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

VANABALLARY-3 (4D3A9A2c) MICROWATERSHED

Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

Citation: Rajendra Hegde, Ramesh Kumar, S.C., K.V. Niranjana, S. Srinivas, M.Lalitha, B.A. Dhanorkar, R.S. Reddy and S.K. Singh (2019). “Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Vana Ballary-3 (4D3A9A2c) Microwatershed, Koppal Taluk and District, Karnataka”, ICAR-NBSS&LUP Sujala MWS Publ.207, ICAR – NBSS & LUP, RC, Bangalore. p.123 & 36.

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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 Vana Ballary-3 microwatershed in Koppal Taluk, and District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micro-watershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date: 01.06.2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

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

The present study covers an area of 606 ha in Koppal taluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 92 per cent is covered by soils, five per cent by rock out crops and 2 per cent by water bodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below

- *The soils belong to 18 soil series and 35 soil phases (management units) and 10 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 320 m grid interval.*
- *Land suitability for growing 28 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 32 per cent is shallow (25-50 cm), 39 per cent moderately shallow (50-75 cm), 13 per cent is moderately deep (75- 100 cm), 8 per cent is deep (100-150cm) and < 1 per cent is very deep soils (>150 cm).*
- *About <1 per cent is sandy at the surface, 19 per cent is loamy and 73 per cent has clayey soils at the surface.*
- *About 24 per cent of the area has non-gravelly (<15%) soils, 45 per cent gravelly (15-35%), 18 per cent has very gravelly soils (35-60 % gravel) and 4 per cent has extremely gravelly (60-80%) soils.*

- *With respect to available water capacity 32 per cent of the area has very low (<50mm/m), 48 per cent of the area has low (51-100 mm/m) and 13 per cent is medium (101-150 mm/m).*
- *An area of about <1 per cent has nearly level (0-1%) lands,87 per cent very gently sloping (1-3%) lands and 4 per cent has gently sloping(3-5%) lands.*
- *An area of about 33 per cent is slightly eroded (e1) and 59 per cent is moderately eroded (e2) lands.*
- *An area of about 4 per cent is strongly to moderately acid (pH 5.0 to 6.0), 15 per cent is slightly acid (pH 6.0 to 6.5), 41 per cent has neutral (pH 6.5 to 7.3) soils, 12 per cent slightly alkaline (pH 7.3 to 7.8), 12 per cent moderately alkaline (pH 7.8 to 8.4) and 9 per cent strongly alkaline (pH 8.4 to 9.0) soils..*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that soils are non saline.*
- *Organic carbon is high (>0.75%) in the entire area of the microwatershed.*
- *Available phosphorus is medium (23-57 kg/ha) in 20 per cent and high (>57 kg/ha) in 73 per cent of the soils.*
- *Available potassium is low (<145 kg/ha) in 4 per cent, medium (145-337 kg/ha) in 68 per cent and high (>337 kg/ha) in 21 per cent of the soils.*
- *Available sulphur is low (<10 ppm) in 80 per cent, medium (10-20 ppm) in 13 per cent and high (>20 ppm) in <1 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in 92 per cent and medium (0.5-1.0 ppm) in <1 per cent of the microwatershed.*
- *Available iron is deficient in 62 per cent of the area and sufficient (>4.5 ppm) in 30 per cent of the area.*
- *Available zinc is deficient (<0.6 ppm) in 21 per cent and sufficient (>0.6 ppm) in 72 per cent area of the microwatershed.*
- *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	*14 (2)*	*269(44)*	*Pomegranate*	*8(1)*	*68(11)*
Maize	*8(1)*	*279(46)*	*Guava*	*8(1)*	*45 (7)*
Bajra	*50(8)*	*239(40)*	*Jackfruit*	*8(1)*	*45(7)*
Redgram	*8(1)*	*50 (8)*	*Jamun*	-	*53(9)*
Bengal gram	*6 (<1)*	*277 (46)*	*Musambi*	*8 (1)*	*68 (11)*
Groundnut	*30(5)*	*161(27)*	*Lime*	*8(1)*	*68(11)*
Sunflower	*8(1)*	*65 (11)*	*Cashew*	*8(1)*	*65(11)*
Cotton	*6 (<1)*	*276(46)*	*Custard apple*	*56(9)*	*278(46)*
Chilli	*8(1)*	*177(29)*	*Amla*	*50(8)*	*284 (47)*
Tomato	*8(1)*	*177(29)*	*Tamarind*	-	*49(8)*
Drumstick	*20(3)*	*53 (9)*	*Marigold*	*8(1)*	*275(45)*
Mulberry	*49(8)*	*102(17)*	*Chrysanthemum*	*8(1)*	*275(45)*
Mango	-	*49(8)*	*Jasmine*	*8(1)*	*252(42)*
Sapota	*8(1)*	*45(7)*	*Crossandra*	*8(1)*	*193(32)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 10 identified LUCs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.

- *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.,*
- *Drainage line treatment and Soil and water conservation treatment plans have been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. This 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 geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest in farmers for farming, large tracts of cultivable lands are turning into fallows in many areas and this trend is continuing at an alarming rate.

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

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state. The continued neglect and unscientific use of the resources for a long time has led to the situation observed at present in the state. It is a known fact and established beyond doubt by many studies in the past that the cause for all kinds of degradation is the neglect and irrational use of the land resources. Hence, there is 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 Ballary-3 microwatershed in Koppal Taluk, Koppal District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery. Later, an attempt will be made to uplink this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological Units (LEUs) map.

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

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Ballary-3 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig2.1). It lies between $15^0$25' and $15^0$27' North latitudes and $76^0$15' and $76^0$18 East longitudes and covers an area of about 606 ha. It comprises parts of Kenchanadoni, Kukanapalli, Abbigeri and Vanabellary villages. It is about 38 km from Koppal town and is bounded by Vanabellary on the north, Kukanapalli on the eastern and western side, Abbigeri and Kenchanadoni on the northwestern part of the microwatershed.

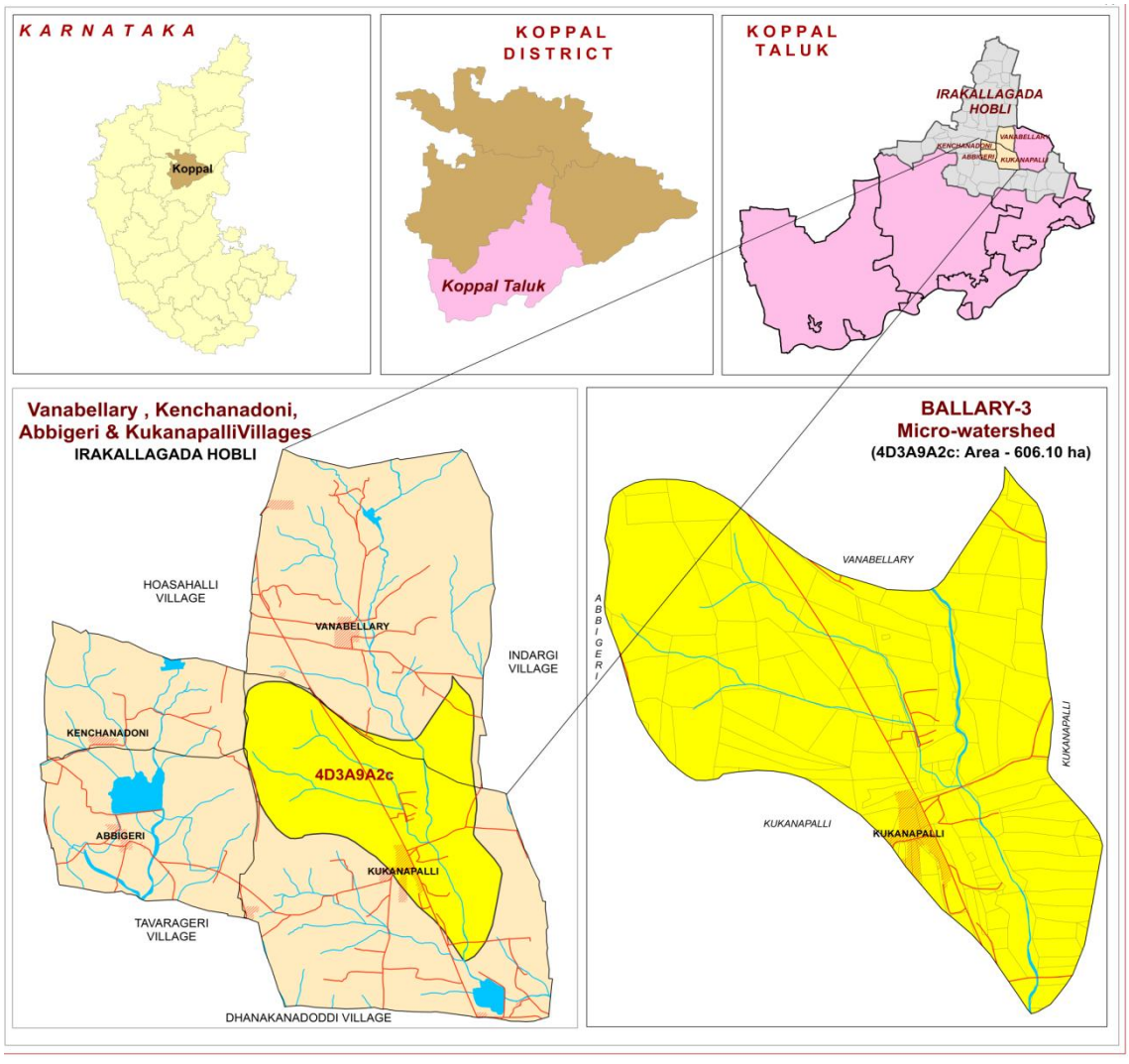


Fig.2.1 Location map of Ballary-3 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Fig.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 Ballary-3 village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent 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 544 to 562 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought - prone with total annual rainfall of 662 mm (Table 2.1). Of this, a maximum of 424 mm precipitation 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**	

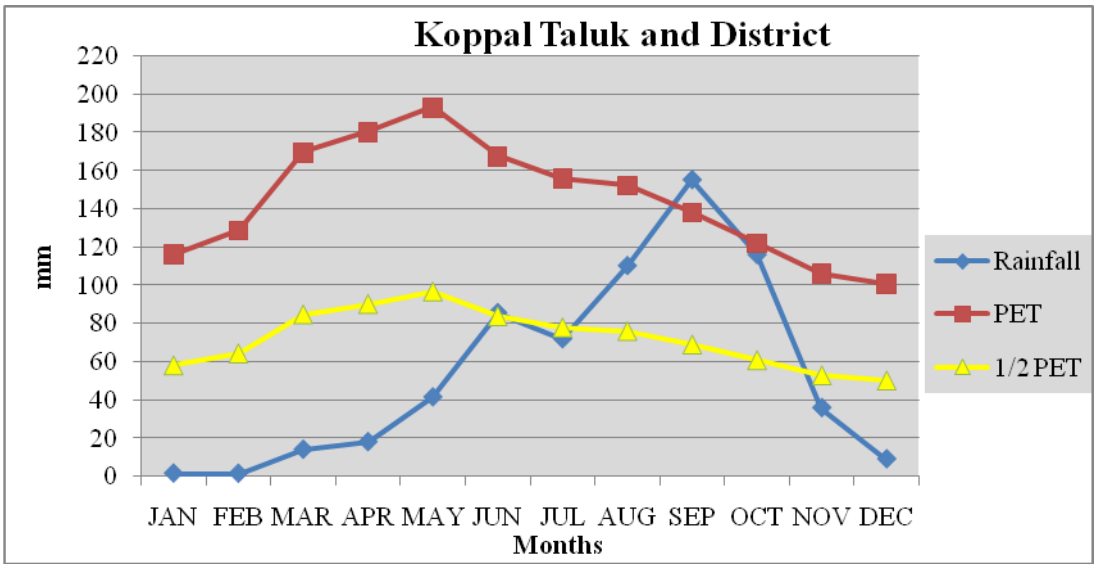


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Ballary-3 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, paddy, bajra, cotton, safflower, sunflower, red gram, cowpea, drumstick, pomegranate, mango, bengalgram and groundnut (Fig 2.5). While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Ballary-3 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 Ballary-3 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 Ballary-3 Microwatershed

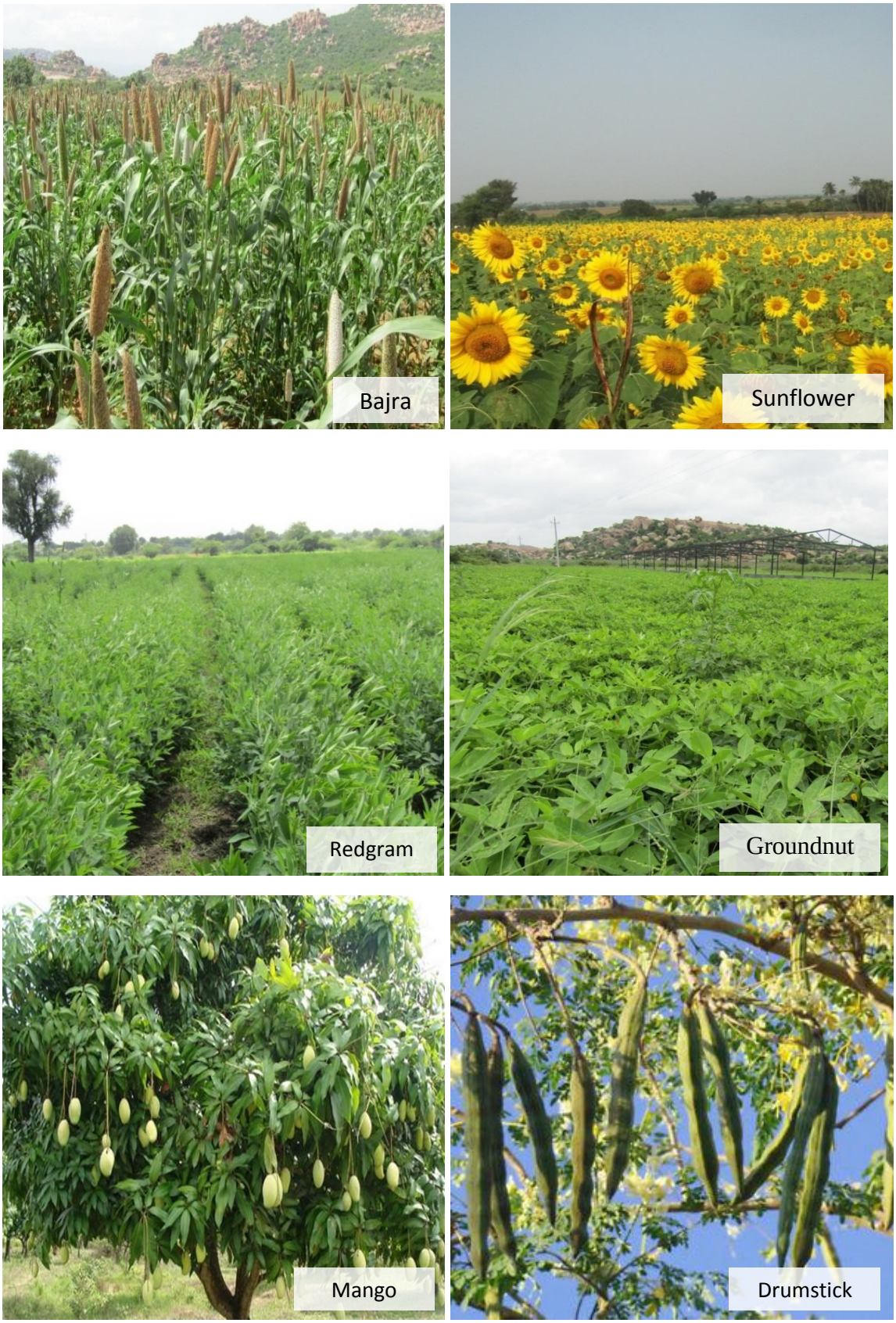


Fig.2.5 (b) Different crops and cropping systems in Ballary-3 Microwatershed

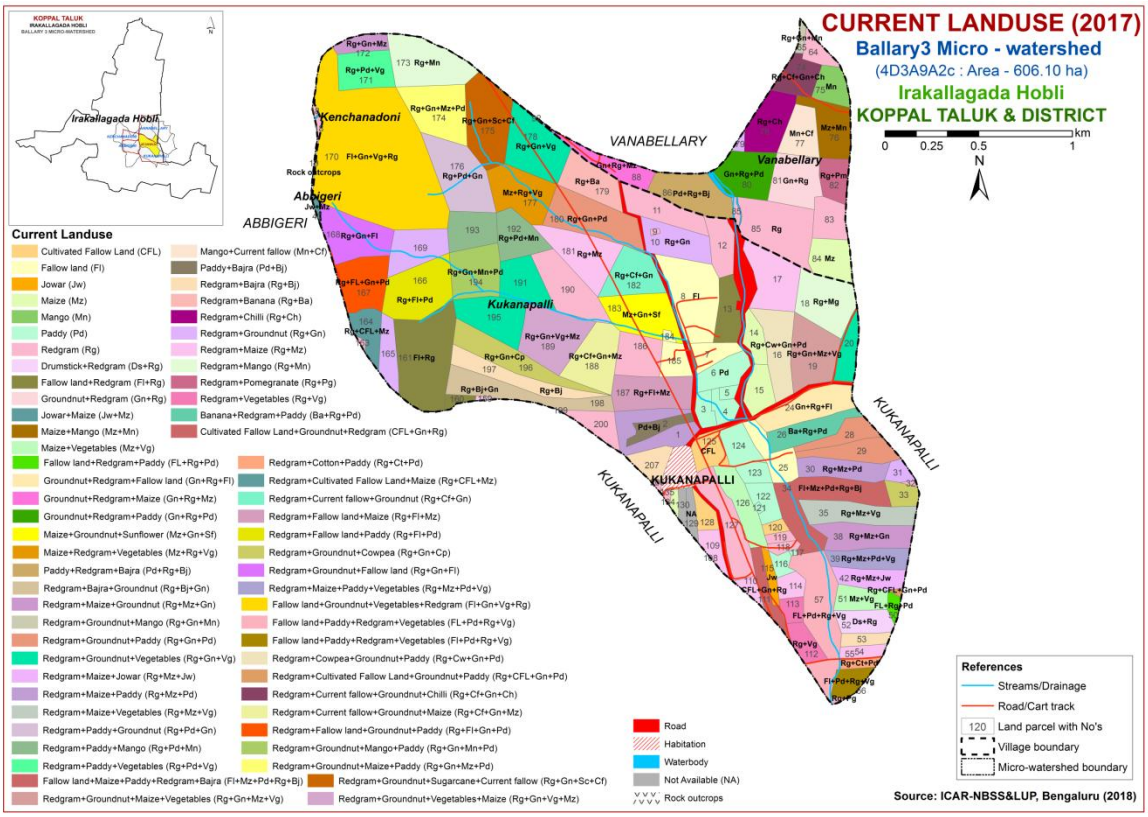


Fig.2.6 Current Land Use – Ballary-3 Microwatershed

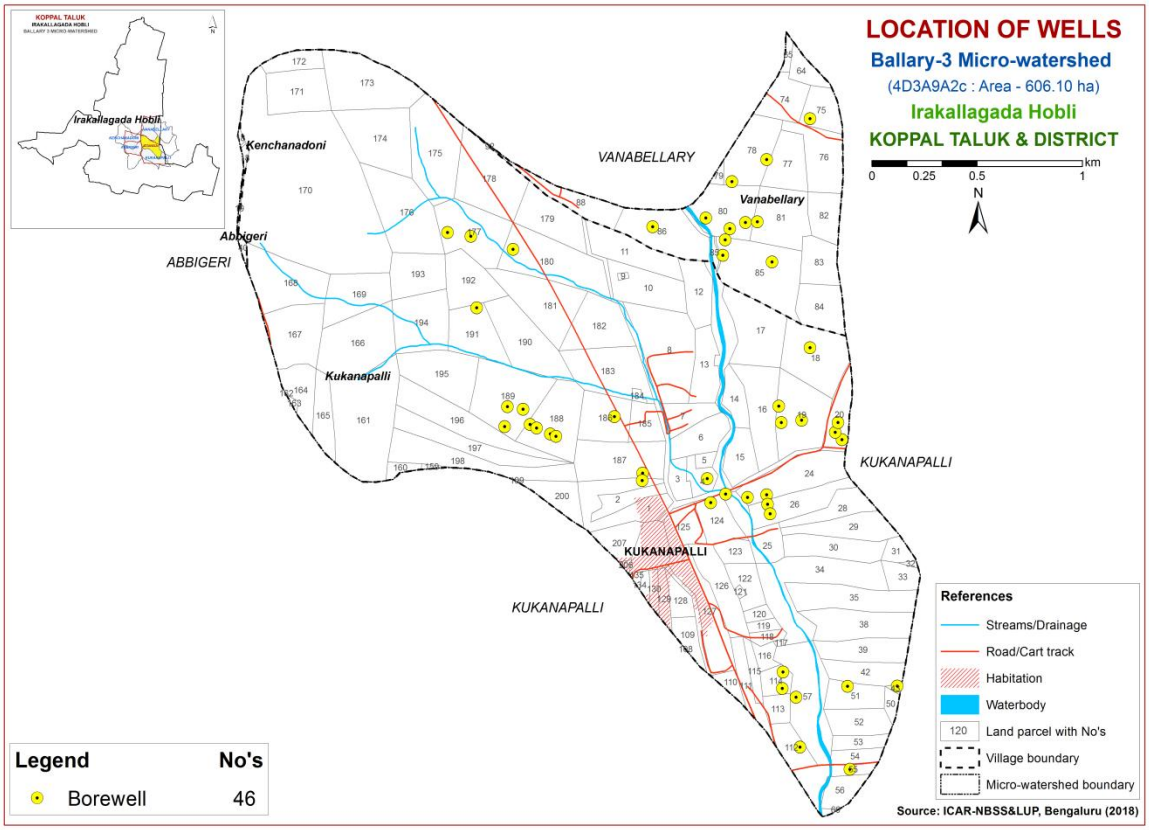


Fig.2.7 Location of wells– Ballary-3 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Ballary-3 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site 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 606 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

False Colour Composites (FCC) of Cartosat-I and LISS-IV merged satellite data covering the microwatershed area was visually interpreted using image interpretation elements and all the available collateral data with local knowledge. The delineated physiographic boundaries were transferred on to a cadastral map overlaid on satellite imagery. Physiographically, the area has been identified as granite gneiss and alluvial landscapes and is divided into landforms such as ridges, mounds and uplands based on slope. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

G1 Hills/ Ridges/ Mounds

G11 Summits

G12 Side slopes

G121 Side slopes with dark grey tones

G2 Uplands

G21 Summits

G22 Gently sloping uplands

G221 Gently sloping uplands, yellowish green (eroded)

G222 Gently sloping uplands, yellowish white (severely eroded)

G23 Very gently sloping uplands

G231 Very gently sloping uplands, yellowish green

G232 Very gently sloping uplands, medium green and pink

G233 Very gently sloping uplands, pink and green (scrub land)

G234 Very gently sloping uplands, medium greenish grey

G235 Very gently sloping uplands, yellowish white (eroded)

G236 Very gently sloping uplands, dark green

G237 Very gently sloping uplands, medium pink (coconut garden)

G238 Very gently sloping uplands, pink and bluish white (eroded)

DSe -Alluvial landscape

DSe 1 Summit

DSe 11 Nearly level Summit with dark grey tone

DSe 12 Nearly level Summit with medium grey tone

DSe 13 Nearly level Summit with whitish grey tone

DSe 14 Nearly level Summit with whitish tone (Calcareousness)

DSe 15 Nearly level Summit with pinkish grey tone

DSe 16 Nearly level Summit with medium pink tone

DSe 17 Nearly level Summit with bluish white tone

DSe 18 Nearly level Summit with greenish grey tone

DSe 2 Very genetly sloping

DSe 21 Very gently sloping, whitish tone

DSe 22 Very gently sloping, greyish pink tone

DSe 23 Very gently sloping, whitish grey tone

DSe 24 Very gently sloping, medium grey tone

DSe 25 Very gently sloping, medium pink tone

DSe 26 Very gently sloping, dark grey tone

DSe 27 Very gently sloping, bluish grey tone

DSe 28 Very gently sloping, greenish grey tone

DSe 29 Very gently sloping, Pinkish grey

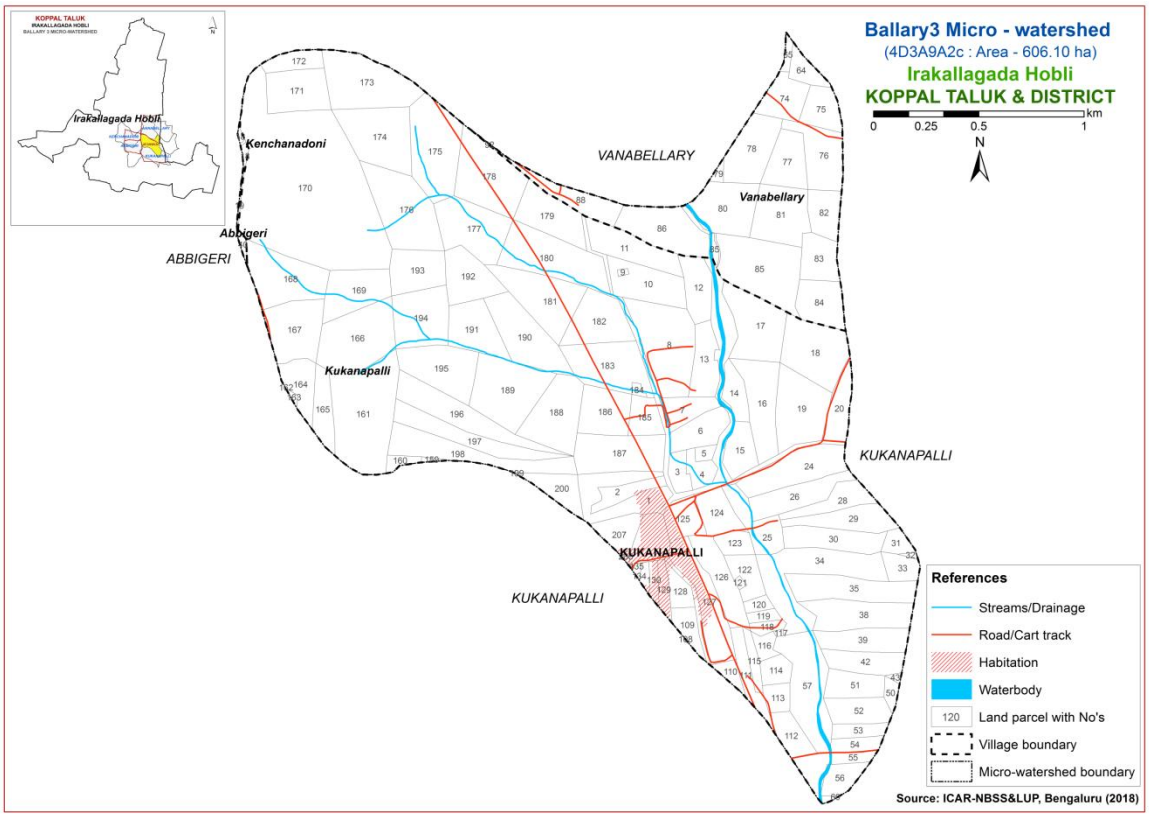


Fig 3.1 Scanned and Digitized Cadastral map of Ballary-3 Microwatershed

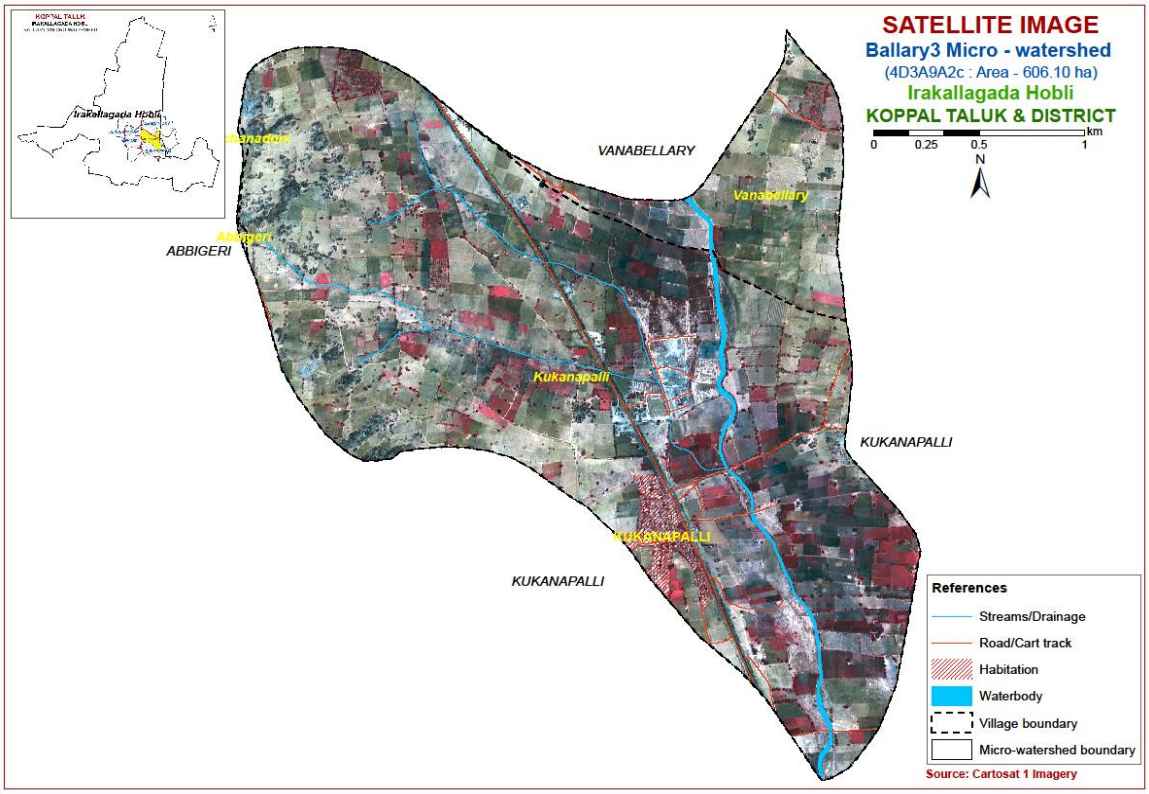


Fig.3.2 Satellite Image of Ballary-3 Microwatershed

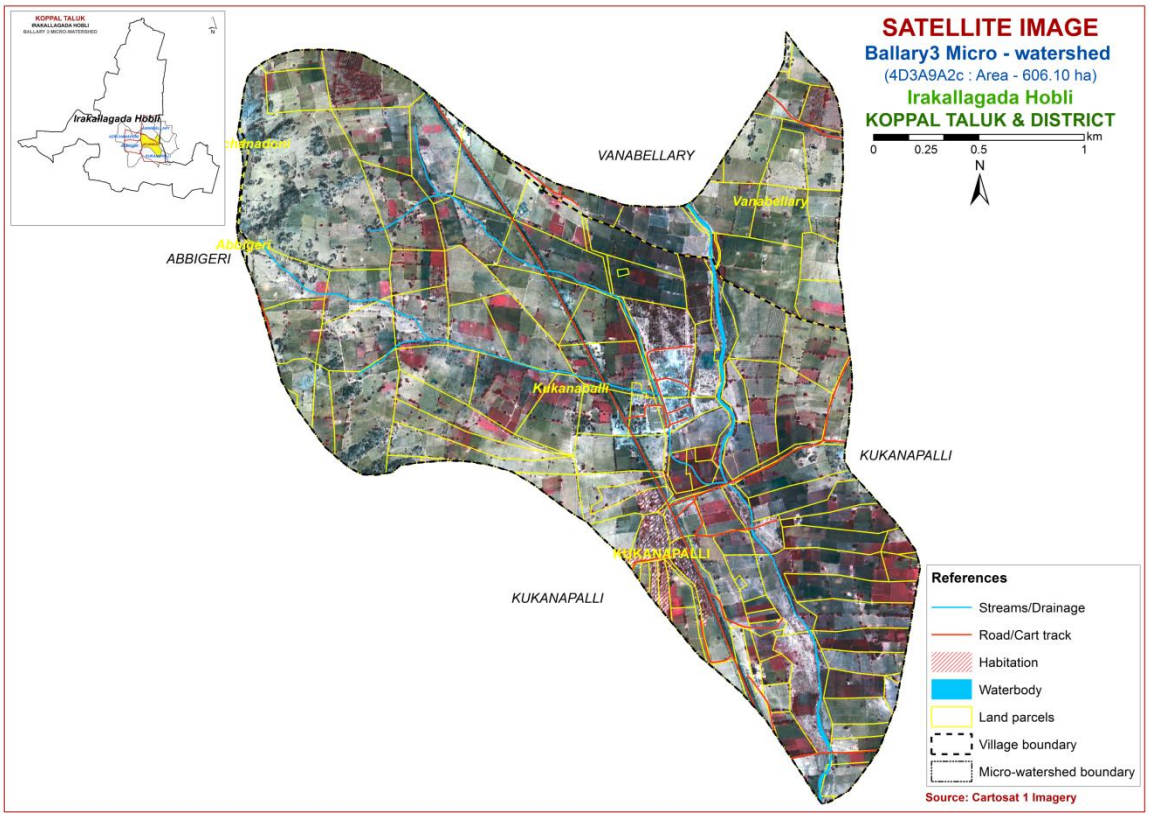


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Ballary-3 Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nallas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheets. While traversing, landforms and physiographic units identified were checked and preliminary soil legend was prepared by studying soils at few selected places. Then, intensive traversing of each physiographic unit like hills, ridges, uplands and plains was carried out. Based on the variability observed on the surface, transects (Fig 3.4) were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010).

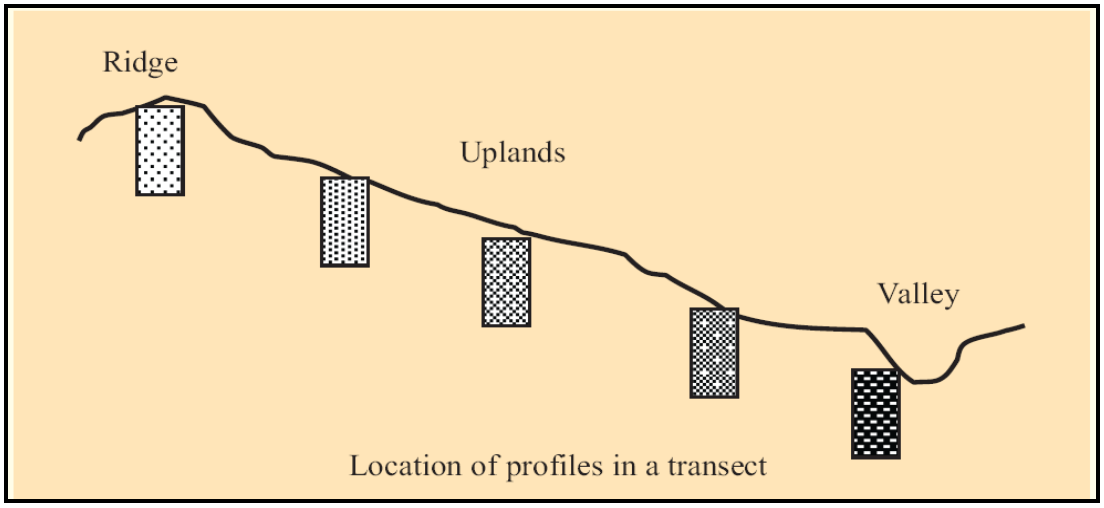


Fig: 3.4. Location of profiles in a transect

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, 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, 18 soil series were identified in Ballary-3 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo -usness**
1	**Abbigeri (ABR)**	25-50	2.5YR 3/3, 3/4	gsc-c	>35	Ap-Bt-Cr	-
2	**Harve (HRV)**	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr-	-
3	**Kaggalipura (KGP)**	25-50	2.5YR2.5/4,3/4, 3/6	gscl-gsc	15-35	Ap-Bt-Cr	-
4	**Hatti (HTI)**	50-75	5 YR 3/3, 3/4,	gsc	15-35	Ap-Bt-Cr	-
5	**Kutegoudanah undi (KGH)**	50-75	7.5YR3/2,3/3,3/4	gscl	15-35	Ap-Bt-Cr	-
6	**Lakkur (LKR)**	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	--
7	**Mukhadahalli (MKH)**	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	-
8	**Bidanagere (BDG)**	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	-
9	**Gollarahatti (GHT)**	75-100	2.5YR3/4,3/6,4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
10	**Hooradhahalli (HDH)**	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	-
11	**Jedigere (JDG)**	100-150	5YR 4/6, 3/4, 7.5YR 3/4, 4/6	sc-c	<15	Ap-Bt-BC-C	-
12	**Mornal (MNL)**	100-150	5YR 3/4, 2.5 YR 3/4, 4/6	gsc	15-35	Ap-Bt-Cr	-
13	**Honnenahalli (HNH)**	50-75	7.5YR3/3,4/310YR3/3	sc	-	Ap-Bw-Cr	-
14	**Thondigere (TDG)**	>150	7.5YR3/3,3/4,4/6 10YR3/3,4/3, 4/4,4/6	sl, scl, sc	-	Ap-Bw-C	-
Soils of Alluvial Landscape							
15	**Muttal (MTL)**	25-50	10YR3/2,3/3,4/2 7.5YR3/2,3/3,6/4	gc	15-35	Ap-Bw-Ck	e-ev
16	**Ravanaki (RNK)**	50-75	7.5YR3/2,3/3,5/2,5/31 0YR3/1,3/2,4/1, 4/2, 5/1,6/1	c	<15	Ap-Bw-Cr	e-ev
17	**Dambarahalli (DRL)**	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bw-Ck	e-es
18	**Narasapura (NSP)**	75-100	10 YR 3/1, 3/2, 4/2,	c		Ap-Bw-Cr	e-es

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of

symbols. During the survey many soil profile pits, few mini pits 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 mini pits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 35 mapping units representing 18 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 35 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one soil phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units

The 35 soil phases identified and mapped in the microwatershed were regrouped into 10 Land management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Ballary-3 microwatershed, five soil and site characteristics, namely the soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land management Units are expected to behave similarly for a given level of management.

3.5 Laboratory Characterization

Soil samples for each series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from farmer's fields in Ballary-3 microwatershed (59 samples) for fertility status (major and micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Ballary-3 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and granite gneiss				
	ABR	Abbigere soils are shallow (25-50 cm), well drained, have dark reddish brown gravelly red sandy clay to clay soils occurring on very gently sloping uplands under cultivation.		**3 (0.49)**
470		ABRbB2g2	Loamy sand surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	3 (0.49)
	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		**27(4.49)**
465		HRVcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7 (1.14)
26		HRVhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	20 (3.35)
	KGP	Kaggalipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay loam to sandy clay soils occurring on nearly level to moderately sloping uplands under cultivation		**71(11.67)**
17		KGPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	37 (6.1)
18		KGPhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	1 (0.16)
19		KGPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	33 (5.41)
	HTI	Hatti soils are moderately shallow (50-75 cm), well drained, have dark reddish brown gravelly red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**110(18.24)**
101		HTIiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	26 (4.36)
102		HTIiB2g2	Sandy clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	84 (13.88)
	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		**3 (0.48)**
69		KGHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.48)
	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		**27 (4.46)**
49		LKRhC2g3	Sandy clay loam surface, slope 3-5% moderate erosion, extremely gravelly (60-80%)	27 (4.46)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy		**11(1.82)**

		clay loam soils occurring on gently very gently to gently sloping uplands under cultivation		
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	8 (1.32)
85		MKHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	0.13 (0.02)
86		MKHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly(35-60%)	3 (0.48)
	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		**49(8.14)**
180		BDGcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	0.04 (0.01)
192		BDGiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	9 (1.56)
193		BDGiB1g2	Sandy clay surface, slope 1-3%,, slight erosion, very gravelly (35-60%)	20 (3.27)
194		BDGiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	20 (3.3)
	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 very gently sloping uplands under cultivation		**1 (0.14)**
142		GHThB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.14)
	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		**2(0.46)**
126		HDHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	2 (0.39)
128		HDHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	0.41 (0.07)
	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		**12 (1.98)**
213		JDGiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	12 (1.98)
	MNL	Mornal soils are deep (100-150 cm), well drained, have dark reddish brown to red gravelly sandy clay loam soils occurring on very gently sloping uplands under cultivation		**29 (4.87)**
209		MNLiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	29 (4.87)
	HNH	Honnenahalli soils are moderately deep (50-75 cm), moderately well drained, have brown to dark brown sandy clay soils occurring on nearly level to very gently sloping lowlands under		**10 (1.63)**

		cultivation		
464		HNHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	10 (1.63)
	TDG	Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown, black sandy clay soils occurring on nearly level to very gently sloping lowlands under cultivation		**4 (0.68)**
441		TDGmA1	Clay surface, slope 0-1%,slight erosion	4 (0.68)
Soils of alluvial landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black gravelly clay soils occurring on nearly level to gently sloping plains under cultivation		**93(15.31)**
307		MTLmB1	Clay surface, slope 1-3%, slight erosion,	62 (10.17)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	31 (5.14)
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, calcareous cracking clay black soils occurring on nearly level to very gently sloping plains under cultivation		**75(12.38)**
331		RNKiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	11 (1.87)
333		RNKmB1	Clay surface, slope 1-3%,slight erosion,	40 (6.61)
334		RNKmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	14 (2.27)
336		RNKmB2	Clay surface, slope 1-3%,, moderate erosion	10 (1.63)
	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 plains under cultivation		**18 (2.88)**
342		DRLiB2	Sandy clay surface, slope 1-3%, moderate erosion	7 (1.14)
344		DRLmA1	Clay surface, slope 0-1%,slight erosion	2 (0.3)
348		DRLmB1	Clay surface, slope 1-3%,, slight erosion	9 (1.44)
	NSP	Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**6 (0.94)**
362		NSPmB2	Clay surface, slope 1-3%,, moderate erosion	6 (0.94)
999		Rockout crops	Rock lands, both massive and bouldery with little or no soil	32(5.27)
1000		Others	Habitation & waterbody	14(2.39)

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

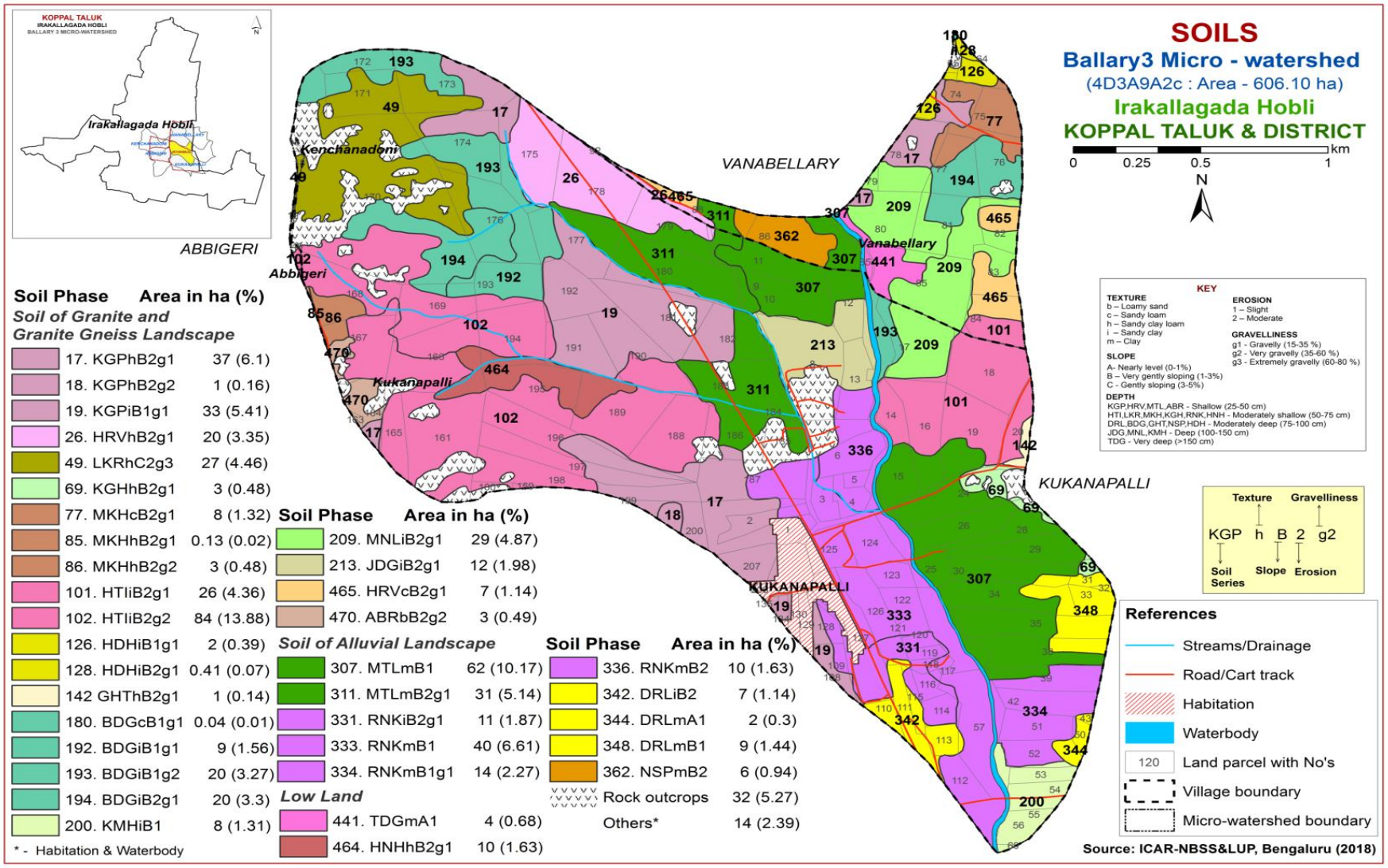


Fig 3.5 Soil Phase or Management Units- Ballary-3 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Ballary-3 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 18 soil series were 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 18 soil series identified followed by 35 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Ballary-3 microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 14 soil series were identified and mapped. Of these series, Hatti (HTI) series occupies maximum area of 110 ha (18%) followed by Kaggalipura (KGP) series 71 ha (12%). The brief description of the soil series along with the soil phases identified and mapped is given below.

