was 1.71, average hired labour (men) was 12.14 and average hired labour (women) available was 9.71. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.43, average hired labour (men) was 10 and average hired labour (women) available was 8.33. In medium farmers average own labour men available was 3.17, average own labour (women) was 2.17, average hired labour (men) was 6.67 and average hired labour (women) available was 5. In case of large farmers average own labour men available was 2.50, average own labour (women) was 2.50, average hired labour (men) was 5 and average hired labour (women) available was 5.*
- *The results indicated that, 88.57 per cent of the household opined equally that the hired labour was adequate.*
- *The results indicated that, households of the Budagumpa-1 micro watershed possess 25.14 ha (43.40%) of dry land and 32.78 ha (56.60 %) of irrigated land. Marginal farmers possess 5.43 ha (91.85%) of dry land 0.48 ha (8.15%) of irrigated land. Small farmers possess 7.89 ha (89.65 %) of dry land and 0.89 ha (10.14 %) of irrigated land. Semi medium farmers possess 4.05 ha (35.39 %) of dry land and 7.39 ha (64.61%) of irrigated land. Medium farmers possess 7.77 ha (41.56%) of dry land and 10.93 ha (58.44%) irrigated land. Large farmers possess 13.10 ha (100%) of irrigated land.*
- *The results indicated that, the average value of dry land was Rs. 345927.24 and average value of irrigated was Rs. 353,684.73. In case of marginal famers, the average land value was Rs. 552,160.94 for dry land and Rs. 1,660,504.12 for irrigated land. In case of small famers, the average land value was Rs. 316,666.67 for dry land Rs. 898,181.80 for irrigated land. In case of semi medium famers, the average land value was Rs. 247,000 for dry land and Rs. 541,073.38 for irrigated land. In case of medium famers, the average land value was Rs. 283,020.83 for dry land and Rs. 384,222.22 for irrigated land. In case of large farmers the average land value was Rs. 137,391.84 for irrigated land.*
- *The results indicated that, there were 14 functioning bore wells in the micro watershed.*
- *The results indicated that, there were 1functioning and 1 defunctioning open wells in the micro watershed.*

- *The results indicated that, bore well was the major irrigation source for 40 per cent of the farmers and open well was source of irrigation for 2.86 per cent.*
- *The results indicated that on an average the depth of the bore well was 35.71 meters.*
- *The results indicated that, in case of marginal farmers there was 0.96 per cent of irrigated land, in case of small farmers there was 0.89 ha of irrigated land, in case of semi medium farmers there was 9.31 ha of irrigated land, medium farmers were having 11.34 ha of irrigated land and large farmers were having 1.62 ha of irrigated land. On an average there were 24.12 ha of irrigated land.*
- *The results indicated that, farmers have grown groundnut (11.58ha), ladies figure (1.29 ha), maize (26.93 ha), mango (2.43 ha), onion (0.40 ha), paddy (0.85 ha), sorghum (1.21 ha), tomato (0.81 ha) in kharif season. Also grown groundnut (2.43 ha) and maize (0.48 ha) in Rabi season. Marginal farmers have grown groundnut, ladies figure, maize and paddy. Small farmers have grown groundnut, maize, paddy and sorghum. Semi medium farmers have grown groundnut, maize and tomato. Medium farmers have grown groundnut, maize, mango, onion and tomato. Large farmers have grown groundnut, ladies figure and maize.*
- *The results indicated that, the cropping intensity in Budagumpa-1 micro watershed was found to be 72.72 per cent. In case of marginal farmers it was 98.73 per cent, in small farmers it was 90.79, in semi medium farmers it was 90.48, in medium farmers it was 89.13 per cent and in large farmers it was 32.56 per cent.*
- *The results indicated that, 85.71 per cent of the households have bank account and 77.14 per cent of the households have savings. 100 percent of marginal, small and large farmers possess both bank account savings respectively. In case of semi medium farmers, 100 per cent of possess bank account and 85.71 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account and 66.67 per cent have savings respectively.*
- *The results indicated that, 75 per cent of marginal, 71.43 per cent of small, 28.57 per cent of semi medium, 16.67 per cent of medium farmers and 50 per cent of large farmers have borrowed credit from different sources.*
- *The results indicated that, 6.67 per cent have availed loan in cooperative Bank, 26.67 per cent have availed loan from friends/relatives, 53.33 per cent have availed loan in Grameena bank and 13.33 per cent have availed loan from money lender.*
- *The results indicated that, marginal, small, semi medium and medium have availed Rs.50833.33, Rs. 109000, Rs. 316000 and Rs, 310000 respectively. Overall average credit amount availed by households in the micro watershed is 119,466.67.*
- *The results indicated that, 100 per cent of the households have borrowed loan for agriculture production.*
- *The results indicated that, 81.82 per cent of the household's barrowed private credit for agriculture production and 18.18 per cent of the household's barrowed private credit for social functions like marriage.*

- *Results indicated that 100 per cent of households were unpaid their institutional loan.*
- *Results indicated that 54.55 per cent of the households have partially paid their loan and 45.45 per cent have unpaid their private credit.*
- *The results indicated that 25 per cent of the households were opined that helped to perform timely agricultural operations and 75 per cent of the households were opined that higher rate of interest.*
- *The results indicated that, 9.09 per cent of the households were opined that easy accessibility of credit, 54.55 per cent of the households were opined that loan amount was adequate to fulfill the requirement and 18.18 per cent of the households were opined that helped to perform timely agricultural operations.*
- *The results indicated that, the total cost of cultivation for maize was Rs. 20131.66. The gross income realized by the farmers was Rs. 22249.38. The net income from maize cultivation was Rs. 2117.73. Thus the benefit cost ratio was found to be 1:1.11.*
- *The results indicated that, the total cost of cultivation for groundnut was Rs. 52091.06. The gross income realized by the farmers was Rs. 69130.38. The net income from groundnut cultivation was Rs. 17039.32. Thus the benefit cost ratio was found to be 1:1.33.*
- *The results indicated that, the total cost of cultivation for paddy was Rs. 79623.59. The gross income realized by the farmers was Rs. 67722.91. The net income from paddy cultivation was Rs. -11900.69. Thus the benefit cost ratio was found to be 1:0.85.*
- *The results indicated that, the total cost of cultivation for bajra was Rs. 23029.06. The gross income realized by the farmers was Rs. 22625.29. The net income from bajra cultivation was Rs. -403.77. Thus the benefit cost ratio was found to be 1:0.98.*
- *The results indicated that, the total cost of cultivation for tomato was Rs. 65128.50. The gross income realized by the farmers was Rs. 49400. The net income from tomato cultivation was Rs. -15728.50. Thus the benefit cost ratio was found to be 1:0.76.*
- *The results indicated that, the total cost of cultivation for mango was Rs. 38242.52. The gross income realized by the farmers was Rs. 24700. The net income from mango cultivation was Rs. -13542.52. Thus the benefit cost ratio was found to be 1:0.65.*
- *The results indicated that, 28.57 per cent of the households opined that dry fodder was adequate and 25.71 per cent of the households opined that green fodder was adequate.*
- *The table indicated that, in landless farmers, the average income from wage was Rs. 106000. In marginal farmers the average income from wage was Rs. 28,750 and agriculture was Rs. 81,118.75. In small farmers the average income from business was Rs. 25,000, wage was Rs. 18,571.43, agriculture was Rs. 68,921.43 and dairy farm was Rs. 3,500. In semi medium farmers the average income from service/salary was Rs. 8,571.43, wage was Rs. 9,285.71 and agriculture was Rs. 72,142.86. In medium farmers the average income from wage was Rs. 10,833.33, agriculture was*

Rs. 67,500, and dairy farm was Rs. 333.33. In case of large farmers the average income from wage was Rs. 10,000, agriculture was Rs. 110,000 and dairy farm was Rs. 1,000.

- *The results indicated that, in landless farmers, the average expenditure from wage was Rs. 23000, in marginal farmers the average expenditure from wage was Rs.5750 and agriculture was Rs.40875. In case of small farmers the average expenditure from business was Rs. 115,000, wage was Rs. 6,600, agriculture was Rs. 24,571.43 and dairy farm was Rs. 15,000. In case of semi medium farmers the average expenditure from service/salary was Rs.20000, wage was Rs. 1,600 and agriculture was Rs. 29,285.71. In case of medium farmers the average expenditure from wage was Rs. 4,000, agriculture was Rs. 28,000 and dairy farm was Rs. 500. In large farmers the average expenditure from wage was Rs.500, agriculture was Rs.55000 and dairy farm was Rs.500.*
- *The results indicated that, sampled households have grown 34 coconut and 131 mango trees in their field and also planted 2 coconut trees in their back yard.*
- *The results indicated that, households have planted 2 teak, 76 neem and 5 tarmind trees in their field and also planted 1 neem tree in their back yard.*
- *The results indicate that, households have an average investment capacity of Rs. 5,200.14 for land development, Rs. 2,314.43 in irrigation facility, Rs.2714.29 for improved crop production and Rs.971.43 for improved livestock management.*
- *Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 750 for irrigation facility, Rs.1375 for improved crop production and Rs.875 for improved livestock management. Small farmers have an average investment capacity of Rs. 2857.14 for land development, Rs. 1142.86 in irrigation facility, Rs.1714.29 for improved crop production and Rs.428.57 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 7515 for land development, Rs. 4715 in irrigation facility, Rs.4428.57 for improved crop production and Rs.1142.86 for improved livestock management. Medium farmers have an average investment capacity of Rs. 11666.67 for land development, Rs. 4666.67 for irrigation facility, Rs.5166.67 for improved crop production and Rs.1833.33 for improved livestock management. Large farmers have an average investment capacity of Rs. 9000 for land development, Rs. 3000 for irrigation facility, Rs.5000 for improved crop production and Rs.2500 for improved livestock management.*
- *The results indicated that, for land development, 2.86 per cent of the farmers were depend on government subsidy, 40 per cent were depend on loan from the bank and 2.86 per cent of the households were depend on soft loan. 2.86 per cent of the households were dependent on government subsidy; own funds and soft loan for land development for irrigation facility respectively and 28.57 per cent were dependent on loan from the bank for irrigation facility. Similarly for improved crop production,*

31.43 per cent of the households were dependent on loan from the bank, 8.57 per cent were dependent on their own funds and 2.86 per cent of the households were dependent on soft loan. For improved livestock management 17.14 per cent of the households were dependent on loan from bank, 8.57 per cent were dependent on own funds and 2.86 per cent were dependent on soft loan.