4.1.1 Abbigere series (ABR): Abbigere soils are shallow (25-50 cm), well drained, have dark reddish brown, gravelly red sandy clay to clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation.

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 3 to 4. The texture is sandy clay with 20 to 35 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 2.5 to 4 and chroma 2 to 3. Its texture is sandy clay to clay with gravel content of more than 35 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 Abbigere (ABR) series

4.1.2 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 weathered 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).Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.3 Kaggalipura (KGP) Series: Kaggalipura soils are shallow (25-50 cm), well drained, have brown to dark reddish gravelly brown sandy clay loam to sandy clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands. The Kaggalipura series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Rhodustalfs.

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

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

4.1.4 Hatti (HTI) Series: Hatti soils are moderately shallow (50-75cm), well drained, have dark reddish brown, gravelly sandy clay red soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation.

The thickness of the solum ranges from 57 to 74 cm. The thickness of A horizon ranges from 16 to 20 cm. Its colour is in 5 YR hue with value and chroma 3 to 4. The texture varies from sandy loam to sandy clay loam and sandy clay with 15 to 60 per cent gravel. The thickness of B horizon ranges from 45 to 56 cm. Its colour is in 5 YR hue with value 3 and chroma 3 to 4. Texture is sandy clay with 15 to 35 per cent gravel. The available water capacity is low (50-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Hatti (HTI) Series

4.1.5 Kutegoudanahundi (KGH) Series: Kutegoudanahundi soils are moderatly shallow (50-75 cm), well drained, have brown to dark brown, gravelly 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

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

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

Landscape and soil profile characteristics of Lakkur (LKR) Series

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

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

Landscape and soil profile characteristics of Mukhadahalli (MKH) 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). Four soil phases were identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

4.1.9 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

4.1.10 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). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

4.1.11 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 weathered 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). One soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Jedigere (JDG) 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 Honnenahalli (HNH) Series: Honnenahalli soils are moderately deep (50 to 75 cm), moderately well drained, have brown to dark brown, sandy clay soils. They have developed from colluvio-alluvium and occur on nearly level to very gently sloping lowlands. The Honnenahalli series has been tentatively classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 52 to 74 cm. The thickness of A horizon ranges from 12 to 21 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 clay loam to sandy loam with 5 to 10 per cent gravel. The thickness of B horizon ranges from 45 to 62 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 and chroma 3 to 4. Its texture is sandy clay. The available water capacity is medium (100-150 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Honnenahalli (HNH) Series

4.1.14 Thondigere (TDG) Series: Thondigere soils are very deep (>150 cm), well drained, have dark brown to dark yellowish brown sandy clay loam stratified soils. They have developed from alluvio- colluvium and occur on nearly level to very gently sloping lowlands under cultivation. The Thondigere Series has been classified as a member of the fine- loamy, mixed, isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 10 YR, 5 YR and 7.5 YR hue with value 3 to 4 and chroma 4. The texture is sandy clay 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 to 4 and chroma 3 to 6. Its texture is sandy loam, sandy clay loam and sandy clay. The available water capacity is medium (101-150 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Thondigere (TDG) Series

4.2 Soils of Alluvial Landscape

In this landscape, 4 soil series were identified and mapped. Of these, Muttal (MTL) series occupies maximum area of 93 ha (15%) followed by Ravanki (RNK) 75 ha (12%). The brief description of each series along with the soil phases identified and mapped is given below.

4.2.1 Muttal (MTL) Series: Muttal soils are shallow (25-50 cm), well drained, have dark brown to very dark grayish brown, calcareous gravelly clay soils. They have developed from alluvium and occur on nearly level to very gently sloping uplands. The Muttal series has been classified as a member of the clayey, mixed, isohyperthermic (calc) family of (Paralithic) Haplustepts.

The thickness of the solum ranges from 30 to 50 cm. The thickness of A horizon ranges from 15 to 18 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 18 to 32 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay. The available water capacity is low (50-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Muttal (MTL) Series

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

The thickness of the solum ranges from 50 to 75 cm. The thickness of A horizon ranges from 15 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 35 to 60 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is clay with gravel content of <15 per

cent and are calcareous. The available water capacity is low (51-100 mm/m). Four soil phases were identified and mapped.

Landscape and Soil Profile Characteristics of Ravanaki (RNK) Series

4.2.3 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 uplands 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). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Dambarahalli (DRL) Series

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

The thickness of the solum is 76 to 98 cm. The thickness of A horizon ranges from 15 to 19 cm. Its colour is in 10 YR hue with value 3 and chroma 1 to 2.The texture is clay with no gravel. The thickness of B horizon ranges from 57 to 83 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is medium (101-150 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Narsapura (NSP) series

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

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-21	Ap	74.00	8.34	17.66	9.62	11.57	15.76	23.13	13.92	20	sl	-	-
21-35	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…

Series Name: Mukahadahalli (MKH), Pedon: R-11
Location: $15^0$22'05.4"N, $76^0$04'10.3"E, Halageri village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey-skeletal, mixed, isohyperthermic Typic Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-19	Ap	65.71	8.83	25.46	9.27	9.06	14.42	21.52	11.43	70	scl	16.54	8.60
19-32	Bt	55.89	11.13	32.98	6.47	9.18	11.89	19.19	9.18	50	scl	19.24	12.78
32-58	Bt	47.95	10.41	41.63	17.52	3.78	9.13	9.55	7.97	50	sc	24.03	16.02

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-19	7.38	-	-	0.09	0.2	0.00	8.97	4.32	0.26	0.22	13.77	14.84	0.58	93	1.49
19-32	7.5	-	-	0.106	0.41	0.00	15.98	3.27	0.16	0.50	19.91	20.88	0.63	95	2.38
32-58	7.46	-	-	0.173	0.49	0.00	19.71	4.53	0.23	1.32	25.79	25.76	0.62	100	5.11

Contd…

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…

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: 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…

Soil Series: Thondigere (TDG), Pedon: RM-24
Location: $13^0$28'21"N, $76^0$52'50"E, (4B3D3N1b), Sanabanahalli village, Gubbi taluk, Tumakuru district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine -loamy, mixed, isohyperthermic Fluventic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very 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	73.83	10.36	15.81	11.20	16.19	15.99	18.84	11.61	-	sl	-	-
17-30	A2	77.02	9.01	13.97	10.12	18.83	18.72	19.43	9.92	-	sl	-	-
30-39	A3	76.42	8.45	15.13	7.49	13.36	15.59	26.01	13.97	-	sl	-	-
39-50	Bw1	63.75	9.90	26.35	5.80	9.27	10.49	18.53	19.65	-	scl	-	-
50-71	Bw2	53.49	15.81	30.70	1.44	4.72	10.57	22.28	14.48	-	scl	-	-
71-95	Bw3	36.35	22.32	41.33	1.46	5.83	16.25	6.25	6.56	-	c	-	-
95-114	Bc1	57.96	13.88	28.16	4.39	12.35	14.18	16.94	10.10	-	scl	-	-
114 - >150	Bc2	50.16	16.94	32.91	3.64	12.90	11.34	13.11	9.16	-	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}							%	%
0-17	7.02	-	-	0.05	0.62	0.00	4.33	1.14	0.28	0.08	5.83	5.77	0.36	100.00	1.44
17-30	7.80	-	-	0.07	0.37	0.00	4.64	0.44	0.06	0.01	5.15	5.15	0.37	100.02	0.24
30-39	7.55	-	-	0.04	0.29	0.00	4.27	0.33	0.05	0.03	4.69	4.64	0.31	100.00	0.75
39-50	7.69	-	-	0.05	0.25	0.00	7.03	0.49	0.07	0.07	7.66	8.45	0.32	90.66	0.82
50-71	8.09	-	-	0.04	0.12	0.00	9.09	1.43	0.13	0.38	11.02	12.26	0.40	89.94	3.10
71-95	7.97	-	-	0.08	0.29	0.00	11.84	1.27	0.11	0.46	13.68	14.42	0.35	94.85	3.21
95-114	8.32	-	-	0.05	0.29	0.00	9.28	1.23	0.15	0.31	10.97	11.74	0.42	93.44	2.65
114 - >150	8.34	-	-	0.07	0.25	0.00	13.90	1.71	0.13	0.83	16.57	17.61	0.54	94.07	4.70

Contd…

Series Name: Muttal (MTL), Pedon: RM-13
Location: $15^0$14'30.8"N, $75^0$56'50.6"E, Gatareddihalla village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey, mixed, isohyperthermic (calc) (Paralithic) 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
0-20	Ap	39.05	13.74	47.21	3.05	5.05	8.21	14.63	8.11	15-30	c	29.95	17.94
20-34	Bwk	28.77	19.57	51.66	4.81	4.71	4.92	9.09	5.24	10	c	33.44	21.56

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	8.27	-	-	0.202	0.79	6.10	-	-	0.62	0.25	-	36.64	0.78	-	0.69
20-34	8.36	-	-	0.177	0.99	23.04	-	-	0.29	0.38	-	39.60	0.77	-	0.96

Contd…

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

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

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

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-28	8.86	-	-	0.483	0.63	15.48	-	-	0.86	6.27	-	37.00	0.64	-	16.94
28-55	8.61	-	-	1.4	0.23	13.68	-	-	0.68	12.27	-	53.20	0.81	-	23.06
55-80	8.35	-	-	4.53	0.91	11.40	-	-	0.75	28.97	-	54.80	0.76	-	52.86

Contd…

Series Name: Narsapura (NSP), Pedon: A2/RM-2

Location: $15^0$19'86.9"N, $75^0$57'86.1"E, Kavalura village, Koppal taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-29	Ap	31.32	16.52	52.16	5.51	5.40	5.51	9.83	5.08	10	c	38.86	27.64
29-52	Bw1	13.30	22.08	64.62	2.52	2.41	2.41	3.67	2.29	05	c	49.88	40.05
52-77	BW2	13.22	17.39	69.40	3.56	2.41	1.95	2.76	2.53	05	c	51.33	41.55

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}							%	%
0-29	9.16	-	-	0.615	0.23	9.36	-	-	0.72	10.98	-	51.09	0.98	-	21.49
29-52	8.69	-	-	2.01	0.5	8.64	-	-	0.55	24.42	-	60.63	0.94	-	40.27
52-77	8.52	-	-	2.68	0.46	7.68	-	-	0.50	25.65	-	60.74	0.88	-	42.24

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 35 soil map units identified in the Ballary-3 microwatershed are grouped under two land capability classes and six land capability subclasses (Fig. 5.1).

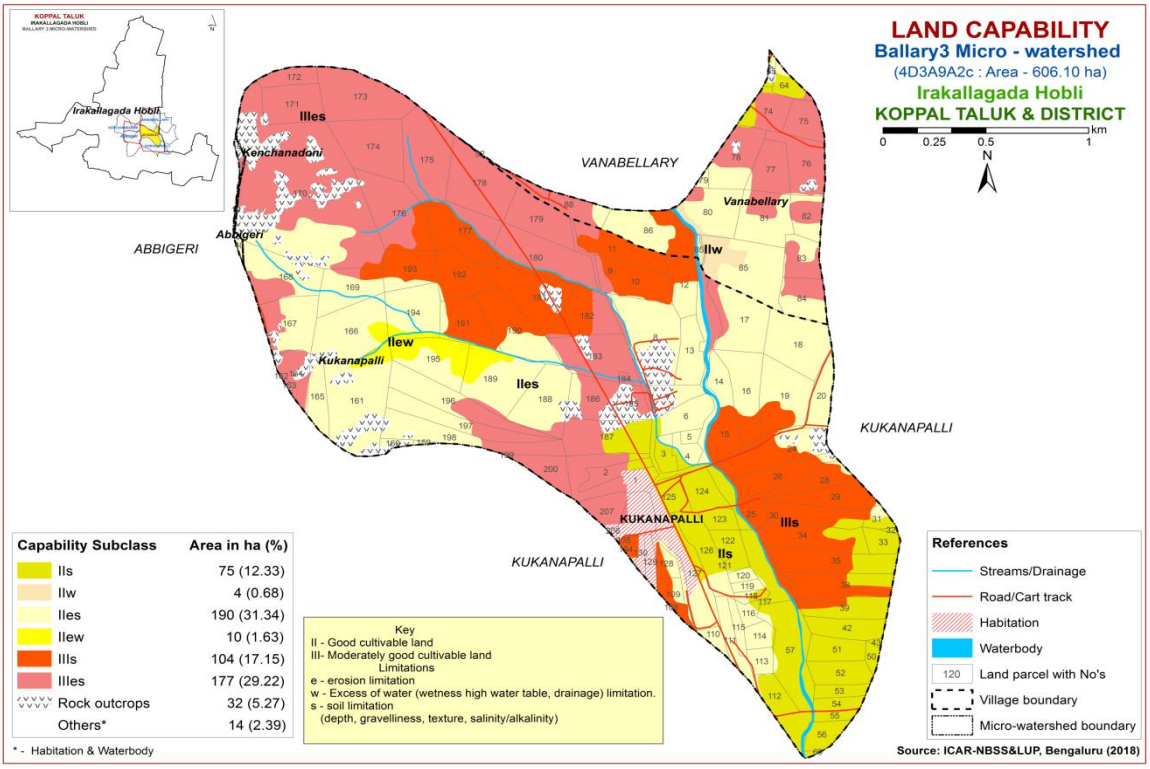


Fig. 5.1 Land Capability map of Ballary-3 Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good lands (Class II) cover an area of about 279 ha (46%) and distributed in the western, eastern, southern, central and northern part of the microwatershed with minor problems of soil, drainage and erosion. Moderately good lands (Class III) occupy an area of about 281 ha (46 %) and distributed in the major part of the microwatershed with severe limitations of soil and erosion.

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). The area extent and their geographical distribution in the microwatershed is given in Fig. 5.2.

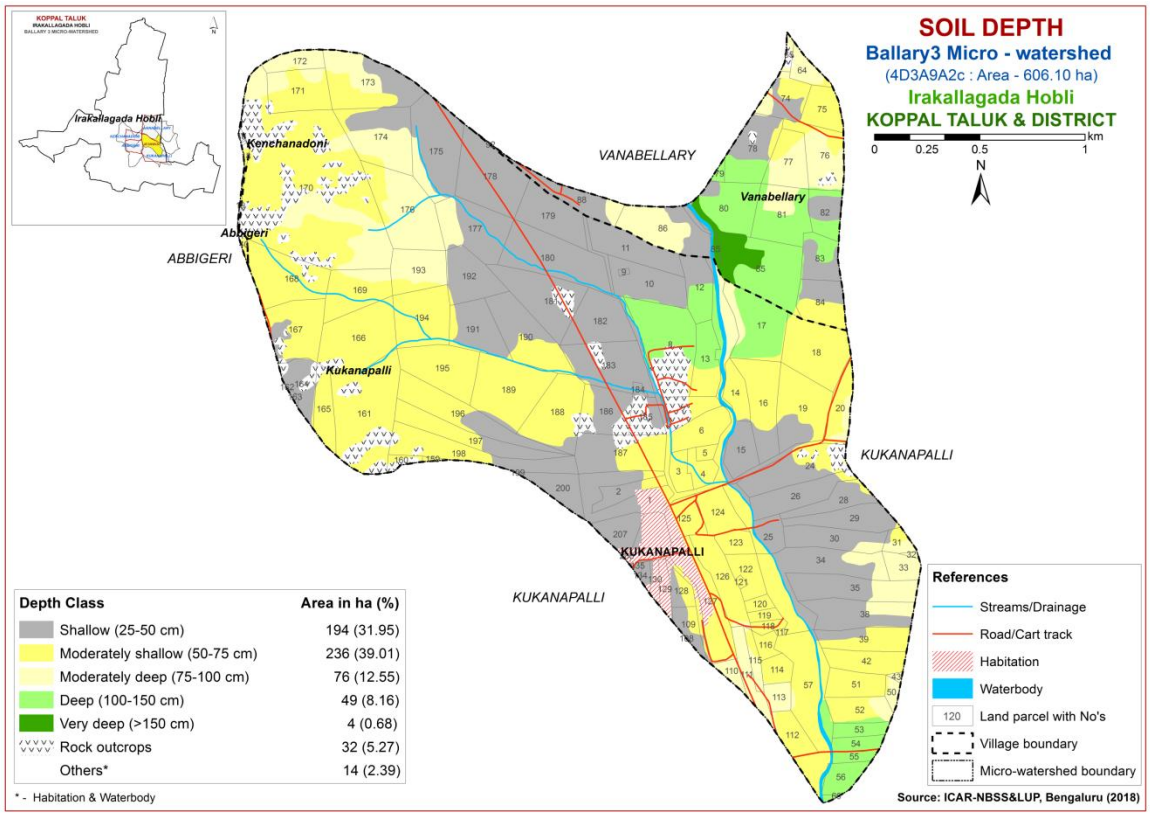


Fig. 5.2 Soil Depth map of Ballary-3 Microwatershed

An area of about 194 ha (32%) is shallow (25-50 cm) and distributed in the northern, western and eastern part of the microwatershed. Moderately shallow (50-75 cm)

soils cover a maximum area of about 236 ha (39%) and distributed in the major part of the microwatershed. Moderately deep (75-100 cm) soils occupy an area of about 76 ha (13%) and distributed in the western and northern part of the microwatershed. Deep to very deep (100- >150 cm) soils occupy an area of about 53 ha (9%) and are distributed in the northern and southern part of the microwatershed.

The most productive lands cover about 53 ha (9%) where all climatically adopted long duration crops be grown. The problem lands cover about 194 ha (32%) 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 behaviour, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Fig 5.3.

An area of about 3 ha (<1%) is sandy at the surface and distributed in the western part of the microwatershed. An area of about 117 ha (19%) is loamy at the surface and distributed in the northern, western and eastern part of the microwatershed. Clayey soils cover an area of about 440 ha (73%) and are distributed in the major part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (73 %) 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 are loamy (19%) 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 <1 per cent area that has moisture and nutrient constraints.

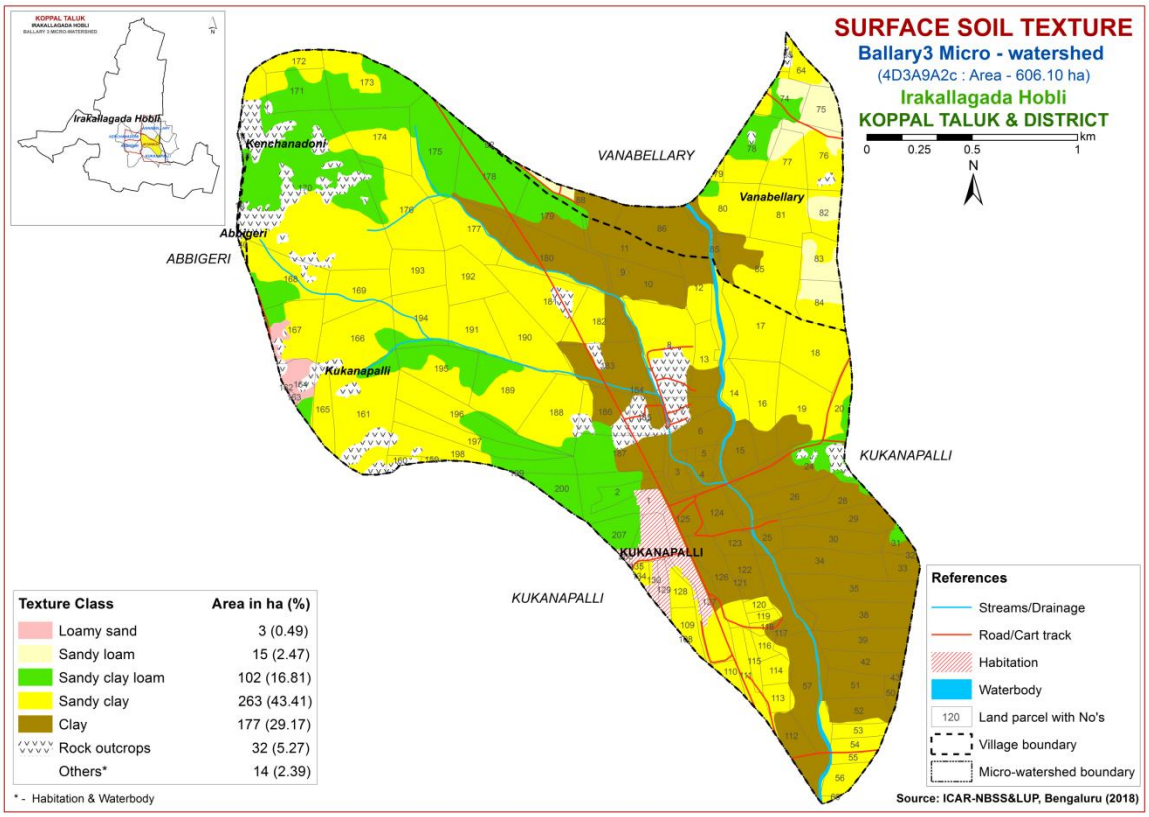


Fig. 5.3 Surface Soil Texture map of Ballary-3 Microwatershed

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover an area of about 147 ha (24%) and distributed in the southern, central and northern part of the microwatershed. Maximum area of about 275 ha (45 %) is covered by gravelly (15-35% gravel) soils and are distributed in the major part of the microwatershed. Very gravelly (35-60%) soils cover an area of about 111 ha (18%) and distributed in the northern and northwestern part of the microwatershed. Extremely gravelly (60-80%) soils occupy 27 ha (4%) and distributed in the northwestern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 24 per cent. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem soils that are very gravelly (35-

60%) to extremely gravelly (60-80%) where only short duration crops can be grown cover about 22 per cent.

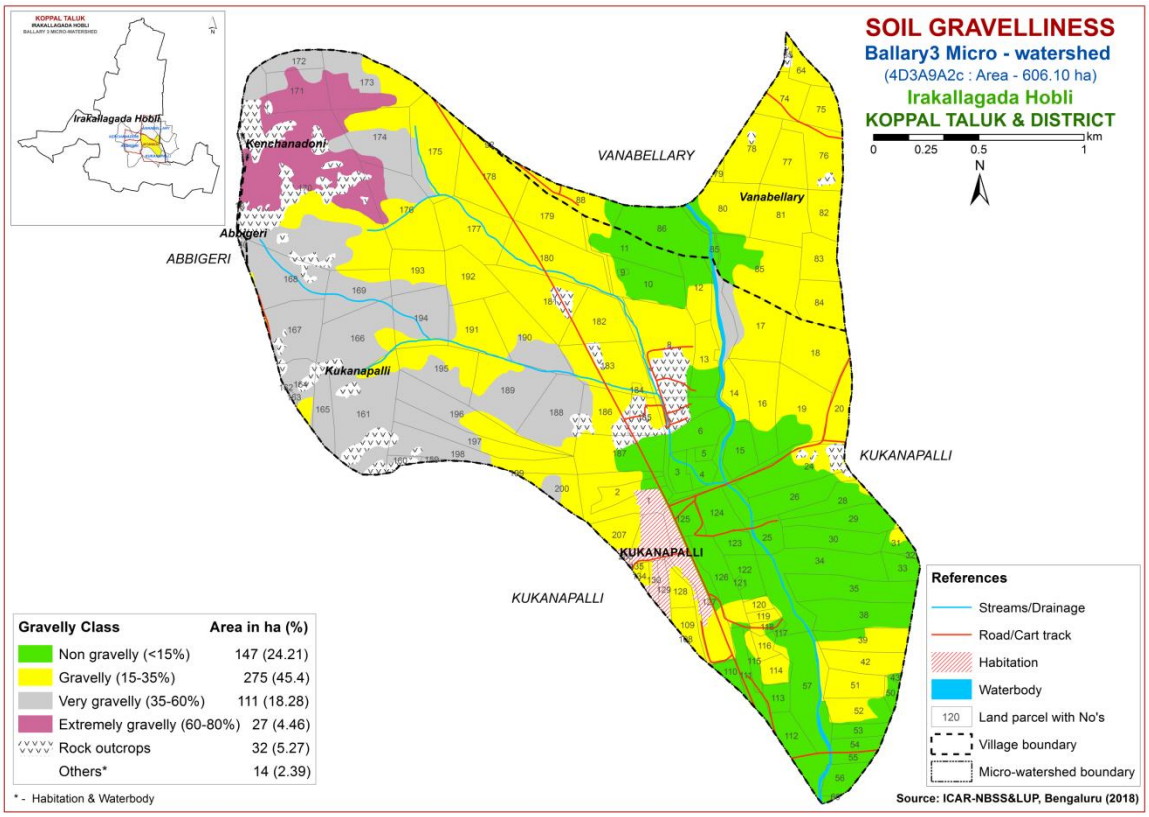


Fig. 5.4 Soil Gravelliness map of Ballary-3 Microwatershed

5.5 Available Water Capacity

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

An area of about 191 ha (32 %) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the western, northern and northeastern part of the microwatershed. Maximum area of about 292 ha (48 %) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 77 ha (13 %) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the southern and eastern part of the microwatershed.

An area of about 191 ha (32 %) 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.

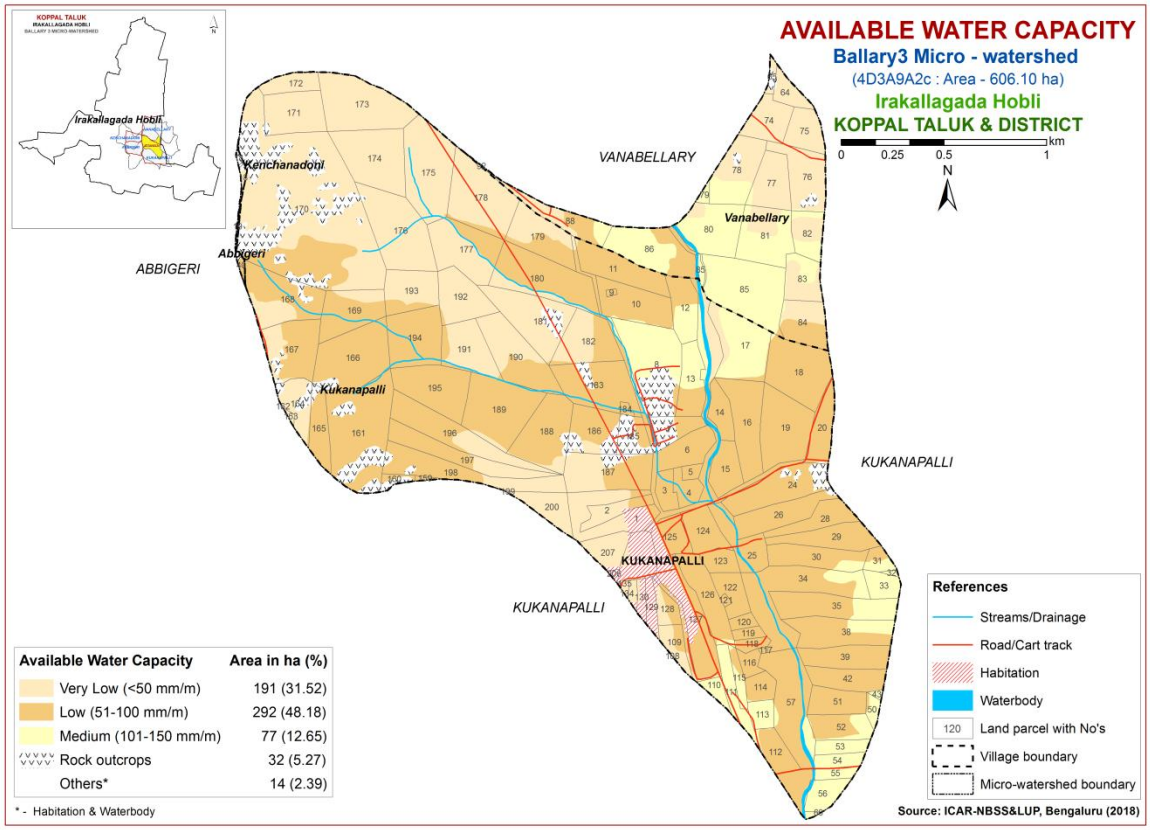


Fig. 5.5 Soil Available Water Capacity map of Ballary-3 Microwatershed

5.6 Soil Slope

Soil slope refers to the inclination of the surface of the land. It is defined by gradient, shape and length, and is an integral feature of any soil as a natural body. Slope is considered important in soil genesis, land use and land development. The length and gradient of slope influences the rate of runoff, infiltration, erosion and deposition. The soil map units were grouped into three 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).

An area of about 6 ha (<1 %) falls under nearly level (0-1% slope) lands and distributed in the northern and southeastern part of the microwatershed. Very gently sloping (1-3%) lands cover a maximum area of about 527 ha (87 %) and distributed in the major part of the microwatershed. Gently sloping (3-5%) lands cover an area of about 27 ha (4%) and distributed in the northwestern 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, except an area of about 27 ha(4%) which need appropriate soil and water conservation measures.

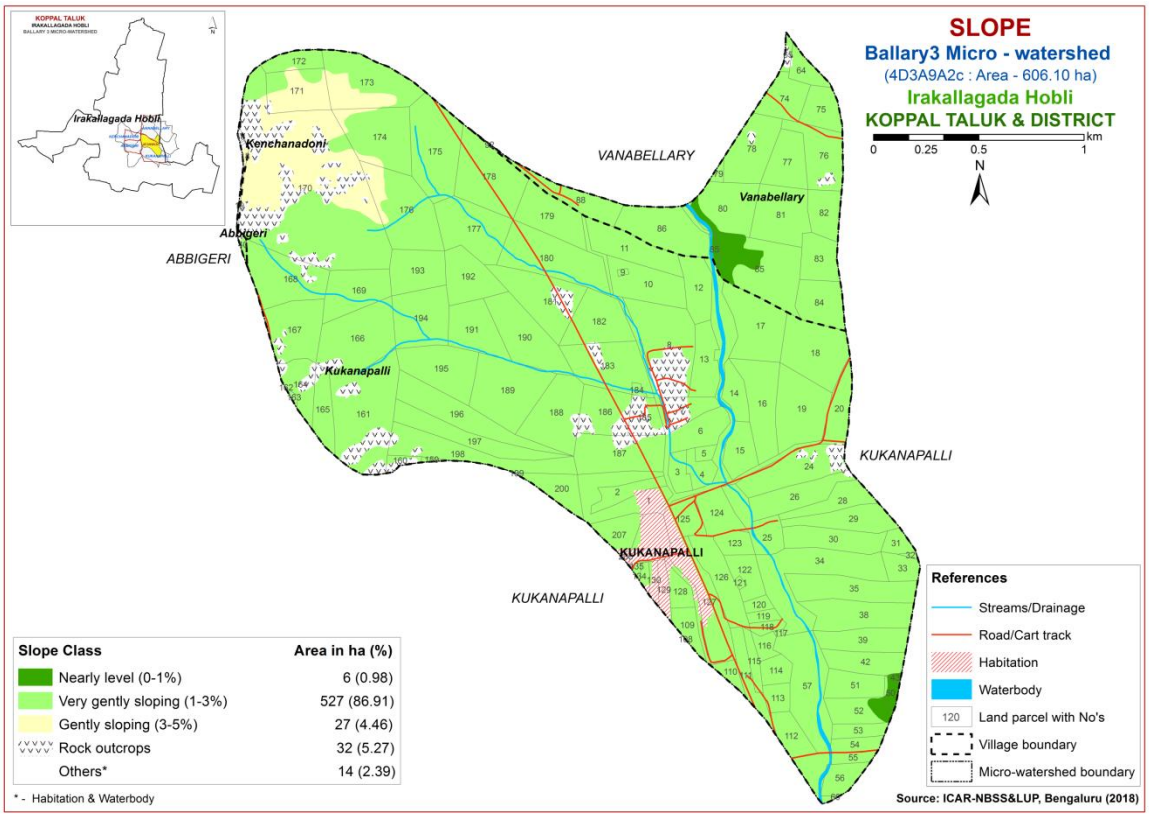


Fig. 5.6 Soil Slope map of Ballary-3 Microwatershed

5.7 Soil Erosion

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

Slightly eroded lands cover an area of about 203 ha (33%) and distributed in the eastern, southern, northern and central part of the microwatershed. Maximum area of about 357 ha (59 %) is moderately eroded (e2 class) and 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.

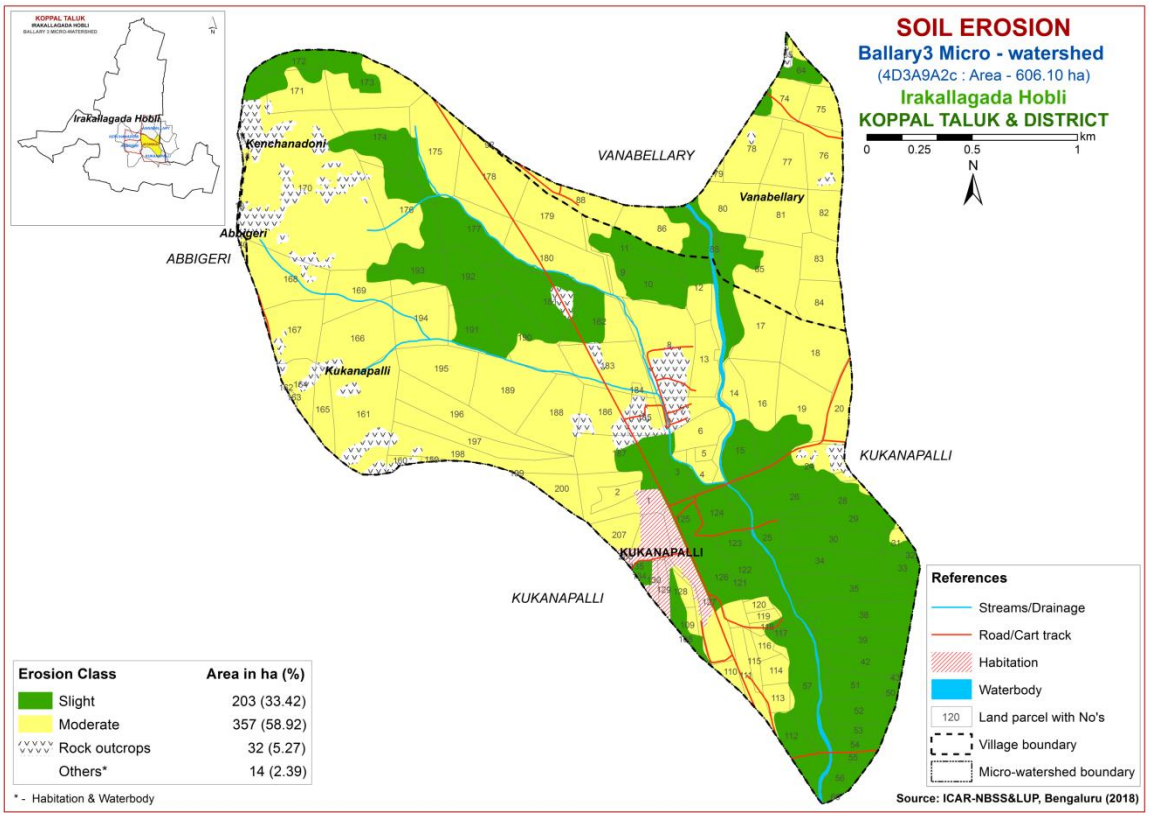


Fig. 5.7 Soil Erosion map of Ballary-3 Microwatershed

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 Ballary-3 microwatershed for soil reaction (pH) showed that strongly to moderately (pH 5.0-6.0) acid soils cover an area of about 22 ha (4%) and distributed in the northern part of the microwatershed. Slightly acid soils (pH 6.0-6.5) cover an area of about 94 ha (15%) and distributed in the northwestern part of the microwatershed. Neutral soils (pH 6.5-7.3) cover a maximum area of about 251 ha (41%) and distributed in the major part of the microwatershed. An area of about 142 ha (23%) is slightly to moderately alkaline (pH 7.3-8.4) and is distributed in the southern, eastern and central part of the microwatershed. Strongly alkaline (pH 8.4-9.0) soils cover an area of about 52 ha (9%) and are distributed in the southern part of the microwatershed (Fig.6.1). Thus, major portion of the soils in the microwatershed is neutral to alkaline in reaction.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available nitrogen) is high (>0.75%) in the entire area microwatershed area (Fig.6.3).

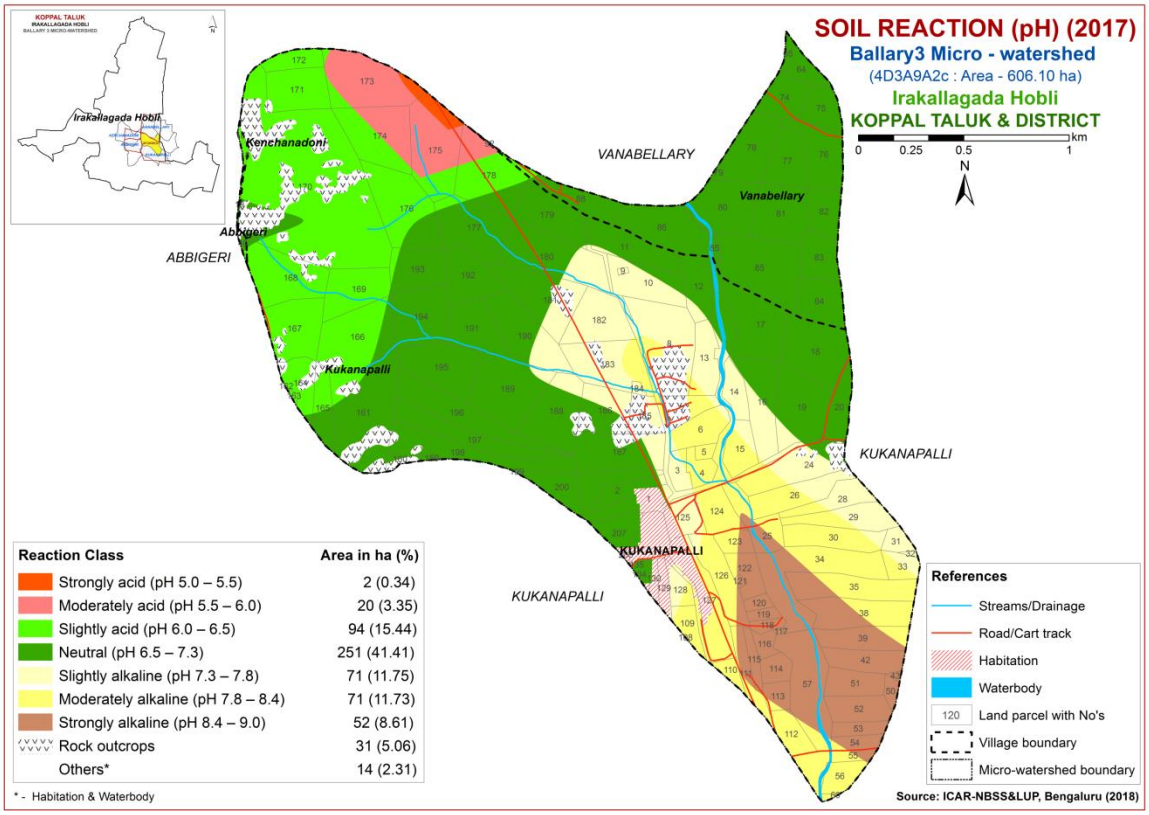


Fig.6.1 Soil Reaction (pH) map of Ballary-3 Microwatershed

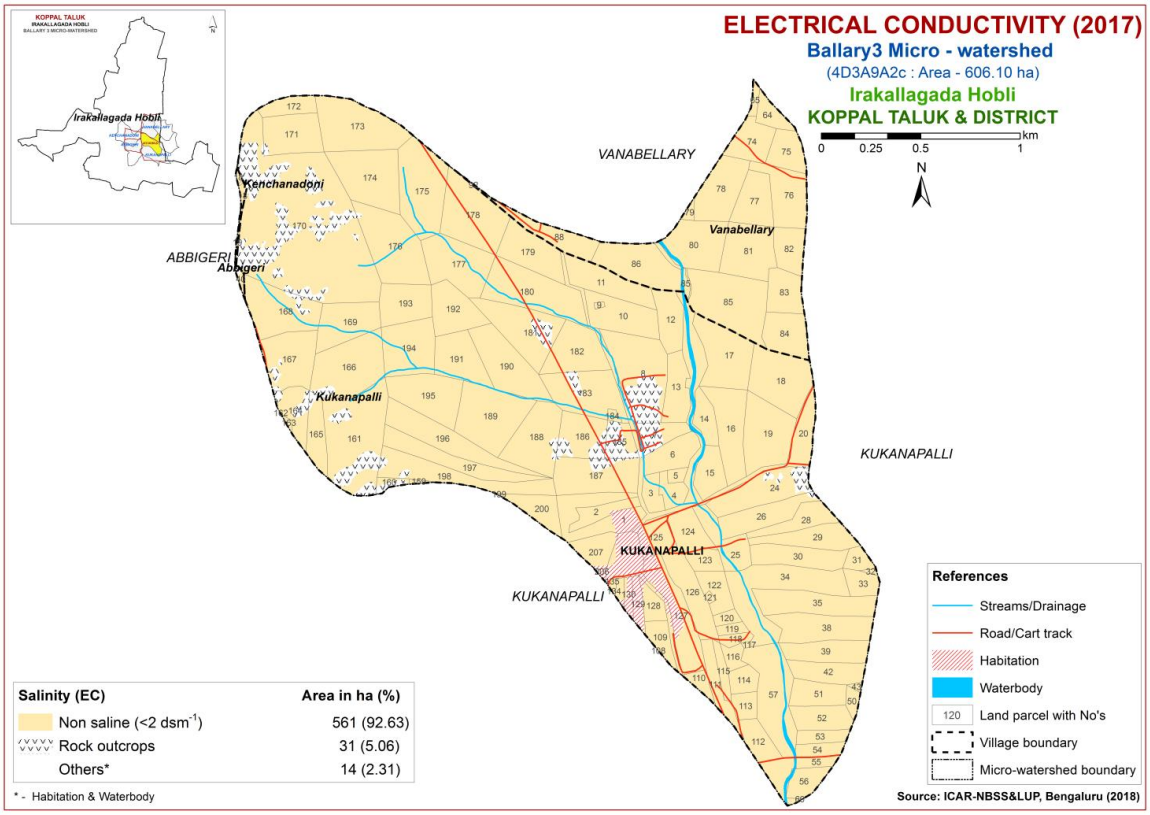


Fig.6.2 Electrical Conductivity (EC) map of Ballary-3 Microwatershed

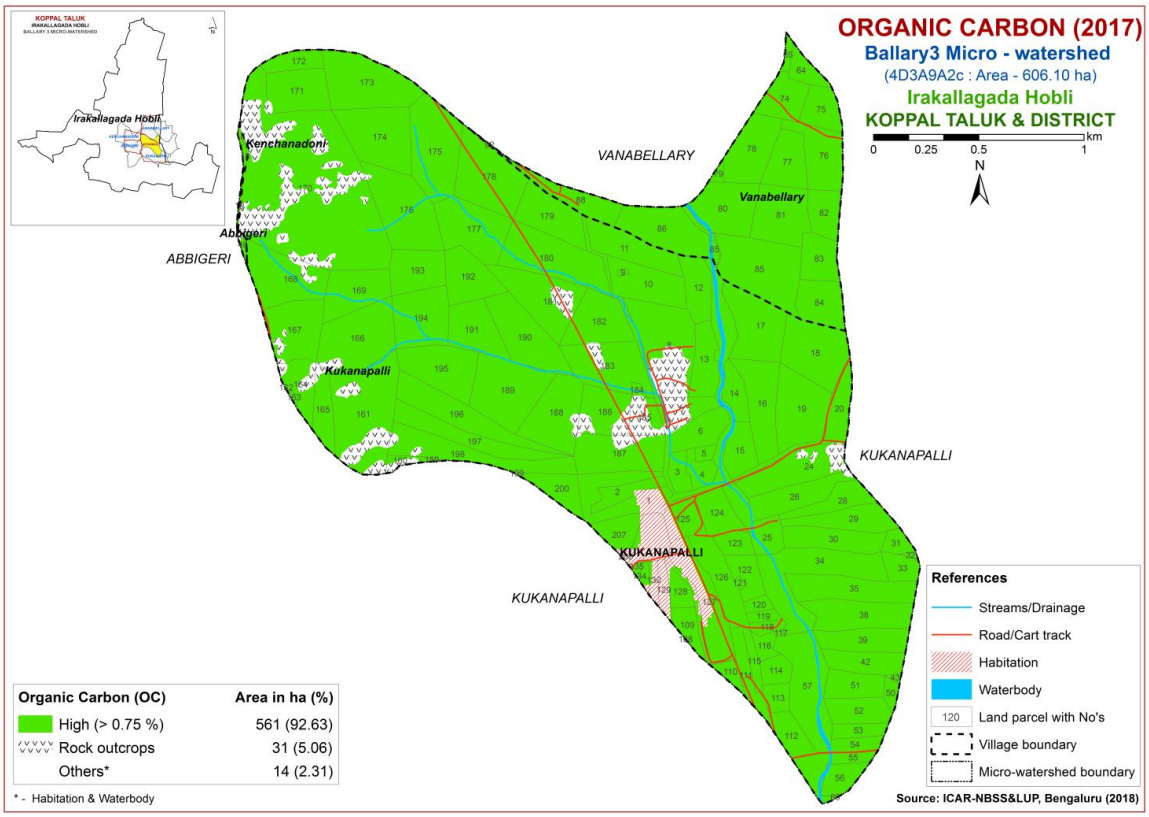


Fig.6.3 Soil Organic Carbon map of Ballary-3 Microwatershed

6.4 Available Phosphorus

An area of about 121 ha (20 %) is medium (23-57 kg/ha) in available phosphorus and distributed in the southern and central part of the microwatershed. Maximum area of about 441 ha (73%) is high (>57 kg/ha) and distributed in the major part of the microwatershed. The areas with high phosphorus content reduce 25 per cent from the recommended dose 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

An area of about 22 ha (4%) is low in available potassium and distributed in the western part of the microwatershed. Maximum area of about 409 ha (68 %) is medium (145-337 kg/ha) in available potassium content and distributed in the major part of the microwatershed. An area of about 130 ha (21%) is high in available potassium content and distributed in the northern, western and central part of the microwatershed. The areas with high potassium content reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium (Fig 6.5).

6.6 Available Sulphur

Soil analysis of available sulphur content in Ballary-3 microwatershed showed that a maximum area of about 483 ha (80 %) is low and distributed in the major part of

the microwatershed. An area of about 79 ha (13%) is medium (10-20 ppm) in available sulphur content and distributed in the southern part of the microwatershed. An area of about <1 ha (< 1%) is high (>20ppm) in available sulphur and distributed in the southwestern 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 in Ballary-3 microwatershed is low (< 0.5ppm) in a maximum area of about 556 ha (92%) and distributed in the major part of the microwatershed. An area of about 6 ha (<1%) is medium in available boron and distributed in the northern part microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content in the soils of the Ballary-3 microwatershed is deficient (<4.5 ppm) in an area of about 378 ha (62 %) and distributed in the major part. An area of about 184 ha (30%) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the northeastern, northern and northwestern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of about 127 ha (21%) and distributed in the western, southern and southeastern part of the microwatershed. It is sufficient (>0.6 ppm) in a maximum area of about 435 ha (72%) and distributed in the major part of the microwatershed (Fig 6.11).

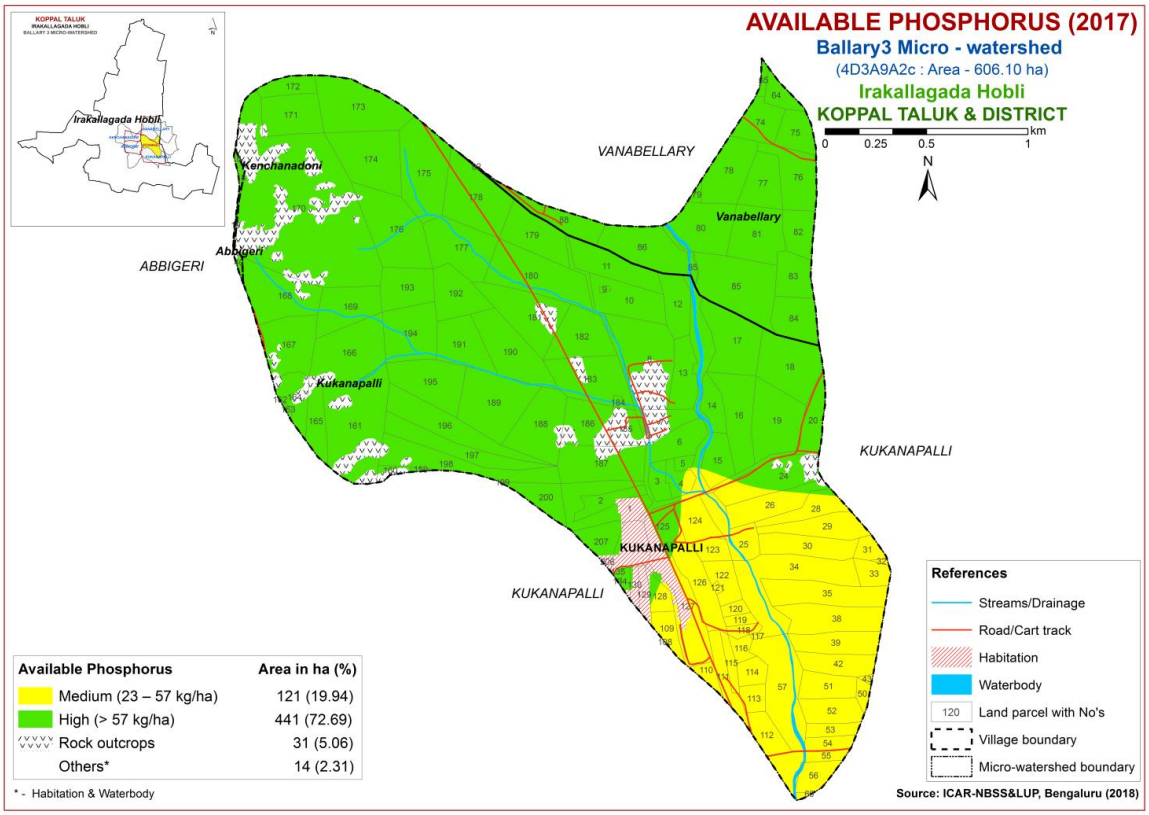


Fig.6.4 Soil Available Phosphorus map of Ballary-3 Microwatershed

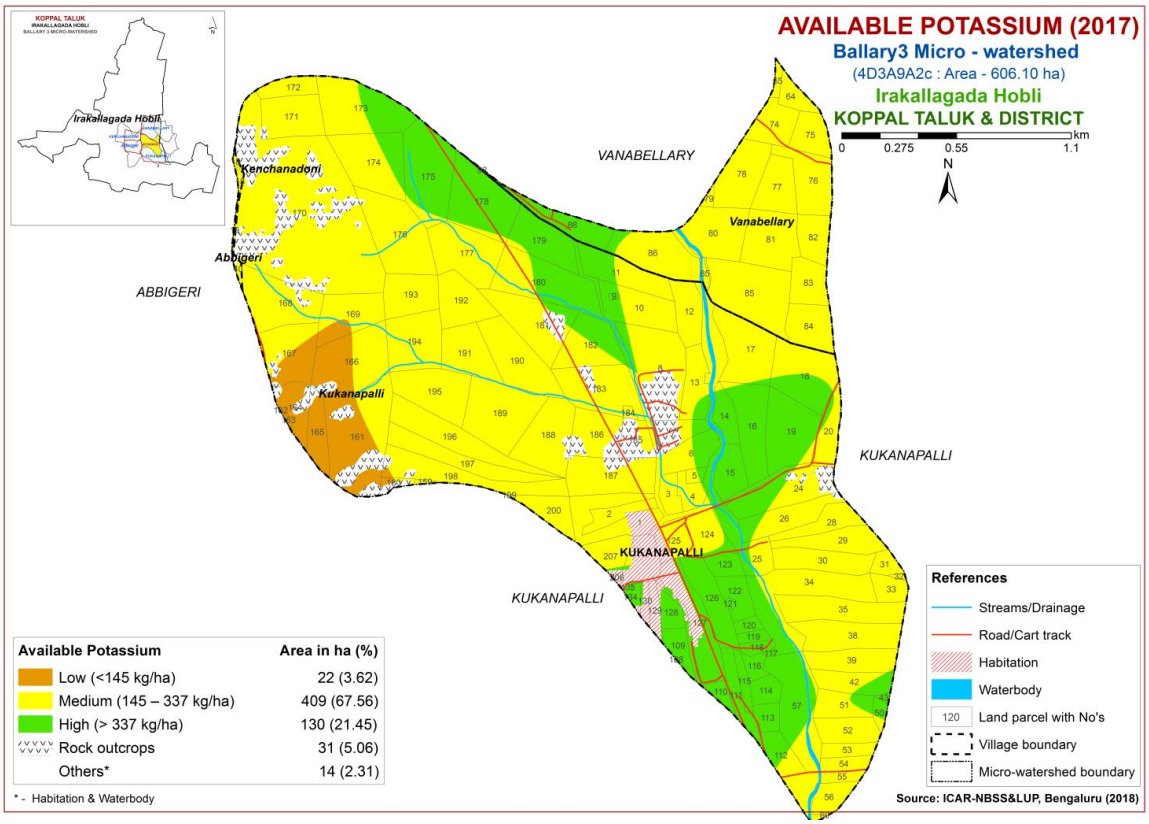


Fig.6.5 Soil Available Potassium map of Ballary-3 Microwatershed

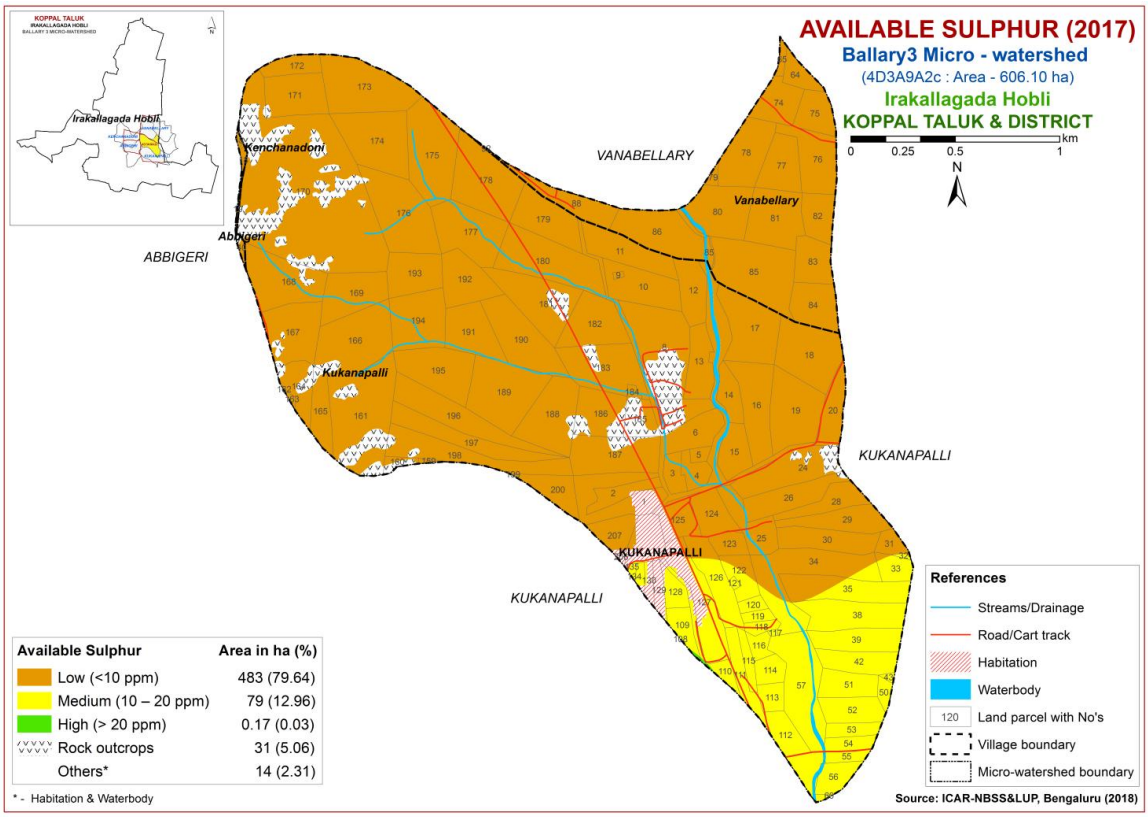


Fig.6.6 Soil Available Sulphur map of Ballary-3 Microwatershed

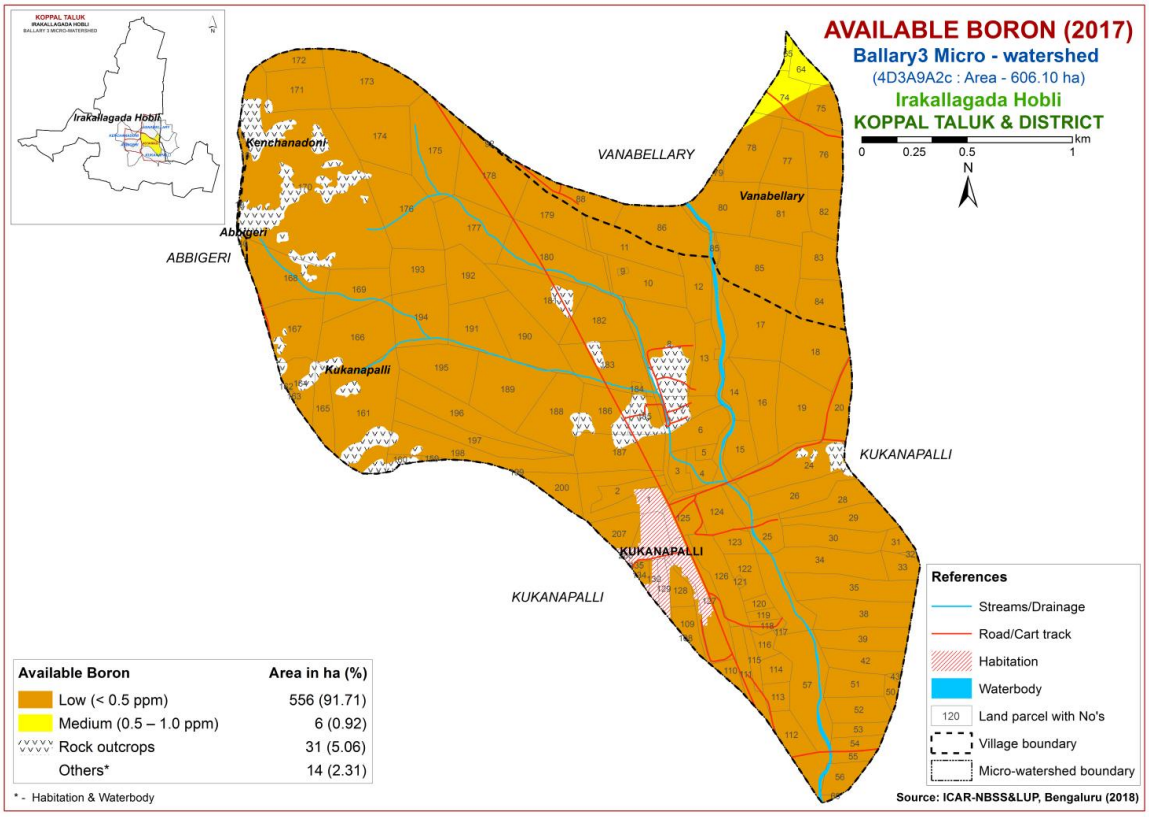


Fig.6.7 Soil Available Boron map of Ballary-3 Microwatershed

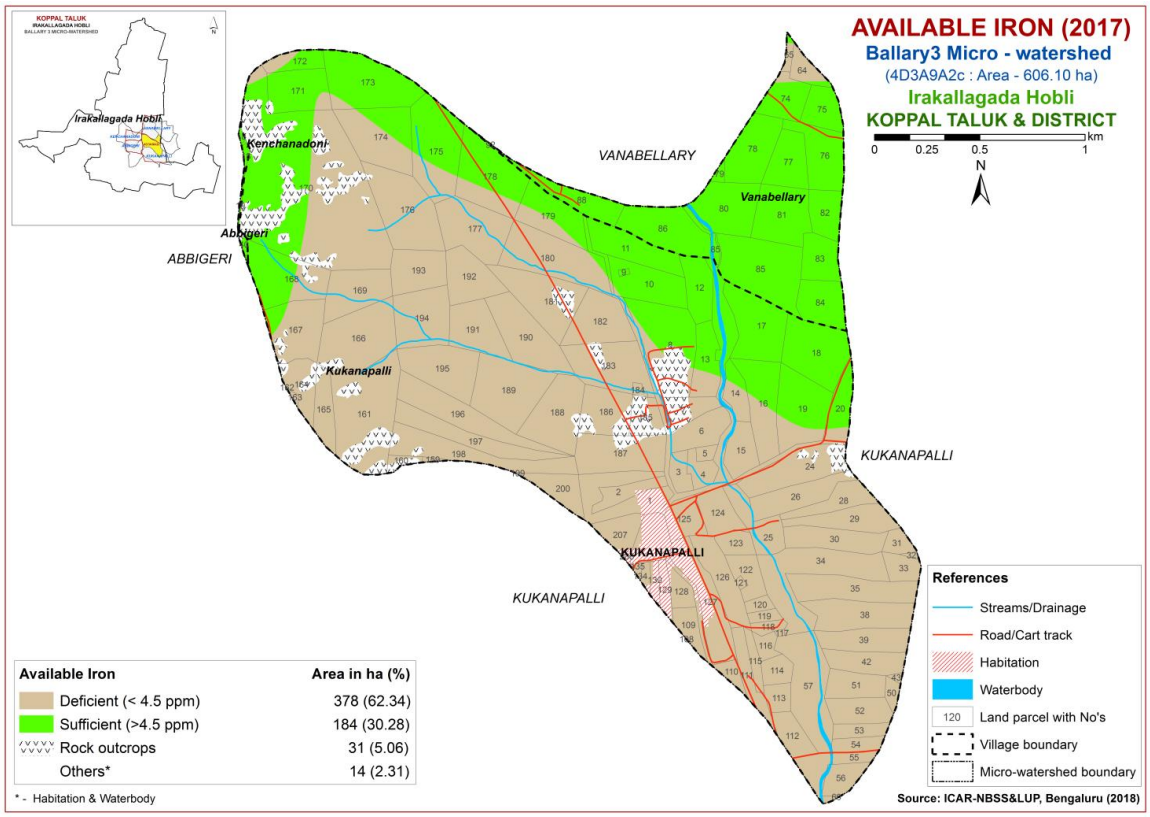


Fig.6.8 Soil Available Iron map of Ballary-3 Microwatershed

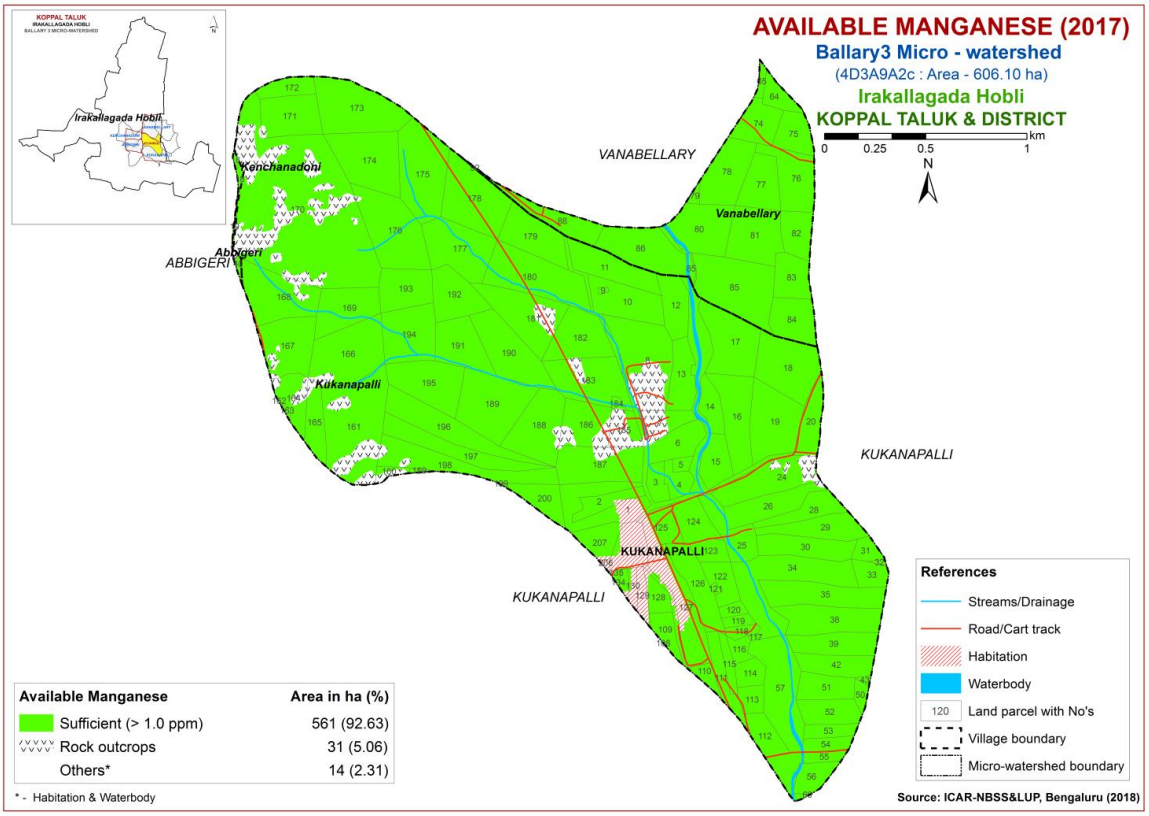


Fig.6.9 Soil Available Manganese map of Ballary-3 Microwatershed

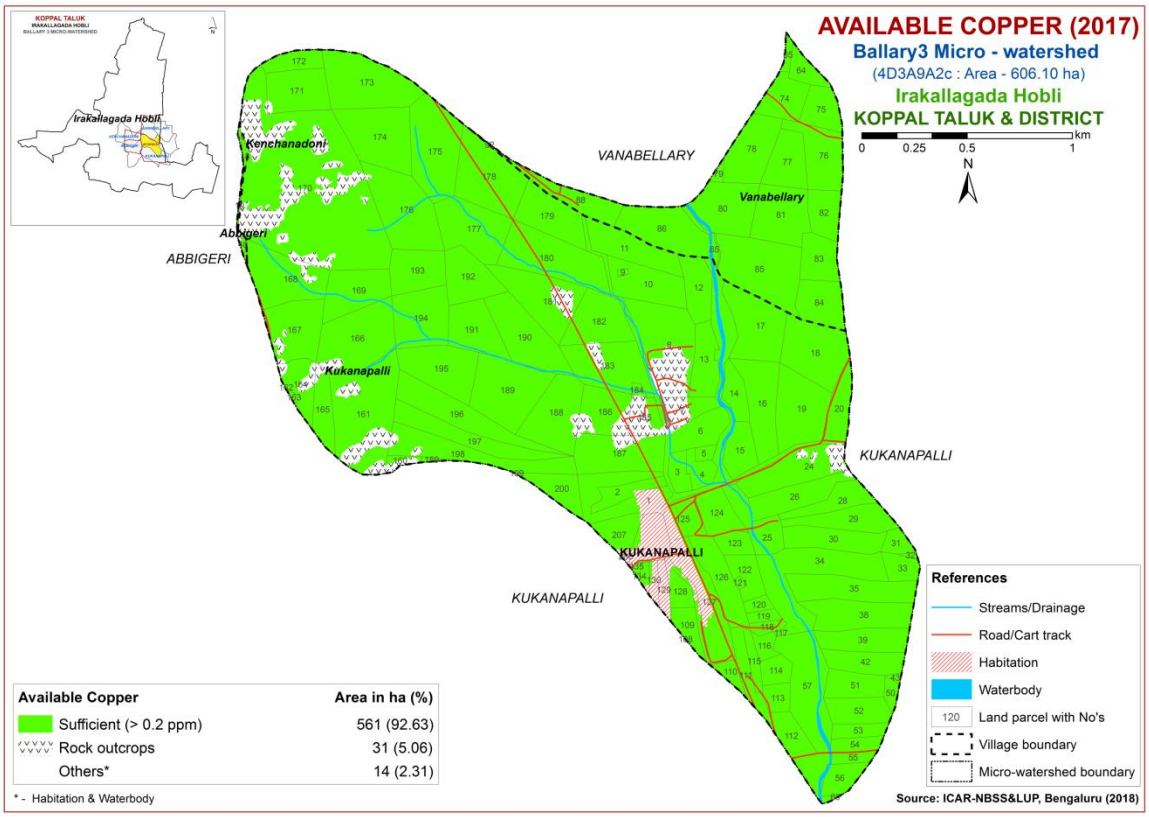


Fig.6.10 Soil Available Copper map of Ballary-3 Microwatershed

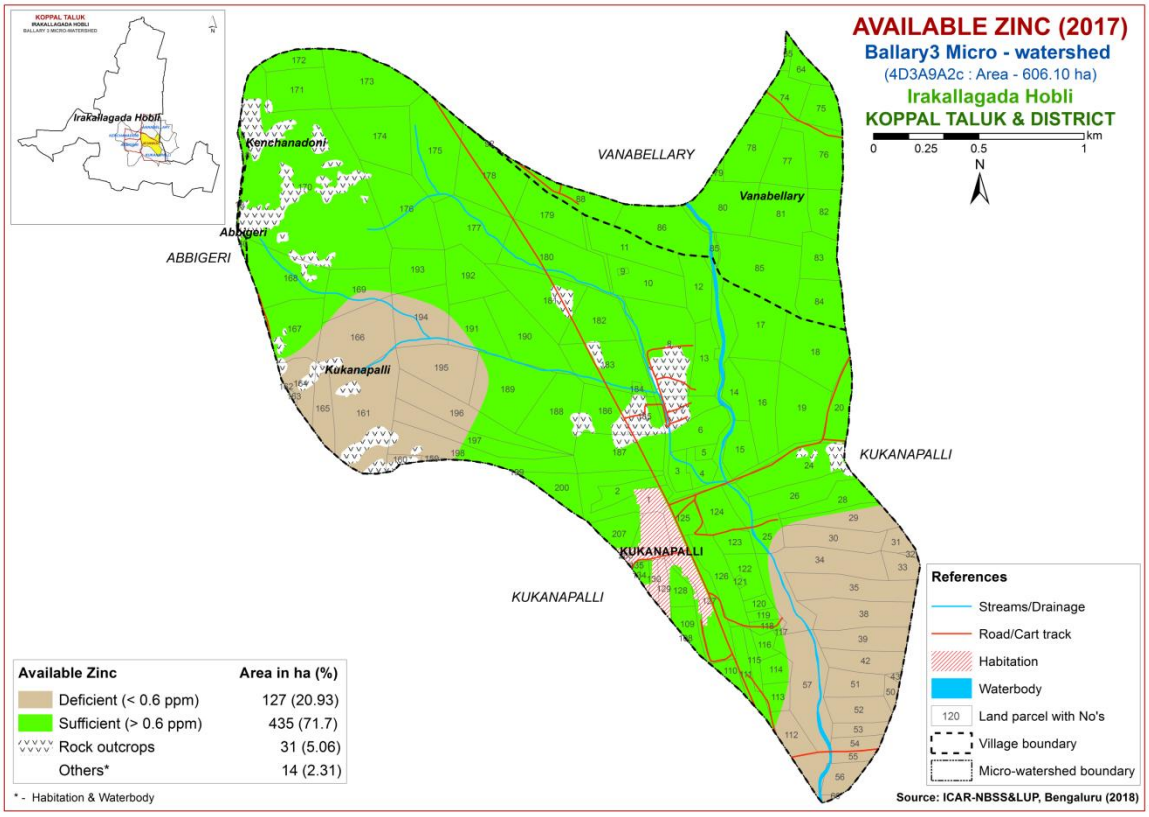


Fig.6.11 Soil Available Zinc map of Ballary-3 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Ballary-3 microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1- Highly Suitable, Class S2- Moderately Suitable and Class S3- Marginally Suitable. Order N has two Classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 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 crops 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 14 ha (2 %) for growing sorghum and occur in the southern and northern part of the microwatershed. Maximum area of about 269 ha (44 %) is moderately suitable (Class S2) for growing sorghum and

Table 7.1 Soil-Site Characteristics of Ballary-3 Microwatershed

Soil Map Units	Climate (P)(mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surface	Subsurface	Surface	Subsurface								
ABRbB2g2	662	<90	WD	25-50	ls	sc-c	35-60	>35	<50	1-3	moderate	-	-	-	-	-
HRVcB2g1	662	<90	WD	25-50	sl	gscl	15-35	>35	<50	1-3	moderate	-	-	-	-	
HRVhB2g1	662	<90	WD	25-50	scl	gscl	15-35	>35	<50	1-3	moderate	-	-	-	-	
KGPhB2g1	662	<90	WD	25-50	scl	gscl-gsc	15-35	15-35	51-100	1-3	moderate	-	-	-	-	
KGPhB2g2	662	<90	WD	25-50	scl	gscl-gsc	35-60	15-35	51-100	1-3	moderate	-	-	-	-	
KGPiB1g1	662	<90	WD	25-50	sc	gscl-gsc	15-35	15-35	51-100	1-3	slight	-	-	-	-	
HTIiB2g1	662	<90	WD	50-75	sc	gsc	15-35	15-35	51-100	1-3	moderate	-	-	-	-	
HTIiB2g2	662	<90	WD	50-75	sc	gsc	35-60	15-35	51-100	1-3	moderate	-	-	-	-	
KGHhB2g1	662	<90	WD	50-75	scl	scl	15-35	15-35	101-150	1-3	moderate	-	-	-	-	
LKRhC2g3	662	<90	WD	50-75	scl	gsc	60-80	40-60	51-100	3-5	moderate	8.18	0.30	4.51	12.19	100
MKHcB2g1	662	<90	WD	50-75	sl	gscl	15-35	>35	51-100	1-3	moderate	7.38	0.09	1.49	14.84	93
MKHhB2g1	662	<90	WD	50-75	scl	gscl	15-35	>35	51-100	1-3	moderate	7.38	0.09	1.49	14.84	93
MKHhB2g2	662	<90	WD	50-75	scl	gscl	35-60	>35	51-100	1-3	moderate	7.38	0.09	1.49	14.84	93
BDGcB1g1	662	<90	WD	75-100	sl	gc	15-35	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BDGiB1g1	662	<90	WD	75-100	sc	gc	15-35	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BDGiB1g2	662	<90	WD	75-100	sc	gc	35-60	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BDGiB2g1	662	<90	WD	75-100	sc	gc	15-35	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	52.56
GHThB2g1	662	<90	WD	75-100	scl	gscl	15-35	15-35	100-150	1-3	moderate	5.70	0.06	4.10	3.17	73
HDHiB1g1	662	<90	WD	75-100	sc	gsc-gc	15-35	>35	51-100	1-3	slight	6.54	0.07	7.11	0.48	84
HDHiB2g1	662	<90	WD	75-100	sc	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	0.48	84
JDGiB2g1	662	<90	WD	100-150	sc	sc-c	15-35	<15	>200	1-3	moderate	-	-	-	-	-
MNLiB2g1	662	<90	WD	100-150	sc	gscl	15-35	15-35	101-150	1-3	moderate	7.89	0.13	5.04	9.01	101
HNHhB2g1	662	<90	MWD	50-75	scl	sc	15-35	-	101-150	1-3	moderate	-	-	-	-	-
TDGmA1	662	<90	MWD	>150	c	scl	-	-	101-150	0-1	slight	-	-	-	-	-
MTLmB1	662	<90	WD	25-50	c	gc	-	15-35	51-100	1-3	slight	8.27	0.20	0.69	36.64	-
MTLmB2g1	662	<90	WD	25-50	c	gc	15-35	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
RNKiB2g1	662	<90	MWD	50-75	c	c	15-35	<15	51-100	1-3	moderate	8.86	0.48	16.94	37	-

Soil Map Units	Climate (P)(mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surface	Subsurface	Surface	Subsurface								
RNKmB1	662	<90	MWD	50-75	c	c	-	<15	51-100	1-3	slight	8.86	0.48	16.94	37	-
RNKmB1g1	662	<90	MWD	50-75	c	c	15-35	<15	51-100	1-3	slight	8.86	0.48	16.94	37	-
RNKmB2	662	<90	MWD	50-75	c	c	-	<15	51-100	1-3	moderate	8.86	0.48	16.94	37	-
DRLiB2	662	<90	MWD	75-100	sc	c	-	<15	151-200	1-3	moderate	-	-	-	-	-
DRLmA1	662	<90	MWD	75-100	c	c	-	<15	151-200	0-1	slight	-	-	-	-	-
DRLmB1	662	<90	MWD	75-100	c	c	-	<15	151-200	1-3	slight	-	-	-	-	-
NSPmB2	662	<90	MWD	75-100	c	c	-		101-150	1-3	moderate	9.16	0.61	21.49	51.09	-

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

distributed in the major part of the microwatershed with minor limitations of calcareousness, nutrient availability, texture, drainage, rooting depth and gravelliness. An area of about 250 ha (41 %) is marginally suitable (Class S3) and distributed in the eastern, northern and western part of the microwatershed. They have moderate limitations of gravellines, rooting depth, calcareousness and texture. Area currently not suitable (Class N1) for growing sorghum cover about 27 (4%) and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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

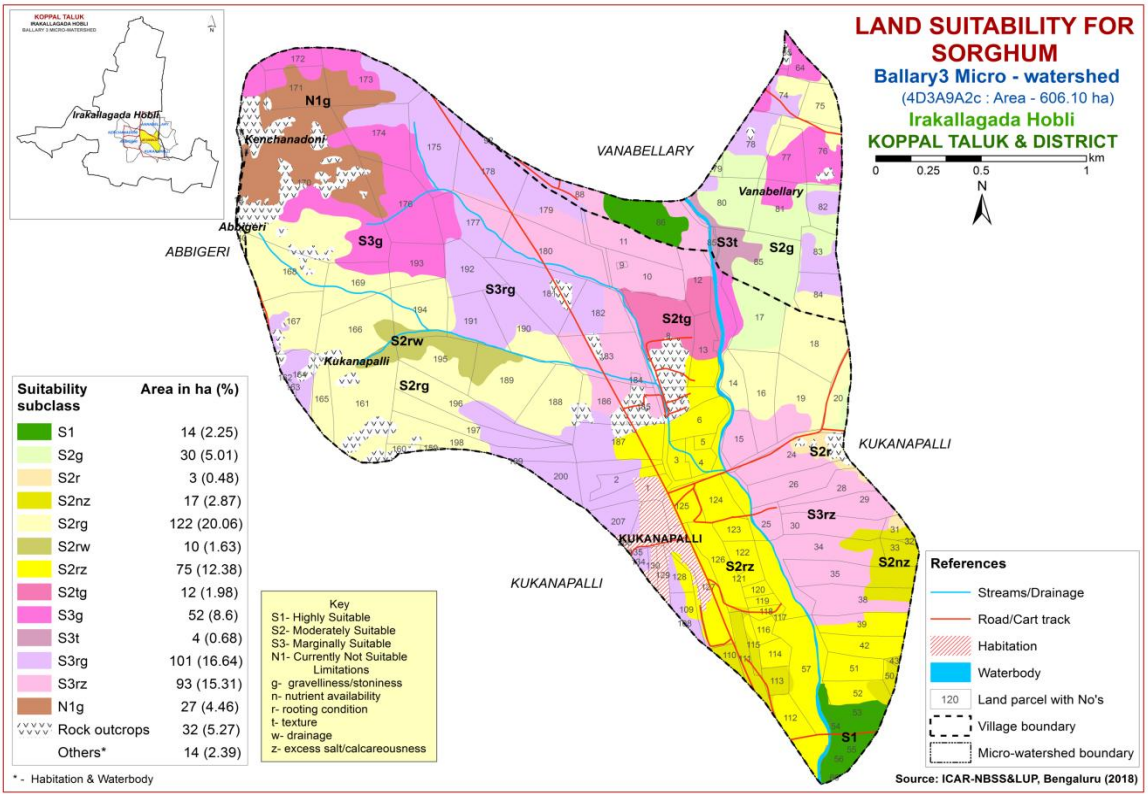


Fig. 7.1 Land Suitability map of Sorghum

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 are 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	

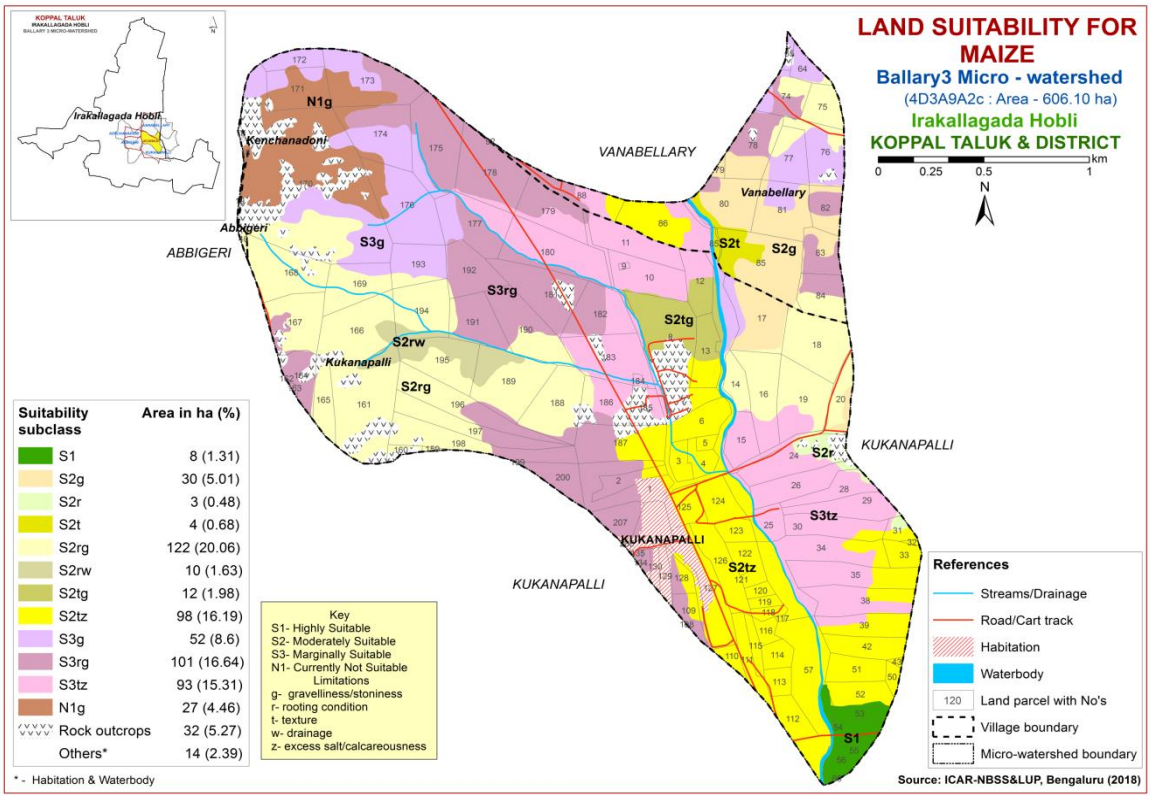


Fig. 7.2 Land Suitability map of Maize

Highly suitable (Class S1) lands occupy an area of about 8 ha (1 %) for growing maize and distributed in the southern part of the microwatershed. An area of about 279 ha (46 %) is moderately suitable (Class S2) and distributed in the major part of the microwatershed with minor limitations of calcareousness, rooting depth, texture, drainage and gravelliness. Marginally suitable (Class S3) lands cover an area of about 246 ha (41%) and occur in the eastern, northern and western part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture and calcareousness. Area currently not suitable (Class N1) for growing maize cover about 27 (4%) and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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 a land suitability map for growing bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

Highly suitable (Class S1) lands occupy an area of about 50 ha (8 %) for growing bajra and occur in the southern and northeastern part of the microwatershed. An area of about 239 ha (40 %) is moderately suitable (Class S2) for growing bajra and distributed in the western, southern and central part of the microwatershed with minor limitations of texture, rooting depth, calcareousness, drainage and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 270 ha (45 %) and occur in the major major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth and calcareousness.