- *The results indicated that, Bajra, ladies finger, maize, paddy, sorghum and tomato crops were sold to the extent of 100 per cent. Groundnut and mango were sold to the extent of 90.99 per cent and 66.67 per cent respectively. Average price obtained by bajra was Rs.1300/q, groundnut was Rs.3531.82/q, ladies finger was Rs.1250/q, maize was Rs.1145/q, mango was Rs.2000/q, paddy was Rs.1450/q, sorghum was Rs.2100/q and tomato was Rs.1000/q.*
- *The results indicated that, 40 percent of the households have sold their produce to local/village merchant, 42.85 percent of the households sold their produce in regulated markets and 2.85 percent of the households sold their produce in cooperative marketing society.*
- *The results indicated that 17.14 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 11.43 per cent have used truck as a mode of transport.*
- *The results indicated that, 37.14 per cent of the households have experienced the soil and water erosion problems i.e. 25 percent of marginal farmers, 28.57 per cent of small farmers, 57.14 per cent of semi medium farmers, 66.67 percent of medium farmers and 50 per cent of the large farmers.*
- *The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of marginal farmers, small farmers, semi medium farmers and large farmers and 83.33 per cent of the medium farmers respectively.*
- *The results indicated that, 14.29 per cent of the households have adopted field bunding which includes 25 per cent of marginal, 28.57 per cent of small farmers and 14.29 per cent of semi medium farmers.*
- *The results indicated that, 100 per cent of the households who adopted field bunding opined that bunds required full replacement.*
- *The results indicated that 14.29 per cent of soil conservation structure is constructed by government.*
- *The results indicated that, 97.14 percent used fire wood as a source of fuel.*
- *The results indicated that, piped supply was the source of drinking water for 57.14 per cent, 25.71 per cent of them were using bore well and 14.29 per cents of the households were using lake/tank for drinking water.*
- *The results indicated that, electricity was the major source of light for 100 per cent of the households.*
- *The results indicated that, 54.29 per cent of the households possess sanitary toilet i.e. 100 per cent of landless, 12.50 per cent of marginal, 100 per cent of small, 14.29*

per cent of semi medium, 16.67 per cent of medium and 100 per cent of large farmers had sanitary toilet facility.

- *The results indicated that, 97.14 per cent of the sampled households possessed BPL card.*
- *The results indicated that, 28.57 per cent of the households participated in NREGA programme which included 20 per cent of the landless, 25 percent of the marginal, 14.29 per cent of the small, 42.86 per cent of the semi medium, 33.33 percent of the medium farmers and 50 per cent of the large farmers.*
- *The results indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 97.14 per cent, 5.71 per cent, 17.14 per cent, 25.71 per cent, 82.86 per cent, 85.71 per cent and 77.14 per cent respectively.*
- *The results indicated that, oilseed; vegetables, fruits, milk, egg and meat were inadequate for 91.43 per cent, 80 per cent, 68.57 per cent, 11.43 per cent, 11.43 per cent and 17.14 per cent respectively.*
- *The results indicated that milk were market surplus for 2.86 per cent of the households.*
- *The results indicated that, Lower fertility status of the soil and wild animal menace on farm field was experienced by 82.86 per cent of the households, frequent incidence of pest and diseases was experienced by 37.14 per cent of the farmers, inadequacy of irrigation water was experienced by 31.43 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced and high rate of interest on credit was experienced by 40 per cent of the farmers, low price for the agricultural commodities was experienced by 71.43 per cent of the farmers, lack of marketing facilities in the area was experienced 80 per cent of the households, inadequate of extension services experienced by 71.43 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 2.86 per cent of the farmers.*

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

Budagumpa-1 micro-watershed (Kerehalli sub-watershed, Koppal Taluk and District) is located at North latitude $15^0$23’34.604’’ to 15^0 24’48.936’’ and East longitude 76^0 17’59.327’’ to76^0 17’36.903’’ covering an area of 363.29 ha and spread across Dhanakandoddi, Amarapur, Budhagumpa and Balebavi villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 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 Budagumpa-1 micro watershed is presented in Table 1 and it indicated that 35 farmers were sampled in Budagumpa-1 micro watershed among them 8 (22.86%) were marginal farmers, 7 (20 %) were small farmers, 7 (20 %) were semi medium farmers, 6 (17.14%) were medium farmers, 2(5.71%) were large farmers and 5 (14.29%) landless farmers were also interviewed for the survey.

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

S. N.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	14.29	8	22.86	7	20	7	20	6	17.14	2	5.71	35	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Budagumpa-1 micro watershed is presented in Table 2. The data indicated that there were 157 population households were there in the studied micro watershed. Among them 89 (56.69%) men and 68 (43.31 %) were women. The average family size of landless was 5, marginal, small and semi medium farmers were 7 and medium and large farmers were 6. On an average the family size was 4.

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

S.N.	Particular	LL (24)		MF (28)		SF (31)		SMF (26)		MDF (37)		LF (11)		All (157)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Male	12	50	16	57.14	17	54.84	16	61.54	23	62.16	5	45.45	89	56.69
2	Female	12	50	12	42.86	14	45.16	10	38.46	14	37.84	6	54.55	68	43.31
Total		24	100	28	100	31	100	26	100	37	100	11	100	157	100
Average		5		4		4		4		6		6		4	

Age wise classification of population: The age wise classification of household members in Budagumpa-1 micro watershed is presented in Table 3. The data indicated that 20 (12.74%) people were in 0-15 years of age, 76 (48.41 %) were in 16-35 years of age, 47 (29.94 %) were in 36-60 years of age and 14 (8.92%) were above 61 years of age.

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

S. N.	Particulars	LL (24)		MF (28)		SF (31)		SMF (26)		MDF (37)		LF (11)		All (157)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years	6	25	5	17.86	4	12.90	0	0	5	13.51	0	0	20	12.74
2	16-35 years	9	37.50	15	53.57	18	58.06	12	46.15	20	54.05	2	18.18	76	48.41
3	36-60 years	5	20.83	6	21.43	8	25.81	9	34.62	10	27.03	9	81.82	47	29.94
4	> 61 years	4	16.67	2	7.14	1	3.23	5	19.23	2	5.41	0	0	14	8.92
Total		24	100	28	100	31	100	26	100	37	100	11	100	157	100

Education level of household members: Education level of household members in Budagumpa-1 micro watershed is presented in Table 4. The results indicated that the Budagumpa-1had 42.04 per cent illiterates, 1.27 per cent functional literates, 22.93 per cent of them had primary school education, 8.92 per cent of them had middle school, 12.74 per cent them had high school education, 5.10 per cent of them had PUC education and 6.37 per cent of them had degree education.

Table 4: Education level of household members in Budagumpa-1 micro watershed

S. N.	Particulars	LL (24)		MF (28)		SF (31)		SMF (26)		MDF (37)		LF (11)		All (157)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	8	33.33	10	35.71	12	38.71	13	50	15	40.54	8	72.73	66	42.04
2	Functional Literate	0		0	0	0	0	0	0	1	2.70	1	9.09	2	1.27
3	Primary School	12	50	8	28.57	10	32.26	3	11.54	2	5.41	1	9.09	36	22.93
4	Middle School	0	0	2	7.14	3	9.68	5	19.23	4	10.81	0	0	14	8.92
5	High School	3	12.50	4	14.29	4	12.90	1	3.85	8	21.62	0	0	20	12.74
6	PUC	0	0	3	10.71	1	3.23	1	3.85	3	8.11	0	0	8	5.10
7	Degree	1	4.17	1	3.57	1	3.23	3	11.54	3	8.11	1	9.09	10	6.37
Total		24	100	28	100	31	100	26	100	37	100	11	100	157	100

Occupation of household heads: The data regarding the occupation of the household heads in Budagumpa-1 micro watershed is presented in Table 5. The results indicated that, 77.14 per cent of households practicing agriculture, 8.57 per cent of the household heads were agricultural labour and 14.29 per cent of the household heads were general labour.

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

S. N.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	7	87.50	6	85.71	7	100	5	83.33	2	100	27	77.14
2	Agricultural Labour	0	0	1	12.50	1	14.29	0	0	1	16.67	0	0	3	8.57
3	General Labour	5	100	0	0	0	0	0	0	0	0	0	0	5	14.29
Total		5	100	8	100	7	100	7	100	7	100	2	100	35	100

Occupation of the household members: The data regarding the occupation of the household members in Budagumpa-1 micro watershed is presented in Table 6. The results indicated that agriculture was the major occupation for 40.76 per cent of the household members, 23.57 per cent were agricultural labourers, 11.46 per cent were general labours and 0.64 per cent were in private sector, were in trade and business, housewives and children's and 21.02 per cent of them were students. In case of landless farmers 70.83 per cent of them were general labours and 29.17 per cent of them were students.

In case of marginal farmers 42.86 per cent of them were doing agriculture, 17.86 per cent of them were agriculture labour, 3.57 per cent of them were general labour and 35.71 per cent of them were students. In small farmers 61.29 per cent of them were doing agriculture, 16.13 per cent of them were agriculture labour, 3.23 per cent of them were in private service and 3.23 per cent of them were doing trade& business and housewives. In

case of semi medium farmers 50 per cent of them were agriculturist, 34.62 per cent of them were agriculture labour and 11.54 per cent of them were students. In medium farmers 37.84 per cent of them were agriculturist, 35.14 per cent of them were agricultural labour and 21.62 per cent of them were students. Similarly in case of large farmers 54.55 per cent of them were agriculturist and 45.45 per cent of them were agricultural labour.

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

S. N.	Particulars	LL (24)		MF (28)		SF (31)		SMF (26)		MDF (37)		LF (11)		All (157)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	12	42.86	19	61.29	13	50	14	37.84	6	54.55	64	40.76
2	Agricultural Labour	0	0	5	17.86	5	16.13	9	34.62	13	35.14	5	45.45	37	23.57
3	General Labour	17	70.83	1	3.57	0	0	0	0	0	0	0	0	18	11.46
4	Private Service	0	0	0	0	0	0	1	3.85	0	0	0	0	1	0.64
5	Trade & Business	0	0	0	0	1	3.23	0	0	0	0	0	0	1	0.64
6	Student	7	29.17	10	35.71	5	16.13	3	11.54	8	21.62	0	0	33	21.02
7	Others	0	0	0	0	0	0	0	0	1	2.70	0	0	1	0.64
8	Housewife	0	0	0	0	1	3.23	0	0	0	0	0	0	1	0.64
9	Children	0	0	0	0	0	0	0	0	1	2.70	0	0	1	0.64
Total		24	100	28	100	31	100	26	100	37	100	11	100	157	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Budagumpa-1micro-watershed is presented in Table 7. The results showed that 0.64 per cent of them participated in cooperative bank and 99.36 per cent of them have not participated in any local institutions. Landless, marginal, semi medium, medium and large farmers were found to have no participation in any local institutions. Small farmers were found to participate in one or the other local institutions.

Table 7: Institutional Participation of household members in Budagumpa-1 micro watershed

S. N.	Particulars	LL (24)		MF (28)		SF (31)		SMF (26)		MDF (37)		LF (11)		All (157)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	24	100	28	100	30	96.77	26	100	37	100	11	100	156	99.36
2	Cooperative bank	0	0	0	0	1	3.23	0	0	0	0	0	0	1	0.64
Total		24	100	28	100	31	100	26	100	37	100	11	100	157	100

Table 8: Type of house owned by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	5	100	5	62.50	2	28.57	5	71.43	5	83.33	1	50	23	65.71
2	Katcha	0	0	3	37.50	5	71.43	1	14.29	0	0	0	0	9	25.71
3	Pucca/RCC	0	0	0	0	0	0	1	14.29	1	16.67	1	50	3	8.57
Total		5	100	8	100	7	100	7	100	6	100	2	100	35	100

Type of house owned: The data regarding the type of house owned by the households in Budagumpa-1 micro watershed is presented in Table 8. The results indicated that 65.71

per cent of the households possess thatched house, 25.71 per cent of the households possess Katcha house and 8.57 per cent of the households possess Pacca house.

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Budagumpa-1 micro watershed is presented in Table 9. The results showed that, 74.29 per cent of the households possess TV, 48.57 per cent of the households possess mixer/grinder, 17.14 per cent of the households possess bicycle, 31.43 per cent of the households possess motor cycle and 100 per cent of the households possess mobile phones.