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	35-60	60-80	-
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

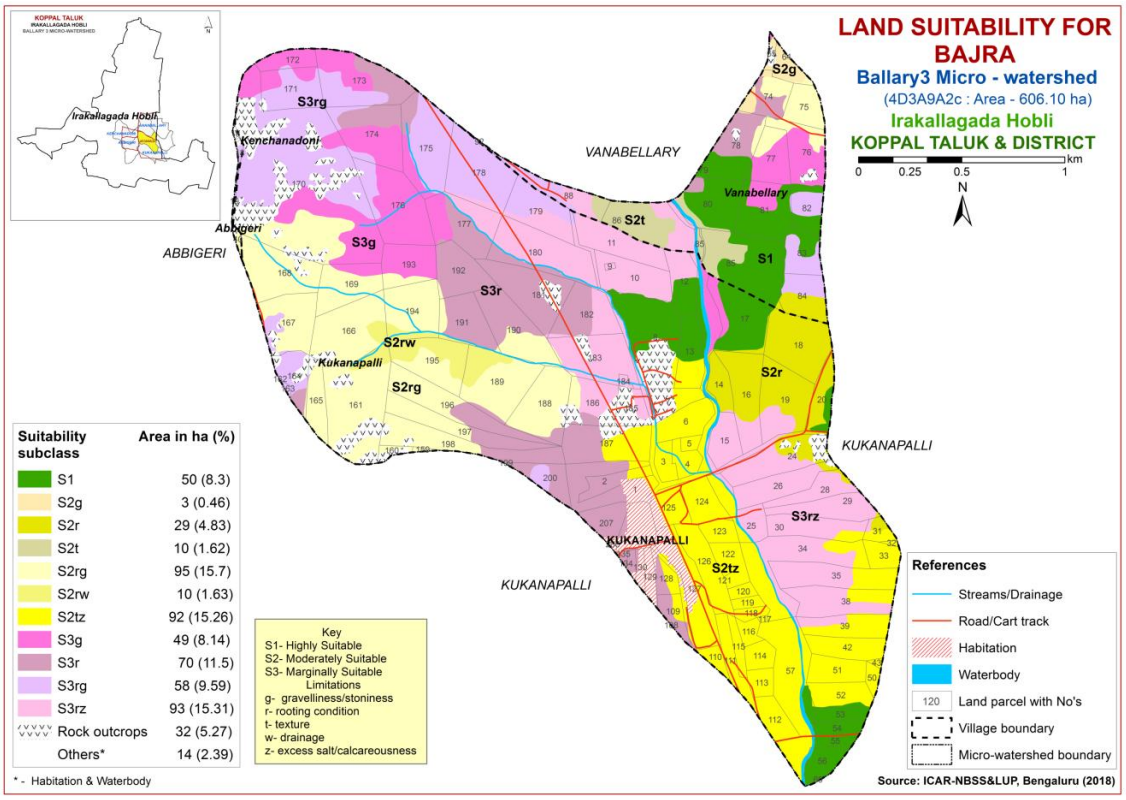


Fig. 7.3 Land Suitability map of Bajra

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.

An area of about 8 ha (1%) is highly suitable (Class S1) for growing redgram and distributed in the southern part of the microwatershed. An area of about 50 ha (8 %) is moderately suitable (Class S2) for growing redgram and occur in the northeastern part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth and calcareousness. Marginally suitable lands (Class S3) occupy maximum area of about 281 ha (46 %) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness, texture, drainage and calcareousness. Area currently not suitable (Class N1) for growing redgram cover about 221 (36%) and distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

Table 7.5 Crop 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	

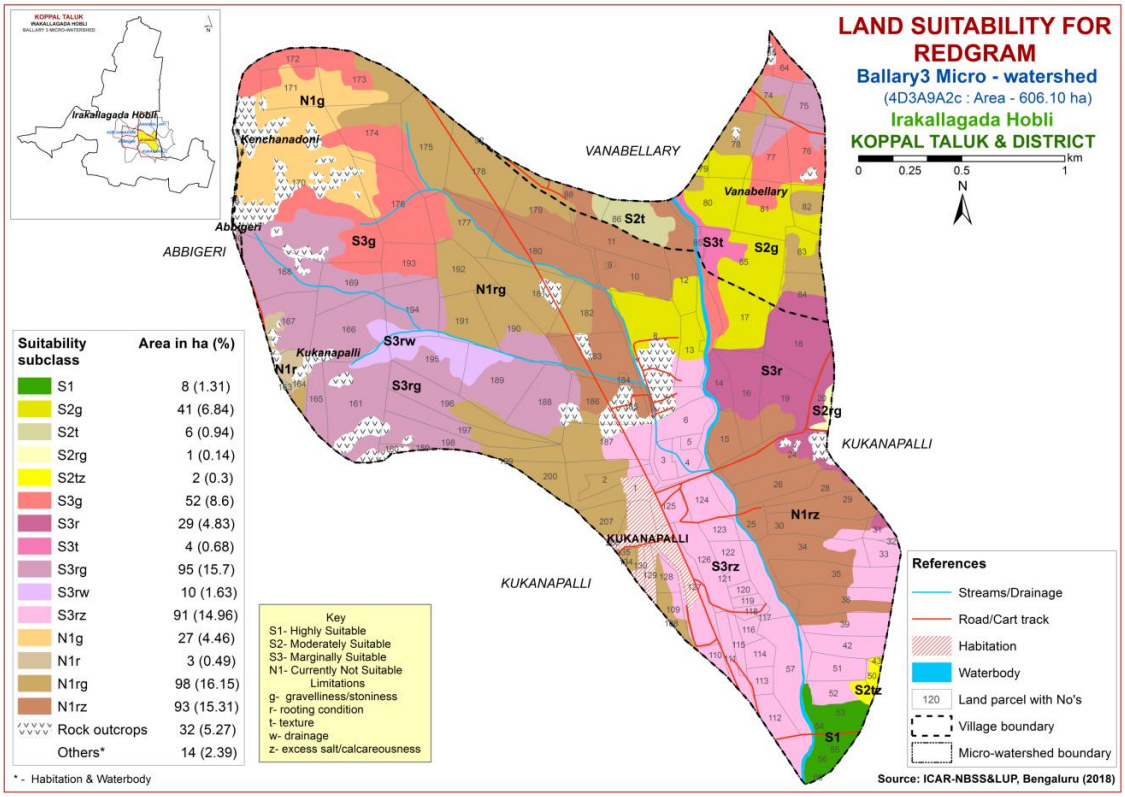


Fig. 7.4 Land Suitability map of Redgram

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.

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; Imper. drained	Poorly drained; excessively drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.7,7.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	Sl, c>60%	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	

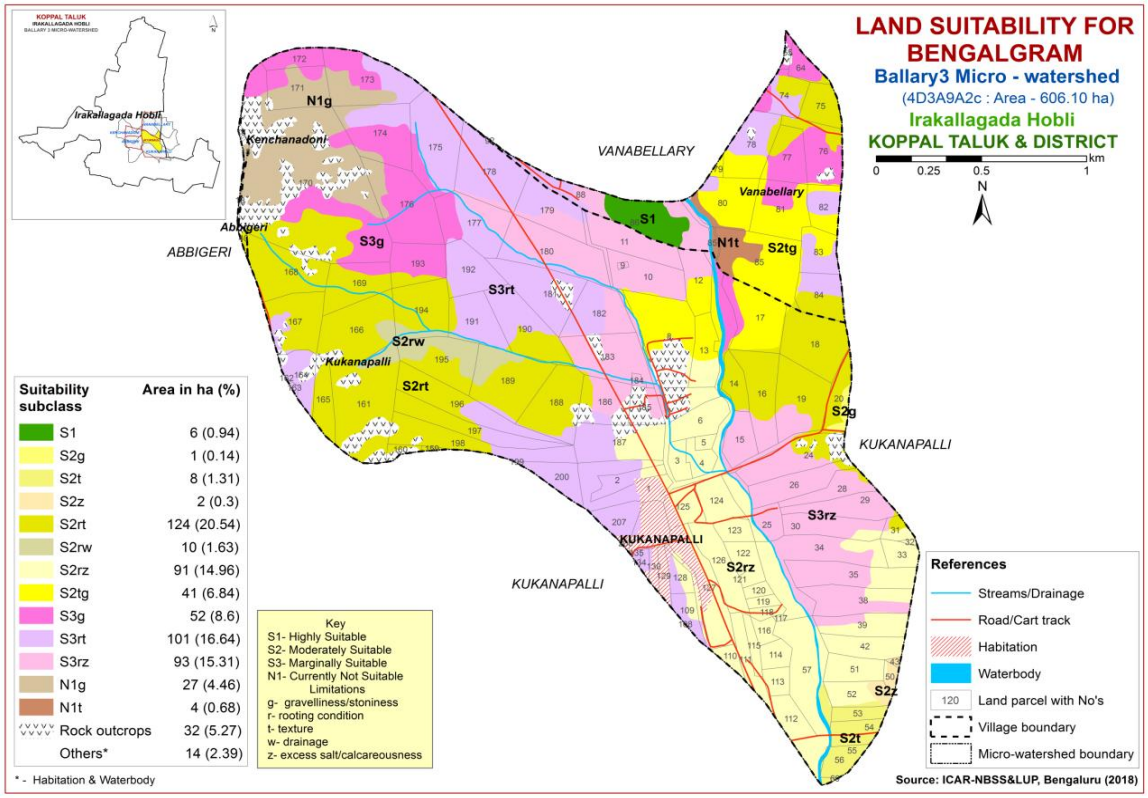


Fig. 7.5 Land Suitability map of Bengal gram

An area of about 6 ha (<1%) in the microwatershed has soils that are highly suitable (Class S1) for growing Bengal gram and are distributed in the northern part of the microwatershed. An area of about 277 ha (46 %) is moderately suitable (Class S2) for growing bengalgram and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness, texture, drainage and gravelliness. Marginally suitable (Class S3) lands cover an area of about 246 ha (41 %) and are distributed in the northern, eastern and western part of the microwatershed. They

have moderate limitations of gravelliness, rooting depth, texture and calcareousness. Area currently not suitable (Class N1) for growing Bengal gram cover about 31 ha (5%) and distributed in the northern part of the microwatershed with severe limitations of gravelliness and texture.

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.

Highly suitable (Class S1) lands for growing groundnut cover about 30 ha (5%) and distributed in the northeastern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 161 ha (27%) and distributed in the northwestern and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and drainage. Maximum area of about 368 ha (61 %) is marginally suitable (Class S3) for growing groundnut and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness.

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	

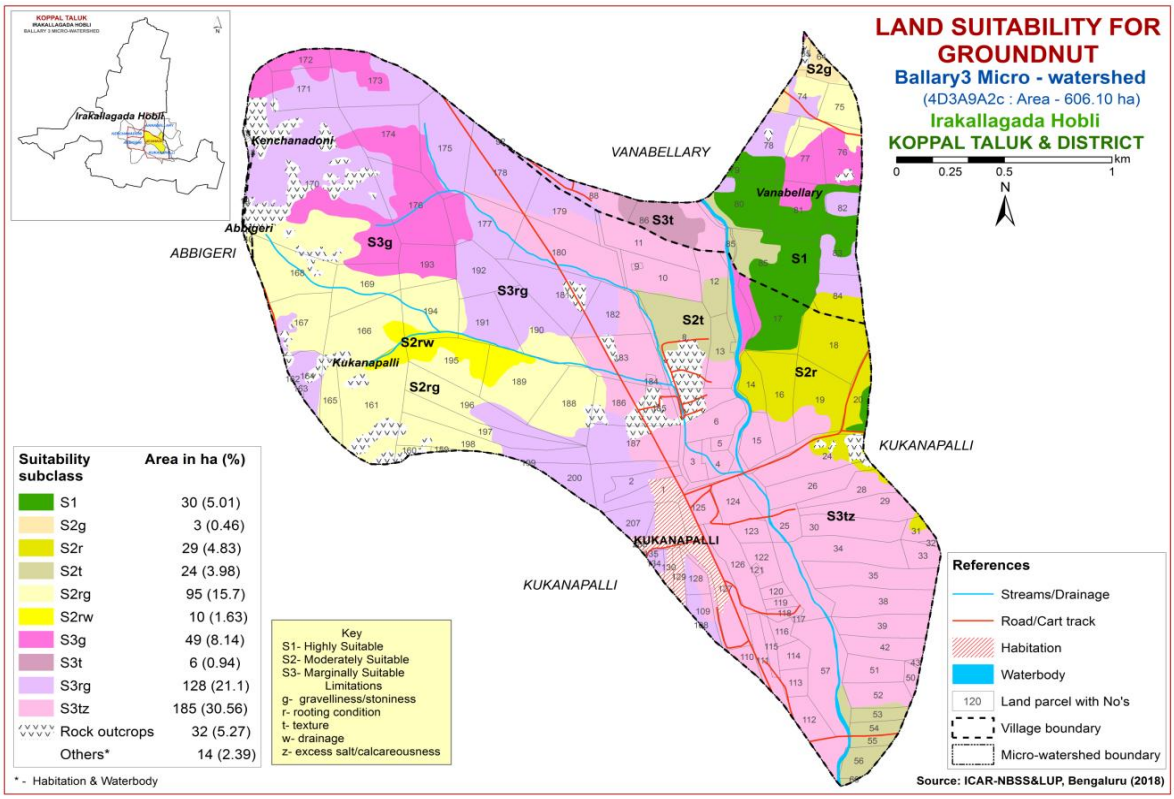


Fig. 7.6 Land Suitability map of Groundnut

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 8 ha (1%) is highly suitable (Class S1) for growing sunflower and are distributed in the southern part of the microwatershed. An area of about 65 ha (11%) is moderately suitable (Class S2) and are distributed in the northern and eastern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 336 ha (55 %) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth, texture, drainage, calcareousness and gravelliness. Area currently not suitable (Class N1) for growing sunflower cover about 150 ha (25%) and distributed in the northern and western part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

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	

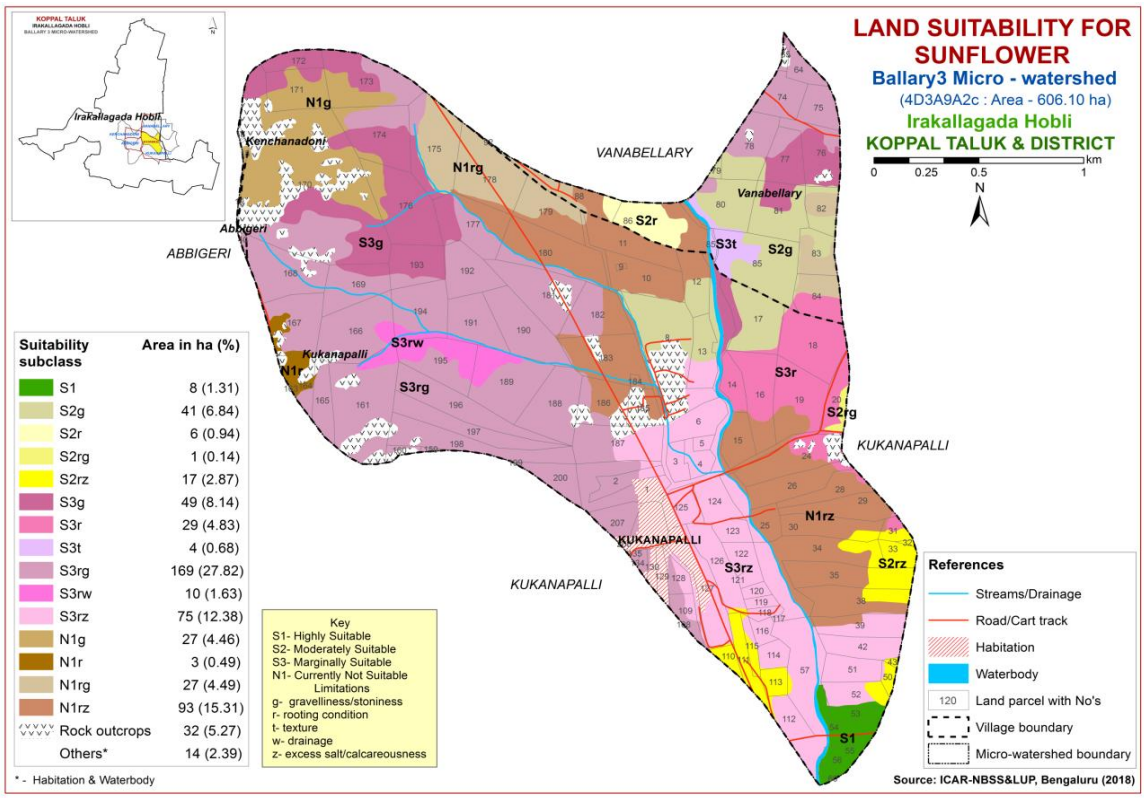


Fig. 7.7 Land Suitability map of Sunflower

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

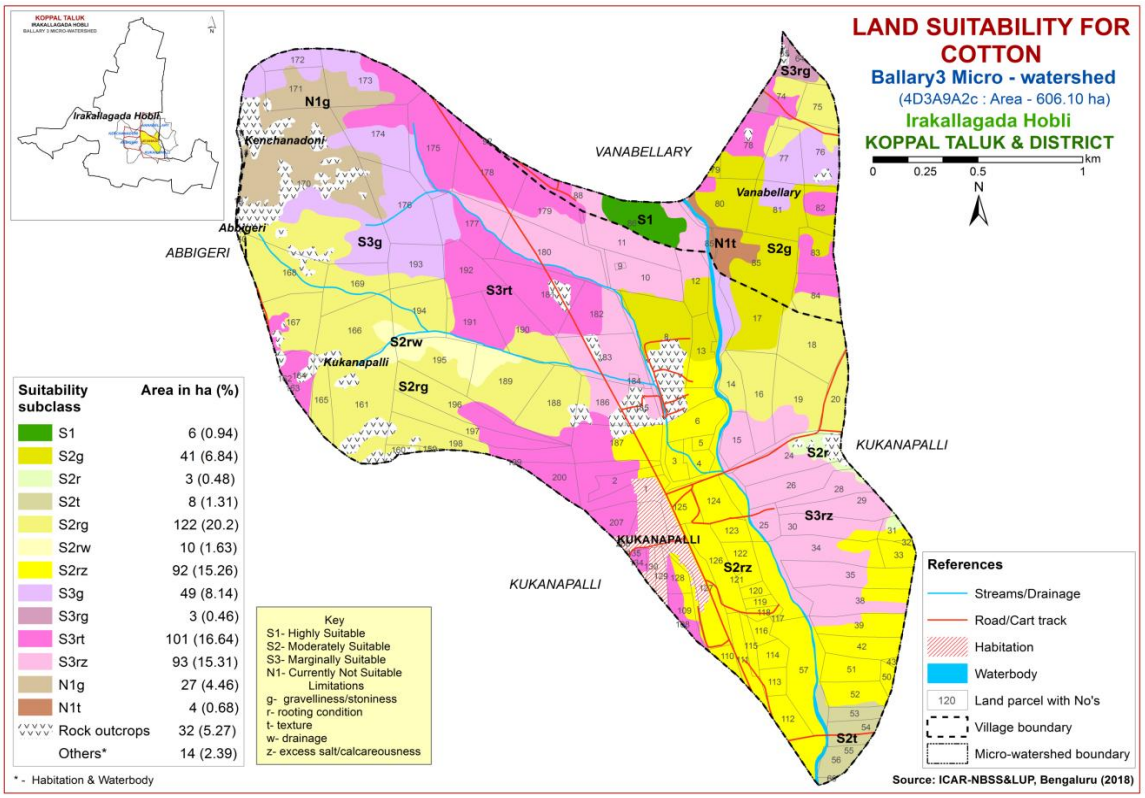


Fig. 7.8 Land Suitability map of Cotton

An area of about 6 ha (<1%) in the microwatershed has soils that are highly suitable (Class S1) for growing cotton and are distributed in the northern part of the microwatershed. An area of about 276 ha (46 %) is moderately suitable (Class S2) for growing cotton and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture, drainage and calcareousness.

Marginally suitable (Class S3) lands cover an area of about 246 ha (41%) and are distributed in the western, northern and eastern part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. Area currently not suitable (Class N1) for growing cotton cover about 31 ha (5%) and distributed in the northern part of the microwatershed with severe limitations of gravelliness and texture.

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

Chilli is one of the major 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 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing chilli and are distributed in the southern part of the microwatershed. An area of about 177 ha (29 %) is moderately suitable (Class S2) for growing chilli and are distributed in the western and northeastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and drainage. Marginally suitable (Class S3) lands cover a maximum area of about 348 ha (57%) and distributed in the major part of the microwatershed. They have moderate limitation of gravelliness. Area currently not suitable (Class N1) cover about 27 ha (4%) and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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	Very poorly drained
Soil reaction	pH	6.5-7.8,6.0-7.0	7.8-8.4	8.4-9.0,5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl, sc, sic,c(m/k)	C(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

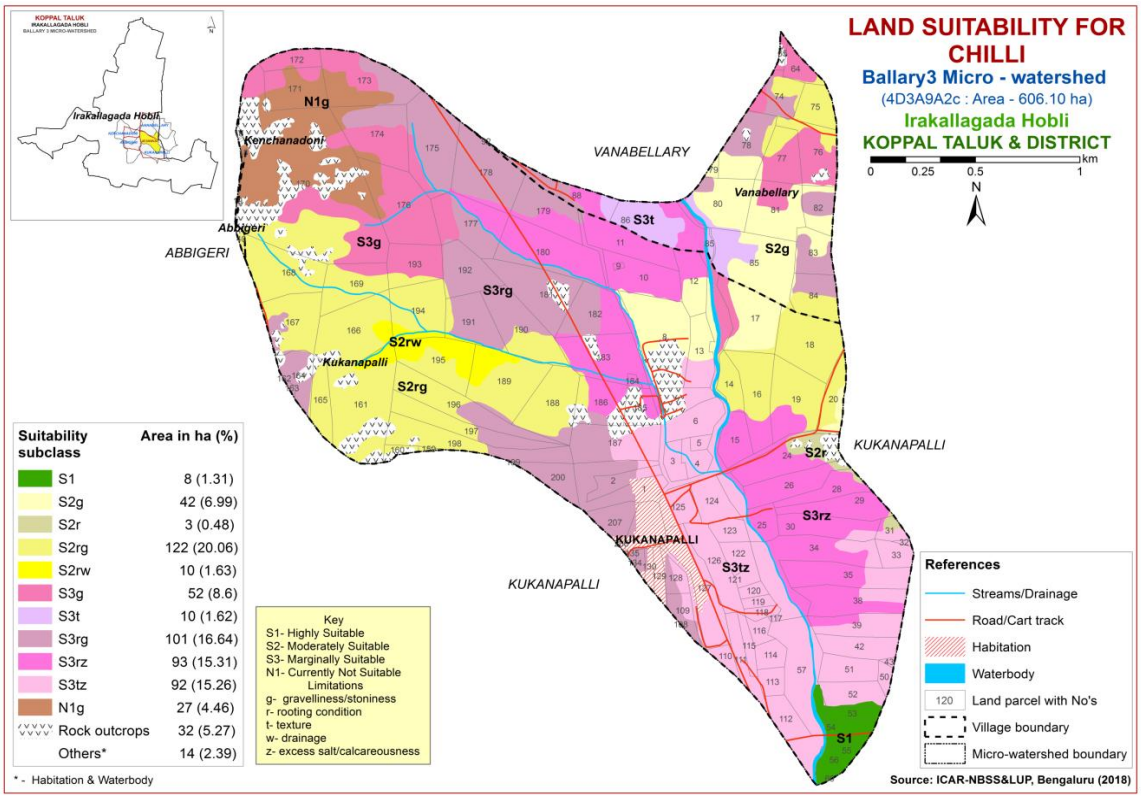


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable 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 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing tomato and are distributed in the southern part of the microwatershed. An area of about 177 ha (29 %) is moderately suitable (Class S2) for growing tomato and are distributed in the western and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and drainage. Marginally suitable (Class S3) lands cover a maximum area of about 348 ha (57 %) and distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth, drainage and calcareousness. Area currently not suitable (Class N1) cover about 27 ha (4%) and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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

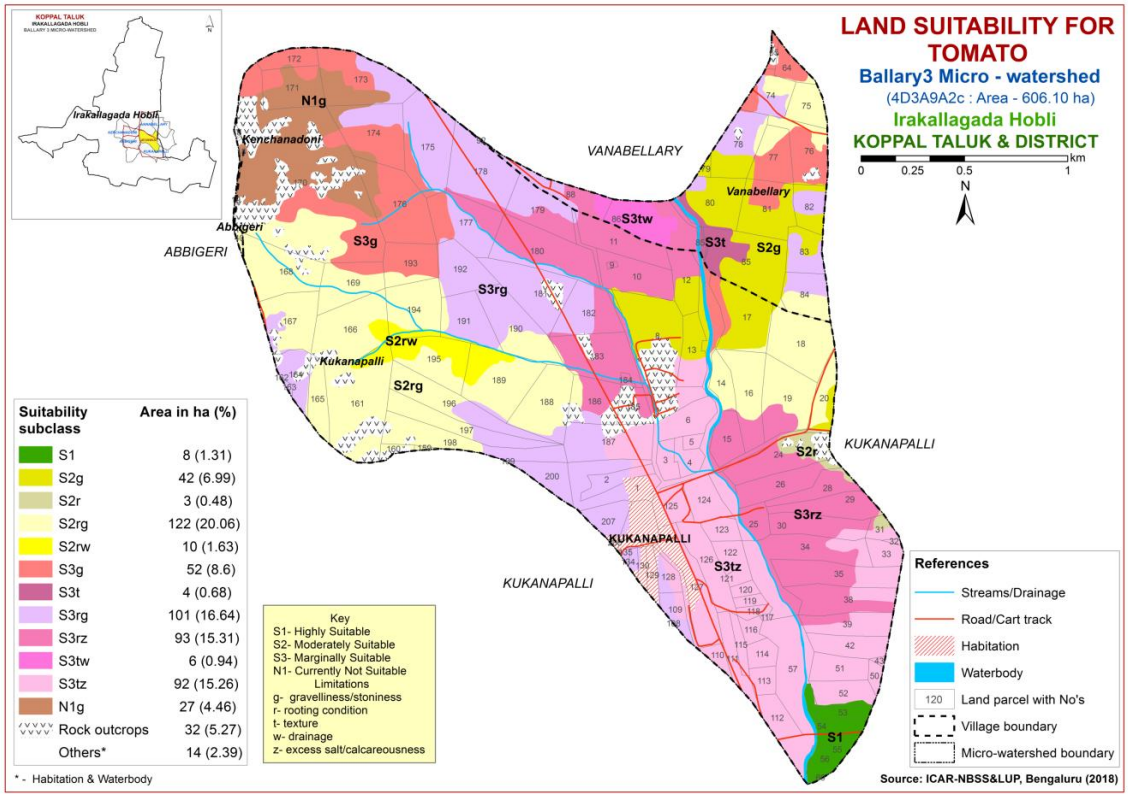


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera)*

Drumstick is one of the most important vegetable crop grown in 2403 ha area in the state. The crop requirements for growing drumstick (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick

was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.11.

Table 7.12 Crop suitability criteria for Drumstick

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

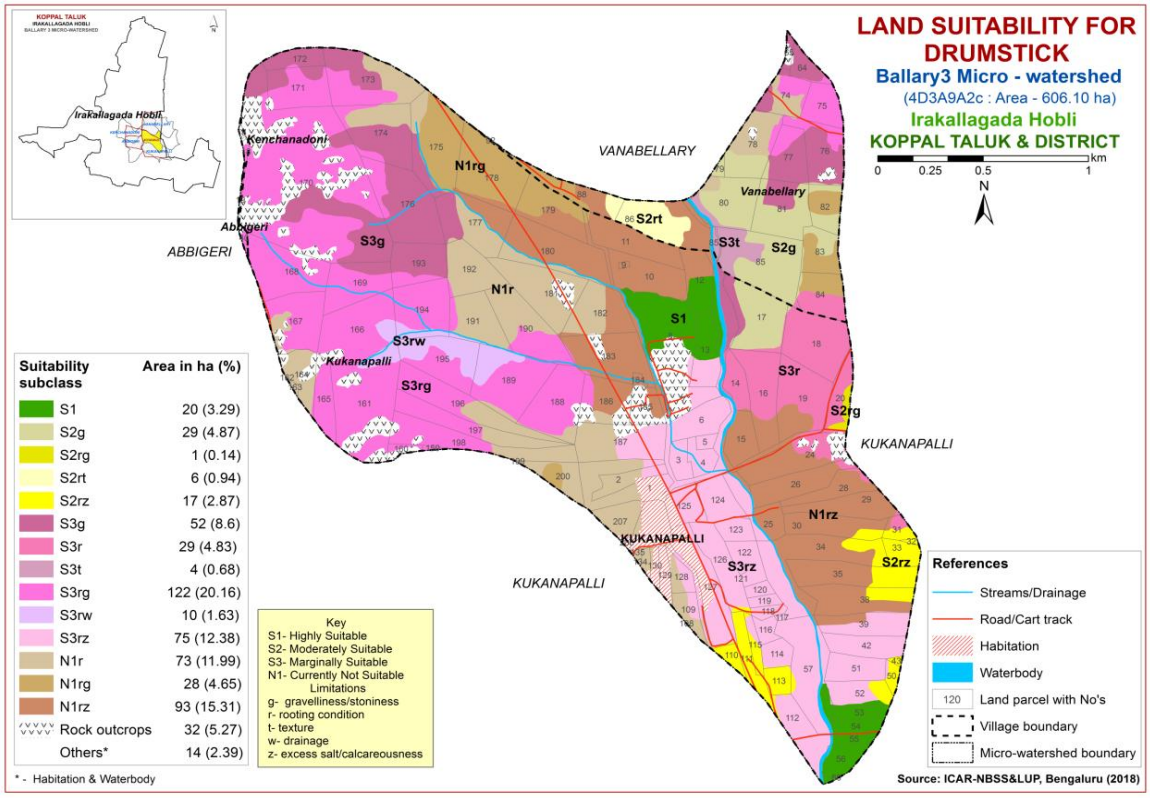


Fig. 7.11 Land Suitability map of Drumstick

An area of about 20 ha (3%) in the microwatershed has soils that are highly suitable (Class S1) for growing drumstick and are distributed in the northern and southern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 53 ha (9%) and are distributed in the southern and northern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 292 ha (48%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness,

drainage, rooting depth, texture and calcareousness. Area currently not suitable (Class N1) for growing drumstick cover about 194 ha (32%) and are distributed in the northern, eastern and western part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the state. The crop requirements for growing mulberry (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

An area of about 49 ha (8%) in the microwatershed has soils that are highly suitable (Class S1) for growing mulberry and are distributed in the northern and southern part of the microwatershed. An area of about 102 ha (17 %) in the microwatershed has soils that are moderately suitable (Class S2) and distributed in the eastern and northern part of the microwatershed. They have minor limitations of rooting depth, gravelliness texture, calcareousness and drainage. Marginally suitable lands cover a maximum area of about 214 ha (35%) and distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, drainage, texture and calcareousness. Area currently not suitable (Class N1) for growing mulberry cover about 194 ha (32%) and distributed in the northern, eastern and western part of the microwatershed. They have severe limitations of rooting depth, gravelliness and calcareousness.

Table 7.13 Crop suitability criteria for Mulberry

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

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

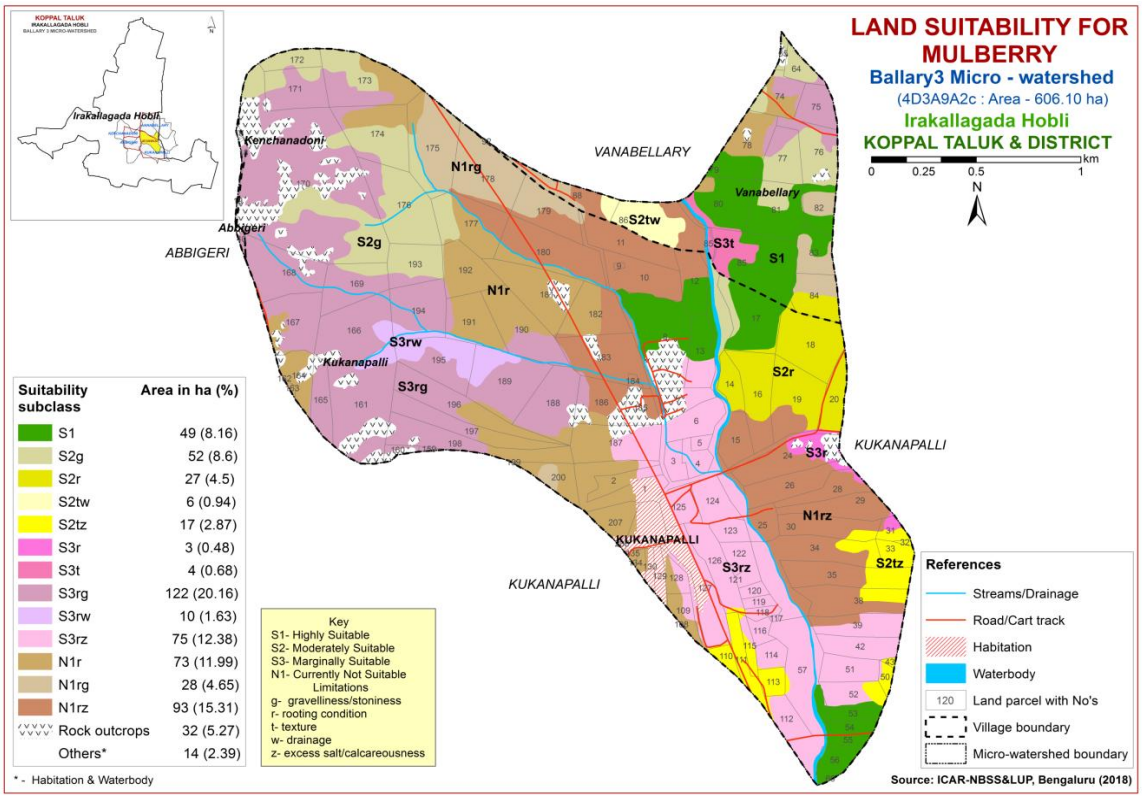


Fig. 7.12 Land Suitability map of Mulberry

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.

Moderately suitable (S2) lands cover an area of about 49 ha (8%) and distributed in the northern and eastern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 80 ha (13%) and occur in the northern and eastern part of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness and calcareousness. Area currently not suitable (Class N1) for growing mango cover a maximum area of about 430 ha (71%) and distributed in the major part of the microwatershed. They have severe limitations of gravelliness, rooting depth, texture, drainage and calcareousness.

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	^0C	28-32	24-27 33-35	36-40	20-24
	Min. temp. before flowering	^0C	10-15	15-22	>22	
Soil moisture	Growing period	Days	>180	150-180	120-150	<120
Soil aeration	Soil drainage	Class	Well drained	Mod. To imper. drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc,l, sil, cl	sl, sc, sic,l,c	c (<60%)	c(>60%),
	pH	1:2.5	5.5-7.5	7.6-8.5:5.0-5.4	8.6-9.0:4.0-4.9	>9.0<4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	%vol	Non-gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

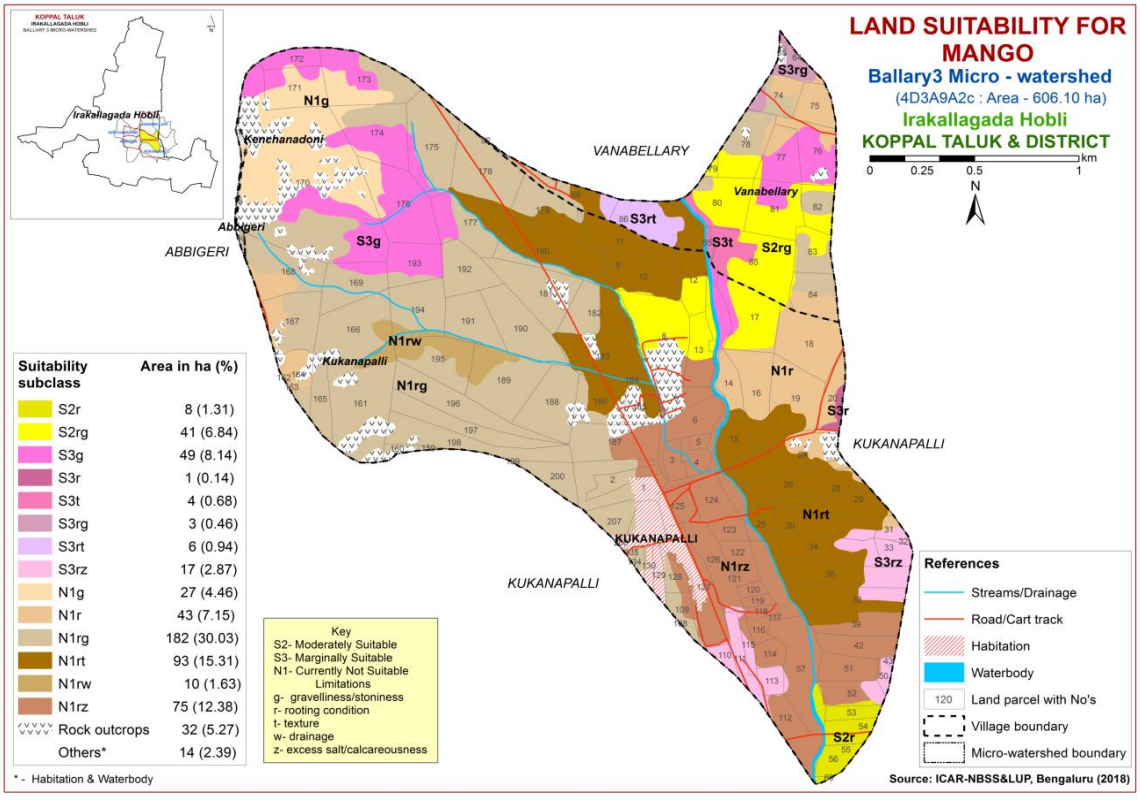


Fig. 7.13 Land Suitability map of Mango

7.14 Land suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of about 29373 ha in almost all the districts of the state. The crop requirements (Table 7.15) 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 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing sapota and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 45 ha (7%) and distributed in the northeastern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 285 ha (47%) and occur in the major part of the microwatershed. They have moderate limitations of texture, gravelliness, rooting depth, drainage and calcareousness. Area currently not suitable (Class N1) for growing sapota cover about 221 ha (36%) and distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

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

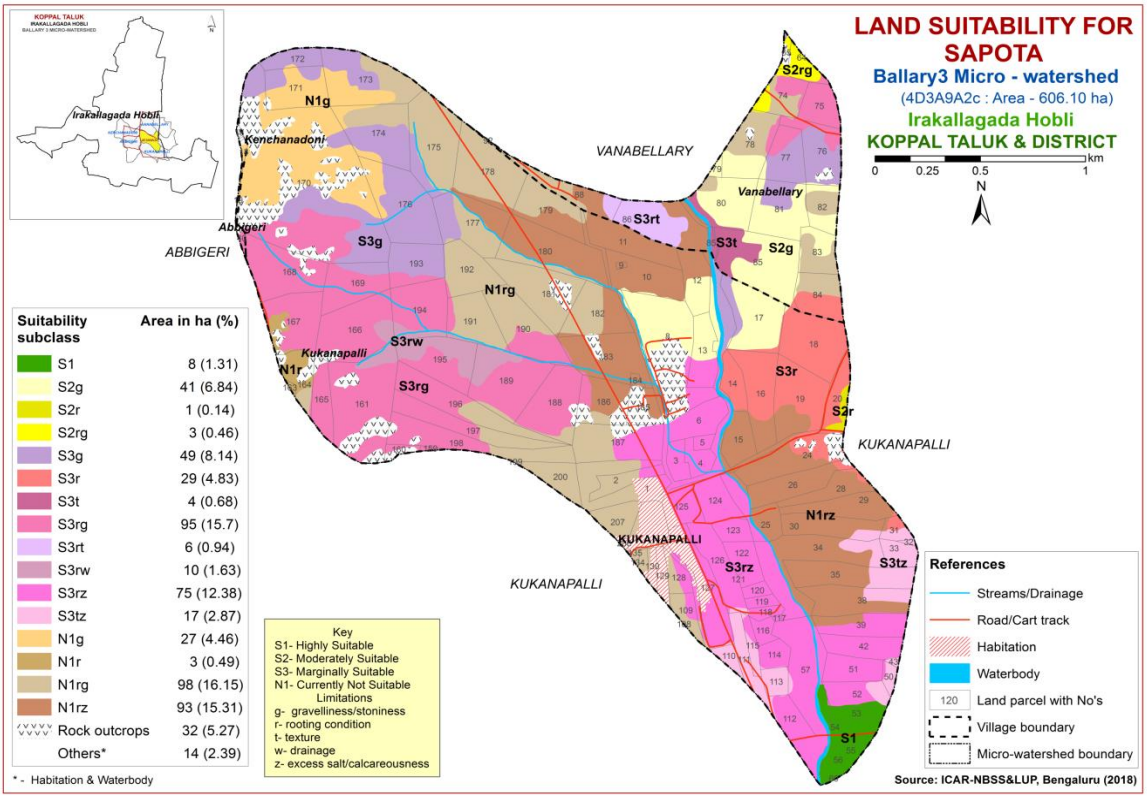


Fig. 7.14 Land Suitability map of Sapota

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 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing pomegranate and are distributed in the southern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 68 ha (11 %) and are distributed in the southern and northeastern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and texture. Marginally suitable (Class S3) lands for growing pomegranate occupy an area of about 289 ha (48 %) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth, texture, drainage and calcareousness. Area currently not suitable (Class N1) for growing pomegranate cover about 194 ha (32%) and are distributed in the northern, western and eastern part of the microwatershed with severe limitations of rooting depth, gravelliness and calcareousness.

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	

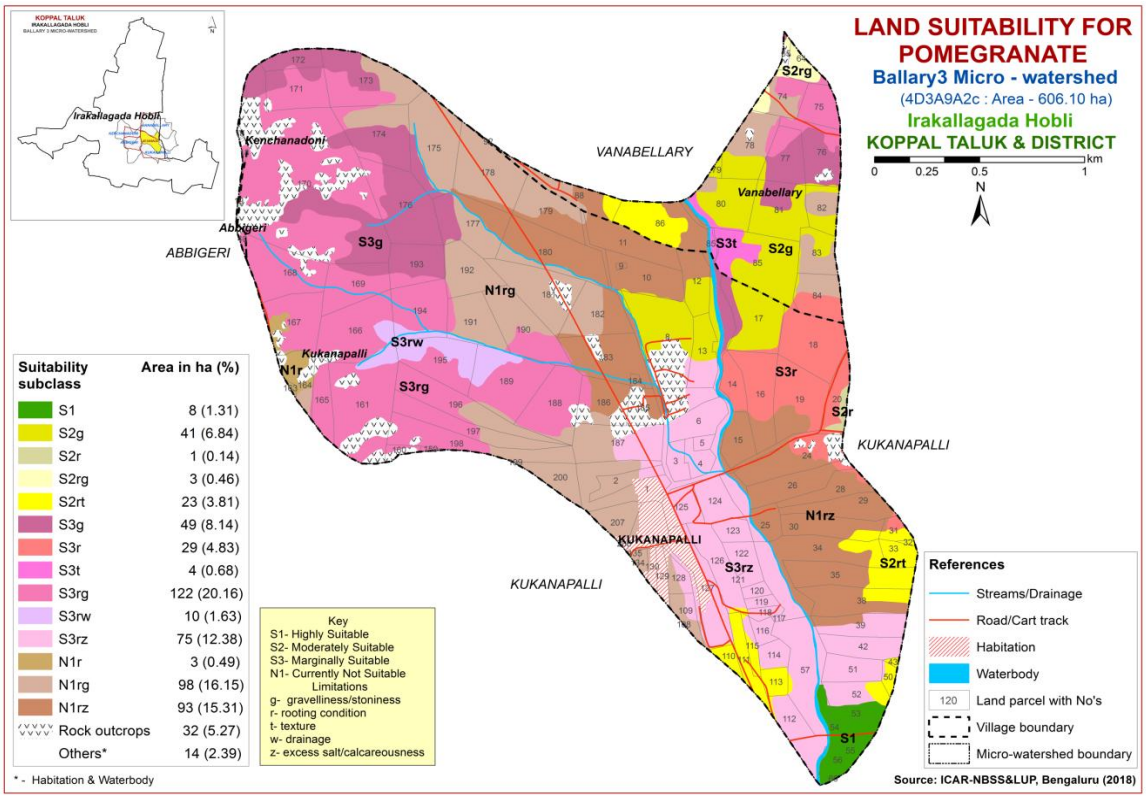


Fig. 7.15 Land Suitability map of Pomegranate

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.

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

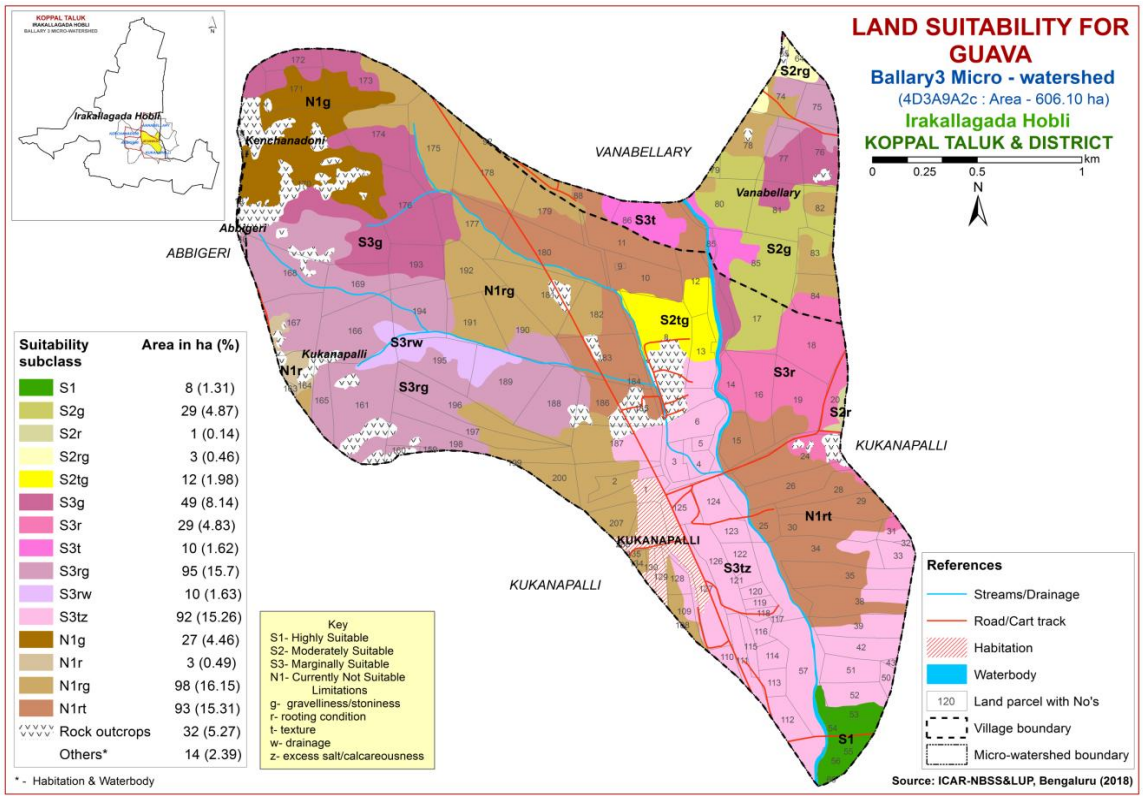


Fig. 7.16 Land Suitability map of Guava

An area of about 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing guava and are distributed in the southern part of the microwatershed. Moderately suitable (Class S2) lands for growing guava occupy an area of about 45 ha (7%) and are distributed in the northern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and texture. Marginally suitable (Class S3) lands cover a maximum area of about 285 ha (47 %) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth, drainage and calcareousness. Area currently not suitable (Class N1) for growing guava cover about 221 ha (36%) and are distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and texture.

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.

An area of about 8 ha (1%) in the microwatershed has soils that are highly suitable (Class S1) for growing jackfruit and are distributed in the southern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 45 ha (7 %) and are distributed in the northeastern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 285 ha (47%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, rooting depth, texture, drainage and calcareousness. Area currently not suitable (Class N1) for growing jackfruit cover about 221 ha (36%) and are distributed in the northern, eastern and western part of the microwatershed with severe limitations of gravelliness, rooting depth and texture.

Table 7.18 Crop suitability criteria for Jackfruit

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

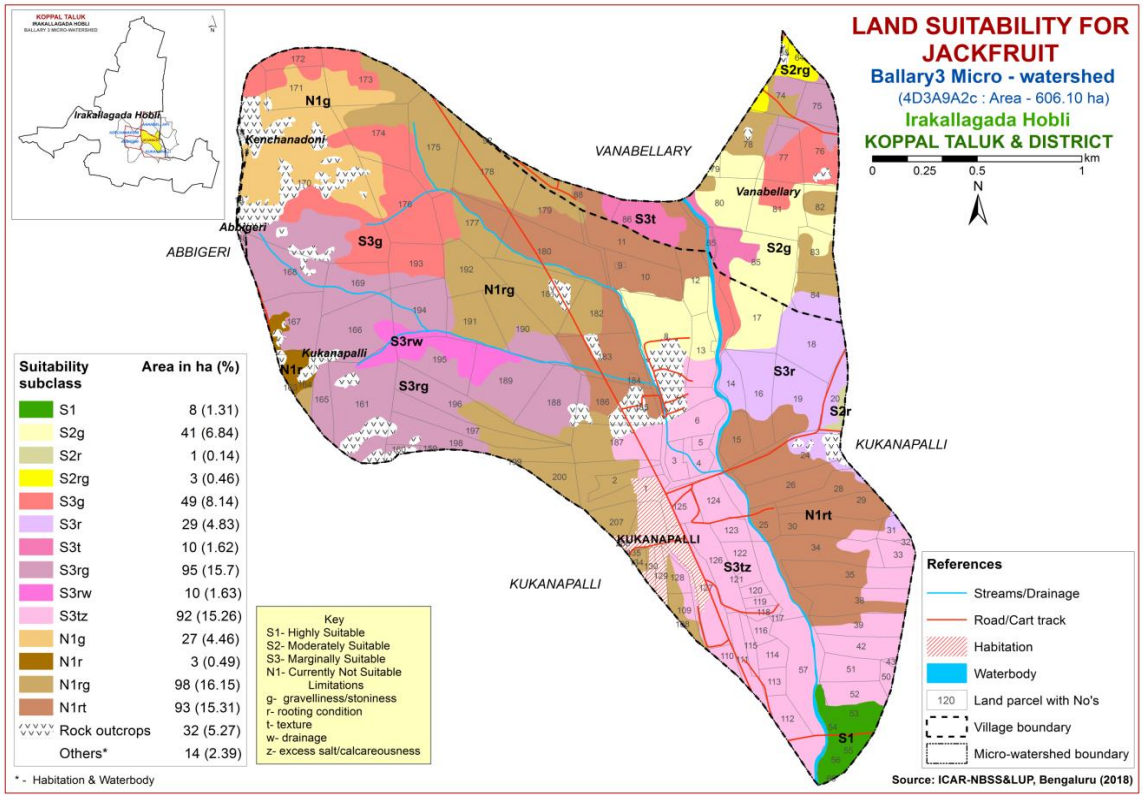


Fig. 7.17 Land Suitability map of Jackfruit

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 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.

Table 7.19 Crop suitability criteria for Jamun

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

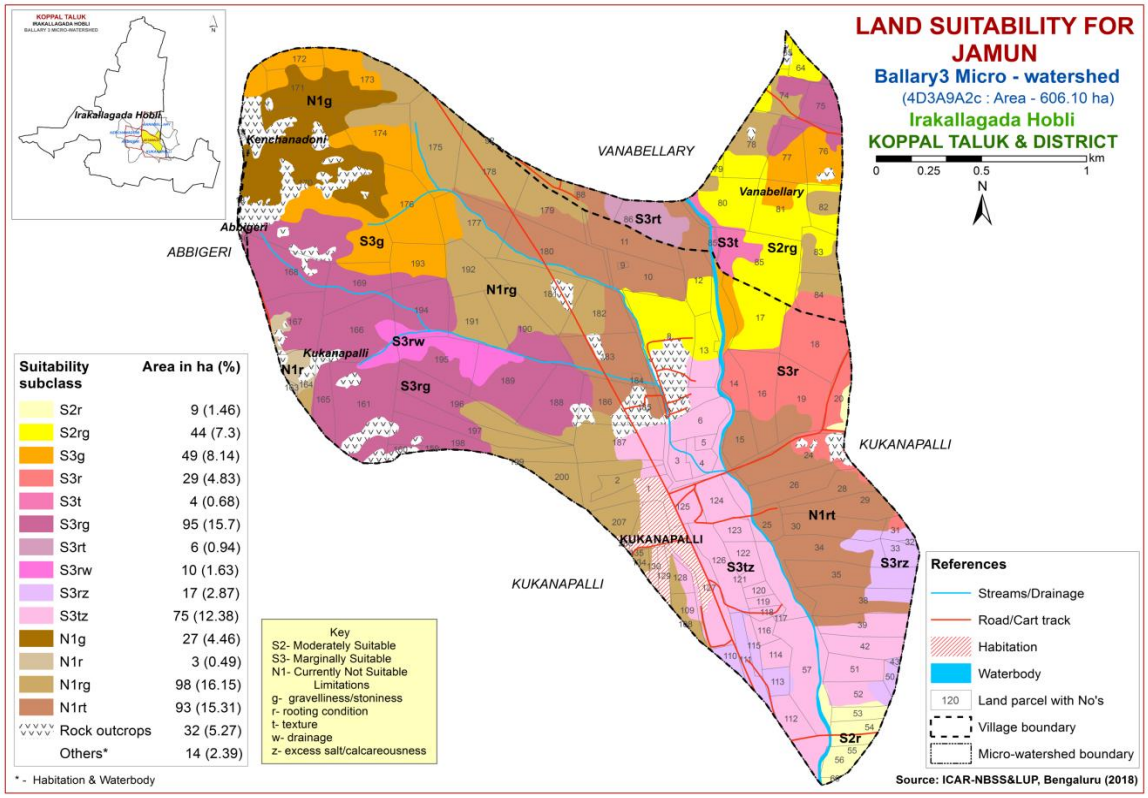


Fig. 7.18 Land Suitability map of Jamun

Moderately suitable (Class S2) lands occupy an area of about 53 ha (9 %) and are distributed in the northeastern and southern part of the microwatershed. They have minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 285 ha (47 %) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth, gravelliness, texture, drainage calcareousness and gravelliness. Area currently not suitable (Class N1) for growing jamun cover about 221 ha (36%) and are distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and texture.

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 8 ha (1%) is highly suitable (Class S1) for growing musambi and are distributed in the southern part of the microwatershed. An area of about 68 ha (11 %) is moderately suitable (Class S2) and occur in the northern and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and

calcareousness. Maximum area of about 262 ha (43%) is marginally suitable (Class S3) for growing musambi and are distributed in the major part of the microwatershed with moderate limitation of gravelliness, rooting depth, texture, calcareousness and drainage. Area currently not suitable (Class N1) for growing musambi cover about 221 ha (36%) and are distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

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 imper. 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	

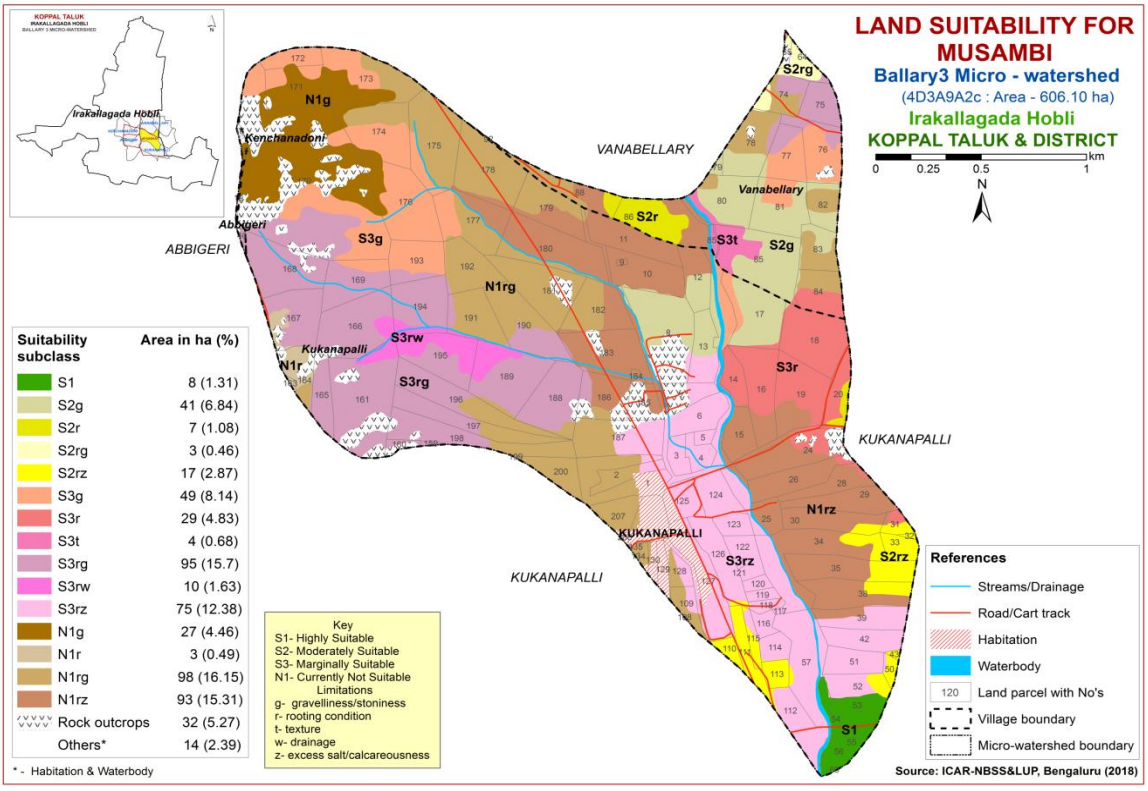


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements 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 8 ha (1%) is highly suitable (Class S1) for growing lime and are distributed in the southern part of the microwatershed. An area of about 68 ha (11 %) is moderately suitable (Class S2) and occur in the northern and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Maximum area of about 262 ha (43 %) is marginally suitable (Class S3) for growing lime and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, rooting depth, texture, drainage and calcareousness. Area currently not suitable (Class N1) for growing lime cover about 221 ha (36%) and are distributed in the northern, western and eastern part of the microwatershed with severe limitations of gravelliness, rooting depth and calcareousness.

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 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	5.5-6.4:7.6-8.0	4.0-5.4,8.1-8.5	<4.0,>8.5
	$CaCO_3$ in root zone	%	Non calcareous	Upto 5	5-10	>10
Rooting conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

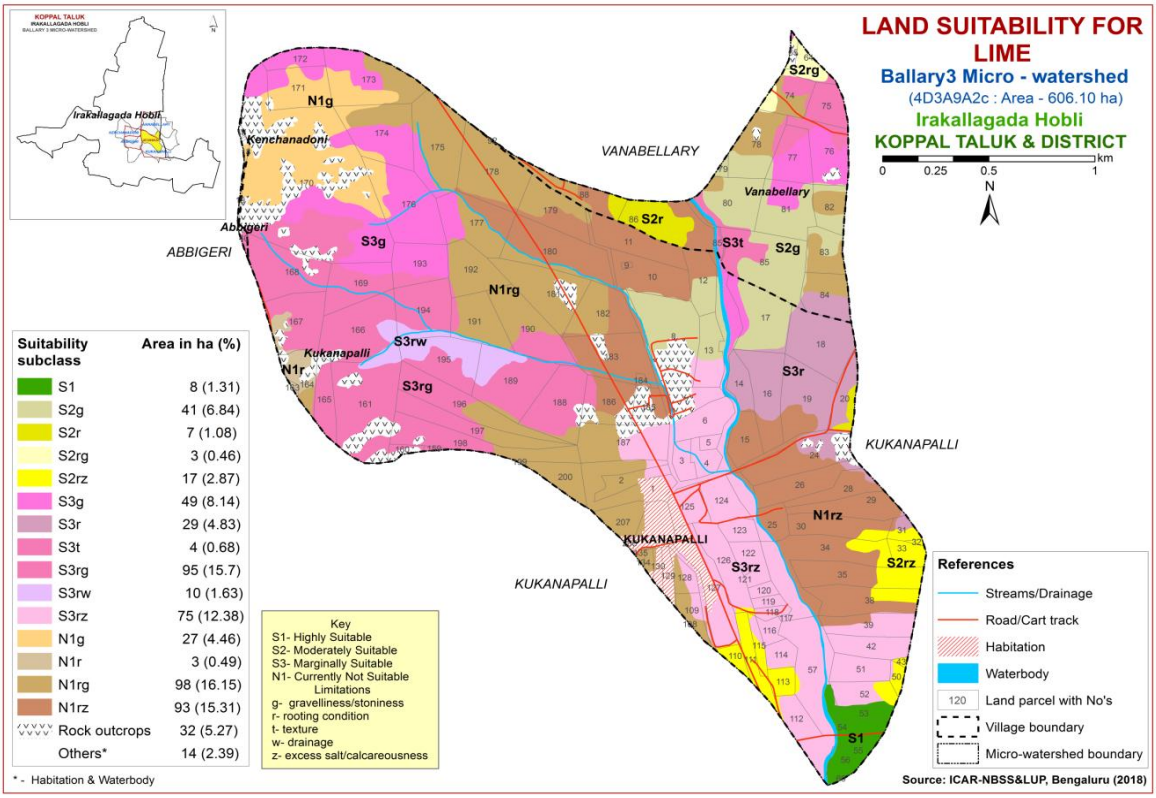


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

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

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

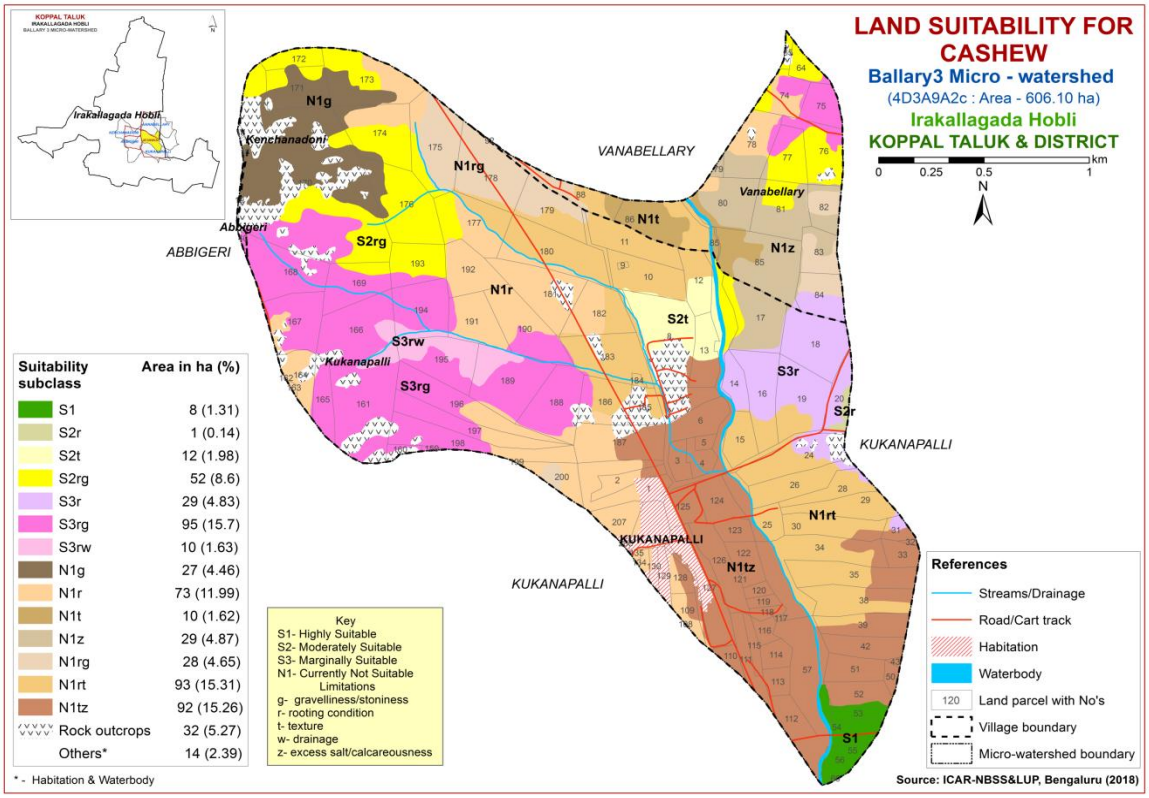


Fig. 7.21 Land Suitability map of Cashew

A small area of about 8 ha (1%) is highly suitable (Class S1) for growing cashew and are distributed in the southern part of the microwatershed. An area of about 65 ha (11 %) is moderately suitable (Class S2) and occur in the northern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and texture. An area of about 134 ha (22%) is marginally suitable (Class S3) for growing cashew and are distributed in the western and eastern part of the microwatershed with moderate limitations of gravelliness, rooting depth and drainage. An area of about 352 ha (58%) is not suitable (Class N1) for growing cashew and distributed in the major part of the microwatershed with severe limitations of gravelliness, rooting depth, texture and calcareousness.

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements(Table 7.23) for growing custard apple were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated .The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

An area of about 56 ha (9%) is highly suitable (Class S1) for growing custard apple and are distributed in the northeastern and southern part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 278 ha (46 %) and occur in the major part of the microwatershed. They have minor limitations of rooting

depth, gravelliness, drainage and calcareousness. Marginally suitable lands cover about 225 ha (37%) and distributed in the northern, western and eastern part of the microwatershed with moderate limitations of rooting depth, texture, gravelliness and calcareousness.

Table 7.23 Crop 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	-

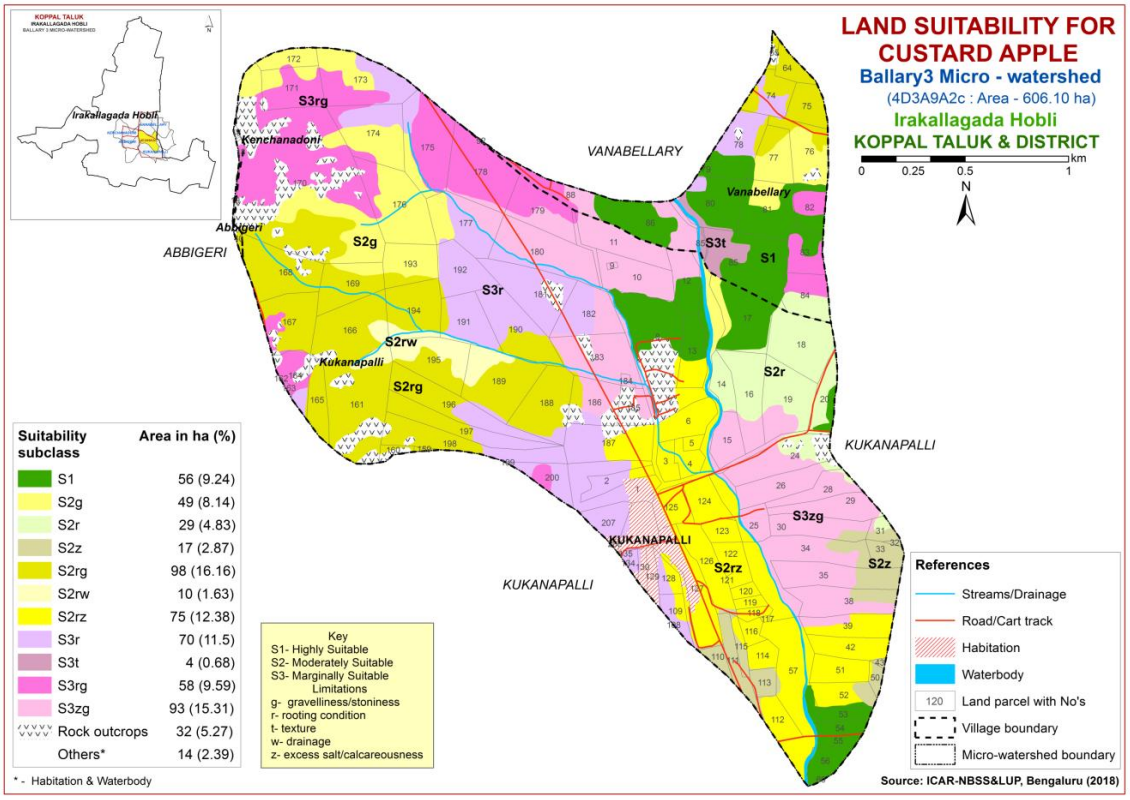


Fig. 7.22 Land Suitability map of Custard Apple

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.

Table 7.24 Crop suitability criteria for Amla

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	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

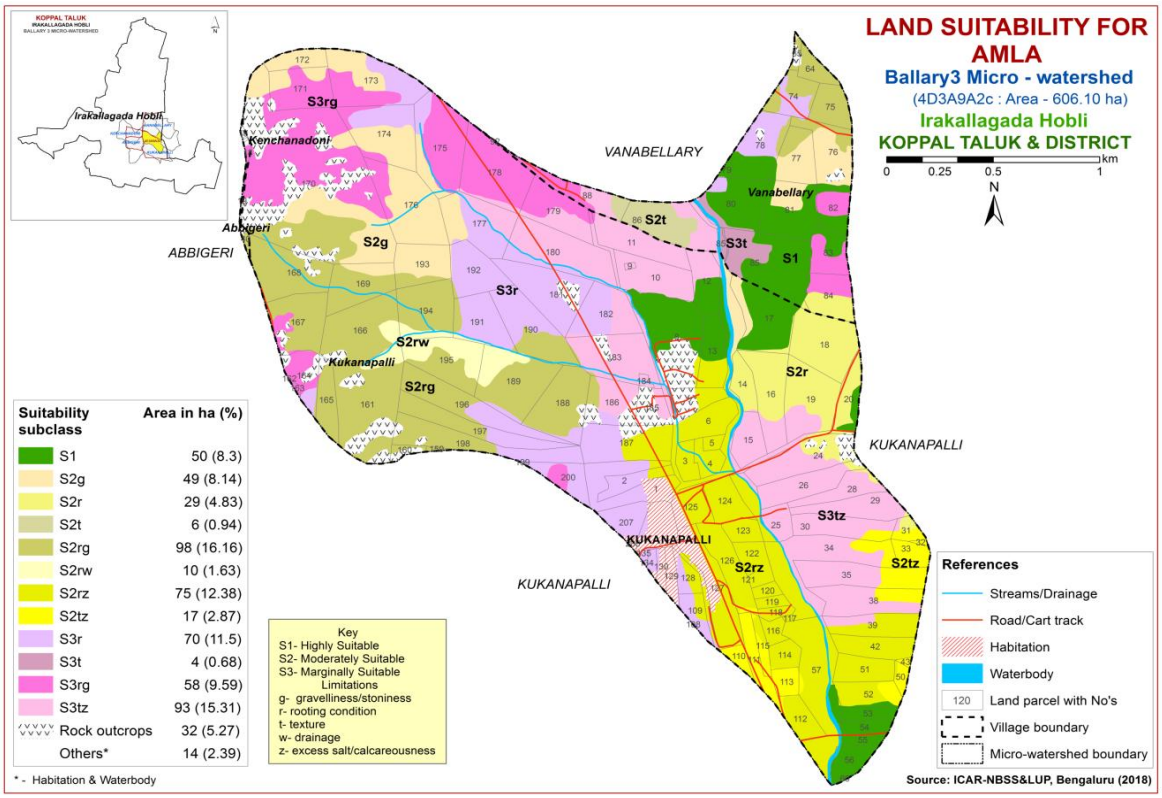


Fig. 7.23 Land Suitability map of Amla

An area of about 50 ha (8%) is highly suitable (Class S1) for growing amla and are distributed in the northeastern and southern part of the microwatershed. Maximum area of about 284 ha (47 %) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth, drainage and calcareousness. Marginally suitable lands cover an area of about 225 ha (37%) and distributed in the northern, eastern and western part of the microwatershed with moderate limitations of rooting depth, texture, gravelliness and calcareousness.

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 Crop suitability criteria for Tamarind

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

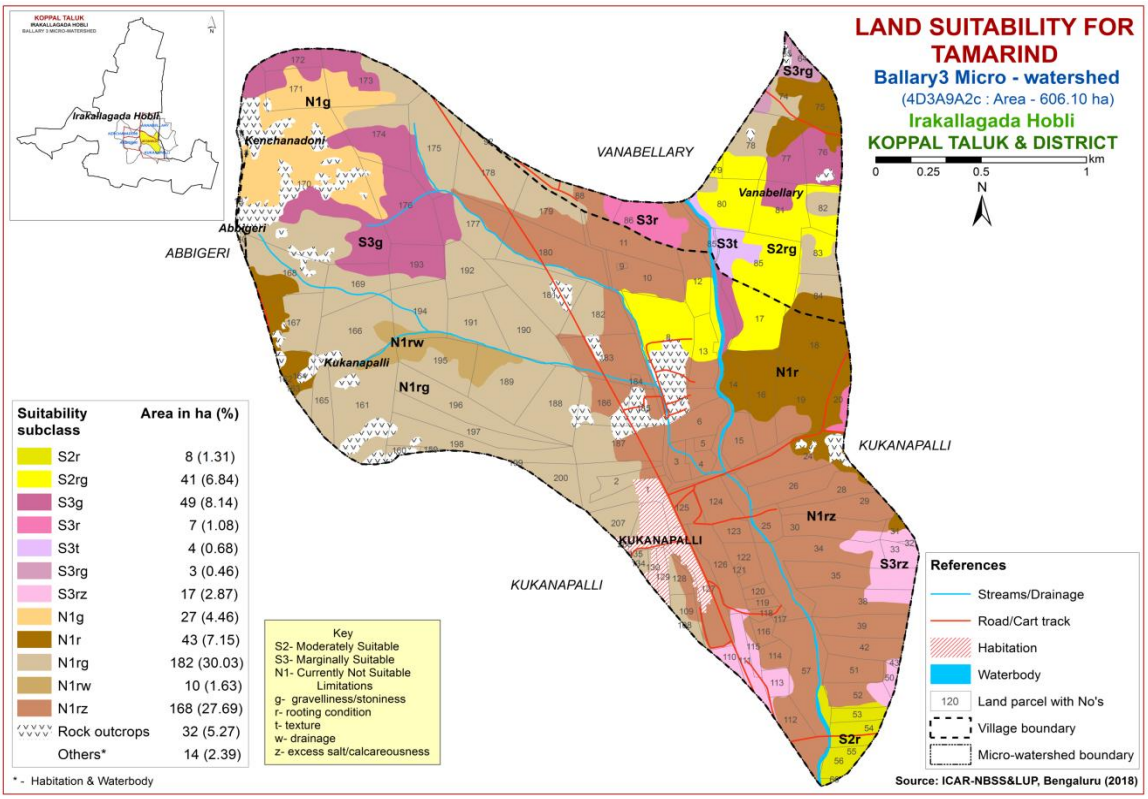


Fig. 7.21 Land Suitability map of Tamarind

An area of about 49 ha (8 %) is moderately suitable (Class S2) and occur in the northeastern and southern part of the microwatershed. They have minor limitations of

gravelliness and rooting depth. An area of about 80 ha (13 %) is marginally suitable (Class S3) for growing tamarind and are distributed in the northern and southern part of the microwatershed with moderate limitations of gravelliness, rooting depth, texture and calcareousness. Currently not suitable (Class N1) lands cover a maximum area of about 430 ha (71%) and are distributed in the major part of the microwatershed with severe limitations of rooting depth, gravelliness, drainage and calcareousness.

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 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 8 ha (1%) is highly suitable (Class S1) for growing marigold and are distributed in the southern part of the microwatershed. An area of about 275 ha (45%) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, texture, rooting depth, drainage and calcareousness. An area of about 250 ha (41%) is marginally suitable (Class S3) for growing marigold and are distributed in the northern, eastern and western part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness. Currently not suitable (Class N1) lands cover an area of about 27 ha (4%) and are distributed in the northern part of the microwatershed with severe limitation of gravelliness.

Table 7.26 Crop suitability criteria for Marigold

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

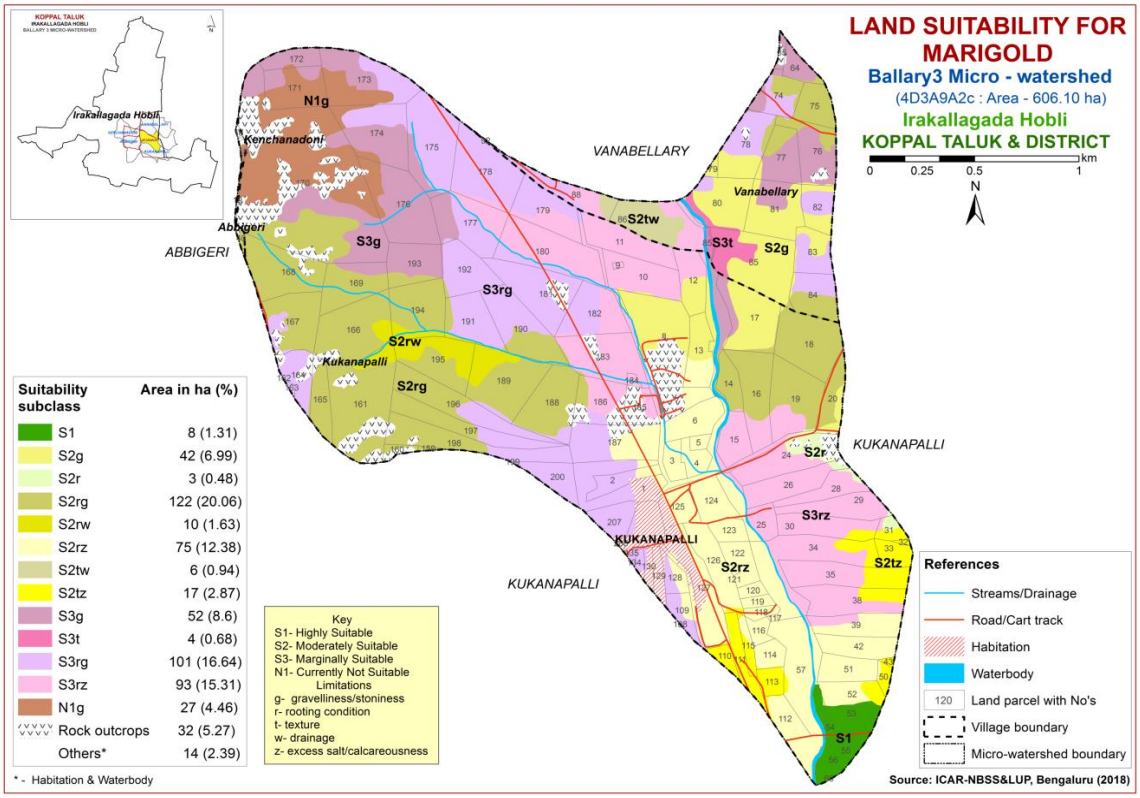


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*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.

An area of about 8 ha (1%) is highly suitable (Class S1) for growing chrysanthemum and are distributed in the southern part of the microwatershed. An area of about 275 ha (45%) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of gravelliness, texture, drainage, rooting depth and calcareousness. An area of about 250 ha (41%) is marginally suitable (Class S3) for growing chrysanthemum and are distributed in the northern, eastern and western part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness. Area currently not suitable (Class N1) cover about 27 ha (4%) and are distributed in the northern part of the microwatershed with severe limitation of gravelliness.