Table 9: Durable Assets owned by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Television	1	20	4	50	7	100	6	85.71	6	100	2	100	26	74.29
2	Mixer/Grinder	0	0	4	50	4	57.14	3	42.86	5	83.33	1	50	17	48.57
3	Bicycle	0	0	2	25	2	28.57	2	28.57	0	0	0	0	6	17.14
4	Motor Cycle	0	0	0	0	5	71.43	1	14.29	4	66.67	1	50	11	31.43
5	Mobile Phone	5	100	8	100	7	100	7	100	6	100	2	100	35	100

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Budagumpa-1 micro watershed is presented in Table 10. The results showed that the average value of television was Rs. 8269, mixer/grinder was Rs. 1676, bicycle was Rs.2166, motor cycle was Rs.29583 and mobile phone was Rs.2303.

Table 10: Average value of durable assets owned by households in Budagumpa-1 micro watershed

Average (Rs)

S.N.	Particulars	LL (5)	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Television	9,000	7,750	8,571	8,000	8,500	8,000	8,269
2	Mixer/Grinder	0	1,750	1,500	1,833	1,700	1,500	1,676
3	Bicycle	0	2,500	1,500	2,500	0	0	2,166
4	Motor Cycle	0	0	26,666	30,000	31,250	40,000	29,583
5	Mobile Phone	2,666	2,766	1,546	3,363.00	1,692	2,000	2,303

Table 11: Farm Implements owned by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	1	12.50	1	14.29	0	0.00	2	33.33	2	100	6	17.14
2	Plough	0	0	2	25	1	14.29	2	28.57	3	50	2	100	10	28.57
3	Power Tiller	0	0	1	12.50	0	0.00	0	0	1	16.67	1	50	3	8.57
4	Tractor	0	0	1	12.50	1	14.29	0	0	1	16.67	1	50	4	11.43
5	Sprayer	0	0	0	0	2	28.57	1	14.29	3	50	0	0	6	17.14
6	Weeder	3	60	8	100	6	85.71	7	100	6	100	2	100	32	91.43
7	Harvester	0	0	0	0	1	14.29	0	0	1	16.67	0	0	2	5.71
8	Thresher	0	0	0	0	1	14.29	0	0	0	0	0	0	1	2.86
9	Chaff Cutter	0	0	0	0	1	14.29	1	14.29	0	0	0	0	2	5.71
10	Blank	2	40	0	0	1	14.29	0	0.00	0	0	0	0	3	8.57

Farm Implements owned: The data regarding the farm implements owned by the households in Budagumpa-1 micro watershed is presented in Table 11. About 17.14 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 8.57 per cent of the households possess power tiller, 11.43 per cent of the households possess tractor, 17.14 per cent of the households possess sprayer, 91.43 per cent of the households possess weeder, 5.71 43 per cent of the households possess harvester, 2.86 per cent of the households possess thresher and 5.71 per cent of the households possess chaff cutter.

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Budagumpa-1 micro watershed is presented in Table 12. The results showed that the average value of bullock cart was Rs.18333; the average value of plough was Rs. 1250, the average value of power tiller was Rs. 25000, the average value of tractor was Rs. 475000, the average value of sprayer was Rs. 10666, the average value of weeder was Rs. 80, the average value of harvester was Rs.35000, the average value of thresher was Rs. 37000 and the average value of chaff cutter was Rs. 3000.

Table 12: Average value of farm implements owned by households in Budagumpa-1 micro watershed

Average (Rs)

Sl.No.	Particulars	LL (5)	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Bullock Cart	0	18,000	20,000	0	18,000	18,000	18,333
2	Plough	0	1166	1000	875	1666	1750	1250
3	Power Tiller	0	25000	0	0	25000	25000	25000
4	Tractor	0	500000	300000	0	600000	500000	475000
5	Sprayer	0	0	22000	5000	5000	0	10666
6	Weeder	100	83	86	76	75	62	80
7	Harvester	0	0	40000	0	30000	0	35000
8	Thresher	0	0	37000	0	0	0	37000
9	Chaff Cutter	0	0	3000	3000	0	0	3000

Livestock possession by the households: The data regarding the Livestock possession by the households in Budagumpa-1 micro watershed is presented in Table 13. The results indicated that, 31.43 per cent of the households possess bullocks, 17.14 per cent of the households possess local cow, 5.71 per cent of the households possess buffalo and 2.86 per cent of the households possess sheep.

Table 13: Livestock possession by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	2	25	1	14.29	2	28.57	4	66.67	2	100	11	31.43
2	Local cow	1	12.50	2	28.57	1	14.29	1	16.67	1	50	6	17.14
3	Buffalo	1	12.50	0	0	1	14.29	0	0	0	0	2	5.71
4	Sheep	1	12.50	0	0	0	0	0	0	0	0	1	2.86
5	blank	5	62.50	5	71.43	4	57.14	2	33.33	0	0	21	60

Average Labour availability: The data regarding the average labour availability in Budagumpa-1 micro watershed is presented in Table 14. The results indicated that, average own labour men available in the micro watershed was 2, average own labour (women) available was 1.61, average hired labour (men) available was 8.80 and average hired labour (women) available was 7.38.

In case of marginal farmers, average own labour men available was 1.25, average own labour (women) was also 1.11, average hired labour (men) was 7.67 and average hired labour (women) available was 7. In case of small farmers, average own labour men available was 1.71, average own labour (women) was 1.71, average hired labour (men) was 12.14 and average hired labour (women) available was 9.71. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.43, average hired labour (men) was 10 and average hired labour (women) available was 8.33. In medium farmers average own labour men available was 3.17, average own labour (women) was 2.17, average hired labour (men) was 6.67 and average hired labour (women) available was 5. In case of large farmers average own labour men available was 2.50, average own labour (women) was 2.50, average hired labour (men) was 5 and average hired labour (women) available was 5.

Table 14: Average Labour availability in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
		N	N	N	N	N	N
1	Own labour Male	1.25	1.71	2.00	3.17	2.50	2.00
2	Own Labour Female	1.11	1.71	1.43	2.17	2.50	1.61
3	Hired labour Male	7.67	12.14	10.00	6.67	5.00	8.80
4	Hired labour Female	7.00	9.71	8.33	5.00	5.00	7.38

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Budagumpa-1 micro watershed is presented in Table 15. The results indicated that, 88.57 per cent of the household opined that the hired labour was adequate.

Table 15: Adequacy of Hired Labour in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	8	100	7	100	6	85.71	6	100	2	100	31	88.57

Distribution of land (ha): The data regarding the distribution of land (ha) in Budagumpa-1 micro watershed is presented in Table 16. The results indicated that, households of the Budagumpa-1 micro watershed possess 25.14 ha (43.40%) of dry land and 32.78 ha (56.60 %) of irrigated land. Marginal farmers possess 5.43 ha (91.85%) of dry land 0.48 ha (8.15%) of irrigated land. Small farmers possess 7.89 ha (89.65 %) of dry land and 0.89 ha (10.14 %) of irrigated land. Semi medium farmers possess 4.05 ha (35.39 %) of dry land and 7.39 ha (64.61%) of irrigated land. Medium farmers possess

7.77 ha (41.56%) of dry land and 10.93 ha (58.44%) irrigated land. Large farmers possess 13.10 ha (100%) of irrigated land.

Table 16: Distribution of land (Ha) in Budagumpa-1 micro watershed

S. N.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	5.43	91.85	7.89	89.86	4.05	35.39	7.77	41.56	0	0	25.14	43.40
2	Irrigated	0.48	8.15	0.89	10.14	7.39	64.61	10.93	58.44	13.10	100	32.78	56.60
Total		5.91	100	8.78	100	11.44	100	18.70	100	13.10	100	57.92	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Budagumpa-1 micro watershed is presented in Table 17. The results indicated that, the average value of dry land was Rs. 345927.24 and average value of irrigated was Rs. 353,684.73.

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

S. N.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
		N	N	N	N	N	N
1	Dry	552,160.94	316,666.67	247,000	283,020.83	0.00	345,927.24
2	Irrigated	1,660,504.12	898,181.80	541,073.38	384,222.22	137,391.84	353,684.73

Status of bore wells: The data regarding the status of bore wells in Budagumpa-1 micro watershed is presented in Table 18. The results indicated that, there were 14 functioning bore wells in the micro watershed.

Table 18: Status of bore wells in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
		N	N	N	N	N	N
1	Functioning	1	1	5	5	2	14

Status of open wells: The data regarding the status of open wells in Budagumpa-1 micro watershed is presented in Table 19. The results indicated that, there were 1functioning and 1 defunctioning open wells in the micro watershed.

Table 19: Status of open wells in Budagumpa-1 micro watershed

Sl.No.	Particulars	MDF (6)	All (35)
		N	N
1	De-functioning	1	1
2	Functioning	1	1

Table 20: Source of irrigation in Budagumpa-1 micro watershed

S.N.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	1	12.50	1	14.29	5	71.43	5	83.33	2	100	14	40
2	Open Well	0	0	0	0	0	0	1	16.67	0	0	1	2.86

Source of irrigation: The data regarding the source of irrigation in Budagumpa-1 micro watershed is presented in Table 20. The results indicated that, bore well was the major

irrigation source for 40 per cent of the farmers and open well was source of irrigation for 2.86 per cent of the farmers.

Depth of water: The data regarding the depth of water in Budagumpa-1 micro watershed is presented in Table 21.The results indicated that on an average the depth of the bore well was 35.71 meters.

Table 21: Depth of water in Budagumpa-1 micro watershed

Sl.No.	Particulars	LL (5)	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
		N	N	N	N	N	N	N
1	Bore Well	0.00	13.34	15.24	71.85	71.12	53.34	35.71

Irrigated Area (ha): The data regarding the irrigated area in Budagumpa-1 micro watershed is presented in Table 22. The results indicated that, in case of marginal farmers there was 0.96 per cent of irrigated land, in case of small farmers there was 0.89 ha of irrigated land, in case of semi medium farmers there was 9.31 ha of irrigated land, medium farmers were having 11.34 ha of irrigated land and large farmers were having 1.62 ha of irrigated land. On an average there were 24.12 ha of irrigated land.

Table 22: Irrigated Area (ha) in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Kharif	0.48	0.89	6.48	11.34	1.62	20.81
2	Rabi	0.48	0.00	2.83	0.00	0.00	3.32
Total		0.96	0.89	9.31	11.34	1.62	24.12

Table 23: Cropping pattern in Budagumpa-1 micro watershed Area (ha)

Sl.No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Kharif - Groundnut	1.78	1.70	4.45	2.02	1.62	11.58
2	Kharif - Ladies finger	0.48	0.00	0.00	0.00	0.81	1.29
3	Kharif - Maize	1.34	4.13	8.10	9.31	4.05	26.93
4	Kharif - Mango	0.00	0.00	0.00	2.43	0.00	2.43
5	Kharif - Onion	0.00	0.00	0.00	0.40	0.00	0.40
6	Kharif - Paddy	0.45	0.40	0.00	0.00	0.00	0.85
7	Kharif - Sorghum	0.00	1.21	0.00	0.00	0.00	1.21
8	Kharif - Tomato	0.00	0.00	0.40	0.40	0.00	0.81
9	Rabi - Groundnut	0.00	0.00	2.43	0.00	0.00	2.43
10	Rabi - Maize	0.48	0.00	0.00	0.00	0.00	0.48
Total		6.32	8.79	15.38	16.60	7.69	54.78

Cropping pattern: The data regarding the cropping pattern in Budagumpa-1 micro watershed is presented in Table 23. The results indicated that, farmers have grown groundnut (11.58ha), ladies figure (1.29 ha), maize (26.93 ha), mango (2.43 ha), onion (0.40 ha), paddy (0.85 ha), sorghum (1.21 ha), tomato (0.81 ha) in kharif season. Also grown groundnut (2.43 ha) and maize (0.48 ha) in Rabi season. Marginal farmers have grown groundnut, ladies figure, maize and paddy. Small farmers have grown groundnut, maize, paddy and sorghum. Semi medium farmers have grown groundnut, maize and

tomato. Medium farmers have grown groundnut, maize, mango, onion and tomato. Large farmers have grown groundnut, ladies figure and maize.

Cropping intensity: The data regarding the cropping intensity in Budagumpa-1 micro watershed is presented in Table 24. The results indicated that, the cropping intensity in Budagumpa-1 micro watershed was found to be 72.72 per cent. In case of marginal farmers it was 98.73 per cent, in small farmers it was 90.79, in semi medium farmers it was 90.48, in medium farmers it was 89.13 per cent and in large farmers it was 32.56 per cent.

Table 24: Cropping intensity (%) in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Cropping Intensity	98.73	90.79	90.48	89.13	32.56	72.72

Possession of Bank account: The data regarding the possession of Bank account and savings in Budagumpa-1 micro watershed is presented in Table 25. The results indicated that, 85.71 per cent of the households have bank account and 77.14 per cent of the households have savings. 100 percent of marginal, small and large farmers possess both bank account savings respectively. In case of semi medium farmers, 100 per cent of possess bank account and 85.71 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account and 66.67 per cent have savings respectively.

Table 25: Possession of Bank account and savings in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	8	100	7	100	7	100	6	100	2	100	30	85.71
2	Savings	8	100	7	100	6	85.71	4	66.67	2	100	27	77.14

Borrowing status: The data regarding the possession of borrowing status in Budagumpa-1 micro watershed is presented in Table 26. The results indicated that, 75 per cent of marginal, 71.43 per cent of small, 28.57 per cent of semi medium, 16.67 per cent of medium farmers and 50 per cent of large farmers have borrowed credit from different sources.

Table 26: Borrowing status in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF(8)		SF (7)		SMF (7)		MDF (6)		LF(2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	6	75	5	71.43	2	28.57	1	16.67	1	50	15	42.86

Table 27: Source of credit availed by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (6)		SF (5)		SMF (2)		MDF (1)		LF (1)		All (15)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cooperative Bank	0	0	0	0	0	0	0	0	1	100	1	6.67
2	Friends/Relatives	3	50	0	0	0	0	1	100	0	0	4	26.67
3	Grameena Bank	2	33.33	5	100	1	50	0	0	0	0	8	53.33
4	Money Lender	1	16.67	0	0	1	50	0	0	0	0	2	13.33

Source of credit: The data regarding the source of credit availed by households in Budagumpa-1 micro watershed is presented in Table 27. The results indicated that, 6.67 per cent have availed loan in cooperative Bank, 26.67 per cent have availed loan from friends/relatives, 53.33 per cent have availed loan in Grameena bank and 13.33 per cent have availed loan from money lender.

Average credit amount: The data regarding the average credit amount availed by households in Budagumpa-1 micro watershed is presented in Table 28. The results indicated that, marginal, small, semi medium and medium have availed Rs.50833.33, Rs. 109000, Rs. 316000 and Rs, 310000 respectively. Overall average credit amount availed by households in the micro watershed was Rs.119,466.67.

Table 28: Average Credit amount availed by households in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (6)	SF (5)	SMF (2)	MDF (1)	All (15)
		N	N	N	N	N
1	Average Credit	50,833.33	109,000	316,000	310,000	119,466.67

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed from institutional sources by households in Budagumpa-1 micro watershed is presented in Table 29. The results indicated that, 100 per cent of the households have borrowed loan for agriculture production.

Table 29: Purpose of credit borrowed (institutional Source) by households in Budagumpa-1 micro watershed

S. N.	Particulars	MF (6)		SF (5)		SMF(2)		MDF(1)		LF (1)		All (16)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture production	6	100	5	100	2	100	1	100	1	100	16	100

Purpose of credit borrowed (Private Credit): The data regarding the purpose of credit borrowed from private sources by households in Budagumpa-1 micro watershed is presented in Table 30. The results indicated that, 81.82 per cent of the household's barrowed private credit for agriculture production and 18.18 per cent of the household's barrowed private credit for social functions like marriage.

Table 30: Purpose of credit borrowed (Private Credit) by households in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (4)		SMF (1)		MDF (1)		All (11)	
		N	%	N	%	N	%	N	%	N	%
1	Agriculture production	4	80	3	75	1	100	1	100	9	81.82
2	Social functions like marriage	1	20	1	25	0	0	0	0	2	18.18

Repayment status of households (Institutional): The data regarding the repayment status of credit borrowed from institutional sources by households in Budagumpa-1 micro watershed is presented in Table 31. Results indicated that 100 per cent of households were unpaid their loan.

Table 31: Repayment status of households (Institutional) in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (6)		SF (5)		SMF (2)		MDF (1)		LF (1)		All (16)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Un paid	2	100	5	100	5	100	4	100	1	100	16	100

Repayment status of households (Private): The data regarding the repayment status of credit borrowed from private sources by households in Budagumpa-1 micro watershed is presented in Table 32. Results indicated that 54.55 per cent of the households have partially paid their loan and 45.45 per cent have unpaid their private credit.

Table 32: Repayment status of households (Private) in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (4)		SMF (1)		MDF (1)		All (11)	
		N	%	N	%	N	%	N	%	N	%
1	Partially paid	2	40	3	75	1	100	0	0	6	54.55
2	Un paid	3	60	1	25	0	0	1	100	5	45.45

Opinion on institutional sources of credit: The data regarding opinion on institutional sources of credit by households in Budagumpa-1 micro watershed is presented in Table 33. The results indicated that 25 per cent of the households were opined that helped to perform timely agricultural operations and 75 per cent of the households were opined that higher rate of interest.

Table 33: Opinion on institutional sources of credit in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (2)		SF (5)		SMF (5)		MDF(4)		All(16)	
		N	%	N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	0	0	4	80	0	0	0	0	4	25
2	Higher rate of interest	2	100	1	20	5	100	4	100	12	75

Table 34: Opinion on non-institutional sources of credit in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (5)		SF (4)		SMF (1)		All (11)	
		N	%	N	%	N	%	N	%
1	Easy accessibility of credit	0	0	1	25	0	0	1	9.09
2	Loan amount was adequate to fulfill the requirement	3	60	2	50	1	100	6	54.55
3	Helped to perform timely agricultural operations	1	20	1	25	0	0	2	18.18

Opinion on non-institutional sources of credit: The data regarding opinion on non-institutional sources of credit by households in Budagumpa-1 micro watershed is presented in Table 34. The results indicated that, 9.09 per cent of the households were opined that easy accessibility of credit, 54.55 per cent of the households were opined that loan amount was adequate to fulfill the requirement and 18.18 per cent of the households were opined that helped to perform timely agricultural operations.

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Budagumpa-1 micro watershed is presented in Table 35. The results indicated that, the total cost of cultivation for maize was Rs. 20131.66. The gross income realized by the farmers was Rs. 22249.38. The net income from maize cultivation was Rs. 2117.73. Thus the benefit cost ratio was found to be 1:1.11.

Table 35: Cost of Cultivation of Maize in Budagumpa-1 micro watershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	28.44	4970.88	24.69
2	Bullock		Pairs/day	0.89	552.32	2.74
3	Tractor		Hours	2.40	1806.53	8.97
4	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.79	1609.91	8.00
5	Seed Inter Crop		Kgs.	0.71	43.40	0.22
6	FYM		Quintal	11.86	1883.79	9.36
7	Fertilizer + micronutrients		Quintal	2.78	2410.10	11.97
8	Pesticides (PPC)		Kgs /liters	0.59	592.80	2.94
9	Irrigation		Number	1.92	0.00	0.00
10	Depreciation charges			0.00	677.45	3.37
11	Land revenue and Taxes			0.00	4.53	0.02
II	**Cost B1**					
12	Interest on working capital				784.84	3.90
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15336.55	76.18
III	**Cost B2**					
14	Rental Value of Land				366.67	1.82
15	**Cost B2 = (Cost B1 + Rental value)**				15703.21	78.00
IV	**Cost C1**					
16	Family Human Labour			11.23	2597.96	12.90
17	**Cost C1 = (Cost B2 + Family Labour)**				18301.17	90.91
V	**Cost C2**					
18	Risk Premium				0.33	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				18301.50	90.91
VI	**Cost C3**					
20	Managerial Cost				1830.15	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				20131.66	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		17.74	19361.77	
		b) Main Crop Sales Price (Rs.)			1091.67	
	By Product	e) Main Product (q)		16.19	2887.61	
		f) Main Crop Sales Price (Rs.)			178.33	
b.	Gross Income (Rs.)				22249.38	
c.	Net Income (Rs.)				2117.73	
d.	Cost per Quintal (Rs./q.)				1135.07	
e.	Benefit Cost Ratio (BC Ratio)				1:1.11	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation of groundnut in Budagumpa-1 micro watershed is presented in Table 36. The results indicated that, the total cost of cultivation for groundnut was Rs. 52091.06. The gross income realized by the farmers was Rs. 69130.38. The net income from groundnut cultivation was Rs. 17039.32. Thus the benefit cost ratio was found to be 1:1.33.

Table 36: Cost of Cultivation of Groundnut in Budagumpa-1 micro watershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	37.53	5929.53	11.38
2	Bullock		Pairs/day	0.99	582.19	1.12
3	Tractor		Hours	3.26	2172.48	4.17
4	Machinery		Hours	0.30	187.12	0.36
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	141.33	19178.22	36.82
6	FYM		Quintal	17.88	3321.56	6.38
7	Fertilizer + micronutrients		Quintal	5.08	4938.49	9.48
8	Pesticides (PPC)		Kgs / liters	1.03	1043.93	2.00
9	Irrigation		Number	4.73	0.00	0.00
10	Depreciation charges			0.00	2034.52	3.91
11	Land revenue and Taxes			0.00	3.82	0.01
II	**Cost B1**					
12	Interest on working capital				3417.94	6.56
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				42809.80	82.18
III	**Cost B2**					
14	Rental Value of Land				357.58	0.69
15	**Cost B2 = (Cost B1 + Rental value)**				43167.37	82.87
IV	**Cost C1**					
16	Family Human Labour			19.64	4187.50	8.04
17	**Cost C1 = (Cost B2 + Family Labour)**				47354.87	90.91
V	**Cost C2**					
18	Risk Premium				0.64	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				47355.51	90.91
VI	**Cost C3**					
20	Managerial Cost				4735.55	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				52091.06	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		18.66	65907.57	
		b) Main Crop Sales Price (Rs.)			3531.82	
	By Product	e) Main Product (q)		17.73	3222.81	
		f) Main Crop Sales Price (Rs.)			181.82	
b.	Gross Income (Rs.)				69130.38	
c.	Net Income (Rs.)				17039.32	
d.	Cost per Quintal (Rs./q.)				2791.43	
e.	Benefit Cost Ratio (BC Ratio)				1:1.33	

Cost of Cultivation of Paddy: The data regarding the cost of cultivation of paddy in Budagumpa-1 micro watershed is presented in Table 37. The results indicated that, the total cost of cultivation for paddy was Rs. 79623.59. The gross income realized by the farmers was Rs. 67722.91. The net income from paddy cultivation was Rs. -11900.69. Thus the benefit cost ratio was found to be 1:0.85.