Table 7.27 Crop suitability criteria for Chrysanthemum

Crop requirement			Rating			
Soil–site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temperature in growing season	^{0}C	18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l ,sl, scl, cl, sil	sicl, sc, sic, c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5,>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	

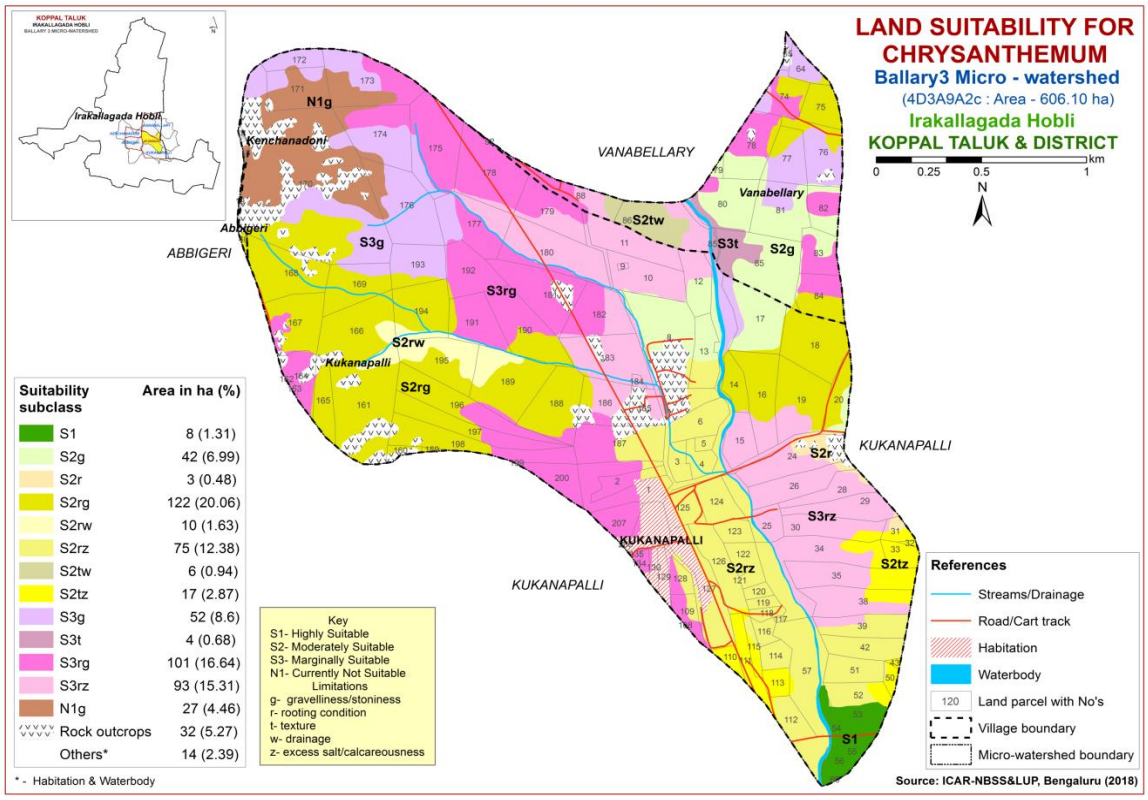


Fig. 7.26 Land Suitability map of Chrysanthemum

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

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.28) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

Table 7.28 Crop suitability criteria for jasmine (irrigated)

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

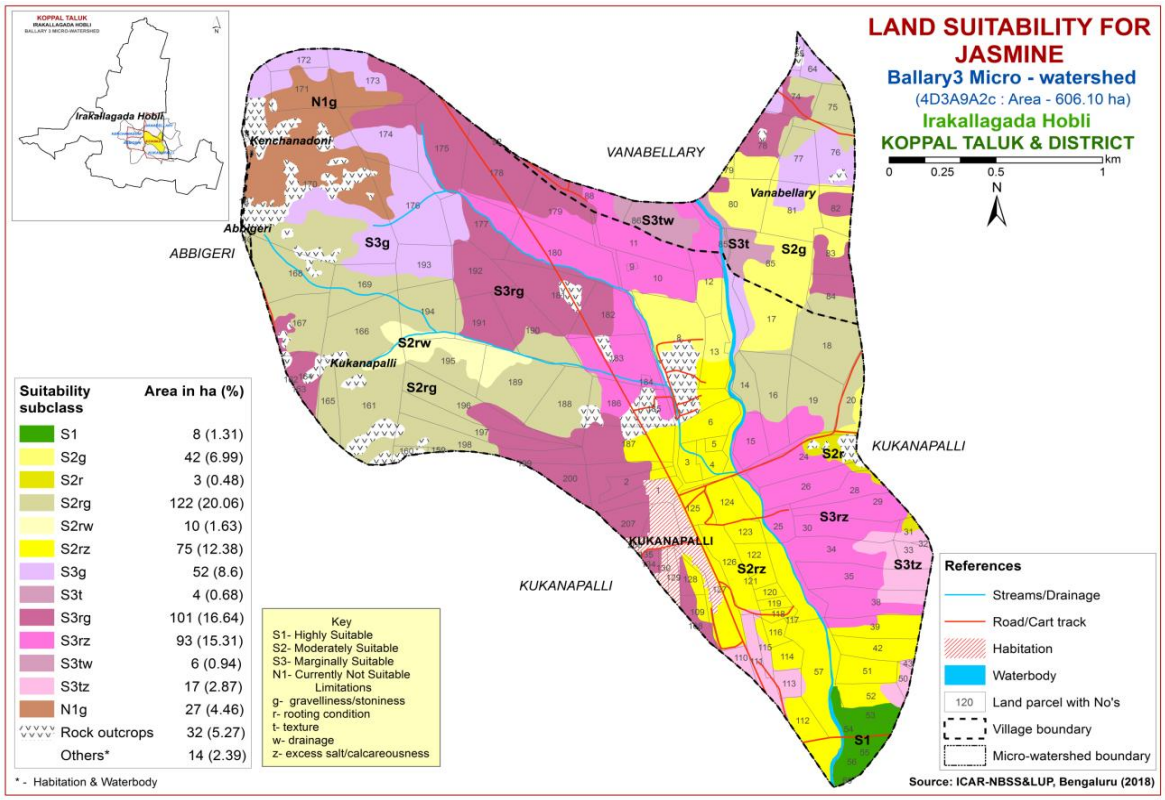


Fig. 7.27 Land Suitability map of Jasmine

An area of about 8 ha (1%) is highly suitable (Class S1) for growing jasmine and are distributed in the southern part of the microwatershed. A small area of about 252 ha (42 %) is moderately suitable (Class S2) and occur in the southern, central and northeastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, drainage and calcareousness. Maximum area of about 273 ha (45%) is marginally suitable (Class S3) for growing jasmine and are distributed in the major part of

the microwatershed with moderate limitations of gravelliness, texture, rooting depth, drainage and calcareousness. Area currently not suitable (Class N1) cover about 27 ha (4%) and are distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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. Land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

An area of about 8 ha (1%) is highly suitable (Class S1) for growing crossandra and are distributed in the southern part of the microwatershed. An area of about 193 ha (32 %) is moderately suitable (Class S2) and occur in the western and eastern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, drainage and calcareousness. Maximum area of about 333 ha (55%) is marginally suitable (Class S3) for growing crossandra and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness. Area currently not suitable (Class N1) cover about 27 ha (4%) and are distributed in the northern part of the microwatershed with severe limitation of gravelliness.

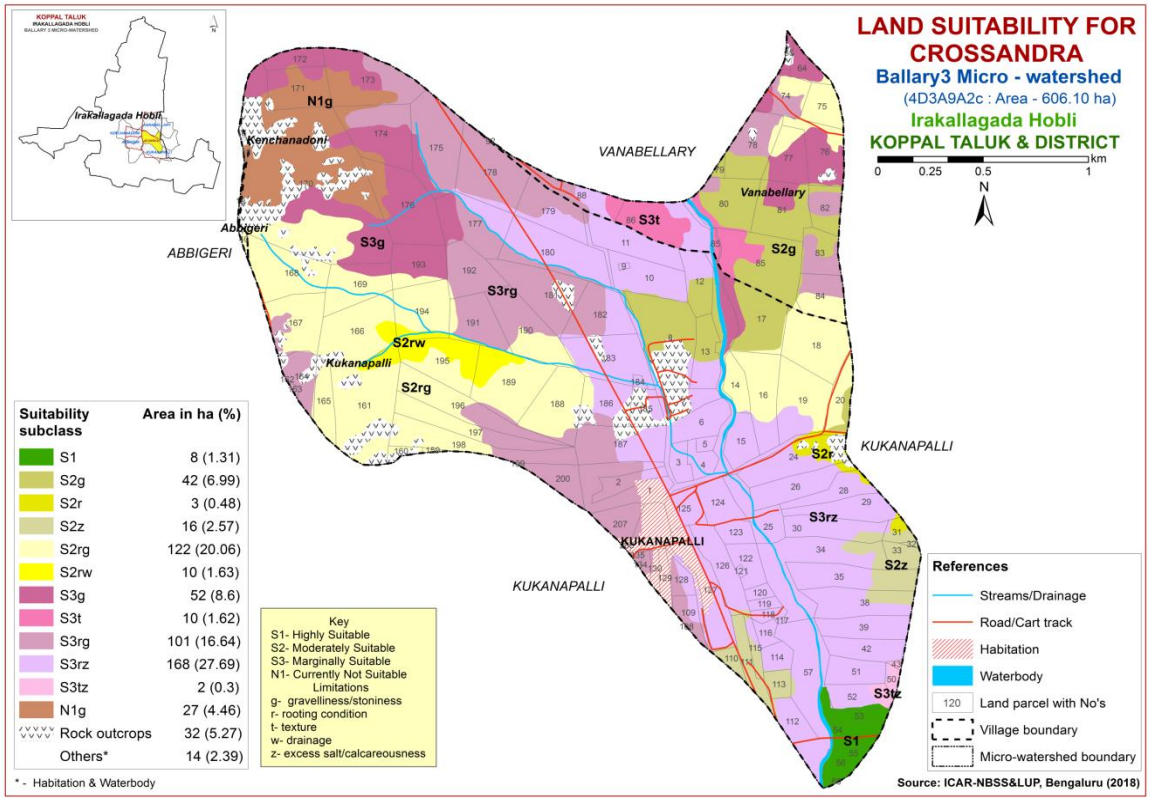


Fig. 7.28 Land Suitability map of Crossandra

7.29 Land Management Units (LMUs)

The 35 soil map units identified in Ballary-3 microwatershed have been grouped into 10 Land management Units (LMUs) for the purpose of preparing a Proposed Crop Plan. Land management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land management Units map (Fig.7.29) has been generated. These Land management Units are expected to behave similarly for a given level of management.

The map units that have been grouped into 10 Land management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	TDGmA1	Very deep, lowland sandy clay loam to sandy loam soils with slopes of 0-1%, slight erosion
2	JDGiB2g1 ,KMHiB1 MNLiB2g1,GHThB2g1	Moderately deep to deep, red sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly 15-35%
3	BDGcB1g1, BDGiB1g1, BDGiB1g2 ,BDGiB2g1, HDHiB1g1,HDHiB2g1	Moderately deep, gravelly red sandy clay to clay soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
4	DRLiB2, DRLmA1, DRLmB1, NSPmB2	Moderately deep black calcareous clayey soils with slopes of 0-3%, slight to moderate erosion
5	HNHhB2g1	Moderately shallow, lowland sandy clay soils with slopes of 1-3%, moderate erosion, gravelly (15-35%)
6	HTIiB2g1, HTIiB2g2, KGHhB2g1	Moderately shallow, red sandy clay to sandy clay loam soils with slopes of 1-3%, moderate erosion, gravelly to very gravelly (15-60%)
7	LKRhC2g3, MKHcB2g1, MKHhB2g1, MKHhB2g2	Moderately shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-5%, moderate erosion, gravelly to extremely gravelly (15-80%)
8	RNKiB2g1, RNKmB1, RNKmB1g1 ,RNKmB2	Moderately shallow, black calcareous clay soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
9	ABRbB2g2, HRVcB2g1, HRVhB2g1, KGPhB2g1 , KGPhB2g2 ,KGPiB1g1	Shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly to very gravelly (15-60%)
10	MTLmB1, MTLmB2g1	Shallow, black calcareous clay soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)

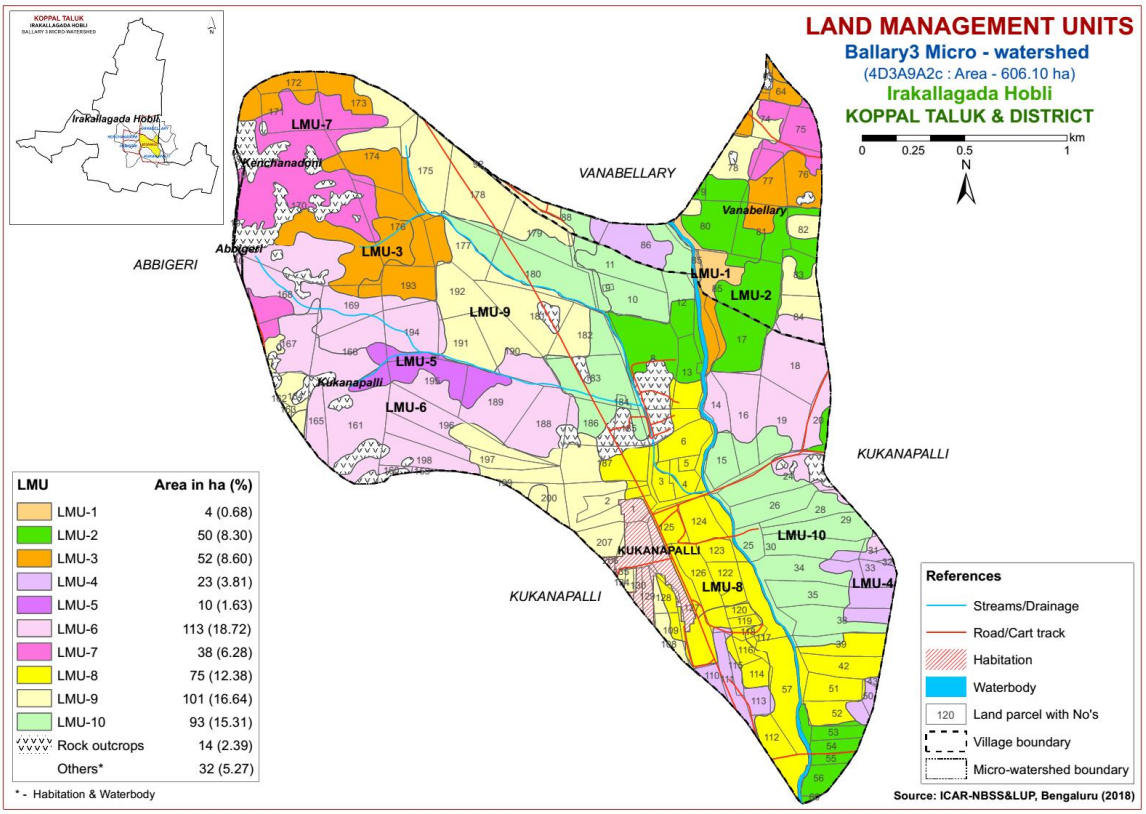


Fig 7.29 Land Management Units map of Ballary-3 microwatershed

7.30 Proposed Crop Plan for Ballary-3 Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the 10 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 28 crops. The resultant proposed crop plan is presented in Table 7.29.

Table 7.29 Proposed Crop Plan for Ballary-3 Microwatershed

Proposed LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	441.TDGmA1 (Very deep, lowland sandy clay loam to sandy loam soils)	**Vanabellary :** 80,85	-	**Vegetable crops:** Brinjal, Tomato, Carrot, Beetroot **Fruit crops:** Custard Apple, Amla **Flower crops:** Marigold, Chrysanthemum, Jasmine	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practises
2	213.JDGiB2g1 200.KMHiB1 209.MNLiB2g1 142.GHThB2g1 (Moderately deep to deep, red sandy clay to sandy clay loam soils)	**Kukanapalli:**8,12,13,17,53,54,55, 56,60 **Vanabellary :** 79,80,81,85	Maize, Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Pomegranate, Guava, Sapota, Mango, Amla, Jackfruit, Jamun, Tamarind, Lime, Musambi, Custard apple **Vegetable crops:** Drumstick, Tomato, Chilli, Brinjal **Flower crops:** Marigold, Chrysanthemum, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
3	180.BDGcB1g1 192.BDGiB1g1 193.BDGiB1g2 194.BDGiB2g1 126.HDHiB1g1 128.HDHiB2g1 (Moderately deep gravelly red sandy clay to clay soils)	**Kukanapalli :**172,174,176,193 **Vanabellary :** 64,76,77	Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops:** Lime, Musambi**,** Jackfruit, Jamun, Amla, Cashew, Custard apple **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
4	342.DRLiB2 344.DRLmA1 348.DRLmB1 362.NSPmB2 (Moderately deep black calcareous clayey soils)	**Kukanapalli:**31,32,33,43,50,110,111,113,115, **Vanabellary :** 86	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Jackfruit, Lime, Musambi, Amla, Custard apple **Vegetable crops:** Drumstick, Chilli, Coriander, Bhendi, Tomato **Flower crops:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
5	464.HNHhB2g1	**Kukanapalli :** 195	Maize	**Fruit crops:** Custard Apple,	Providing proper drainage,

	(Moderately shallow, lowland sandy clay soils)			Amla **Vegetable crops:** Brinjal, Tomato, Chillies	addition of organic manures, green leaf manuring, suitable conservation practices
6	101.HTIiB2g1 102.HTIiB2g2 69.KGHhB2g1 (Moderately shallow, red sandy clay to sandy clay loam soils)	**Abbigeri :** 40 **Kukanapalli:**14,16,18,19,20,159, 161,165,166,167,168,169,188,189 , 194 ,196,197,198 **Vanabellary :**84	Maize, Sorghum, Groundnut, Bajra, Castor	**Fruit crops:** Amla, Custard apple **Flower crops:** Marigold, Chrysanthemum **Vegetable crops:** Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
7	49.LKRhC2g3 77.MKHcB2g1 85.MKHhB2g1 86.MKHhB2g2 (Moderately shallow, red gravelly sandy clay to sandy clay loam soils)	**Kenchanadoni :**19 **Kukanapalli :**170,171,173 **Vanabellary :**75	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)
8	331.RNKiB2g1 333.RNKmB1 334.RNKmB1g1 336.RNKmB2 (Moderately shallow, black calcareous clay soils)	**Kukanapalli:**3,4,6,39,42,5,51,52, 57,112,114,116,117,118,119,120, 121,122,123,124,125,126,127,128	Sorghum, Bajra, Bengal gram, linseed, Safflower, Coriander	**Fruit crops:** Amla, Custard apple **Flower crops:** Marigold, Jasmine Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
9	470.ABRbB2g2 465.HRVcB2g1 26.HRVhB2g1 17.KGPhB2g1 18.KGPhB2g2 19.KGPiB1g1 (Shallow, red gravelly sandy clay to sandy clay loam soils)	**Kukanapalli:**1,2,108,109,134,13 5,162,163,164,175,177,178,179,1 81,182,187,190,191,192,199,200, 207 **Vanabellary :**74,78,82,83,92	Horsegram, Bajra	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
10	307.MTLmB1 311.MTLmB2g1 (Shallow, black calcareous clay soils)	**Kukanapalli :** 9 ,10,11,15, 24,25,26,28,29,30,34,35,38,180,1 83, 184,186, **Vanabellary :** 88	Bengal gram, Horse gram, Coriander	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Sowing across the slope, drip irrigation and mulching is recommended

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Ballary-3 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of HTI (110 ha), MTL (93 ha), RNK (75 ha), KGP (71 ha), BDG (49 ha), MNL (29 ha), LKR (27 ha), HRV (27 ha), DRL (18 ha), JDG(12 ha), MKH (11 ha), HNH (10 ha), NSP (6 ha), TDG (4 ha),ABR (3 ha), KGH (3 ha), HDH (2 ha) and GHT(1 ha).
- 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 2 ha(<1%) is strongly acid (pH 5.0-5.5), 20 ha (3%) moderately acid (pH 5.5-6.0), 94 ha (15%) is slightly acid (pH 6.0-6.5), 251 ha (41%) is neutral (pH 6.5-7.3), 71 ha (12%) is slightly alkaline (pH 7.3-7.8), 71 ha (12 %) is moderately alkaline (pH 7.8-8.4) and 52 ha (9 %) under strongly alkaline (pH 8.4-9.0) in reaction. Thus, major portion of the soils are neutral 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

Acid soils occupy an area of about 116 ha (19%) in the microwatershed. The following measures recommended for reclaiming 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

An area of about 194 ha (32%) is under alkaline soils. The following actions are recommended.

(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

Neutral soils cover about 251 ha(41%) and the following actions are recommended.

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 factors affecting the soil health in the microwatershed. An area of about 357 ha (59 %) is under moderate erosion. The areas with moderate erosion need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

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

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

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

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

- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion, wetness and soil are the major constraints in Ballary-3 Microwatershed.
- **Organic Carbon:** Entire area in the microwatershed is high (>0.75) in OC content.
- **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 area where OC is less than 0.75 per cent. 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 121 ha (20%) and high (>57 kg/ha) in 441 ha (73%) of the soils. The areas with high phosphorus content 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) in 22 ha (4%), medium (145-337 kg/ha) in 409 ha (68%) and high (>337 kg/ha) in 130 ha (21 %) area of the microwatershed. The areas with high potassium content 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.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 483 ha (80%), medium in 79 ha (13%) and high (>20ppm) in <1 ha (<1 %) area of the microwatershed. 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 378 ha (62 %) and sufficient (>4.5 ppm) in 184 ha (30 %) area of the microwatershed. To manage iron deficiency iron sulphate @ 25 kg/ha needs to be applied for 2-3 years.
- **Available Zinc:** It is deficient (<0.6 ppm) in 127 ha (21%) and sufficient (>0.6 ppm) in 435 ha (72 %) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** It is low (<0.5 ppm) in 556 ha (92%) and medium (0.5-1.0 ppm) in 6 ha (<1%) area of the microwatershed. The areas with low in boron content need to be

applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.

- **Available manganese**: It is sufficient in the entire area of the microwatershed**.**
- **Available copper:** It is sufficient in the entire area of the microwatershed**.**
- **Soil acidity:** The microwatershed has 116 ha (19%) area with soils that are slightly to strongly acid. These areas need application of lime (Calcium Carbonate).
- **Soil alkalinity:** An area of about 194 ha (32%) in the microwatershed has soils that are slightly to strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

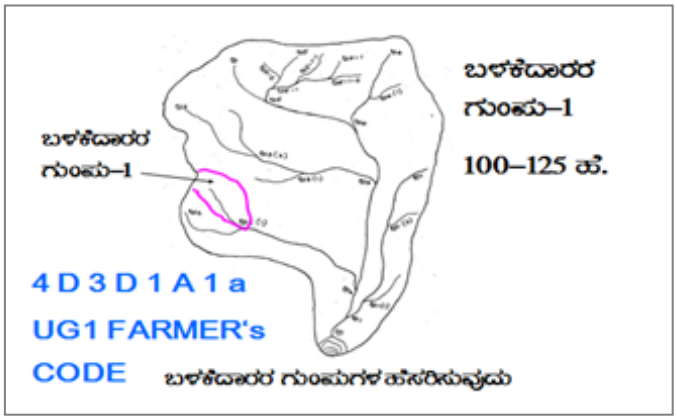
  Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Ballary-3 microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

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



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

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

Steps for Survey and Preparation of Treatment Plan

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

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

9.1 Treatment Plan

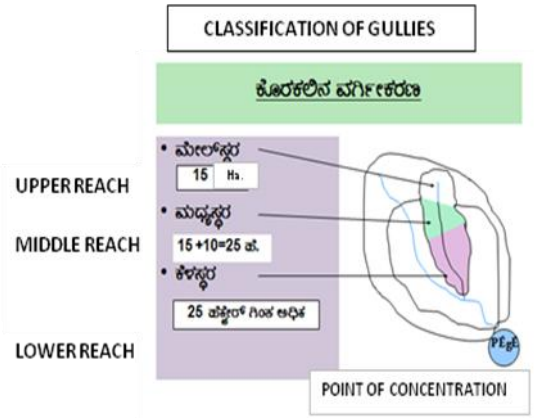
The treatment plan recommended for arable lands is briefly described below.

9.1.1 Arable Land Treatment

A. BUNDING

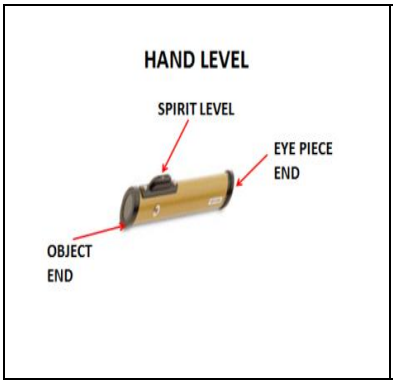
Steps for Survey and Preparation of Treatment Plan	
Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale Drainage lines are 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)

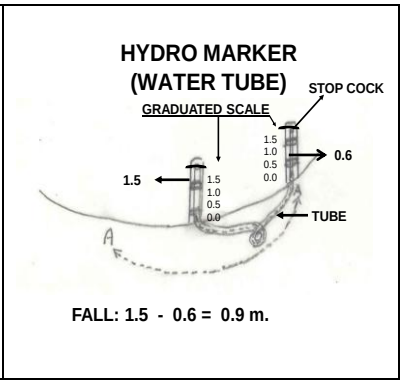
USER GROUP-1



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 clayey 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.

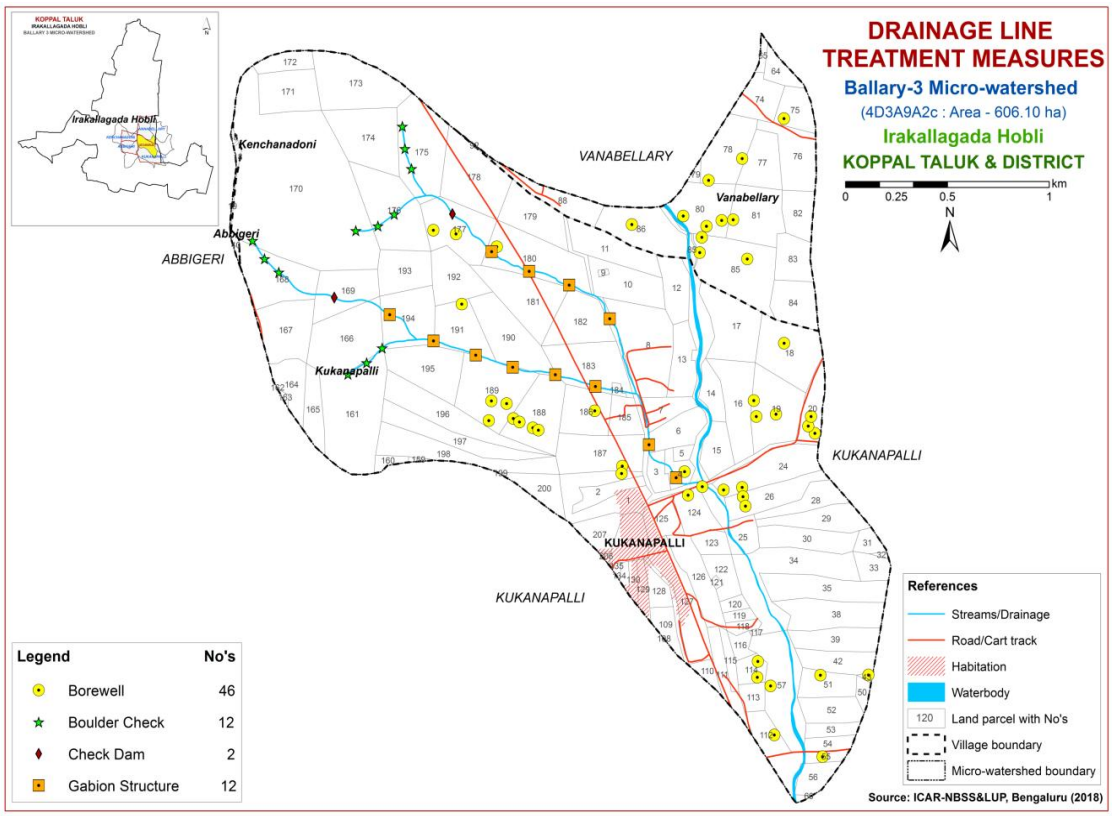


Fig. 9.1 Drainage line treatment map of Ballary-3 Microwatershed

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. A maximum area of about 355 ha (59%) needs trench cum bunding, an area of about 6 ha (< 1%) needs strengthening of existing bunds/bunding and about 199 ha (33 %) requires graded bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

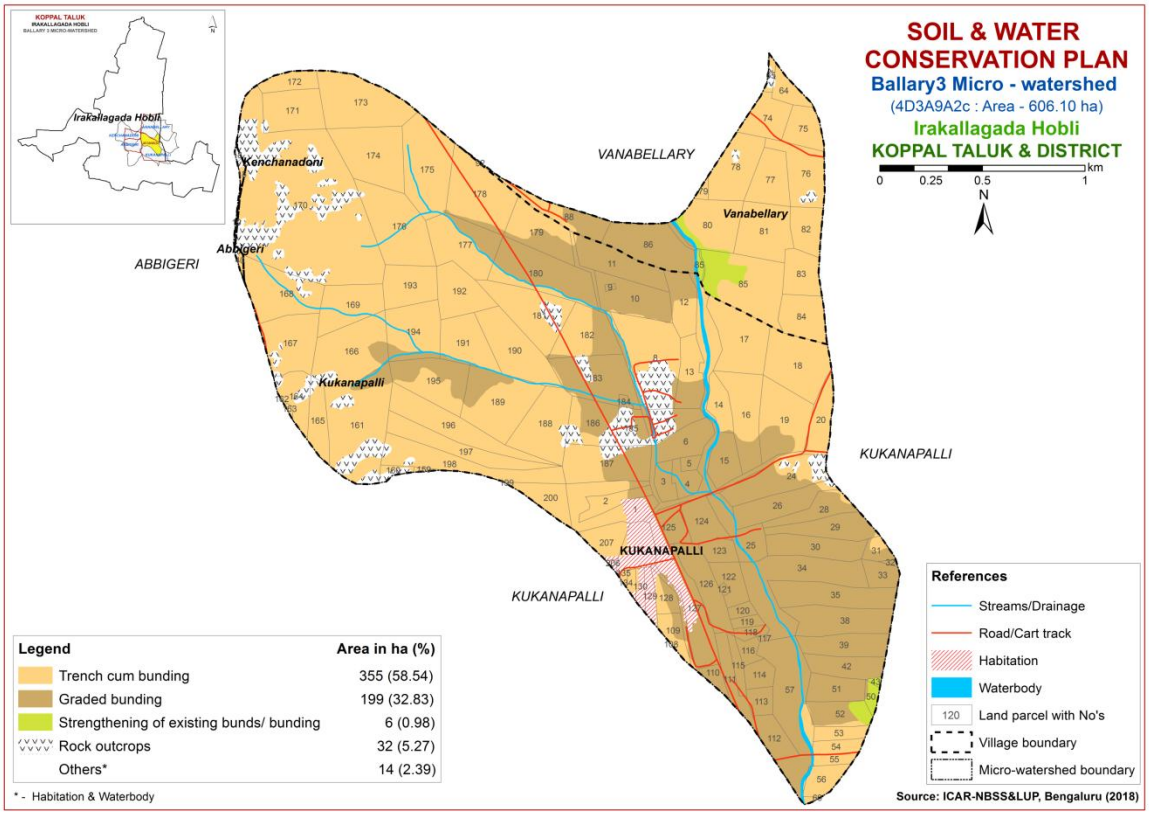


Fig. 9.1 Soil and Water Conservation Plan map of Ballary-3 Microwatershed

9.3 Greening of Microwatershed

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

It is recommended to open the pits during the 1st week of March along the contour and heap the 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

Ballary-3 Microwatershed

Soil Phase Information

Village	Survey No.	Total 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
Kukanapalli	1	6.37	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize+Paddy (Rg+Mz+Pd)	1 Borewell	IIIes	Trench cum bunding
Kukanapalli	2	2.31	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Bajra (Pd+Bj)	Not Available	IIIes	Trench cum bunding
Kukanapalli	3	1.71	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Kukanapalli	4	1.78	RNKmB2	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	1 Borewell	IIes	Graded bunding
Kukanapalli	5	0.63	RNKmB2	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Kukanapalli	6	3.72	RNKmB2	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Kukanapalli	7	2.82	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Not Available	Rock outcrops	Rock outcrops
Kukanapalli	8	10.43	JDGiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	Trench cum bunding
Kukanapalli	9	0.15	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Graded bunding
Kukanapalli	10	5.77	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIIs	Graded bunding
Kukanapalli	11	5.54	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Graded bunding
Kukanapalli	12	3.79	JDGiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Trench cum bunding
Kukanapalli	13	3.96	JDGiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Redgram (Fl+Rg)	Not Available	IIes	Trench cum bunding
Kukanapalli	14	2.4	HTIiB2g1	LMU-6	Moderately shallow (50-75 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
Kukanapalli	15	3.22	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Graded bunding
Kukanapalli	16	6.65	HTIiB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cowpea+Groundnut+ Paddy (Rg+Cw+Gn+Pd)	Not Available	IIes	Trench cum bunding
Kukanapalli	17	7.59	MNLiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize (Rg+Mz)	Not Available	IIes	Trench cum bunding
Kukanapalli	18	8.03	HTIiB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Mango (Rg+Mg)	1 Borewell	IIes	Trench cum bunding
Kukanapalli	19	7.8	HTIiB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Maize+ Vegetables (Rg+Gn+Mz+Vg)	3 Borewell	IIes	Trench cum bunding
Kukanapalli	20	3.3	HTIiB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+ Vegetables (Rg+Gn+Vg)	3 Borewell	IIes	Trench cum bunding
Kukanapalli	24	7.02	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Redgram+Fallow land (Gn+Rg+Fl)	2 Borewell	IIIs	Graded bunding
Kukanapalli	25	4.05	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	1 Borewell	IIIs	Graded bunding
Kukanapalli	26	4.98	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Banana+Redgram+Paddy (Ba+Rg+Pd)	2 Borewell	IIIs	Graded bunding
Kukanapalli	28	3.32	MTLmB1	LMU-10	Shallow (25-50	Clay	Non gravelly	Low (51-100	Very gently	Slight	Redgram+Groundnut+Paddy	Not	IIIs	Graded

Village	Survey No.	Total 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
					cm)		(<15%)	mm/m)	sloping (1-3%)		(Rg+Gn+Pd)	Available		bunding
Kukanapalli	29	4.53	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+Paddy (Rg+Gn+Pd)	Not Available	IIIs	Graded bunding
Kukanapalli	30	4.84	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Paddy (Rg+Mz+Pd)	Not Available	IIIs	Graded bunding
Kukanapalli	31	1.33	DRLmB1	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIs	Graded bunding
Kukanapalli	32	0.16	DRLmB1	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Graded bunding
Kukanapalli	33	1.97	DRLmB1	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+Cowpea (Rg+Gn+Cp)	Not Available	IIs	Graded bunding
Kukanapalli	34	10.92	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallowland+Maize+Paddy+ Redgram+Bajra(Fl+Mz+Pd+Rg+Bj)	Not Available	IIIs	Graded bunding
Kukanapalli	35	6.66	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Vegetables (Rg+Mz+Vg)	Not Available	IIIs	Graded bunding
Kukanapalli	38	6.43	MTLmB1	LMU-10	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Groundnut (Rg+Mz+Gn)	Not Available	IIIs	Graded bunding
Kukanapalli	39	4.5	RNKmB1g1	LMU-8	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Paddy+Vegetabl es (Rg+Mz+Pd+Vg)	Not Available	IIs	Graded bunding
Kukanapalli	42	3.76	RNKmB1g1	LMU-8	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Jowar (Rg+Mz+Jw)	Not Available	IIs	Graded bunding
Kukanapalli	43	0.21	DRLmA1	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Redgram+Cultivated Fallow land+ Groundnut+Paddy(Rg+CFL+Gn+Pd)	1 Borewell	IIs	Strengthening of existing bunds
Kukanapalli	50	0.83	DRLmA1	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Fallow land+Redgram+Paddy (FL+Rg+Pd)	Not Available	IIs	Strengthening of existing bunds
Kukanapalli	51	3.35	RNKmB1g1	LMU-8	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Vegetables (Mz+Vg)	1 Borewell	IIs	Graded bunding
Kukanapalli	52	3.56	RNKmB1g1	LMU-8	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Drumstick+Redgram (Ds+Rg)	Not Available	IIs	Graded bunding
Kukanapalli	53	1.68	KMHiB1	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Bajra(Rg+Bj)	Not Available	IIs	Trench cum bunding
Kukanapalli	54	1.6	KMHiB1	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize (Rg+Mz)	Not Available	IIs	Trench cum bunding
Kukanapalli	55	1.12	KMHiB1	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Cotton+Paddy (Rg+Ct+Pd)	1 Borewell	IIs	Trench cum bunding
Kukanapalli	56	2.42	KMHiB1	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Fallowland+Paddy+Redgram+ Vegetables (Fl+Pd+Rg+Vg)	Not Available	IIs	Trench cum bunding
Kukanapalli	57	11.51	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallowland+Paddy+Redgram+ Vegetables (Fl+Pd+Rg+Vg)	1 Borewell	IIs	Graded bunding
Kukanapalli	60	0.02	KMHiB1	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Pomegranate (Rg+Pg)	Not Available	IIs	Trench cum bunding
Kukanapalli	108	0	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+Vegetables (Rg+Gn+Vg)	Not Available	IIIs	Trench cum bunding
Kukanapalli	109	2.01	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize (Rg+Mz)	Not Available	IIIs	Trench cum bunding
Kukanapalli	110	1.12	DRLiB2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize (Rg+Mz)	Not Available	IIes	Graded bunding
Kukanapalli	111	2.74	DRLiB2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow Land+ Groundnut+Redgram(CFL+Gn+Rg)	Not Available	IIes	Graded bunding
Kukanapalli	112	2.67	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Vegetables (Rg+Vg)	1 Borewell	IIs	Graded bunding

Village	Survey No.	Total 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
Kukanapalli	113	1.58	DRLiB2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Vegetables (Rg+Vg)	Not Available	IIes	Graded bunding
Kukanapalli	114	1.79	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize (Rg+Mz)	2 Borewell	IIes	Graded bunding
Kukanapalli	115	1.28	DRLiB2	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kukanapalli	116	1.16	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Kukanapalli	117	0.12	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Kukanapalli	118	0.88	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Graded bunding
Kukanapalli	119	0.79	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kukanapalli	120	0.81	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow Land (CFL)	Not Available	IIes	Graded bunding
Kukanapalli	121	0.21	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Kukanapalli	122	2.59	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Kukanapalli	123	1.79	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Kukanapalli	124	3.41	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	1 Borewell	IIs	Graded bunding
Kukanapalli	125	3.05	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Cultivated Fallow Land (CFL)	Not Available	IIs	Graded bunding
Kukanapalli	126	4.94	RNKmB1	LMU-8	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Vegetables (Mz+Vg)	Not Available	IIs	Graded bunding
Kukanapalli	127	6.76	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kukanapalli	128	1.73	RNKiB2g1	LMU-8	Moderately shallow (50-75 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow Land (CFL)	Not Available	IIes	Graded bunding
Kukanapalli	129	1.27	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Kukanapalli	130	0.81	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Kukanapalli	134	0.53	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Trench cum bunding
Kukanapalli	135	0.22	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Trench cum bunding
Kukanapalli	159	0.2	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize (Rg+Mz)	Not Available	IIes	Trench cum bunding
Kukanapalli	160	0.83	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Fallow land+Redgram (Fl+Rg)	Not Available	Rock outcrops	Rock outcrops
Kukanapalli	161	14.26	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Redgram (Fl+Rg)	Not Available	IIes	Trench cum bunding
Kukanapalli	162	0	ABRbB2g2	LMU-9	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIIes	Trench cum bunding
Kukanapalli	163	0.18	ABRbB2g2	LMU-9	Shallow (25-50 cm)	Loamy sand	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Trench cum bunding
Kukanapalli	164	3.39	ABRbB2g2	LMU-9	Shallow (25-50	Loamy	Very gravelly (35-	Very Low (<50	Very gently	Moderate	Redgram+Cultivated Fallow	Not	IIIes	Trench cum

Village	Survey No.	Total 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
					cm)	sand	60%)	mm/m)	sloping (1-3%)		Land+Maize (Rg+CFL+Mz)	Available		bunding
Kukanapalli	165	3.21	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIes	Trench cum bunding
Kukanapalli	166	9.4	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Fallow land+Paddy (Rg+Fl+Pd)	Not Available	IIes	Trench cum bunding
Kukanapalli	167	6.88	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Fallow land+ Groundnut+Paddy(Rg+Fl+Gn+Pd)	Not Available	IIes	Trench cum bunding
Kukanapalli	168	7.97	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Fallow land (Rg+Gn+Fl)	Not Available	IIes	Trench cum bunding
Kukanapalli	169	5.84	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIes	Trench cum bunding
Kukanapalli	170	44.05	LKRhC2g3	LMU-7	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Fallow land+Groundnut+ Vegetables+Redgram(Fl+Gn+Vg+Rg)	Not Available	IIIes	Trench cum bunding
Kukanapalli	171	5.68	LKRhC2g3	LMU-7	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram+Paddy+Vegetables (Rg+Pd+Vg)	Not Available	IIIes	Trench cum bunding
Kukanapalli	172	2.36	BDGiB1g2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize+Groundnut (Rg+Mz+Gn)	Not Available	IIIes	Trench cum bunding
Kukanapalli	173	9.53	LKRhC2g3	LMU-7	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram+Mango (Rg+Mn)	Not Available	IIIes	Trench cum bunding
Kukanapalli	174	8.61	BDGiB1g2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+Maize+ Paddy (Rg+Gn+Mz+Pd)	Not Available	IIIes	Trench cum bunding
Kukanapalli	175	9.79	HRVhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Sugarcane+ Current fallow (Rg+Gn+Sc+Cf)	Not Available	IIIes	Trench cum bunding
Kukanapalli	176	9.81	BDGiB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Paddy+Groundnut (Rg+Pd+Gn)	Not Available	IIIes	Trench cum bunding
Kukanapalli	177	7.7	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram+Vegetables (Mz+Rg+Vg)	2 Borewell	IIIs	Trench cum bunding
Kukanapalli	178	9.07	HRVhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Vegetables (Rg+Gn+Vg)	Not Available	IIIes	Trench cum bunding
Kukanapalli	179	5.8	HRVhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Banana (Rg+Ba)	Not Available	IIIes	Trench cum bunding
Kukanapalli	180	9.52	MTLmB2g1	LMU-10	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Paddy (Rg+Gn+Pd)	1 Borewell	IIIes	Graded bunding
Kukanapalli	181	8	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Maize (Rg+Mz)	Not Available	IIIs	Trench cum bunding
Kukanapalli	182	6.12	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Current fallow+Groundnut (Rg+Cf+Gn)	Not Available	IIIs	Trench cum bunding
Kukanapalli	183	7.72	MTLmB2g1	LMU-10	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Groundnut+Sunflower (Mz+Gn+Sf)	Not Available	IIIes	Graded bunding
Kukanapalli	184	0.31	MTLmB2g1	LMU-10	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIIes	Graded bunding
Kukanapalli	185	2.63	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
Kukanapalli	186	5.14	MTLmB2g1	LMU-10	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIIes	Graded bunding
Kukanapalli	187	7.49	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Fallow land+Maize (Rg+Fl+Mz)	1 Borewell	IIIes	Trench cum bunding
Kukanapalli	188	7.51	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Current Fallow+ Groundnut+Maize Rg+Cf+Gn+Mz)	4 Borewell	IIes	Trench cum bunding
Kukanapalli	189	9.43	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Vegetables + Maize (Rg+Gn+Vg+Mz)	3 Borewell	IIes	Trench cum bunding