Table 37: Cost of Cultivation of Paddy in Budagumpa-1 micro watershed

S.N.	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	36.83	6186.23	7.77
3	Tractor		Hours	4.83	3435.55	4.31
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	70.17	16307.61	20.48
6	FYM		Quintal	49.40	9880.00	12.41
7	Fertilizer + micronutrients		Quintal	15.49	14388.87	18.07
8	Pesticides (PPC)		Kgs /liters	2.36	2357.73	2.96
9	Irrigation		Number	9.88	0.00	0.00
10	Depreciation charges			0.00	18.86	0.02
11	Land revenue and Taxes			0.00	3.29	0.00
II	**Cost B1**					
12	Interest on working capital				5152.23	6.47
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				57730.37	72.50
III	**Cost B2**					
14	Rental Value of Land				333.33	0.42
15	**Cost B2 = (Cost B1 + Rental value)**				58063.70	72.92
IV	**Cost C1**					
16	Family Human Labour			62.98	14320.39	17.99
17	**Cost C1 = (Cost B2 + Family Labour)**				72384.09	90.91
V	**Cost C2**					
18	Risk Premium				1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				72385.09	90.91
VI	**Cost C3**					
20	Managerial Cost				7238.51	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				79623.59	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		37.05	53722.50	
		b) Main Crop Sales Price (Rs.)			1450.00	
	By Product	c) Main Product (q)		48.28	14000.41	
		d) Main Crop Sales Price (Rs.)			290.00	
b.	Gross Income (Rs.)				67722.91	
c.	Net Income (Rs.)				-11900.69	
d.	Cost per Quintal (Rs./q.)				2149.08	
e.	Benefit Cost Ratio (BC Ratio)				1:0.85	

Cost of Cultivation of Bajra: The data regarding the cost of cultivation of bajra in Budagumpa-1 micro watershed is presented in Table 38. The results indicated that, the total cost of cultivation for bajra was Rs. 23029.06. The gross income realized by the farmers was Rs. 22625.29. The net income from bajra cultivation was Rs. -403.77. Thus the benefit cost ratio was found to be 1:0.98.

Table 38: Cost of Cultivation of Bajra in Budagumpa-1 micro watershed

Sl. No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	31.80	4859.72	21.10
2	Bullock		Pairs/day	1.37	733.52	3.19
3	Tractor		Hours	2.08	1526.72	6.63
4	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	13.14	1744.72	7.58
5	Seed Inter Crop		Kgs.	1.31	157.18	0.68
6	FYM		Quintal	13.77	2051.85	8.91
7	Fertilizer + micronutrients		Quintal	2.41	2205.34	9.58
8	Pesticides (PPC)		Kgs / liters	0.82	823.33	3.58
9	Irrigation		Number	0.00	0.00	0.00
10	Depreciation charges			0.00	2305.32	10.01
11	Land revenue and Taxes			0.00	4.12	0.02
II	**Cost B1**					
12	Interest on working capital				837.95	3.64
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17249.76	74.90
III	**Cost B2**					
14	Rental Value of Land				350.00	1.52
15	**Cost B2 = (Cost B1 + Rental value)**				17599.76	76.42
IV	**Cost C1**					
16	Family Human Labour			16.97	3335.25	14.48
17	**Cost C1 = (Cost B2 + Family Labour)**				20935.01	90.91
V	**Cost C2**					
18	Risk Premium				0.50	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**				20935.51	90.91
VI	**Cost C3**					
20	Managerial Cost				2093.55	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**				23029.06	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		16.60	21576.95	
		b) Main Crop Sales Price (Rs.)			1300.00	
	By Product	c) Main Product (q)		9.32	1048.35	
		d) Main Crop Sales Price (Rs.)			112.50	
b.	Gross Income (Rs.)				22625.29	
c.	Net Income (Rs.)				-403.77	
d.	Cost per Quintal (Rs./q.)				1387.49	
e.	Benefit Cost Ratio (BC Ratio)				1:0.98	

Cost of Cultivation of Tomato: The data regarding the cost of cultivation of tomato in Budagumpa-1 micro watershed is presented in Table 39. The results indicated that, the total cost of cultivation for tomato was Rs. 65128.50. The gross income realized by the farmers was Rs. 49400. The net income from tomato cultivation was Rs. -15728.50. Thus the benefit cost ratio was found to be 1:0.76.

Table 39: Cost of Cultivation of Tomato in Budagumpa-1 micro watershed

Sl. No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	86.45	11818.95	18.15
2	Bullock	Pairs/day	2.47	1482.00	2.28
3	Tractor	Hours	6.18	4322.50	6.64
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	1.48	296.40	0.46
6	FYM	Quintal	49.40	9880.00	15.17
7	Fertilizer + micronutrients	Quintal	11.12	10942.10	16.80
8	Pesticides (PPC)	Kgs / liters	2.47	2470.00	3.79
9	Irrigation	Number	9.88	0.00	0.00
10	Depreciation charges		0.00	1378.26	2.12
11	Land revenue and Taxes		0.00	3.29	0.01
II	**Cost B1**				
12	Interest on working capital			2830.74	4.35
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**			45424.24	69.75
III	**Cost B2**				
14	Rental Value of Land			333.33	0.51
15	**Cost B2 = (Cost B1 + Rental value)**			45757.58	70.26
IV	**Cost C1**				
16	Family Human Labour		67.93	13449.15	20.65
17	**Cost C1 = (Cost B2 + Family Labour)**			59206.73	90.91
V	**Cost C2**				
18	Risk Premium			1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**			59207.73	90.91
VI	**Cost C3**				
20	Managerial Cost			5920.77	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**			65128.50	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	49.40	49400.00	
		b) Main Crop Sales Price (Rs.)		1000.00	
b.	Gross Income (Rs.)			49400.00	
c.	Net Income (Rs.)			-15728.50	
d.	Cost per Quintal (Rs./q.)			1318.39	
e.	Benefit Cost Ratio (BC Ratio)			1:0.76	

Cost of Cultivation of Mango: The data regarding the cost of cultivation of mango in Budagumpa-1 micro watershed is presented in Table 40. The results indicated that, the total cost of cultivation for mango was Rs. 38242.52. The gross income realized by the farmers was Rs. 24700. The net income from mango cultivation was Rs. -13542.52. Thus the benefit cost ratio was found to be 1:0.65.

Table 40: Cost of Cultivation of Mango in Budagumpa-1 micro watershed

Sl. No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	11.12	2618.20	6.85
2	Bullock	Pairs/day	0.00	0.00	0.00
3	Tractor	Hours	2.06	1646.67	4.31
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	82.33	20583.33	53.82
6	FYM	Quintal	8.23	1646.67	4.31
7	Fertilizer + micronutrients	Quintal	3.29	3235.70	8.46
8	Pesticides (PPC)	Kgs / liters	0.41	411.67	1.08
9	Irrigation	Number	1.65	0.00	0.00
10	Depreciation charges		0.00	3.29	0.01
11	Land revenue and Taxes		0.00	3.29	0.01
II	**Cost B1**				
12	Interest on working capital			3105.40	8.12
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**			33254.22	86.96
III	**Cost B2**				
14	Rental Value of Land			333.33	0.87
15	**Cost B2 = (Cost B1 + Rental value)**			33587.56	87.83
IV	**Cost C1**				
16	Family Human Labour		5.35	1177.37	3.08
17	**Cost C1 = (Cost B2 + Family Labour)**			34764.92	90.91
V	**Cost C2**				
18	Risk Premium			1.00	0.00
19	**Cost C2 = (Cost C1 + Risk Premium)**			34765.92	90.91
VI	**Cost C3**				
20	Managerial Cost			3476.59	9.09
21	**Cost C3 = (Cost C2 + Managerial Cost)**			38242.52	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	12.35	24700.00	
		b) Main Crop Sales Price (Rs.)		2000.00	
b.	Gross Income (Rs.)			24700.00	
c.	Net Income (Rs.)			-13542.52	
d.	Cost per Quintal (Rs./q.)			3096.56	
e.	Benefit Cost Ratio (BC Ratio)			1:0.65	

Adequacy of fodder: The data regarding the adequacy of fodder in Budagumpa-1 micro watershed is presented in Table 41. The results indicated that, 28.57 per cent of the households opined that dry fodder was adequate and 25.71 per cent of the households opined that green fodder was adequate.

Table 41: Adequacy of fodder in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	2	25	2	28.57	2	28.57	2	33.33	2	100	10	28.57
2	Adequate-Green Fodder	2	25	2	28.57	2	28.57	2	33.33	1	50	9	25.71

Average **Annual gross income of household:** The results of the overall average annual gross income of the household in Budagumpa-1is presented in table 42. The table indicated that, in landless farmers, the average income from wage was Rs. 106000. In marginal farmers the average income from wage was Rs. 28,750 and agriculture was Rs. 81,118.75. In small farmers the average income from business was Rs. 25,000, wage was Rs. 18,571.43, agriculture was Rs. 68,921.43 and dairy farm was Rs. 3,500. In semi medium farmers the average income from service/salary was Rs. 8,571.43, wage was Rs. 9,285.71 and agriculture was Rs. 72,142.86. In medium farmers the average income from wage was Rs. 10,833.33, agriculture was Rs. 67,500, and dairy farm was Rs. 333.33. In case of large farmers the average income from wage was Rs. 10,000, agriculture was Rs. 110,000 and dairy farm was Rs. 1,000.

Table 42: Average Annual gross income of households in Budagumpa-1 micro watershed

S.N.	Particulars	LL (5)	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Service/salary	0	0	0	8,571.43	0	0	1,714.29
2	Business	0	0	25,000	0.00	0	0	5,000
3	Wage	106,000	28,750	18,571.43	9,285.71	10,833.33	10,000	29,714.29
4	Agriculture	0	81,118.75	68,921.43	72,142.86	67,500	110,000	64,611.43
5	Dairy Farm	0	0	3,500	0	333.33	1,000	814.29
Income(Rs.)		106,000	109,868.75	115,992.86	90,000	78,666.67	121,000	101,854.29

Average Annual expenditure of households: The results of the overall average annual expenditure of the households in Budagumpa-1 were presented in Table 43. The results indicated that, in landless farmers, the average expenditure from wage was Rs. 23000, in marginal farmers the average expenditure from wage was Rs.5750 and agriculture was Rs.40875. In case of small farmers the average expenditure from business was Rs. 115,000, wage was Rs. 6,600, agriculture was Rs. 24,571.43 and dairy farm was Rs. 15,000. In case of semi medium farmers the average expenditure from service/salary was Rs.20000, wage was Rs. 1,600 and agriculture was Rs. 29,285.71. In case of medium farmers the average expenditure from wage was Rs. 4,000, agriculture was Rs. 28,000 and dairy farm was Rs. 500. In large farmers the average expenditure from wage was Rs.500, agriculture was Rs.55000 and dairy farm was Rs.500.

Table 43: Average Annual expenditure of households in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	0	0	20,000	0	0	571.43
2	Business	0	0	115,000	0	0	0	3,285.71
3	Wage	23,000	5,750	6,600	1,600	4,000	500	5,914.29
4	Agriculture	0	40,875	24,571.43	29,285.71	28,000	55,000	27,257.14
5	Dairy Farm	0	0	15,000	0	500	500	457.14
Total		23,000	46,625	161,171.43	50,885.71	32,500	56,000	370,182.14
Average		4,600	5,828.13	23,024.49	7,269.39	5,416.67	28,000	10,576.63

Horticulture species grown: The data regarding horticulture species grown in Budagumpa-1 micro watershed is presented in Table 44. The results indicated that, sampled households have grown 34 coconut and 131 mango trees in their field and also planted 2 coconut trees in their back yard.

Table 44: Horticulture species grown in Budagumpa-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	1	2	6	0	7	0	15	0	5	0	34	2
2	Mango	0	0	0	0	0	0	1	0	130	0	0	0	131	0

***F=Field & *B=Back yard**

Forest species grown

The data regarding forest species grown in Budagumpa-1 micro watershed is presented in Table 45. The results indicated that, households have planted 2 teak, 76 neem and 5 tarmind trees in their field and also planted 1 neem tree in their back yard.

Table 45: Forest species grown in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	1	0	1	0	0	0	0	0	2	0
2	Neem	19	1	25	0	14	0	8	0	10	0	76	1
3	Tamarind	1	0	1	0	0	0	3	0	0	0	5	0

***F=Field & *B=Back yard**

Average additional investment capacity: The data regarding average additional investment capacity in Budagumpa-1 micro watershed is presented in Table 46. The results indicate that, households have an average investment capacity of Rs. 5,200.14 for land development, Rs. 2,314.43 in irrigation facility, Rs.2714.29 for improved crop production and Rs.971.43 for improved livestock management.

Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 750 for irrigation facility, Rs.1375 for improved crop production and Rs.875 for improved livestock management. Small farmers have an average investment capacity of Rs. 2857.14 for land development, Rs. 1142.86 in irrigation facility, Rs.1714.29 for improved crop production and Rs.428.57 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 7515 for

land development, Rs. 4715 in irrigation facility, Rs.4428.57 for improved crop production and Rs.1142.86 for improved livestock management. Medium farmers have an average investment capacity of Rs. 11666.67 for land development, Rs. 4666.67 for irrigation facility, Rs.5166.67 for improved crop production and Rs.1833.33 for improved livestock management. Large farmers have an average investment capacity of Rs. 9000 for land development, Rs. 3000 for irrigation facility, Rs.5000 for improved crop production and Rs.2500 for improved livestock management.

Table 46: Average additional investment capacity of households in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (8)	SF (7)	SMF (7)	MDF (6)	LF (2)	All (35)
1	Land development	2,500	2,857.14	7,715	11,666.67	9,000	5,200.14
2	Irrigation facility	750	1,142.86	4,715	4,666.67	3,000	2,314.43
3	Improved crop production	1,375	1,714.29	4,428.57	5,166.67	5,000	2,714.29
4	Improved livestock management	875	428.57	1,142.86	1,833.33	2,500	971.43

Source of funds for additional investment: The data regarding source of funds for additional investment in Budagumpa-1 micro watershed is presented in Table 47. The results indicated that, for land development, 2.86 per cent of the farmers were depend on government subsidy, 40 per cent were depend on loan from the bank and 2.86 per cent of the households were depend on soft loan. 2.86 per cent of the households were dependent on government subsidy; own funds and soft loan for land development for irrigation facility respectively and 28.57 per cent were dependent on loan from the bank for irrigation facility. Similarly for improved crop production, 31.43 per cent of the households were dependent on loan from the bank, 8.57 per cent were dependent on their own funds and 2.86 per cent of the households were dependent on soft loan. For improved livestock management 17.14 per cent of the households were dependent on loan from bank, 8.57 per cent were dependent on own funds and 2.86 per cent were dependent on soft loan.

Table 47: Source of funds for additional investment capacity in Budagumpa-1 micro watershed

Sl. No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Government subsidy	1	2.86	1	2.86	0	0	0	0
2	Loan from bank	14	40	10	28.57	11	31.43	6	17.14
3	Own funds	0	0	1	2.86	3	8.57	3	8.57
4	Soft loan	1	2.86	1	2.86	1	2.86	1	2.86

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Budagumpa-1 micro watershed is presented in Table 48. The results indicated that, Bajra, ladies finger, maize, paddy, sorghum and tomato crops were

sold to the extent of 100 per cent. Groundnut and mango were sold to the extent of 90.99 per cent and 66.67 per cent respectively. Average price obtained by bajra was Rs.1300/q, groundnut was Rs.3531.82/q, ladies finger was Rs.1250/q, maize was Rs.1145/q, mango was Rs.2000/q, paddy was Rs.1450/q, sorghum was Rs.2100/q and tomato was Rs.1000/q.

Table 48: Marketing of the agricultural produce in Budagumpa-1 micro watershed

Sl. No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	85	0	85.0	100	1300
2	Groundnut	222	20	202.0	90.99	3531.82
3	Ladies finger	40	0	40.0	100	1250
4	Maize	541	-10	541.0	100	1145
5	Mango	30	10	20.0	66.67	2000
6	Paddy	32	0	32.0	100	1450
7	Sorghum	22	0	22.0	100	2100
8	Tomato	40	0	40.0	100	1000

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Budagumpa-1 micro watershed is presented in Table 49. The results indicated that, 40 percent of the households have sold their produce to local/village merchant, 42.85 percent of the households sold their produce in regulated markets and 2.85 percent of the households sold their produce in cooperative marketing society.

Table 49: Marketing Channels used for sale of agricultural produce in Budagumpa-1 micro watershed

S. N.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	4	50	1	14.29	5	71.42	4	66.67	0	0	14	40
2	Regulated Market	4	50	6	85.71	1	14.29	2	33.33	2	100	15	42.85
3	Cooperative marketing Society	0	0	0	0	1	14.29	0	0	0	0	1	2.85

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Budagumpa-1 micro watershed is presented in Table 50. The results indicated that 17.14 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 11.43 per cent have used truck as a mode of transport.

Table 50: Mode of transport of agricultural produce in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	4	50	2	28.57	0	0	0	0	0	0	6	17.14
2	Tractor	4	50	5	71.42	5	71.42	4	66.67	2	100	20	57.14
3	Truck	0	0	0	0	2	28.57	2	33.33	0	0	4	11.43

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Budagumpa-1 micro watershed is presented in Table 51. The results indicated that, 37.14 per cent of the households have experienced the soil and water erosion problems i.e. 25 percent of marginal farmers, 28.57 per cent of small farmers, 57.14 per cent of semi medium farmers, 66.67 percent of medium farmers and 50 per cent of the large farmers.

Table 51: Incidence of soil and water erosion problems in Budagumpa-1 micro watershed

S. N.	Particulars	MF(8)		SF (7)		SMF (7)		MDF (6)		LF(2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	2	25	2	28.57	4	57.14	4	66.67	1	50	13	37.14

Interest towards soil testing: The data regarding interest shown towards soil testing in Budagumpa-1 micro watershed is presented in Table 52. The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of marginal farmers, small farmers, semi medium farmers and large farmers and 83.33 per cent of the medium farmers respectively.

Table 52: Interest shown towards soil testing in Budagumpa-1 micro watershed

Sl. No.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	8	100	7	100	7	100	5	83.33	2	100	29	82.86

Soil and water conservation practices and structures adopted: The data regarding soil and water conservation practices and structures adopted in Budagumpa-1 micro watershed is presented in Table 53. The results indicated that, 14.29 per cent of the households have adopted field bunding which includes 25 per cent of marginal, 28.57 per cent of small farmers and 14.29 per cent of semi medium farmers.

Table 53: Soil and water conservation practices and structures adopted in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		All (35)	
		N	%	N	%	N	%	N	%
1	Field Bunding	2	25	2	28.57	1	14.29	5	14.29

Table 54: Status of soil and water conservation structures adopted in Budagumpa-1 micro watershed

Sl. No	Item	Good		Slightly Damaged		Severely Damaged		Full Replacement Required	
		N	%	N	%	N	%	N	%
1	Field Bunding	0	0.0	0	0.0	0	0.0	5	100

Status of soil and water conservation structures adopted: The data regarding status of soil and water conservation structures adopted in Budagumpa-1 micro watershed is

presented in Table 54. The results indicated that, 100 per cent of the households who adopted field bunding opined that bunds required full replacement.

Agencies involved in soil conservation structures: The data regarding agencies involved in soil conservation structures in Budagumpa-1 micro watershed is presented in Table 55. The results indicated that 14.29 per cent of soil conservation structure is constructed by government.

Table 55: Agencies involved in soil conservation structures in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		SF (7)		SMF (7)		All (35)	
		N	%	N	%	N	%	N	%
1	Govt.	2	25	2	28.57	1	14.29	5	14.29

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Budagumpa-1 micro watershed is presented in Table 56. The results indicated that, 97.14 percent used fire wood as a source of fuel.

Table 56: Usage pattern of fuel for domestic use in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	5	100	8	100	7	100	7	100	5	83.33	2	100	34	97.14

Source of drinking water: The data regarding source of drinking water in Budagumpa-1 micro watershed is presented in Table 57. The results indicated that, piped supply was the source of drinking water for 57.14 per cent, 25.71 per cent of them were using bore well and 14.29 per cents of the households were using lake/tank for drinking water.

Table 57: Source of drinking water in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	2	40	6	75	7	100	2	28.57	2	33.33	1	50	20	57.14
2	Bore Well	0	0	0	0	0	0	5	71.43	3	50	1	50	9	25.71
3	Lake/ Tank	3	60	2	25	0	0	0	0	0	0	0	0	5	14.29

Source of light: The data regarding source of light in Budagumpa-1 micro watershed is presented in Table 58. The results indicated that, electricity was the major source of light for 100 per cent of the households.

Table 58: Source of light in Budagumpa-1 micro watershed

S.N.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100	8	100	7	100	7	100	5	83.33	2	100	35	100

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Budagumpa-1 micro watershed is presented in Table 59. The results indicated that, 54.29 per cent of the households possess sanitary toilet i.e. 100 per cent of landless,

12.50 per cent of marginal, 100 per cent of small, 14.29 per cent of semi medium, 16.67 per cent of medium and 100 per cent of large farmers had sanitary toilet facility.

Table 59: Existence of Sanitary toilet facility in Budagumpa-1 micro watershed

S.N.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF(6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	100	1	12.50	1	100	1	14.29	1	16.67	2	100	19	54.29

Possession of PDS card: The data regarding possession of PDS card in Budagumpa-1 micro watershed is presented in Table 60. The results indicated that, 97.14 per cent of the sampled households possessed BPL card.

Table 60: Possession of PDS card in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	8	100	7	100	7	100	5	83.33	2	100	34	97.14

Participation in NREGA programme: The data regarding participation in NREGA programme in Budagumpa-1 micro watershed is presented in Table 61. The results indicated that, 28.57 per cent of the households participated in NREGA programme which included 20 per cent of the landless, 25 percent of the marginal, 14.29 per cent of the small, 42.86 per cent of the semi medium, 33.33 percent of the medium farmers and 50 per cent of the large farmers.

Table 61: Participation in NREGA programme in Budagumpa-1 micro watershed

S. N.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	1	20	2	25	1	14.29	3	42.86	2	33.33	1	50	10	28.57

Adequacy of food items: The data regarding adequacy of food items in Budagumpa-1 micro watershed is presented in Table 62. The results indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 97.14 per cent, 5.71 per cent, 17.14 per cent, 25.71 per cent, 82.86 per cent, 85.71 per cent and 77.14 per cent respectively.