Village	Survey No.	Total 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
Kukanapalli	190	7.75	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Trench cum bunding
Kukanapalli	191	5.49	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut+Vegetables (Rg+Gn+Vg)	1 Borewell	IIIs	Trench cum bunding
Kukanapalli	192	5.21	KGPiB1g1	LMU-9	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Paddy+Mango (Rg+Pd+Mn)	Not Available	IIIs	Trench cum bunding
Kukanapalli	193	4.99	BDGiB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Paddy+Mango (Rg+Pd+Mn)	Not Available	IIIs	Trench cum bunding
Kukanapalli	194	6.94	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Mango+ Paddy (Rg+Gn+Mn+Pd)	Not Available	IIes	Trench cum bunding
Kukanapalli	195	7.16	HNHhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Vegetables (Rg+Gn+Vg)	Not Available	IIew	Graded bunding
Kukanapalli	196	7.37	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut+Cowpea (Rg+Gn+Cp)	Not Available	IIes	Trench cum bunding
Kukanapalli	197	5.72	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bajra(Rg+Bj)	Not Available	IIes	Trench cum bunding
Kukanapalli	198	7.57	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bajra+Groundnut (Rg+Bj+Gn)	Not Available	IIes	Trench cum bunding
Kukanapalli	199	0.03	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Maize+Groundnut (Rg+Mz+Gn)	Not Available	IIIes	Trench cum bunding
Kukanapalli	200	3.17	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Trench cum bunding
Kukanapalli	206	0.2	Habitation	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	Not Available	Others	Others
Kukanapalli	207	2.78	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bajra (Rg+Bj)	Not Available	IIIes	Trench cum bunding
Abbigeri	40	0.36	HTIiB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Maize (Jw+Mz)	Not Available	IIes	Trench cum bunding
Kenchanadoni	18	0.47	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Not Available	Rock outcrops	Rock outcrops
Kenchanadoni	19	0.18	LKRhC2g3	LMU-7	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Rock outcrops	Not Available	IIIes	Trench cum bunding
Vanabellary	64	1.89	HDHiB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Trench cum bunding
Vanabellary	65	0.58	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Redgram+Groundnut+Mango (Rg+Gn+Mn)	Not Available	Rock outcrops	Rock outcrops
Vanabellary	74	3.84	KGPhB2g1	LMU-9	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+Chilli (Rg+Cf+Gn+Ch)	Not Available	IIIes	Trench cum bunding
Vanabellary	75	3.22	MKHcB2g1	LMU-7	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Mango (Mn)	1 Borewell	IIIes	Trench cum bunding
Vanabellary	76	5.69	BDGiB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Mango (Mz+Mn)	Not Available	IIIes	Trench cum bunding
Vanabellary	77	4.48	BDGiB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Mango+Current fallow (Mn+Cf)	Not Available	IIIes	Trench cum bunding
Vanabellary	78	6.17	KGPhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Chilli (Rg+Ch)	2 Borewell	IIIes	Trench cum bunding
Vanabellary	79	0.41	MNLiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIes	Trench cum bunding
Vanabellary	80	6.7	MNLiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram+Paddy (Gn+Rg+Pd)	3 Borewell	IIes	Trench cum bunding
Vanabellary	81	6.75	MNLiB2g1	LMU-2	Deep (100-150 cm)	Sandy	Gravelly (15-	Medium (101-	Very gently	Moderate	Groundnut+Redgram (Gn+Rg)	1	IIes	Trench cum

Village	Survey No.	Total 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
						clay	35%)	150 mm/m)	sloping (1-3%)			Borewell		bunding
Vanabellary	82	3.25	HRVcB2g1	LMU-9	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Pomegranate (Rg+Pm)	Not Available	IIIes	Trench cum bunding
Vanabellary	83	3.67	HRVcB2g1	LMU-9	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Trench cum bunding
Vanabellary	84	4.51	HTIiB2g1	LMU-6	Moderately shallow (50-75 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
Vanabellary	85	10.91	MNLiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	3 Borewell	IIes	Trench cum bunding
Vanabellary	86	7.37	NSPmB2	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy+Redgram+Bajra (Pd+Rg+Bj)	1 Borewell	IIes	Graded bunding
Vanabellary	88	4.2	MTLmB2g1	LMU-10	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram+Maize (Gn+Rg+Mz)	Not Available	IIIes	Graded bunding
Vanabellary	92	0.06	HRVhB2g1	LMU-9	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Trench cum bunding

Appendix II

Ballary-3 Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kukanapalli	1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	3	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	4	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	5	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	7	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kukanapalli	8	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	9	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	10	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	11	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	12	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	13	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	14	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	18	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	19	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	20	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	24	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	26	Moderately alkaline	Non saline	High (>	Medium (23 –	Medium (145	Low (<10	Low (< 0.5	Deficient (<	Sufficient (>	Sufficient (>	Sufficient (>

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 7.8 – 8.4)	(<2 dsm)	0.75 %)	57 kg/ha)	– 337 kg/ha)	ppm)	ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Kukanapalli	28	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	29	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	30	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	31	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	32	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	33	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	34	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	38	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	39	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	42	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	43	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	50	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	51	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	52	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	53	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	54	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	55	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	56	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	57	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	60	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	108	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	109	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	110	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kukanapalli	111	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	112	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	113	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	114	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	115	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	116	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	117	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	118	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	119	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	120	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	121	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	122	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	123	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	124	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	125	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	126	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	127	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	128	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	129	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kukanapalli	130	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kukanapalli	134	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	135	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	159	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	160	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kukanapalli	161	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Kukanapalli	162	Slightly acid (pH 6.0	Non saline	High (>	High (> 57	Low (<145	Low (<10	Low (< 0.5	Deficient (<	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		– 6.5)	(<2 dsm)	0.75 %)	kg/ha)	kg/ha)	ppm)	ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Kukanapalli	163	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Kukanapalli	164	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Kukanapalli	165	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Kukanapalli	166	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	167	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	168	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	169	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	170	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	171	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	172	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	173	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	174	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	175	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	176	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	177	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	178	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	179	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	180	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	181	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	182	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	183	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	184	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	185	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kukanapalli	186	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kukanapalli	187	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	188	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	189	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	190	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	191	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	192	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	194	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	195	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	196	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	197	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	198	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukanapalli	199	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	200	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukanapalli	206	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kukanapalli	207	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Abbigeri	40	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kenchanad oni	18	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kenchanad oni	19	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	64	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	65	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Vanabellary	74	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	75	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	76	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	77	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Vanabellary	78	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	79	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	80	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	81	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	82	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	83	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	85	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	86	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	88	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Vanabellary	92	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Ballary-3 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	Crosandra	Drumstick	Mulbery
Kukanapalli	1	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	2	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	3	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	4	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	5	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	6	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	7	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Kukanapalli	8	S2rg	S2tg	S2g	S2tg	S2tg	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	S2t	S2rg	S2g	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S1	S1
Kukanapalli	9	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	10	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	11	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	12	S2rg	S2tg	S2g	S2tg	S2tg	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	S2t	S2rg	S2g	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S1	S1
Kukanapalli	13	S2rg	S2tg	S2g	S2tg	S2tg	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	S2t	S2rg	S2g	S2t	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S1	S1
Kukanapalli	14	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Kukanapalli	15	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	16	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Kukanapalli	17	S2rg	S2g	S2g	S2g	S2g	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	N1z	S2rg	S2g	S1	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S2g	S1
Kukanapalli	18	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Kukanapalli	19	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Kukanapalli	20	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Kukanapalli	24	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	25	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	26	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	28	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	29	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	30	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	31	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	32	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	33	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	34	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	35	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	38	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	39	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	42	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	43	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S3tz	S2rz	S2tz
Kukanapalli	50	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S3tz	S2rz	S2tz

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	Crosandra	Drumstick	Mulbery
Kukanapalli	51	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	52	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	53	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kukanapalli	54	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kukanapalli	55	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kukanapalli	56	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kukanapalli	57	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	60	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Kukanapalli	108	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	109	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	110	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	111	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	112	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	113	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	114	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	115	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2z	S2rz	S2tz
Kukanapalli	116	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	117	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	118	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	119	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	120	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	121	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	122	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	123	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	124	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	125	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	126	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	127	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	128	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S3rz	S3rz	S3rz
Kukanapalli	129	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
Kukanapalli	130	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
Kukanapalli	134	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	135	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	159	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	160	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Kukanapalli	161	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	162	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	N1r	N1r
Kukanapalli	163	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	N1r	N1r
Kukanapalli	164	N1r	S3rg	N1r	S3rg	N1r	S3rt	N1r	N1r	S3rt	N1r	N1r	S3rg	N1r	S3rg	N1r	N1r	N1r	S3rg	S3rg	S3rg	S3rg	S3rg	N1r	S3rg	S3rg	S3rg	N1r	N1r
Kukanapalli	165	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	166	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	167	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg

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	Crosandra	Drumstick	Mulbery
Kukanapalli	168	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	169	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	170	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	S3rg	N1g	S3rg	N1g	N1g	N1g	S3rg	N1g	N1g	N1g	N1g	S3rg	S3rg	N1g	N1g	S3rg	S3rg
Kukanapalli	171	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	S3rg	N1g	S3rg	N1g	N1g	N1g	S3rg	N1g	N1g	N1g	N1g	S3rg	S3rg	N1g	N1g	S3rg	S3rg
Kukanapalli	172	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
Kukanapalli	173	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	S3rg	N1g	S3rg	N1g	N1g	N1g	S3rg	N1g	N1g	N1g	N1g	S3rg	S3rg	N1g	N1g	S3rg	S3rg
Kukanapalli	174	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
Kukanapalli	175	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
Kukanapalli	176	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
Kukanapalli	177	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	178	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
Kukanapalli	179	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
Kukanapalli	180	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	181	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	182	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	183	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	184	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	185	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Kukanapalli	186	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Kukanapalli	187	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	188	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	189	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	190	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	191	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	192	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	193	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
Kukanapalli	194	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	195	N1rw	S2rw	S3rw	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rw	S2rw	S3rw	S3rw	S3rw	S2rw	S2rw	S2rw	S2rw	S2rw	S3rw	S2rw	S2rw	S2rw	S3rw	S3rw
Kukanapalli	196	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	197	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	198	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kukanapalli	199	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	200	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Kukanapalli	206	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
Kukanapalli	207	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Abbigeri	40	N1rg	S2rg	S3rg	S2rg	S3rg	S2rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg
Kenchanadoni	18	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Kenchanadoni	19	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	N1g	S3rg	N1g	S3rg	N1g	N1g	N1g	S3rg	N1g	N1g	N1g	N1g	S3rg	S3rg	N1g	N1g	S3rg	S3rg
Vanabellary	64	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
Vanabellary	65	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Vanabellary	74	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Vanabellary	75	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S2rg	S3rg	S3rg

Village	Survey 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	Crosandra	Drumstick	Mulbery
Vanabellary	76	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
Vanabellary	77	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
Vanabellary	78	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3rg	N1r	N1r
Vanabellary	79	S2rg	S2g	S2g	S2g	S2g	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	N1z	S2rg	S2g	S1	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S2g	S1
Vanabellary	80	S2rg	S2g	S2g	S2g	S2g	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	N1z	S2rg	S2g	S1	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S2g	S1
Vanabellary	81	S2rg	S2g	S2g	S2g	S2g	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	N1z	S2rg	S2g	S1	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S2g	S1
Vanabellary	82	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
Vanabellary	83	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
Vanabellary	84	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S2rg	S2rg	S3r	S2r
Vanabellary	85	S2rg	S2g	S2g	S2g	S2g	S2g	S2rg	S2g	S2tg	S2g	S2g	S1	S2g	S1	N1z	S2rg	S2g	S1	S2g	S2g	S2g	S2g	S2g	S1	S2g	S2g	S2g	S1
Vanabellary	86	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S3t	S2rt	S2tw
Vanabellary	88	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Vanabellary	92	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

RO-Rock outcrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE STUDY

- *Results indicated that 37 farmers were sampled in Bellary-3 micro watershed among them 5 (13.51%) were marginal farmers, 13 (35.14%) were small farmers, 10(27.03%) were semi medium farmers, 4 (10.81%) were medium farmers and 5 (13.51%) landless farmers were also interviewed for the survey.*
- *The data indicated that there were 179 population households were there in the studied micro watershed. Among them 115 (64.25%) men and 64 (35.75%) were women. The average family size of landless and small was, semi medium and medium farmers were 5 and Marginal farmers were 6.*
- *The data indicated that 22 (12.29%) people were in 0-15 years of age, 88 (49.16%) were in 16-35 years of age, 50 (27.93%) were in 36-60 years of age and 19 (10.61%) were above 61 years of age.*
- *The results indicated that the Bellary-3 had 32.96 per cent illiterates, 19.55 per cent of them had primary school education, 13.41 per cent of them had both middle school, 14.53 per cent them had high school education, 7.26 per cent of them had PUC education, 0.56 per cent them had Diploma education and ITI, 6.15 per cent of them had degree education, 1.68 per cent of them had masters education and 3.35 per cent them had others.*
- *The results indicated that, 75.68 per cent of households practicing agriculture, 16.22 per cent of the household heads were agricultural labour and 8.11 per cent of the household heads were general labour.*
- *The results indicated that agriculture was the major occupation for 60.89 per cent of the household members, 6.70 per cent were agricultural labourers and general labours, 0.56 percent were in household industry, 4.47 per cent of them were in private sector, 15.08 per cent of them were students and 3.35 per cent of them were children.*
- *In case of landless households 20 per cent were agricultural labour, 60 per cent were general labourers and 20 per cent were students. In case of marginal farmers 76.67 per cent were agriculturist, 3.33 percent was in private service and 20 per cent were students. In case of small farmers 68.97 per cent of them were agriculturist and 5.17 per cent of them were agricultural labours, and 18.97 per cent of them were students. In case of semi medium farmers 70.59 per cent of the family members were agriculturist, 5.88 per cent were general labour and were in private service and 3.92 per cent of them were students. In case of medium farmers 50 per cent of the family members were agriculturist, 10 per cent were general labour, 20 per cent were students and 20 per cent of them were in private service.*
- *The results showed that 1.12 per cent of them participated in self help groups and 98.88 per cent of them have not participated in any local institutions.*

- *The results indicated that 81.08 per cent of the households possess Katcha house, 8.11 per cent of the households possess Pucca house and 8.11 per cent of the households possess Semi Pacca house.*
- *The results showed that, 2.70 per cent of the households possess radio, 59.46 per cent of the households possess TV, 24.32 per cent of the households possess Mixer grinder, 27.03 per cent of the households possess bicycle, 37.84 per cent of the households possess motor cycle and 97.30 per cent of the households possess mobile phones.*
- *The results showed that the average value of radio was Rs.500, television was Rs. 3409, mixer grinder was Rs.1033, bicycle was Rs.1400, motor cycle was Rs.35000 and mobile phone was Rs.1398.*
- *About 18.92 per cent of the households possess bullock cart and plough, 13.51 per cent of the households possess sprayer, 70.27 per cent of the households possess weeder, 5.41 per cent of the households possess thresher and 29.73 per cent of the households possess chaff cutter.*
- *The results showed that the average value of bullock cart was Rs.16000; the average value of plough was Rs. 1133, the average value of sprayer was Rs. 2300, the average value of weeder was Rs. 32, the average value of thresher was Rs. 500 and the average value of chaff cutter was Rs. 1327.*
- *The results indicated that, 37.84 per cent of the households possess bullocks, 32.43 per cent of the households possess local cow, 2.70 per cent of the households possess crossbred cow and 5.41 per cent of the households possess poultry birds. In case of marginal farmers, 40 per cent of the households possess bullock and 20 per cent of the household possess local cow and poultry birds respectively. In case of small farmers, 38.46 per cent of households possess bullock, 46.15 per cent possess local cow and 7.69 per cent possess poultry birds. In case of semi medium farmers, 40 per cent of the households possess bullock, 30 per cent of the household possess local cow and 10 per cent of the households possess crossbred cow. In medium farmers 75 per cent of the households possess bullock and 50 per cent of the household possess local cow.*
- *The results indicated that, average own labour men available in the micro watershed was 6.72, average own labour (women) available was 4.25, average hired labour (men) available was 8.41 and average hired labour (women) available was 8.16.*
- *In case of marginal farmers, average own labour men available was 3, average own labour (women) was also 1.40, average hired labour (men) was 9.40 and average hired labour (women) available was 9.60. In case of small farmers, average own labour men available was 13, average own labour (women) was 8.31, average hired labour (men) was 9.92 and average hired labour (women) available was 9.85. In case of semi medium farmers, average own labour men available was 2.20, average own labour (women) was 1.60, average hired labour (men) was 6.90 and average hired labour (women) available was 6.20. In medium farmers average own labour men*

available was 2.25, average own labour (women) was 1.25, average hired labour (men) was 6 and average hired labour (women) available was 5.75.

- *The results indicated that, 86.49 per cent of the household opined that hired labour was adequate.*
- *The results indicated that, households of the Bellary-3 micro watershed possess 29.40 ha (55.96%) of dry land and 23.14 ha (44.04%) of irrigated land. Marginal farmers possess 2.10 ha (70.61%) of dry land and 0.88 ha (29.39%) of irrigated land. Small farmers possess 18.41ha (95.79%) of dry land and 0.81ha (4.21%) of irrigated land. Semi medium farmers possess 7.27ha (40.35%) of dry land and 10.74 ha (59.65%) of irrigated land. Medium farmers possess 1.62 (13.13%) of dry land and 10.71ha (86.87%) of irrigated land.*
- *The results indicated that, the average value of dry land was Rs. 302,629.41 and average value of irrigated was Rs. 395,293.31. In case of marginal famers, the average land value was Rs. 664,999.99 for dry land and Rs. 1,540,896.49 for irrigated land. In case of small famers, the average land value was Rs. 255,255.06 for dry land Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 302,561.25 for dry land and Rs. 325,612.05 for irrigated land. In case of medium famers, the average land value was Rs. 370,500 for dry land and Rs. 326,719.58 for irrigated land.*
- *The results indicated that, there were 14 functioning and 4 de-functioning bore wells in the micro watershed.*
- *The results indicated that, bore well was the major irrigation source for 37.84 per cent of the farmers and 2.70 per cent households were using open well for irrigation.*
- *The results indicated that on an average the depth of the bore well was 27.51 meters.*
- *The results indicated that, in case of marginal farmers there was 0.40 ha of irrigated land, in case of small farmers there was 1.62 ha of irrigated land, semi medium farmers were having 8.10 ha of irrigated land and medium farmers were having 12.11 ha of irrigated land. On an average there were 22.23 ha of irrigated land.*
- *The results indicated that, farmers have grown bajra (3.24 ha), groundnut (10.26 ha), maize (37.65 ha), paddy (0.81 ha) and tomato (0.54 ha) in kharif season. Farmers grown bajra (1.62 ha) and sunflower (0.40 ha) in Rabi season. Also grown groundnut (2.83 ha) in summer season. Marginal farmers had grown maize, tomato and groundnut. Small farmers had grown bajra, groundnut and maize. Semi medium farmers had grown Bajra, groundnut, maize and sunflower. Medium farmers had grown groundnut, maize, paddy and tomato.*
- *The results indicated that, the cropping intensity in Bellary-3 micro watershed was found to be 83.06 per cent. In case of marginal farmers it was 100 per cent, in small farmers it was 81.04 , in semi medium farmers it was 91.19 and in medium farmers it was 69.68 per cent.*

- *The results indicated that, 83.78 per cent of the households have bank account and 2.70 per cent of them savings. In land less farmers 80 per cent of the household possess bank account. Among marginal farmers 60 percent of them possess bank account and 20 per cent of the household possess savings. 92.31 per cent of small farmers possess bank account. In semi medium farmers possess 80 per cent of them possess bank account and medium category of farmers possess 100 per cent of bank account. The results indicated that, 80 per cent of landless, 60 per cent of marginal, 92.31 per cent of small, 80 per cent of the semi medium and 100 per cent of medium farmers have borrowed credit from different sources.*
- *The results indicated that, 3.23 per cent have availed loan from friends/ relatives and 9.68 per cent have availed loan from Grameena bank.*
- *The results indicated that, semi medium farmers have availed Rs.52500. Overall average credit amount availed by households in the micro watershed is 13,548.39.*
- *The results indicated that, 100 per cent of the households have borrowed loan for agriculture production.*
- *The results indicated that, 100 percent of loan was taken for household consumption.*
- *Results indicated that 100 percent of the households have unpaid their institutional loan.*
- *Results indicated that 100 per cent of the households have partially paid their private loan.*
- *The results indicated that, the total cost of cultivation for bajra was Rs. 18425.71. The gross income realized by the farmers was Rs. 31260.94. The net income from bajra cultivation was Rs. 12835.23, thus the benefit cost ratio was found to be 1:1.7.*
- *The results indicated that, the total cost of cultivation for maize was Rs. 31011.05. The gross income realized by the farmers was Rs. 43640.22. The net income from maize cultivation was Rs. 12629.17. Thus the benefit cost ratio was found to be 1:1.41.*
- *The results indicated that, the total cost of cultivation for paddy was Rs. 33295.80. The gross income realized by the farmers was Rs. 37297.00. The net income from paddy cultivation was Rs. 4001.20. Thus the benefit cost ratio was found to be 1:1.12.*
- *The results indicated that, the total cost of cultivation for groundnut was Rs. 44988.36. The gross income realized by the farmers was Rs. 104414.40. The net income from groundnut cultivation was Rs. 59426.04. Thus the benefit cost ratio was found to be 1:2.32.*
- *The results indicated that, the total cost of cultivation for Sunflower was Rs. 47943.10. The gross income realized by the farmers was Rs. 103740.00. The net income from Sunflower cultivation was Rs. 55796.90. Thus the benefit cost ratio was found to be 1:2.16.*
- *The results indicated that, the total cost of cultivation for Tomato was Rs. 102707.41. The gross income realized by the farmers was Rs. 335876.41. The net income from*

Tomato cultivation was Rs. 233169.00. Thus the benefit cost ratio was found to be 1:3.27.

- *The results indicated that, 43.24 per cent of the households opined that dry fodder was adequate and 8.11 per cent of the households opined that green fodder was adequate.*
- *The table indicated that, in landless farmers, the average income from wage Rs.66000.In marginal farmers the average income from service/salary was Rs.16000, wage was Rs.39000 and agriculture was Rs.52240. In small farmers the average income from wage was Rs.8076.92 and agriculture was Rs.97480.77 and dairy farm was Rs.3826.92. In semi medium farmers the average income from service/salary was Rs.15000, business was rs.12000, wage was Rs.22200 and agriculture was Rs.132600. In medium farmers the average income from service/salary was Rs.218000, wage was Rs.5000 and agriculture was Rs.287500.*
- *The results indicated that in landless, the average expenditure from wage was Rs.3333.33. In marginal farmers the average expenditure from agriculture was Rs.22200. In small farmers the average expenditure from wage was Rs.2000, agriculture was Rs.51464.54 and dairy farm was Rs.7666.67. In semi medium farmers the average expenditure from business was Rs.60000, wage was Rs.20000 and agriculture was Rs.65000.In medium farmers the average expenditure from agriculture was Rs.126250.*
- *The results indicated that, sampled households have grown 65 coconut, 1 lemon and 7 mango trees in their field and also planted 2 coconut and 1 mango trees in their backyard.*
- *The results indicated that, households have planted 4 Eucalyptus tree, 56 teak trees, and 144 neem trees in their field and also grown 2 Neem tree in the their backyard.*
- *The results indicate that, households have an average investment capacity of Rs. 135.14 for improved crop production and Rs.81.08 for improved livestock management. Small farmers have an average investment capacity of Rs. 384.62 for improved crop production and Rs.230.77 for improved livestock management.*
- *The results indicated that for 2.70 per cent of the households were dependent on loan from the bank for improved crop production and improved livestock management respectively.*
- *The results indicated that, Bajra, sunflower and tomato crops were sold to an extent of 100 per cent. Groundnut, maize and paddy crops were sold to an extent of 97.68 per cent, 98.81 per cent and 70 per cent respectively.*
- *The results indicated that, 2.70 percent of the households have sold their produce to agent/traders, 100 percent of the households have sold their produce to local/village merchant and 21.62 percent of the households sold their produce in regulated markets.*

- *The results indicated that 2.70 per cent of the households have used cart as a mode of transport, 100 per cent of them have used tractor and 5.41 per cent have used truck.*
- *The results indicated that, 72.97 per cent of the households have experienced the soil and water erosion problems i.e. 60 percent of marginal farmers, 84.62 per cent of small farmers, 90 per cent of semi medium farmers and 100 percent of medium farmers.*
- *The results indicated that, 81.08 per cent of the households have shown interest in soil testing.*
- *The results indicated that, 72.97 percent used fire wood as a source of fuel and 27.03 percent of the households used LPG.*
- *The results indicated that, piped supply was the source of drinking water for 75.68 per cent, 16.22 per cent of them were using bore well and 8.11 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, 86.49 per cent of the households possess sanitary toilet i.e. 100 per cent of landless, marginal, small, 50 per cent of semi medium and 75 per cent of medium had sanitary toilet facility.*
- *The results indicated that, 100 per cent of the sampled households possessed BPL card and 2.70 per cent of the sampled households have not possessed BPL card.*
- *The results indicated that, 40.54 per cent of the households participated in NREGA programme which included 100 per cent of the landless and marginal, 7.69 per cent of the small, 20 per cent of the semi medium and 50 percent of the medium farmers.*
- *The results indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 91.89 per cent, 27.03 per cent, 81.08 per cent, 5.41 per cent, 75.68 per cent, 48.65 per cent and 21.62 per cent of the households respectively.*
- *The results indicated that, pulses, oilseeds, vegetables, fruits , milk, egg and meat were inadequate for 8.11 per cent, 70.27 per cent, 16.22 per cent, 89.19 per cent, 18.92 per cent, 48.65 per cent and 72.97 per cent of the households respectively.*
- *The results indicated that, Lower fertility status of the soil was the constraint experienced by 81.08 per cent of the households, wild animal menace on farm field (83.78%), frequent incidence of pest and diseases (62.16%), inadequacy of irrigation water (29.73%), high cost of Fertilizers and plant protection chemicals (70.27%), high rate of interest on credit (35.14%), low price for the agricultural commodities (72.97%), lack of marketing facilities in the area (56.76%), inadequate extension services (10.81%), lack of transport for safe transport of the agricultural produce to the market (67.57%), less rainfall (13.51%) and Source of Agri-technology information(Newspaper/TV/Mobile (5.41%).*

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 Jains. 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. It consists of four taluks namely Koppal, Gangavathi, Kushtagi and Yelburga. The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. The Koppal district is having partly red sandy and black soil suitable for agriculture and horticulture crops. Majority of Gangavathi taluk is having black soil. The taluk is also having very few hills with xerophilous vegetation. The partly red sandy soil and black soil of mixed geographical origin are found in the Yelburga taluk.

Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiographic, 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 Ephemeral in nature, these come under Tungabhadra sub-basin.

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

Bellary-3 micro-watershed (Indaragi sub-watershed, Koppal Taluk and District) is located at North latitude $15^0$27’19.874’’ to 15^0 25’21.625” and East longitude 76^0 18’22.953’’ to $76^0$16’35.511’’ covering an area of 606.27 ha and spread across Vanabelary, Indargi, Abbagiri and Kukanapalli 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 37 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Bellary-3 micro watershed is presented in Table 1 and it indicated that 37 farmers were sampled in Bellary-3 micro watershed among them 5 (13.51%) were marginal farmers, 13 (35.14%) were small farmers, 10(27.03%) were semi medium farmers, 4 (10.81%) were medium farmers and 5 (13.51%) landless farmers were also interviewed for the survey.

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

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	13.51	5	13.51	13	35.14	10	27.03	4	10.81	37	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Bellary-3 micro watershed is presented in Table 2. The data indicated that there were 179 population households were there in the studied micro watershed. Among them 115 (64.25%) men and 64 (35.75%) were women. The average family size of landless and small was, semi medium and medium farmers were 5 and Marginal farmers were 6.

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

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF(4)		All (179)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Male	11	55	20	66.67	39	67.24	32	62.75	13	65	115	64.25
2	Female	9	45	10	33.33	19	32.76	19	37.25	7	35	64	35.75
Total		20	100	30	100	58	100	51	100	20	100	179	100
Average		4		6		4		5		5		4	

Age wise classification of population: The age wise classification of household members in Bellary-3 micro watershed is presented in Table 3. The data indicated that 22 (12.29%) people were in 0-15 years of age, 88 (49.16%) were in 16-35 years of age, 50 (27.93%) were in 36-60 years of age and 19 (10.61%) were above 61 years of age.

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

Sl. No.	Particulars	LL (20)		MF (30)		SF (58)		SMF (51)		MDF (20)		All (179)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years	2	10	4	13.33	6	10.34	6	11.76	4	20	22	12.29
2	16-35 years	11	55	16	53.33	32	55.17	21	41.18	8	40	88	49.16
3	36-60 years	7	35	8	26.67	16	27.59	13	25.49	6	30	50	27.93
4	> 61 years	0	0	2	6.67	4	6.90	11	21.57	2	10	19	10.61
Total		20	100	30	100	58	100	51	100	20	100	179	100

Education level of household members: Education level of household members in Bellary-3 micro watershed is presented in Table 4. The results indicated that the Bellary-3 had 32.96 per cent illiterates, 19.55 per cent of them had primary school education, 13.41

per cent of them had both middle school, 14.53 per cent them had high school education, 7.26 per cent of them had PUC education, 0.56 per cent them had Diploma education and ITI, 6.15 per cent of them had degree education, 1.68 per cent of them had masters education and 3.35 per cent them had others.

Table 4: Education level of household members in Bellary-3 micro watershed

Sl. No.	Particulars	LL (20)		MF (30)		SF (58)		SMF (51)		MDF(20)		All (179)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	6	30	9	30.00	16	27.59	16	31.37	12	60	59	32.96
2	Primary School	3	15	4	13.33	12	20.69	15	29.41	1	5	35	19.55
3	Middle School	2	10	6	20.00	6	10.34	6	11.76	4	20	24	13.41
4	High School	7	35	8	26.67	6	10.34	3	5.88	2	10	26	14.53
5	PUC	1	5	0	0.00	9	15.52	3	5.88	0	0	13	7.26
6	Diploma	0	0	0	0.00	1	1.72	0	0.00	0	0	1	0.56
7	ITI	0	0	1	3.33	0	0.00	0	0.00	0	0	1	0.56
8	Degree	1	5	2	6.67	5	8.62	2	3.92	1	5	11	6.15
9	Masters	0	0	0	0.00	1	1.72	2	3.92	0	0	3	1.68
10	Others	0	0	0	0.00	2	3.45	4	7.84	0	0	6	3.35
Total		20	100	30	100	58	100	51	100	20	100	179	100

Occupation of household heads: The data regarding the occupation of the household heads in Bellary-3 micro watershed is presented in Table 5. The results indicated that, 75.68 per cent of households practicing agriculture, 16.22 per cent of the household heads were agricultural labour and 8.11 per cent of the household heads were general labour.

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

Sl. No.	Particulars	LL (5)		MF (5)		SF (13)		SMF(10)		MDF(4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	5	100	11	84.62	10	100	2	50	28	75.68
2	Agricultural Labour	2	40	0	0	1	7.69	1	10	2	50	6	16.22
3	General Labour	3	60	0	0	0	0.00	0	0	0	0	3	8.11
4	Others	0	0	0	0	1	7.69	0	0	0	0	1	2.70
Total		5	100	5	100	13	100.00	11	10	4	100	38	100

Occupation of the household members: The data regarding the occupation of the household members in Bellary-3 micro watershed is presented in Table 6. The results indicated that agriculture was the major occupation for 60.89 per cent of the household members, 6.70 per cent were agricultural labourers and general labours, 0.56 percent were in household industry, 4.47 per cent of them were in private sector, 15.08 per cent of them were students and 3.35 per cent of them were children.

In case of landless households 20 per cent were agricultural labour, 60 per cent were general labourers and 20 per cent were students. In case of marginal farmers 76.67 per cent were agriculturist, 3.33 percent was in private service and 20 per cent were students. In case of small farmers 68.97 per cent of them were agriculturist and 5.17 per cent of them were agricultural labours, and 18.97 per cent of them were students. In case of semi medium farmers 70.59 per cent of the family members were agriculturist, 5.88

per cent were general labour and were in private service and 3.92 per cent of them were students. In case of medium farmers 50 per cent of the family members were agriculturist, 10 per cent were general labour, 20 per cent were students and 20 per cent of them were in private service.

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

Sl. No.	Particulars	LL (20)		MF (30)		SF (58)		SMF (51)		MDF(20)		All (179)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	23	76.67	40	68.97	36	70.59	10	50	109	60.89
2	Agricultural Labour	4	20	0	0	3	5.17	3	5.88	2	10	12	6.70
3	General Labour	12	60	0	0	0	0.00	0	0.00	0	0	12	6.70
4	Household industry	0	0	0	0	1	1.72	0	0.00	0	0	1	0.56
5	Private Service	0	0	1	3.33	0	0.00	3	5.88	4	20	8	4.47
6	Student	4	20	6	20	11	18.97	2	3.92	4	20	27	15.08
7	Others	0	0	0	0	1	1.72	3	5.88	0	0	4	2.23
8	Children	0	0	0	0	2	3.45	4	7.84	0	0	6	3.35
Total		20	100	30	100	58	100	51	100	20	100	179	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Bellary-3 micro-watershed is presented in Table 7. The results showed that 1.12 per cent of them participated in self help groups and 98.88 per cent of them have not participated in any local institutions.

Table 7: Institutional Participation of household members in Bellary-3 micro watershed

Sl. No.	Particulars	LL (20)		MF(30)		SF (58)		SMF(51)		MDF(20)		All (179)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Self Help Group	0	0	0	0	2	3.45	0	0	0	0	2	1.12
2	No Participation	20	100	30	100	56	96.55	51	100	20	100	177	98.88
Total		20	100	30	100	58	100.00	51	100	20	100	179	100

Type of house owned: The data regarding the type of house owned by the households in Bellary-3 micro watershed is presented in Table 8. The results indicated that 81.08 per cent of the households possess Katcha house, 8.11 per cent of the households possess Pucca house and 8.11 per cent of the households possess Semi Pacca house.

Table 8: Type of house owned by households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	1	20	0	0	1	7.69	0	0	0	0	2	5.41
2	Katcha	4	80	5	100	9	69.23	9	90	3	75	30	81.08
3	Pucca/RCC	0	0	0	0	2	15.38	0	0	1	25	3	8.11
Total		5	100	5	100	12	100.00	9	100	4	100	35	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Bellary-3 micro watershed is presented in Table 9. The results showed that, 2.70 per cent of the households possess radio, 59.46 per cent of the households possess TV, 24.32 per cent of the households possess Mixer grinder, 27.03

per cent of the households possess bicycle, 37.84 per cent of the households possess motor cycle and 97.30 per cent of the households possess mobile phones.

Table 9: Durable Assets owned by households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Radio	0	0	0	0	0	0	1	10	0	0	1	2.70
2	Television	2	40	3	60	8	61.54	5	50	4	100	22	59.46
3	Mixer/Grinder	2	40	1	20	6	46.15	0	0	0	0	9	24.32
4	Bicycle	1	20	2	40	4	30.77	3	30	0	0	10	27.03
5	Motor Cycle	0	0	1	20	6	46.15	3	30	4	100	14	37.84
6	Mobile Phone	5	100	5	100	13	100	9	90	4	100	36	97.30

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Bellary-3 micro watershed is presented in Table 10. The results showed that the average value of radio was Rs.500, television was Rs. 3409, mixer grinder was Rs.1033, bicycle was Rs.1400, motor cycle was Rs.35000 and mobile phone was Rs.1398.

Table 10: Average value of durable assets owned by households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
1	Radio	0	0	0	500	0	500
2	Television	2,000	3,000	2,625	5,100	3,875	3,409
3	Mixer/Grinder	1,000	1,000	1,050	0	0	1,033
4	Bicycle	1,000	1,500	1,000	2,000	0	1,400
5	Motor Cycle	0	35,000	33,333	36,666	36,250	35,000
6	Mobile Phone	785	1,371	1,304	2,090	1,200	1,398

Farm Implements owned: The data regarding the farm implements owned by the households in Bellary-3 micro watershed is presented in Table 11. About 18.92 per cent of the households possess bullock cart and plough, 13.51 per cent of the households possess sprayer, 70.27 per cent of the households possess weeder, 5.41 per cent of the households possess thresher and 29.73 per cent of the households possess chaff cutter.

Table 11: Farm Implements owned by households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	1	20	4	30.77	1	10	1	20	7	18.92
2	Plough	0	0	2	40	4	30.77	1	10	0	0	7	18.92
3	Sprayer	0	0	2	40	1	7.69	2	20	0	0	5	13.51
4	Weeder	5	100	2	40	10	76.92	7	70	2	50	26	70.27
5	Thresher	0	0	1	20	1	7.69	0	0	0	0	2	5.41
6	Chaff Cutter	0	0	2	40	6	46.15	3	30	0	0	11	29.73

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Bellary-3 micro watershed is presented in Table 12. The results showed that the average value of bullock cart was Rs.16000; the average value of plough was Rs. 1133, the average value of sprayer was Rs. 2300, the average

value of weeder was Rs. 32, the average value of thresher was Rs. 500 and the average value of chaff cutter was Rs. 1327.

Table 12: Average value of farm implements owned by households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
1	Bullock Cart	0.00	10,000.00	18,000.00	10,000.00	20,000.00	16,000.00
2	Plough	0.00	600.00	666.00	8,000.00	0.00	1,133.00
3	Sprayer	0.00	2,750.00	1,000.00	2,500.00	0.00	2,300.00
4	Weeder	35.00	17.00	32.00	36.00	50.00	32.00
5	Thresher	0.00	500.00	500.00	0.00	0.00	500.00
6	Chaff Cutter	0.00	700.00	1,833.00	733.00	0.00	1,327.00

Livestock possession by the households: The data regarding the Livestock possession by the households in Bellary-3 micro watershed is presented in Table 13. The results indicated that, 37.84 per cent of the households possess bullocks, 32.43 per cent of the households possess local cow, 2.70 per cent of the households possess crossbred cow and 5.41 per cent of the households possess poultry birds.

Table 13: Livestock possession by households in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Bullock	2	40.00	5	38.46	4	40.00	3	75.00	14	37.84
2	Local cow	1	20.00	6	46.15	3	30.00	2	50.00	12	32.43
3	Crossbred cow	0	0.00	0	0.00	1	10.00	0	0.00	1	2.70
4	Poultry birds	1	20.00	1	7.69	0	0.00	0	0.00	2	5.41

Average Labour availability: The data regarding the average labour availability in Bellary-3 micro watershed is presented in Table 14. The results indicated that, average own labour men available in the micro watershed was 6.72, average own labour (women) available was 4.25, average hired labour (men) available was 8.41 and average hired labour (women) available was 8.16.

Table 14: Average Labour availability in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		N	N	N	N	N
1	Own labour Male	3.00	13.00	2.20	2.25	6.72
2	Own Labour Female	1.40	8.31	1.60	1.25	4.25
3	Hired labour Male	9.40	9.92	6.90	6.00	8.41
4	Hired labour Female	9.60	9.85	6.20	5.75	8.16

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Bellary-3 micro watershed is presented in Table 15. The results indicated that, 86.49 per cent of the household opined that hired labour was adequate.

Table 15: Adequacy of Hired Labour in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate	5	100.00	13	100.00	10	100.00	4	100.00	32	86.49

Distribution of land (ha): The data regarding the distribution of land (ha) in Bellary-3 micro watershed is presented in Table 16. The results indicated that, households of the Bellary-3 micro watershed possess 29.40 ha (55.96%) of dry land and 23.14 ha (44.04%) of irrigated land. Marginal farmers possess 2.10 ha (70.61%) of dry land and 0.88 ha (29.39%) of irrigated land. Small farmers possess 18.41ha (95.79%) of dry land and 0.81ha (4.21%) of irrigated land. Semi medium farmers possess 7.27ha (40.35%) of dry land and 10.74 ha (59.65%) of irrigated land. Medium farmers possess 1.62 (13.13%) of dry land and 10.71ha (86.87%) of irrigated land.

Table 16: Distribution of land (Ha) in Bellary-3 micro watershed

Sl. No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	2.10	70.61	18.41	95.79	7.27	40.35	1.62	13.13	29.40	55.96
2	Irrigated	0.88	29.39	0.81	4.21	10.74	59.65	10.71	86.87	23.14	44.04
Total		2.98	100	19.22	100	18.01	100	12.33	100	52.54	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Bellary-3 micro watershed is presented in Table 17. The results indicated that, the average value of dry land was Rs. 302,629.41 and average value of irrigated was Rs. 395,293.31. In case of marginal famers, the average land value was Rs. 664,999.99 for dry land and Rs. 1,540,896.49 for irrigated land. In case of small famers, the average land value was Rs. 255,255.06 for dry land Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 302,561.25 for dry land and Rs. 325,612.05 for irrigated land. In case of medium famers, the average land value was Rs. 370,500 for dry land and Rs. 326,719.58 for irrigated land.

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

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		N	N	N	N	N
1	Dry	664,999.99	255,255.06	302,561.25	370,500.00	302,629.41
2	Irrigated	1,540,896.49	988,000.00	325,612.05	326,719.58	395,293.31

Status of bore wells: The data regarding the status of bore wells in Bellary-3 micro watershed is presented in Table 18. The results indicated that, there were 14 functioning and 4 de-functioning bore wells in the micro watershed.

Table 18: Status of bore wells in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		N	N	N	N	N
1	De-functioning	1	0	2	1	4
2	Functioning	1	4	5	4	14

Source of irrigation: The data regarding the source of irrigation in Bellary-3 micro watershed is presented in Table 19. The results indicated that, bore well was the major irrigation source for 37.84 per cent of the farmers and 2.70 per cent households were using open well for irrigation.

Table 19: Source of irrigation in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Bore Well	1	20.00	4	30.77	5	50.00	4	100.00	14	37.84
2	Open Well	0	0.00	0	0.00	0	0.00	1	25.00	1	2.70

Depth of water: The data regarding the depth of water in Bellary-3 micro watershed is presented in Table 20.The results indicated that on an average the depth of the bore well was 27.51 meters.

Table 20: Depth of water in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		N	N	N	N	N
1	Bore Well	17.07	10.55	55.17	60.96	27.51

Irrigated Area (ha): The data regarding the irrigated area (ha) in Bellary-3 micro watershed is presented in Table 21. The results indicated that, in case of marginal farmers there was 0.40 ha of irrigated land, in case of small farmers there was 1.62 ha of irrigated land, semi medium farmers were having 8.10 ha of irrigated land and medium farmers were having 12.11 ha of irrigated land. On an average there were 22.23 ha of irrigated land.

Table 21: Irrigated Area (ha) in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
1	Kharif	0.40	1.62	6.48	12.11	20.61
2	Rabi	0.00	0.00	1.62	0.00	1.62
Total		0.40	1.62	8.10	12.11	22.23

Cropping pattern: The data regarding the cropping pattern in Bellary-3 micro watershed is presented in Table 22. The results indicated that, farmers have grown bajra (3.24 ha), groundnut (10.26 ha), maize (37.65 ha), paddy (0.81 ha) and tomato (0.54 ha) in kharif season. Farmers grown bajra (1.62 ha) and sunflower (0.40 ha) in Rabi season. Also grown groundnut (2.83 ha) in summer season. Marginal farmers had grown maize, tomato and groundnut. Small farmers had grown bajra, groundnut and maize. Semi medium farmers had grown Bajra, groundnut, maize and sunflower. Medium farmers had grown groundnut, maize, paddy and tomato.