Table 62: Adequacy of food items in Budagumpa-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100	8	100	7	100	7	100	6	100	2	100	35	100
2	Pulses	5	100	8	100	7	100	7	100	5	83.33	2	100	34	97.14
3	Oilseed	0	0	0	0	0	0	1	14.29	0	0	1	50	2	5.71
4	Vegetables	0	0	1	12.50	1	14.29	1	14.29	2	33.33	1	50	6	17.14
5	Fruits	1	20	2	25	1	14.29	2	28.57	3	50	0	0	9	25.71
6	Milk	5	100	6	75	6	85.71	6	85.71	5	83.33	1	50	29	82.86
7	Egg	5	100	7	87.50	6	85.71	6	85.71	5	83.33	1	50	30	85.71
8	Meat	4	80	6	75	6	85.71	6	85.71	4	66.67	1	50	27	77.14

Response on Inadequacy of food items: The data regarding inadequacy of food items in Budagumpa-1 micro watershed is presented in Table 63. The results indicated that, oilseed; vegetables, fruits, milk, egg and meat were inadequate for 91.43 per cent, 80 per cent, 68.57 per cent, 11.43 per cent, 11.43 per cent and 17.14 per cent respectively.

Table 63: Response on Inadequacy of food items in Budagumpa-1 micro watershed

Sl. No.	Particulars	LL (5)		MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	5	100	8	100	7	100	6	85.71	5	83.33	1	50	32	91.43
2	Vegetables	5	100	7	87.50	6	85.71	6	85.71	3	50	1	50	28	80
3	Fruits	4	80	6	75.00	5	71.43	5	71.43	2	33.33	2	100	24	68.57
4	Milk	0	0	1	12.50	1	14.29	1	14.29	0	0	1	50	4	11.43
5	Egg	0	0	1	12.50	1	14.29	1	14.29	0	0	1	50	4	11.43
6	Meat	1	20	2	25.00	1	14.29	1	14.29	0	0	1	50	6	17.14

Response on Market Surplus of food items: The data regarding market surplus of food items in Budagumpa-1 micro watershed is presented in Table 64. The results indicated that milk were market surplus for 2.86 per cent of the households.

Table 64: Response on market surplus of food items in Budagumpa-1 micro watershed

Sl.No.	Particulars	MF (8)		All (35)	
		N	%	N	%
1	Milk	1	12.50	1	2.86

Farming constraints: The data regarding farming constraints experienced by households in Budagumpa-1 micro watershed is presented in Table 65. The results indicated that, Lower fertility status of the soil and wild animal menace on farm field was experienced by 82.86 per cent of the households, frequent incidence of pest and diseases was experienced by 37.14 per cent of the farmers, inadequacy of irrigation water was experienced by 31.43 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced and high rate of interest on credit was experienced by 40 per cent of the farmers, low price for the agricultural commodities was experienced by 71.43 per cent of the farmers, lack of marketing facilities in the area was experienced 80 per cent of the households, inadequate of extension services experienced by 71.43 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 2.86 per cent of the farmers.

Table 65: Farming constraints Experienced in Budagumpa-1 micro watershed

S. N.	Particulars	MF (8)		SF (7)		SMF (7)		MDF (6)		LF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	8	100	7	100	7	100	5	83.33	2	100	29	82.86
2	Wild animal menace on farm field	8	100	7	100	7	100	5	83.33	2	100	29	82.86
3	Frequent incidence of pest and diseases	5	62.50	5	71.43	2	28.57	0	0	1	50	13	37.14
4	Inadequacy of irrigation water	5	62.50	4	57.14	1	14.29	0	0	1	50	11	31.43
5	High cost of Fertilizers and plant protection chemicals	6	75	5	71.43	2	28.57	0	0	1	50	14	40
6	High rate of interest on credit	5	62.50	5	71.43	3	42.86	0	0	1	50	14	40
7	Low price for the agricultural commodities	7	87.50	7	100	6	85.71	4	66.67	1	50	25	71.43
8	Lack of marketing facilities in the area	7	87.50	7	100	7	100	5	83.33	2	100	28	80
9	Inadequate extension services	7	87.50	6	85.71	6	85.71	5	83.33	1	50	25	71.43
10	Lack of transport for safe transport of the Agril. produce to the market.	8	100	6	85.71	7	100	4	66.67	1	50	26	74.29
11	Less rainfall	0	0	0	0	0	0	0	0	1	50	1	2.86

Chapter 5

SUMMERY

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

The data indicated that 35 farmers were sampled in Budagumpa-1 micro watershed among them 8 (22.86%) were marginal farmers, 7 (20 %) were small farmers, 7 (20 %) were semi medium farmers, 6 (17.14%) were medium farmers, 2(5.71%) were large farmers and 5 (14.29%) landless farmers were also interviewed for the survey. The data indicated that there were 157 population households were there in the studied micro watershed. Among them 89 (56.69%) men and 68 (43.31 %) were women. The average family size of landless was 5, marginal, small and semi medium farmers were 7 and medium and large farmers were 6. On an average the family size was 4. The data indicated that 20 (12.74%) people were in 0-15 years of age, 76 (48.41 %) were in 16-35 years of age, 47 (29.94 %) were in 36-60 years of age and 14 (8.92%) were above 61 years of age.

The results indicated that the Budagumpa-1had 42.04 per cent illiterates, 1.27 per cent functional literates, 22.93 per cent of them had primary school education, 8.92 per cent of them had middle school, 12.74 per cent them had high school education, 5.10 per cent of them had PUC education and 6.37 per cent of them had degree education. The results indicated that, 77.14 per cent of households practicing agriculture, 8.57 per cent of the household heads were agricultural labour and 14.29 per cent of the household heads were general labour.

The results indicated that agriculture was the major occupation for 40.76 per cent of the household members, 23.57 per cent were agricultural labourers, 11.46 per cent were general labours and 0.64 per cent were in private sector, were in trade and business, housewives and children's and 21.02 per cent of them were students. In case of landless farmers 70.83 per cent of them were general labours and 29.17 per cent of them were students. In case of marginal farmers 42.86 per cent of them were doing agriculture, 17.86 per cent of them were agriculture labour, 3.57 per cent of them were general labour and 35.71 per cent of them were students. In small farmers 61.29 per cent of them were doing agriculture, 16.13 per cent of them were agriculture labour, 3.23 per cent of them were in private service and 3.23 per cent of them were doing trade& business and housewives. In case of semi medium farmers 50 per cent of them were agriculturist, 34.62 per cent of them were agriculture labour and 11.54 per cent of them were students. In medium farmers 37.84 per cent of them were agriculturist, 35.14 per cent of them were

agricultural labour and 21.62 per cent of them were students. Similarly in case of large farmers 54.55 per cent of them were agriculturist and 45.45 per cent of them were agricultural labour. The results showed that 0.64 per cent of them participated in cooperative bank and 99.36 per cent of them have not participated in any local institutions. Landless, marginal, semi medium, medium and large farmers were found to have no participation in any local institutions. Small farmers were found to participate in one or the other local institutions.

The results indicated that 65.71 per cent of the households possess thatched house, 25.71 per cent of the households possess Katcha house and 8.57 per cent of the households possess Pacca house. The results showed that, 74.29 per cent of the households possess TV, 48.57 per cent of the households possess mixer/grinder, 17.14 per cent of the households possess bicycle, 31.43 per cent of the households possess motor cycle and 100 per cent of the households possess mobile phones. The results showed that the average value of television was Rs. 8269, mixer/grinder was Rs. 1676, bicycle was Rs.2166, motor cycle was Rs.29583 and mobile phone was Rs.2303.

The result showed that about 17.14 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 8.57 per cent of the households possess power tiller, 11.43 per cent of the households possess tractor, 17.14 per cent of the households possess sprayer, 91.43 per cent of the households possess weeder, 5.71 43 per cent of the households possess harvester, 2.86 per cent of the households possess thresher and 5.71 per cent of the households possess chaff cutter. The results showed that the average value of bullock cart was Rs.18333; the average value of plough was Rs. 1250, the average value of power tiller was Rs. 25000, the average value of tractor was Rs. 475000, the average value of sprayer was Rs. 10666, the average value of weeder was Rs. 80, the average value of harvester was Rs.35000, the average value of thresher was Rs. 37000 and the average value of chaff cutter was Rs. 3000. The results indicated that, 31.43 per cent of the households possess bullocks, 17.14 per cent of the households possess local cow, 5.71 per cent of the households possess buffalo and 2.86 per cent of the households possess sheep. The data indicated that in case of marginal farmers, 25 per cent of the households possess local cow and 12.50 per cent of the households possess local cow, buffalo and sheep respectively. In case of small farmers, 14.29 per cent of households possess bullock and 28.57 per cent possess local cow. In case of semi medium farmers, 28.57 per cent of the households possess bullock and 14.29 per cent of the households possess local cow and buffalo. 66.67 medium farmers possess bullock and 16.67 farmers possess local cow and 100 per cent of the large farmers possess bullock and 50 per cent of them possess local cow.

The results indicated that, average own labour men available in the micro watershed was 2, average own labour (women) available was 1.61, average hired labour (men) available was 8.80 and average hired labour (women) available was 7.38. The data showed that in case of marginal farmers, average own labour men available was 1.25,

average own labour (women) was also 1.11, average hired labour (men) was 7.67 and average hired labour (women) available was 7. In case of small farmers, average own labour men available was 1.71, average own labour (women) was 1.71, average hired labour (men) was 12.14 and average hired labour (women) available was 9.71. In case of semi medium farmers, average own labour men available was 2, average own labour (women) was 1.43, average hired labour (men) was 10 and average hired labour (women) available was 8.33. In medium farmers average own labour men available was 3.17, average own labour (women) was 2.17, average hired labour (men) was 6.67 and average hired labour (women) available was 5. In case of large farmers average own labour men available was 2.50, average own labour (women) was 2.50, average hired labour (men) was 5 and average hired labour (women) available was 5.

The results indicated that, 88.57 per cent of the household opined equally that the hired labour was adequate. The results indicated that, households of the Budagumpa-1 micro watershed possess 25.14 ha (43.40%) of dry land and 32.78 ha (56.60 %) of irrigated land. Marginal farmers possess 5.43 ha (91.85%) of dry land 0.48 ha (8.15%) of irrigated land. Small farmers possess 7.89 ha (89.65 %) of dry land and 0.89 ha (10.14 %) of irrigated land. Semi medium farmers possess 4.05 ha (35.39 %) of dry land and 7.39 ha (64.61%) of irrigated land. Medium farmers possess 7.77 ha (41.56%) of dry land and 10.93 ha (58.44%) irrigated land. Large farmers possess 13.10 ha (100%) of irrigated land. The results indicated that, the average value of dry land was Rs. 345927.24 and average value of irrigated was Rs. 353,684.73. In case of marginal famers, the average land value was Rs. 552,160.94 for dry land and Rs. 1,660,504.12 for irrigated land. In case of small famers, the average land value was Rs. 316,666.67 for dry land Rs. 898,181.80 for irrigated land. In case of semi medium famers, the average land value was Rs. 247,000 for dry land and Rs. 541,073.38 for irrigated land. In case of medium famers, the average land value was Rs. 283,020.83 for dry land and Rs. 384,222.22 for irrigated land. In case of large farmers the average land value was Rs. 137,391.84 for irrigated land.

The results indicated that, there were 14 functioning bore wells in the micro watershed. The results indicated that, there were 1functioning and 1 defunctioning open wells in the micro watershed. The results indicated that, bore well was the major irrigation source for 40 per cent of the farmers and open well was source of irrigation for 2.86 per cent. The results indicated that on an average the depth of the bore well was 35.71 meters. The results indicated that, in case of marginal farmers there was 0.96 per cent of irrigated land, in case of small farmers there was 0.89 ha of irrigated land, in case of semi medium farmers there was 9.31 ha of irrigated land, medium farmers were having 11.34 ha of irrigated land and large farmers were having 1.62 ha of irrigated land. On an average there were 24.12 ha of irrigated land. The results indicated that, farmers have grown groundnut (11.58ha), ladies figure (1.29 ha), maize (26.93 ha), mango (2.43 ha), onion (0.40 ha), paddy (0.85 ha), sorghum (1.21 ha), tomato (0.81 ha) in kharif season.

Also grown groundnut (2.43 ha) and maize (0.48 ha) in Rabi season. Marginal farmers have grown groundnut, ladies figure, maize and paddy. Small farmers have grown groundnut, maize, paddy and sorghum. Semi medium farmers have grown groundnut, maize and tomato. Medium farmers have grown groundnut, maize, mango, onion and tomato. Large farmers have grown groundnut, ladies figure and maize.

The results indicated that, the cropping intensity in Budagumpa-1 micro watershed was found to be 72.72 per cent. In case of marginal farmers it was 98.73 per cent, in small farmers it was 90.79, in semi medium farmers it was 90.48, in medium farmers it was 89.13 per cent and in large farmers it was 32.56 per cent. The results indicated that, 85.71 per cent of the households have bank account and 77.14 per cent of the households have savings. 100 percent of marginal, small and large farmers possess both bank account savings respectively. In case of semi medium farmers, 100 per cent of possess bank account and 85.71 per cent farmer's savings. In Medium farmers, 100 per cent of farmers possess bank account and 66.67 per cent have savings respectively. The results indicated that, 75 per cent of marginal, 71.43 per cent of small, 28.57 per cent of semi medium, 16.67 per cent of medium farmers and 50 per cent of large farmers have borrowed credit from different sources.

The results indicated that, 6.67 per cent have availed loan in cooperative Bank, 26.67 per cent have availed loan from friends/relatives, 53.33 per cent have availed loan in Grameena bank and 13.33 per cent have availed loan from money lender. The results indicated that, marginal, small, semi medium and medium have availed Rs.50833.33, Rs. 109000, Rs. 316000 and Rs, 310000 respectively. Overall average credit amount availed by households in the micro watershed is 119,466.67. The results indicated that, 100 per cent of the households have borrowed loan for agriculture production. The results indicated that, 81.82 per cent of the household's barrowed private credit for agriculture production and 18.18 per cent of the household's barrowed private credit for social functions like marriage. Results indicated that 100 per cent of households were unpaid their institutional loan. Results indicated that 54.55 per cent of the households have partially paid their loan and 45.45 per cent have unpaid their private credit.

The results indicated that 25 per cent of the households were opined that helped to perform timely agricultural operations and 75 per cent of the households were opined that higher rate of interest. The results indicated that, 9.09 per cent of the households were opined that easy accessibility of credit, 54.55 per cent of the households were opined that loan amount was adequate to fulfill the requirement and 18.18 per cent of the households were opined that helped to perform timely agricultural operations. The results indicated that, the total cost of cultivation for maize was Rs. 20131.66. The gross income realized by the farmers was Rs. 22249.38. The net income from maize cultivation was Rs. 2117.73. Thus the benefit cost ratio was found to be 1:1.11.The results indicated that, the total cost of cultivation for groundnut was Rs. 52091.06. The gross income realized by the farmers was Rs. 69130.38. The net income from groundnut cultivation was Rs.

17039.32. Thus the benefit cost ratio was found to be 1:1.33. The results indicated that, the total cost of cultivation for paddy was Rs. 79623.59. The gross income realized by the farmers was Rs. 67722.91. The net income from paddy cultivation was Rs. -11900.69. Thus the benefit cost ratio was found to be 1:0.85. The results indicated that, the total cost of cultivation for bajra was Rs. 23029.06. The gross income realized by the farmers was Rs. 22625.29. The net income from bajra cultivation was Rs. -403.77. Thus the benefit cost ratio was found to be 1:0.98.

The results indicated that, the total cost of cultivation for tomato was Rs. 65128.50. The gross income realized by the farmers was Rs. 49400. The net income from tomato cultivation was Rs. -15728.50. Thus the benefit cost ratio was found to be 1:0.76. The results indicated that, the total cost of cultivation for mango was Rs. 38242.52. The gross income realized by the farmers was Rs. 24700. The net income from mango cultivation was Rs. -13542.52. Thus the benefit cost ratio was found to be 1:0.65. The results indicated that, 28.57 per cent of the households opined that dry fodder was adequate and 25.71 per cent of the households opined that green fodder was adequate.

The table indicated that, in landless farmers, the average income from wage was Rs. 106000. In marginal farmers the average income from wage was Rs. 28,750 and agriculture was Rs. 81,118.75. In small farmers the average income from business was Rs. 25,000, wage was Rs. 18,571.43, agriculture was Rs. 68,921.43 and dairy farm was Rs. 3,500. In semi medium farmers the average income from service/salary was Rs. 8,571.43, wage was Rs. 9,285.71 and agriculture was Rs. 72,142.86. In medium farmers the average income from wage was Rs. 10,833.33, agriculture was Rs. 67,500, and dairy farm was Rs. 333.33. In case of large farmers the average income from wage was Rs. 10,000, agriculture was Rs. 110,000 and dairy farm was Rs. 1,000.

The results indicated that, in landless farmers, the average expenditure from wage was Rs. 23000, in marginal farmers the average expenditure from wage was Rs.5750 and agriculture was Rs.40875. In case of small farmers the average expenditure from business was Rs. 115,000, wage was Rs. 6,600, agriculture was Rs. 24,571.43 and dairy farm was Rs. 15,000. In case of semi medium farmers the average expenditure from service/salary was Rs.20000, wage was Rs. 1,600 and agriculture was Rs. 29,285.71. In case of medium farmers the average expenditure from wage was Rs. 4,000, agriculture was Rs. 28,000 and dairy farm was Rs. 500. In large farmers the average expenditure from wage was Rs.500, agriculture was Rs.55000 and dairy farm was Rs.500. The results indicated that, sampled households have grown 34 coconut and 131 mango trees in their field and also planted 2 coconut trees in their back yard. The results indicated that, households have planted 2 teak, 76 neem and 5 tarmind trees in their field and also planted 1 neem tree in their back yard.

The results indicate that, households have an average investment capacity of Rs. 5,200.14 for land development, Rs. 2,314.43 in irrigation facility, Rs.2714.29 for

improved crop production and Rs.971.43 for improved livestock management. Marginal households have an average investment capacity of Rs. 2500 for land development, Rs. 750 for irrigation facility, Rs.1375 for improved crop production and Rs.875 for improved livestock management. Small farmers have an average investment capacity of Rs. 2857.14 for land development, Rs. 1142.86 in irrigation facility, Rs.1714.29 for improved crop production and Rs.428.57 for improved livestock management. Semi medium farmers have an average investment capacity of Rs. 7515 for land development, Rs. 4715 in irrigation facility, Rs.4428.57 for improved crop production and Rs.1142.86 for improved livestock management. Medium farmers have an average investment capacity of Rs. 11666.67 for land development, Rs. 4666.67 for irrigation facility, Rs.5166.67 for improved crop production and Rs.1833.33 for improved livestock management. Large farmers have an average investment capacity of Rs. 9000 for land development, Rs. 3000 for irrigation facility, Rs.5000 for improved crop production and Rs.2500 for improved livestock management.

The results indicated that, for land development, 2.86 per cent of the farmers were depend on government subsidy, 40 per cent were depend on loan from the bank and 2.86 per cent of the households were depend on soft loan. 2.86 per cent of the households were dependent on government subsidy; own funds and soft loan for land development for irrigation facility respectively and 28.57 per cent were dependent on loan from the bank for irrigation facility. Similarly for improved crop production, 31.43 per cent of the households were dependent on loan from the bank, 8.57 per cent were dependent on their own funds and 2.86 per cent of the households were dependent on soft loan. For improved livestock management 17.14 per cent of the households were dependent on loan from bank, 8.57 per cent were dependent on own funds and 2.86 per cent were dependent on soft loan. The results indicated that, Bajra, ladies finger, maize, paddy, sorghum and tomato crops were sold to the extent of 100 per cent. Groundnut and mango were sold to the extent of 90.99 per cent and 66.67 per cent respectively. Average price obtained by bajra was Rs.1300/q, groundnut was Rs.3531.82/q, ladies finger was Rs.1250/q, maize was Rs.1145/q, mango was Rs.2000/q, paddy was Rs.1450/q, sorghum was Rs.2100/q and tomato was Rs.1000/q. The results indicated that, 40 percent of the households have sold their produce to local/village merchant, 42.85 percent of the households sold their produce in regulated markets and 2.85 percent of the households sold their produce in cooperative marketing society.

The results indicated that 17.14 per cent of the households have used cart as a mode of transport, 57.14 per cent of them have used tractor and 11.43 per cent have used truck as a mode of transport. The results indicated that, 37.14 per cent of the households have experienced the soil and water erosion problems i.e. 25 percent of marginal farmers, 28.57 per cent of small farmers, 57.14 per cent of semi medium farmers, 66.67 percent of medium farmers and 50 per cent of the large farmers. The results indicated that, 82.86 per cent of the households have shown interest in soil testing including 100 per cent of

marginal farmers, small farmers, semi medium farmers and large farmers and 83.33 per cent of the medium farmers respectively. The results indicated that, 14.29 per cent of the households have adopted field bunding which includes 25 per cent of marginal, 28.57 per cent of small farmers and 14.29 per cent of semi medium farmers.

The results indicated that, 100 per cent of the households who adopted field bunding opined that bunds required full replacement. The results indicated that 14.29 per cent of soil conservation structure is constructed by government. The results indicated that, 97.14 percent used fire wood as a source of fuel. The results indicated that, piped supply was the source of drinking water for 57.14 per cent, 25.71 per cent of them were using bore well and 14.29 per cents of the households were using lake/tank for drinking water. The results indicated that, electricity was the major source of light for 100 per cent of the households. The results indicated that, 54.29 per cent of the households possess sanitary toilet i.e. 100 per cent of landless, 12.50 per cent of marginal, 100 per cent of small, 14.29 per cent of semi medium, 16.67 per cent of medium and 100 per cent of large farmers had sanitary toilet facility.

The results indicated that, 97.14 per cent of the sampled households possessed BPL card. The results indicated that, 28.57 per cent of the households participated in NREGA programme which included 20 per cent of the landless, 25 percent of the marginal, 14.29 per cent of the small, 42.86 per cent of the semi medium, 33.33 percent of the medium farmers and 50 per cent of the large farmers. The results indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 97.14 per cent, 5.71 per cent, 17.14 per cent, 25.71 per cent, 82.86 per cent, 85.71 per cent and 77.14 per cent respectively. The results indicated that, oilseed; vegetables, fruits, milk, egg and meat were inadequate for 91.43 per cent, 80 per cent, 68.57 per cent, 11.43 per cent, 11.43 per cent and 17.14 per cent respectively. The results indicated that milk were market surplus for 2.86 per cent of the households.

The results indicated that, Lower fertility status of the soil and wild animal menace on farm field was experienced by 82.86 per cent of the households, frequent incidence of pest and diseases was experienced by 37.14 per cent of the farmers, inadequacy of irrigation water was experienced by 31.43 per cent of the households, high cost of Fertilizers and plant protection chemicals was experienced and high rate of interest on credit was experienced by 40 per cent of the farmers, low price for the agricultural commodities was experienced by 71.43 per cent of the farmers, lack of marketing facilities in the area was experienced 80 per cent of the households, inadequate of extension services experienced by 71.43 per cent of the households, lack of transport for safe transport of the agricultural produce to the market was experienced by 74.29 per cent of the households and less rainfall was experienced by 2.86 per cent of the farmers.