Table 22: Cropping pattern in Bellary-3 micro watershed Area (ha)

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
1	Kharif - Bajra	0.00	2.43	0.81	0.00	3.24
2	Kharif - Groundnut	0.00	5.74	1.21	3.30	10.26
3	Kharif - Maize	2.95	11.03	16.79	6.88	37.65
4	Kharif - Paddy	0.00	0.00	0.00	0.81	0.81
5	Kharif - Tomato	0.14	0.00	0.00	0.40	0.54
6	Rabi - Bajra	0.00	0.00	1.62	0.00	1.62
7	Rabi - Sunflower	0.00	0.00	0.40	0.00	0.40
8	Summer - Groundnut	0.40	0.00	2.43	0.00	2.83
Total		3.49	19.20	23.26	11.40	57.35

Cropping intensity: The data regarding the cropping intensity in Bellary-3 micro watershed is presented in Table 23. The results indicated that, the cropping intensity in Bellary-3 micro watershed was found to be 83.06 per cent. In case of marginal farmers it was 100 per cent, in small farmers it was 81.04, in semi medium farmers it was 91.19 and in medium farmers it was 69.68 per cent.

Table 23: Cropping intensity (%) in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
1	Cropping Intensity	100.00	81.04	91.19	69.68	83.06

Possession of Bank account: The data regarding the possession of Bank account and savings in Bellary-3 micro watershed is presented in Table 24. The results indicated that, 83.78 per cent of the households have bank account and 2.70 per cent of them savings. In land less farmers 80 per cent of the household possess bank account. Among marginal farmers 60 percent of them possess bank account and 20 per cent of the household possess savings. 92.31 per cent of small farmers possess bank account. In semi medium farmers possess 80 per cent of them possess bank account and medium category of farmers possess 100 per cent of bank account.

Table 24: Possession of Bank account and savings in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	4	80	3	60	12	92.31	8	80	4	100	31	83.78
2	Savings	0	0	1	20	0	0.00	0	0	0	0	1	2.70

Borrowing status: The data regarding the possession of borrowing status in Bellary-3 micro watershed is presented in Table 25. The results indicated that, 80 per cent of landless, 60 per cent of marginal, 92.31 per cent of small, 80 per cent of the semi medium and 100 per cent of medium farmers have borrowed credit from different sources.

Table 25: Borrowing status in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF(10)		MDF(4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	4	80	3	60	12	92.31	8	80	4	100	31	83.78

Source of credit: The data regarding the source of credit availed by households in Bellary-3 micro watershed is presented in Table 26. The results indicated that, 3.23 per cent have availed loan from friends/ relatives and 9.68 per cent have availed loan from Grameena bank.

Table 26: Source of credit availed by households in Bellary-3 micro watershed

Sl.No.	Particulars	SMF (8)		All (31)	
		N	%	N	%
1	Friends/Relatives	1	12.50	1	3.23
2	Grameena Bank	3	37.50	3	9.68

Average credit amount: The data regarding the average credit amount availed by households in Bellary-3 micro watershed is presented in Table 27. The results indicated

that, semi medium farmers have availed Rs.52500. Overall average credit amount availed by households in the micro watershed is 13,548.39.

Table 27: Average Credit amount availed by households in Bellary-3 micro watershed

Sl.No.	Particulars	SMF (8)	All (31)
		N	N
1	Average Credit	52,500.00	13,548.39

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

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

Sl.No.	Particulars	SMF (3)		All (3)	
		N	%	N	%
1	Agriculture production	3	100.00	3	100.00

Purpose of credit borrowed (Private Credit): The data regarding the purpose of credit borrowed from private sources by households in Bellary-3 micro watershed is presented in Table 29. The results indicated that, 100 percent of loan was taken for household consumption.

Table 29: Purpose of credit borrowed (Private Credit) by households in Bellary-3 micro watershed

Sl.No.	Particulars	SMF (1)		All (1)	
		N	%	N	%
1	Household consumption	1	100.00	1	100.00

Repayment status of households (Institutional): The data regarding the repayment status of credit borrowed from institutional sources by households in Bellary-3 micro watershed is presented in Table 30. Results indicated that 100 percent of the households have unpaid their institutional loan.

Table 30: Repayment status of households (Institutional) **in Bellary-3 micro watershed**

Sl.No.	Particulars	SMF (3)		All (3)	
		N	%	N	%
1	Un paid	3	100.00	3	100.00

Repayment status of households (Private): The data regarding the repayment status of credit borrowed from private sources by households in Bellary-3 micro watershed is presented in Table 31. Results indicated that 100 per cent of the households have partially paid their private loan.

Table 31: Repayment status of households (Private) in Bellary-3 micro watershed

Sl.No.	Particulars	SMF (1)		All (1)	
		N	%	N	%
1	Partially paid	1	100.00	1	100.00

Cost of Cultivation of Bajra: The data regarding the cost of cultivation of bajra in Bellary-3 micro watershed is presented in Table 32. The results indicated that, the total cost of cultivation for bajra was Rs. 18425.71. The gross income realized by the farmers was Rs. 31260.94. The net income from bajra cultivation was Rs. 12835.23, thus the benefit cost ratio was found to be 1:1.7.

Table 32: Cost of Cultivation of Bajra in Bellary-3 micro watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	33.04	5273.45	28.62
2	Bullock	Pairs/day	0.77	463.13	2.51
3	Tractor	Hours	2.62	1968.28	10.68
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	6.79	784.22	4.26
6	Seed Inter Crop	Kgs.	0.00	0.00	0.00
7	FYM	Quintal	12.35	1605.50	8.71
8	Fertilizer + micronutrients	Quintal	2.47	1976.00	10.72
9	Pesticides (PPC)	Kgs / liters	0.00	0.00	0.00
10	Irrigation	Number	0.00	0.00	0.00
11	Repairs		0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	47.86	0.26
14	Land revenue and Taxes		0.00	4.32	0.02
II	**Cost B1**				
16	Interest on working capital			523.89	2.84
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			12646.65	68.64
III	**Cost B2**				
18	Rental Value of Land			616.67	3.35
19	**Cost B2 = (Cost B1 + Rental value)**			13263.31	71.98
IV	**Cost C1**				
20	Family Human Labour		16.83	3487.33	18.93
21	**Cost C1 = (Cost B2 + Family Labour)**			16750.64	90.91
V	**Cost C2**				
22	Risk Premium			0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**			16750.64	90.91
VI	**Cost C3**				
24	Managerial Cost			1675.06	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			18425.71	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	30.88	31260.94	
		b) Main Crop Sales Price (Rs.)		1012.50	
b.	Gross Income (Rs.)			31260.94	
c.	Net Income (Rs.)			12835.23	
d.	Cost per Quintal (Rs./q.)			596.78	
e.	Benefit Cost Ratio (BC Ratio)			1:1.7	

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Bellary-3 micro watershed is presented in Table 33. The results indicated that, the total cost of cultivation for maize was Rs. 31011.05. The gross income realized by the farmers was Rs. 43640.22. The net income from maize cultivation was Rs. 12629.17. Thus the benefit cost ratio was found to be 1:1.41.

Table 33: Cost of Cultivation of Maize in Bellary-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	36.06	6558.64	21.15
2	Bullock		Pairs/day	1.07	667.24	2.15
3	Tractor		Hours	3.29	2257.38	7.28
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	24.81	4494.65	14.49
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	21.02	2951.63	9.52
8	Fertilizer + micronutrients		Quintal	4.51	3491.87	11.26
9	Pesticides (PPC)		Kgs/liters	0.88	882.28	2.85
10	Irrigation		Number	1.85	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	80.08	0.26
14	Land revenue and Taxes			0.00	4.53	0.01
II	**Cost B1**					
16	Interest on working capital				1418.47	4.57
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				22806.78	73.54
III	**Cost B2**					
18	Rental Value of Land				461.11	1.49
19	**Cost B2 = (Cost B1 + Rental value)**				23267.89	75.03
IV	**Cost C1**					
20	Family Human Labour			23.28	4923.81	15.88
21	**Cost C1 = (Cost B2 + Family Labour)**				28191.70	90.91
V	**Cost C2**					
22	Risk Premium				0.17	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				28191.87	90.91
VI	**Cost C3**					
24	Managerial Cost				2819.19	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				31011.05	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		37.56	43346.32	
		b) Main Crop Sales Price (Rs.)			1154.17	
	By Product	e) Main Product (q)		2.66	293.90	
		f) Main Crop Sales Price (Rs.)			110.42	
b.	Gross Income (Rs.)				43640.22	
c.	Net Income (Rs.)				12629.17	
d.	Cost per Quintal (Rs./q.)				825.72	
e.	Benefit Cost Ratio (BC Ratio)				1:1.41	

Cost of Cultivation of Paddy: The data regarding the cost of cultivation of paddy in Bellary-3 micro watershed is presented in Table 34. The results indicated that, the total cost of cultivation for paddy was Rs. 33295.80. The gross income realized by the farmers was Rs. 37297.00. The net income from paddy cultivation was Rs. 4001.20. Thus the benefit cost ratio was found to be 1:1.12.

Table 34: Cost of Cultivation of Paddy in Bellary-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	54.34	10250.50	30.79
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	3.71	2778.75	8.35
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	172.90	6916.00	20.77
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	3.71	2470.00	7.42
9	Pesticides (PPC)		Kgs / liters	1.24	1235.00	3.71
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	0.02	0.00
14	Land revenue and Taxes			0.00	4.12	0.01
II	**Cost B1**					
16	Interest on working capital				1274.52	3.83
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				24928.91	74.87
III	**Cost B2**					
18	Rental Value of Land				400.00	1.20
19	**Cost B2 = (Cost B1 + Rental value)**				25328.91	76.07
IV	**Cost C1**					
20	Family Human Labour			22.23	4940.00	14.84
21	**Cost C1 = (Cost B2 + Family Labour)**				30268.91	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				30268.91	90.91
VI	**Cost C3**					
24	Managerial Cost				3026.89	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				33295.80	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		24.70	37050.00	
		b) Main Crop Sales Price (Rs.)			1500.00	
	By Product	e) Main Product (q)		2.47	247.00	
		f) Main Crop Sales Price (Rs.)			100.00	
b.	Gross Income (Rs.)				37297.00	
c.	Net Income (Rs.)				4001.20	
d.	Cost per Quintal (Rs./q.)				1348.01	
e.	Benefit Cost Ratio (BC Ratio)				1:1.12	

Cost of Cultivation of Ground nut: The data regarding the cost of cultivation of groundnut in Bellary-3 micro watershed is presented in Table 35. The results indicated that, the total cost of cultivation for groundnut was Rs. 44988.36. The gross income realized by the farmers was Rs. 104414.40. The net income from groundnut cultivation was Rs. 59426.04. Thus the benefit cost ratio was found to be 1:2.32.

Table 35: Cost of Cultivation of Groundnut in Bellary-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	47.07	7911.16	17.58
2	Bullock		Pairs/day	1.28	660.98	1.47
3	Tractor		Hours	2.86	2018.44	4.49
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	134.42	15621.67	34.72
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	21.91	2958.12	6.58
8	Fertilizer + micronutrients		Quintal	3.19	2763.58	6.14
9	Pesticides (PPC)		Kgs / liters	0.86	856.47	1.90
10	Irrigation		Number	2.88	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	156.98	0.35
14	Land revenue and Taxes			0.00	5.10	0.01
II	**Cost B1**					
16	Interest on working capital				2663.98	5.92
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				35616.48	79.17
III	**Cost B2**					
18	Rental Value of Land				490.91	1.09
19	**Cost B2 = (Cost B1 + Rental value)**				36107.39	80.26
IV	**Cost C1**					
20	Family Human Labour			23.11	4791.12	10.65
21	**Cost C1 = (Cost B2 + Family Labour)**				40898.51	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				40898.51	90.91
VI	**Cost C3**					
24	Managerial Cost				4089.85	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				44988.36	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		23.20	104414.03	
		b) Main Crop Sales Price (Rs.)			4500.00	
	By Product	e) Main Product (q)		0.06	0.37	
		f) Main Crop Sales Price (Rs.)			6.00	
b.	Gross Income (Rs.)				104414.40	
c.	Net Income (Rs.)				59426.04	
d.	Cost per Quintal (Rs./q.)				1938.89	
e.	Benefit Cost Ratio (BC Ratio)				1:2.32	

Cost of Cultivation of Sunflower: The data regarding the cost of cultivation of Sunflower in Bellary-3 micro watershed is presented in Table 36. The results indicated that, the total cost of cultivation for Sunflower was Rs. 47943.10. The gross income realized by the farmers was Rs. 103740.00. The net income from Sunflower cultivation was Rs. 55796.90. Thus the benefit cost ratio was found to be 1:2.16.

Table 36: Cost of Cultivation of Sunflower in Bellary-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	74.10	14079.00	29.37
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	4.94	3705.00	7.73
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.88	4446.00	9.27
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	4.94	3952.00	8.24
9	Pesticides (PPC)		Kgs / liters	2.47	2470.00	5.15
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	66.69	0.14
14	Land revenue and Taxes			0.00	4.12	0.01
II	**Cost B1**					
16	Interest on working capital				1304.16	2.72
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				30026.97	62.63
III	**Cost B2**					
18	Rental Value of Land				466.67	0.97
19	**Cost B2 = (Cost B1 + Rental value)**				30493.63	63.60
IV	**Cost C1**					
20	Family Human Labour			64.22	13091.00	27.31
21	**Cost C1 = (Cost B2 + Family Labour)**				43584.63	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				43584.63	90.91
VI	**Cost C3**					
24	Managerial Cost				4358.46	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				47943.10	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		29.64	103740.00	
		b) Main Crop Sales Price (Rs.)			3500.00	
b.	Gross Income (Rs.)				103740.00	
c.	Net Income (Rs.)				55796.90	
d.	Cost per Quintal (Rs./q.)				1617.51	
e.	Benefit Cost Ratio (BC Ratio)				1:2.16	

Cost of Cultivation of Tomato: The data regarding the cost of cultivation of Tomato in Bellary-3 micro watershed is presented in Table 37. The results indicated that, the total cost of cultivation for Tomato was Rs. 102707.41. The gross income realized by the farmers was Rs. 335876.41. The net income from Tomato cultivation was Rs. 233169.00. Thus the benefit cost ratio was found to be 1:3.27.

Table 37: Cost of Cultivation of Tomato in Bellary-3 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	145.22	26788.60	26.08
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	14.60	10951.54	10.66
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.87	15219.56	14.82
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	9.73	9059.09	8.82
9	Pesticides (PPC)		Kgs / liters	4.87	4867.35	4.74
10	Irrigation		Number	21.79	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	428.64	0.42
14	Land revenue and Taxes			0.00	3.71	0.00
II	**Cost B1**					
16	Interest on working capital				3497.52	3.41
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				70816.01	68.95
III	**Cost B2**					
18	Rental Value of Land				433.33	0.42
19	**Cost B2 = (Cost B1 + Rental value)**				71249.35	69.37
IV	**Cost C1**					
20	Family Human Labour			106.94	22121.03	21.54
21	**Cost C1 = (Cost B2 + Family Labour)**				93370.38	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				93370.38	90.91
VI	**Cost C3**					
24	Managerial Cost				9337.04	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				102707.41	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		3196.47	335629.41	
		b) Main Crop Sales Price (Rs.)			105.00	
	By Product	e) Main Product (q)		4.94	247.00	
		f) Main Crop Sales Price (Rs.)			50.00	
b.	Gross Income (Rs.)				335876.41	
c.	Net Income (Rs.)				233169.00	
d.	Cost per Quintal (Rs./q.)				32.13	
e.	Benefit Cost Ratio (BC Ratio)				1:3.27	

Adequacy of fodder: The data regarding the adequacy of fodder in Bellary-3 micro watershed is presented in Table 38. The results indicated that, 43.24 per cent of the households opined that dry fodder was adequate and 8.11 per cent of the households opined that green fodder was adequate.

Table 38: Adequacy of fodder in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	1	20.00	7	53.85	6	60.00	2	50.00	16	43.24
2	Adequate-Green Fodder	0	0.00	2	15.38	1	10.00	0	0.00	3	8.11

Average Annual gross income of households: The results of the overall average annual gross income of the household in Bellary-3 is presented in table 39. The table indicated that, in landless farmers, the average income from wage was Rs.66000.In marginal farmers the average income from service/salary was Rs.16000, wage was Rs.39000 and agriculture was Rs.52240. In small farmers the average income from wage was Rs.8076.92 and agriculture was Rs.97480.77 and dairy farm was Rs.3826.92. In semi medium farmers the average income from service/salary was Rs.15000, business was Rs.12000, wage was Rs.22200 and agriculture was Rs.132600. In medium farmers the average income from service/salary was Rs.218000, wage was Rs.5000 and agriculture was Rs.287500.

Table 39: Average Annual gross income (Rs.) of households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	16,000	0.00	15,000	218,000	29,783.78
2	Business	0	0	0.00	12,000	0	3,243.24
3	Wage	66,000	39,000	8,076.92	22,200	5,000	23,567.57
4	Agriculture	0	52,240	97,480.77	132,600	287,500	111,471.62
5	Dairy Farm	0	0	3,826.92	0	0	1,344.59
Income(Rs.)		60,000	107,240	109,384.62	181,800	510,500	169,410.81

Table 40: Average Annual expenditure of households in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (13)	SMF (10)	MDF (4)	All (37)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Business	0.00	0.00	0.00	60,000	0.00	1,621.62
2	Wage	3,333.33	0.00	2,000.00	20,000	0.00	2,162.16
3	Agriculture	0.00	22,200	51,461.54	65,000	126,250	52,297.30
4	Dairy Farm	0.00	0.00	7,666.67	0	0.00	621.62
Total		3,333.33	22,200	61,128.21	145,000	126,250	357,911.54
Average		666.67	4,440	4,702.17	14,500	31,562.50	9,673.28

Average Annual expenditure of households: The results of the overall average annual expenditure of the household in Bellary-3 were presented in Table 40. The results indicated that in landless, the average expenditure from wage was Rs.3333.33. In marginal farmers the average expenditure from agriculture was Rs.22200. In small

farmers the average expenditure from wage was Rs.2000, agriculture was Rs.51464.54 and dairy farm was Rs.7666.67. In semi medium farmers the average expenditure from business was Rs.60000, wage was Rs.20000 and agriculture was Rs.65000.In medium farmers the average expenditure from agriculture was Rs.126250.

Horticulture species grown: The data regarding horticulture species grown in Bellary-3 micro watershed is presented in Table 41. The results indicated that, sampled households have grown 65 coconut, 1 lemon and 7 mango trees in their field and also planted 2 coconut and 1 mango trees in their backyard.

Table 41: Horticulture species grown in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		F	B	F	B	F	B	F	B	F	B
1	Coconut	15	0	30	2	7	0	13	0	65	2
2	Lemon	0	0	0	0	0	0	1	0	1	0
3	Mango	0	0	2	1	2	0	3	0	7	1

Forest species grown: The data regarding forest species grown in Bellary-3 micro watershed is presented in Table 42. The results indicated that, households have planted 4 Eucalyptus tree, 56 teak trees, and 144 neem trees in their field and also grown 2 Neem tree in the their backyard.

Table 42: Forest species grown in Bellary-3 micro watershed

Sl. No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		F	B	F	B	F	B	F	B	F	B
1	Eucalyptus	0	0	0	0	3	0	1	0	4	0
2	Teak	1	0	5	0	50	0	0	0	56	0
3	Neem	11	0	55	0	67	0	11	2	144	2

Average additional investment capacity: The data regarding average additional investment capacity in Bellary-3 micro watershed is presented in Table 43. The results indicate that, households have an average investment capacity of Rs. 135.14 for improved crop production and Rs.81.08 for improved livestock management. Small farmers have an average investment capacity of Rs. 384.62 for improved crop production and Rs.230.77 for improved livestock management.

Table 43: Average additional investment capacity of households in Bellary-3 micro watershed

Sl.No.	Particulars	SF (13)	All (37)
		Rs.	Rs.
1	Improved crop production	384.62	135.14
2	Improved livestock management	230.77	81.08

Source of funds for additional investment: The data regarding source of funds for additional investment in Bellary-3 micro watershed is presented in Table 44. The results indicated that for 2.70 per cent of the households were dependent on loan from the bank for improved crop production and improved livestock management respectively.

Table 44: Source of funds for additional investment capacity in Bellary-3 micro watershed

Sl.No	Item	Improved crop production		Improved livestock management	
		N	%	N	%
1	Loan from bank	1	2.7	1	2.7

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Bellary-3 micro watershed is presented in Table 45. The results indicated that, Bajra, sunflower and tomato crops were sold to an extent of 100 per cent. Groundnut, maize and paddy crops were sold to an extent of 97.68 per cent, 98.81 per cent and 70 per cent respectively.

Table 45: Marketing of the agricultural produce in Bellary-3 micro watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	145.0	0.0	145.0	100.0	1012.5
2	Groundnut	259.0	6.0	253.0	97.68	4500.0
3	Maize	1265.0	15.0	1250.0	98.81	1196.43
4	Paddy	20.0	6.0	14.0	70.0	1500.0
5	Sunflower	12.0	0.0	12.0	100.0	3500.0
6	Tomato	2200.0	0.0	2200.0	100.0	105.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Bellary-3 micro watershed is presented in Table 46. The results indicated that, 2.70 percent of the households have sold their produce to agent/traders, 100 percent of the households have sold their produce to local/village merchant and 21.62 percent of the households sold their produce in regulated markets.

Table 46: Marketing Channels used for sale of agricultural produce in Bellary-3 micro watershed

Sl. No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	0	0	1	10	0	0	1	2.70
2	Local/village Merchant	5	100	13	100	10	100	4	100	37	100
3	Regulated Market	0	0	2	15.38	4	40	2	50	8	21.62

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Bellary-3 micro watershed is presented in Table 47. The results indicated that 2.70 per cent of the households have used cart as a mode of transport, 100 per cent of them have used tractor and 5.41 per cent have used truck.

Table 47: Mode of transport of agricultural produce in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Cart	1	20.00	0	0.00	0	0.00	0	0.00	1	2.70
2	Tractor	6	120.00	16	123.08	15	150.00	6	150.00	37	100
3	Truck	0	0.00	0	0.00	0	0.00	2	50.00	2	5.41

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Bellary-3 micro watershed is presented in Table 48. The results

indicated that, 72.97 per cent of the households have experienced the soil and water erosion problems i.e. 60 percent of marginal farmers, 84.62 per cent of small farmers, 90 per cent of semi medium farmers and 100 percent of medium farmers.

Table 48: Incidence of soil and water erosion problems in Bellary-3 micro watershed

Sl. No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	3	60	11	84.62	9	90	4	100	27	72.97

Interest towards soil testing: The data regarding interest shown towards soil testing in Bellary-3 micro watershed is presented in Table 49. The results indicated that, 81.08 per cent of the households have shown interest in soil testing.

Table 49: Interest shown towards soil testing in Bellary-3 micro watershed

Sl.No.	Particulars	MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	5	100	12	92.31	9	90	4	100	30	81.08

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Bellary-3 micro watershed is presented in Table 50. The results indicated that, 72.97 percent used fire wood as a source of fuel and 27.03 percent of the households used LPG.

Table 50: Usage pattern of fuel for domestic use in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	3	60.00	3	60.00	11	84.62	8	80.00	2	50.00	27	72.97
2	LPG	2	40.00	2	40.00	2	15.38	2	20.00	2	50.00	10	27.03

Source of drinking water: The data regarding source of drinking water in Bellary-3 micro watershed is presented in Table 51. The results indicated that, piped supply was the source of drinking water for 75.68 per cent, 16.22 per cent of them were using bore well and 8.11 per cents of the households were using lake/tank for drinking water.

Table 51: Source of drinking water in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100	4	80	11	84.62	6	60	2	50	28	75.68
2	Bore Well	0	0	1	20	1	7.69	3	30	1	25	6	16.22
3	Lake/ Tank	0	0	0	0	1	7.69	1	10	1	25	3	8.11

Table 52: Source of light in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100	5	100	13	100	10	100	4	100	37	100

Source of light: The data regarding source of light in Bellary-3 micro watershed is presented in Table 52. The results indicated that, electricity was the major source of light for 100 per cent of the households.

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Bellary-3 micro watershed is presented in Table 53. The results indicated that, 86.49 per cent of the households possess sanitary toilet i.e. 100 per cent of landless, marginal, small, 50 per cent of semi medium and 75 per cent of medium had sanitary toilet facility.

Table 53: Existence of Sanitary toilet facility in Bellary-3 micro watershed

Sl. No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	100	5	100	13	100	5	50	3	75	32	86.49

Possession of PDS card: The data regarding possession of PDS card in Bellary-3 micro watershed is presented in Table 54. The results indicated that, 100 per cent of the sampled households possessed BPL card and 2.70 per cent of the sampled households have not possessed BPL card.

Table 54: Possession of PDS card in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	5	100	5	100	13	100	9	90	4	100	37	100
2	Not Possessed	0	0	0	0	0	0	1	10	0	0	1	2.70

Participation in NREGA programme: The data regarding participation in NREGA programme in Bellary-3 micro watershed is presented in Table 55. The results indicated that, 40.54 per cent of the households participated in NREGA programme which included 100 per cent of the landless and marginal, 7.69 per cent of the small, 20 per cent of the semi medium and 50 percent of the medium farmers.

Table 55: Participation in NREGA programme in Bellary-3 micro watershed

Sl. No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	5	100	5	100	1	7.69	2	20	2	50	15	40.54

Table 56: Adequacy of food items in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100	5	100	13	100	10	100	4	100	37	100.00
2	Pulses	4	80	5	100	12	92.31	9	90	4	100	34	91.89
3	Oilseed	1	20	1	20	4	30.77	3	30	1	25	10	27.03
4	Vegetables	1	20	5	100	12	92.31	9	90	3	75	30	81.08
5	Fruits	0	0	1	20	0	0.00	0	0	1	25	2	5.41
6	Milk	2	40	4	80	11	84.62	8	80	3	75	28	75.68
7	Egg	1	20	1	20	8	61.54	5	50	3	75	18	48.65
8	Meat	0	0	0	0	4	30.77	3	30	1	2	8	21.62

Adequacy of food items: The results (Table 56) indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 91.89 per cent, 27.03 per cent, 81.08 per cent, 5.41 per cent, 75.68 per cent, 48.65 per cent and 21.62 per cent of the households respectively.

Response on Inadequacy of food items: The data regarding inadequacy of food items in Bellary-3 micro watershed is presented in Table 57. The results indicated that, pulses, oilseeds, vegetables, fruits , milk, egg and meat were inadequate for 8.11 per cent, 70.27 per cent, 16.22 per cent, 89.19 per cent, 18.92 per cent, 48.65 per cent and 72.97 per cent of the households respectively.

Table 57: Response on Inadequacy of food items in Bellary-3 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (13)		SMF (10)		MDF (4)		All (37)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Pulses	1	20	0	0	1	7.69	1	10	0	0	3	8.11
2	Oilseed	3	60	4	80	9	69.23	7	70	3	75	26	70.27
3	Vegetables	3	60	0	0	1	7.69	1	10	1	25	6	16.22
4	Fruits	5	100	4	80	12	92.31	9	90	3	75	33	89.19
5	Milk	3	60	1	20	1	7.69	1	10	1	25	7	18.92
6	Egg	4	80	4	80	4	30.77	5	50	1	25	18	48.65
7	Meat	5	100	5	100	9	69.23	5	5	3	75	27	72.97

Farming constraints: The data regarding farming constraints experienced by households in Bellary-3 micro watershed is presented in Table 58. The results indicated that, Lower fertility status of the soil was the constraint experienced by 81.08 per cent of the households, wild animal menace on farm field (83.78%), frequent incidence of pest and diseases (62.16%), inadequacy of irrigation water (29.73%), high cost of Fertilizers and plant protection chemicals (70.27%), high rate of interest on credit (35.14%), low price for the agricultural commodities (72.97%), lack of marketing facilities in the area (56.76%), inadequate extension services (10.81%), lack of transport for safe transport of the agricultural produce to the market (67.57%), less rainfall (13.51%) and Source of Agri-technology information(Newspaper/TV/Mobile (5.41%).

Table 58: Farming constraints Experienced in Bellary-3 micro watershed

Sl. No.	Particulars	MF (5)		SF (13)		SMF(10)		MDF(4)		All (37)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	5	100	12	92.31	9	90	4	100	30	81.08
2	Wild animal menace on farm field	5	100	12	92.31	10	100	4	100	31	83.78
3	Frequent incidence of pest and diseases	4	80	9	69.23	6	60	4	100	23	62.16
4	Inadequacy of irrigation water	1	20	6	46.15	2	20	2	50	11	29.73
5	High cost of Fertilizers and plant protection chemicals	4	80	9	69.23	9	90	4	100	26	70.27
6	High rate of interest on credit	2	40	7	53.85	2	20	2	50	13	35.14
7	Low price for the agricultural commodities	4	80	11	84.62	8	80	4	100	27	72.97
8	Lack of marketing facilities in the area	4	80	9	69.23	6	60	2	50	21	56.76
9	Inadequate extension services	0	0	1	7.69	2	20	1	25	4	10.81
10	Lack of transport for safe transport of the Agril produce to the market.	4	80	11	84.62	7	70	3	75	25	67.57
11	Less rainfall	0	0	3	23.08	1	10	1	25	5	13.51
12	Source of Agri-technology information(Newspaper/TV/Mobile)	1	20	0	0.00	1	10	0	0	2	5.41

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 37 households located in the micro watershed were interviewed for the survey.

Results indicated that 37 farmers were sampled in Bellary-3 micro watershed among them 5 (13.51%) were marginal farmers, 13 (35.14%) were small farmers, 10(27.03%) were semi medium farmers, 4 (10.81%) were medium farmers and 5 (13.51%) landless farmers were also interviewed for the survey. The data indicated that there were 179 population households were there in the studied micro watershed. Among them 115 (64.25%) men and 64 (35.75%) were women. The average family size of landless and small was, semi medium and medium farmers were 5 and Marginal farmers were 6. The data indicated that 22 (12.29%) people were in 0-15 years of age, 88 (49.16%) were in 16-35 years of age, 50 (27.93%) were in 36-60 years of age and 19 (10.61%) were above 61 years of age.

The results indicated that the Bellary-3 had 32.96 per cent illiterates, 19.55 per cent of them had primary school education, 13.41 per cent of them had both middle school, 14.53 per cent them had high school education, 7.26 per cent of them had PUC education, 0.56 per cent them had Diploma education and ITI, 6.15 per cent of them had degree education, 1.68 per cent of them had masters education and 3.35 per cent them had others.

The results indicated that, 75.68 per cent of households practicing agriculture, 16.22 per cent of the household heads were agricultural labour and 8.11 per cent of the household heads were general labour. The results indicated that agriculture was the major occupation for 60.89 per cent of the household members, 6.70 per cent were agricultural labourers and general labours, 0.56 percent were in household industry, 4.47 per cent of them were in private sector, 15.08 per cent of them were students and 3.35 per cent of them were children.

In case of landless households 20 per cent were agricultural labour, 60 per cent were general labourers and 20 per cent were students. In case of marginal farmers 76.67 per cent were agriculturist, 3.33 percent was in private service and 20 per cent were students. In case of small farmers 68.97 per cent of them were agriculturist and 5.17 per cent of them were agricultural labours, and 18.97 per cent of them were students. In case of semi medium farmers 70.59 per cent of the family members were agriculturist, 5.88 per cent were general labour and were in private service and 3.92 per cent of them were

students. In case of medium farmers 50 per cent of the family members were agriculturist, 10 per cent were general labour, 20 per cent were students and 20 per cent of them were in private service.

The results showed that 1.12 per cent of them participated in self help groups and 98.88 per cent of them have not participated in any local institutions. The results indicated that 81.08 per cent of the households possess Katcha house, 8.11 per cent of the households possess Pucca house and 8.11 per cent of the households possess Semi Pacca house. The results showed that, 2.70 per cent of the households possess radio, 59.46 per cent of the households possess TV, 24.32 per cent of the households possess Mixer grinder, 27.03 per cent of the households possess bicycle, 37.84 per cent of the households possess motor cycle and 97.30 per cent of the households possess mobile phones. The results showed that the average value of radio was Rs.500, television was Rs. 3409, mixer grinder was Rs.1033, bicycle was Rs.1400, motor cycle was Rs.35000 and mobile phone was Rs.1398.

About 18.92 per cent of the households possess bullock cart and plough, 13.51 per cent of the households possess sprayer, 70.27 per cent of the households possess weeder, 5.41 per cent of the households possess thresher and 29.73 per cent of the households possess chaff cutter. The results showed that the average value of bullock cart was Rs.16000; the average value of plough was Rs. 1133, the average value of sprayer was Rs. 2300, the average value of weeder was Rs. 32, the average value of thresher was Rs. 500 and the average value of chaff cutter was Rs. 1327.

The results indicated that, 37.84 per cent of the households possess bullocks, 32.43 per cent of the households possess local cow, 2.70 per cent of the households possess crossbred cow and 5.41 per cent of the households possess poultry birds. In case of marginal farmers, 40 per cent of the households possess bullock and 20 per cent of the household possess local cow and poultry birds respectively. In case of small farmers, 38.46 per cent of households possess bullock, 46.15 per cent possess local cow and 7.69 per cent possess poultry birds. In case of semi medium farmers, 40 per cent of the households possess bullock, 30 per cent of the household possess local cow and 10 per cent of the households possess crossbred cow. In medium farmers 75 per cent of the households possess bullock and 50 per cent of the household possess local cow.

The results indicated that, average own labour men available in the micro watershed was 6.72, average own labour (women) available was 4.25, average hired labour (men) available was 8.41 and average hired labour (women) available was 8.16. In case of marginal farmers, average own labour men available was 3, average own labour (women) was also 1.40, average hired labour (men) was 9.40 and average hired labour (women) available was 9.60. In case of small farmers, average own labour men available was 13, average own labour (women) was 8.31, average hired labour (men) was 9.92 and average hired labour (women) available was 9.85. In case of semi medium

farmers, average own labour men available was 2.20, average own labour (women) was 1.60, average hired labour (men) was 6.90 and average hired labour (women) available was 6.20. In medium farmers average own labour men available was 2.25, average own labour (women) was 1.25, average hired labour (men) was 6 and average hired labour (women) available was 5.75.

The results indicated that, 86.49 per cent of the household opined that hired labour was adequate. The results indicated that, households of the Bellary-3 micro watershed possess 29.40 ha (55.96%) of dry land and 23.14 ha (44.04%) of irrigated land. Marginal farmers possess 2.10 ha (70.61%) of dry land and 0.88 ha (29.39%) of irrigated land. Small farmers possess 18.41ha (95.79%) of dry land and 0.81ha (4.21%) of irrigated land. Semi medium farmers possess 7.27ha (40.35%) of dry land and 10.74 ha (59.65%) of irrigated land. Medium farmers possess 1.62 (13.13%) of dry land and 10.71ha (86.87%) of irrigated land.

The results indicated that, the average value of dry land was Rs. 302,629.41 and average value of irrigated was Rs. 395,293.31. In case of marginal famers, the average land value was Rs. 664,999.99 for dry land and Rs. 1,540,896.49 for irrigated land. In case of small famers, the average land value was Rs. 255,255.06 for dry land Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 302,561.25 for dry land and Rs. 325,612.05 for irrigated land. In case of medium famers, the average land value was Rs. 370,500 for dry land and Rs. 326,719.58 for irrigated land.

The results indicated that, there were 14 functioning and 4 de-functioning bore wells in the micro watershed. The results indicated that, bore well was the major irrigation source for 37.84 per cent of the farmers and 2.70 per cent households were using open well for irrigation. The results indicated that on an average the depth of the bore well was 27.51 meters. The results indicated that, in case of marginal farmers there was 0.40 ha of irrigated land, in case of small farmers there was 1.62 ha of irrigated land, semi medium farmers were having 8.10 ha of irrigated land and medium farmers were having 12.11 ha of irrigated land. On an average there were 22.23 ha of irrigated land.

The results indicated that, farmers have grown bajra (3.24 ha), groundnut (10.26 ha), maize (37.65 ha), paddy (0.81 ha) and tomato (0.54 ha) in kharif season. Farmers grown bajra (1.62 ha) and sunflower (0.40 ha) in Rabi season. Also grown groundnut (2.83 ha) in summer season. Marginal farmers had grown maize, tomato and groundnut. Small farmers had grown bajra, groundnut and maize. Semi medium farmers had grown Bajra, groundnut, maize and sunflower. Medium farmers had grown groundnut, maize, paddy and tomato. The results indicated that, the cropping intensity in Bellary-3 micro watershed was found to be 83.06 per cent. In case of marginal farmers it was 100 per cent, in small farmers it was 81.04, in semi medium farmers it was 91.19 and in medium farmers it was 69.68 per cent.

The results indicated that, 83.78 per cent of the households have bank account and 2.70 per cent of them savings. In land less farmers 80 per cent of the household possess bank account. Among marginal farmers 60 percent of them possess bank account and 20 per cent of the household possess savings. 92.31 per cent of small farmers possess bank account. In semi medium farmers possess 80 per cent of them possess bank account and medium category of farmers possess 100 per cent of bank account. The results indicated that, 80 per cent of landless, 60 per cent of marginal, 92.31 per cent of small, 80 per cent of the semi medium and 100 per cent of medium farmers have borrowed credit from different sources.

The results indicated that, 3.23 per cent have availed loan from friends/ relatives and 9.68 per cent have availed loan from Grameena bank. The results indicated that, semi medium farmers have availed Rs.52500. Overall average credit amount availed by households in the micro watershed is 13,548.39. The results indicated that, 100 per cent of the households have borrowed loan for agriculture production. The results indicated that, 100 percent of loan was taken for household consumption. Results indicated that 100 percent of the households have unpaid their institutional loan. Results indicated that 100 per cent of the households have partially paid their private loan.

The results indicated that, the total cost of cultivation for bajra was Rs. 18425.71. The gross income realized by the farmers was Rs. 31260.94. The net income from bajra cultivation was Rs. 12835.23, thus the benefit cost ratio was found to be 1:1.7. The results indicated that, the total cost of cultivation for maize was Rs. 31011.05. The gross income realized by the farmers was Rs. 43640.22. The net income from maize cultivation was Rs. 12629.17. Thus the benefit cost ratio was found to be 1:1.41.

The results indicated that, the total cost of cultivation for paddy was Rs. 33295.80. The gross income realized by the farmers was Rs. 37297.00. The net income from paddy cultivation was Rs. 4001.20. Thus the benefit cost ratio was found to be 1:1.12. The results indicated that, the total cost of cultivation for groundnut was Rs. 44988.36. The gross income realized by the farmers was Rs. 104414.40. The net income from groundnut cultivation was Rs. 59426.04. Thus the benefit cost ratio was found to be 1:2.32.

The results indicated that, the total cost of cultivation for Sunflower was Rs. 47943.10. The gross income realized by the farmers was Rs. 103740.00. The net income from Sunflower cultivation was Rs. 55796.90. Thus the benefit cost ratio was found to be 1:2.16. The results indicated that, the total cost of cultivation for Tomato was Rs. 102707.41. The gross income realized by the farmers was Rs. 335876.41. The net income from Tomato cultivation was Rs. 233169.00. Thus the benefit cost ratio was found to be 1:3.27.

The results indicated that, 43.24 per cent of the households opined that dry fodder was adequate and 8.11 per cent of the households opined that green fodder was adequate.

The table indicated that, in landless farmers, the average income from wage Rs.66000.In marginal farmers the average income from service/salary was Rs.16000, wage was Rs.39000 and agriculture was Rs.52240. In small farmers the average income from wage was Rs.8076.92 and agriculture was Rs.97480.77 and dairy farm was Rs.3826.92. In semi medium farmers the average income from service/salary was Rs.15000, business was rs.12000, wage was Rs.22200 and agriculture was Rs.132600. In medium farmers the average income from service/salary was Rs.218000, wage was Rs.5000 and agriculture was Rs.287500.

The results indicated that in landless, the average expenditure from wage was Rs.3333.33. In marginal farmers the average expenditure from agriculture was Rs.22200. In small farmers the average expenditure from wage was Rs.2000, agriculture was Rs.51464.54 and dairy farm was Rs.7666.67. In semi medium farmers the average expenditure from business was Rs.60000, wage was Rs.20000 and agriculture was Rs.65000.In medium farmers the average expenditure from agriculture was Rs.126250.

The results indicated that, sampled households have grown 65 coconut, 1 lemon and 7 mango trees in their field and also planted 2 coconut and 1 mango trees in their backyard. The results indicated that, households have planted 4 Eucalyptus tree, 56 teak trees, and 144 neem trees in their field and also grown 2 Neem tree in the their backyard. The results indicate that, households have an average investment capacity of Rs. 135.14 for improved crop production and Rs.81.08 for improved livestock management. Small farmers have an average investment capacity of Rs. 384.62 for improved crop production and Rs.230.77 for improved livestock management.

The results indicated that for 2.70 per cent of the households were dependent on loan from the bank for improved crop production and improved livestock management respectively. The results indicated that, Bajra, sunflower and tomato crops were sold to an extent of 100 per cent. Groundnut, maize and paddy crops were sold to an extent of 97.68 per cent, 98.81 per cent and 70 per cent respectively. The results indicated that, 2.70 percent of the households have sold their produce to agent/traders, 100 percent of the households have sold their produce to local/village merchant and 21.62 percent of the households sold their produce in regulated markets. The results indicated that 2.70 per cent of the households have used cart as a mode of transport, 100 per cent of them have used tractor and 5.41 per cent have used truck.

The results indicated that, 72.97 per cent of the households have experienced the soil and water erosion problems i.e. 60 percent of marginal farmers, 84.62 per cent of small farmers, 90 per cent of semi medium farmers and 100 percent of medium farmers. The results indicated that, 81.08 per cent of the households have shown interest in soil testing. The results indicated that, 72.97 percent used fire wood as a source of fuel and 27.03 percent of the households used LPG. The results indicated that, piped supply was

the source of drinking water for 75.68 per cent, 16.22 per cent of them were using bore well and 8.11 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, 86.49 per cent of the households possess sanitary toilet i.e. 100 per cent of landless, marginal, small, 50 per cent of semi medium and 75 per cent of medium had sanitary toilet facility. The results indicated that, 100 per cent of the sampled households possessed BPL card and 2.70 per cent of the sampled households have not possessed BPL card. The results indicated that, 40.54 per cent of the households participated in NREGA programme which included 100 per cent of the landless and marginal, 7.69 per cent of the small, 20 per cent of the semi medium and 50 percent of the medium farmers.

The results indicated that, cereals, pulses, oilseeds, vegetables, fruits , milk, egg and meat were adequate for 100 per cent, 91.89 per cent, 27.03 per cent, 81.08 per cent, 5.41 per cent, 75.68 per cent, 48.65 per cent and 21.62 per cent of the households respectively. The results indicated that, pulses, oilseeds, vegetables, fruits , milk, egg and meat were inadequate for 8.11 per cent, 70.27 per cent, 16.22 per cent, 89.19 per cent, 18.92 per cent, 48.65 per cent and 72.97 per cent of the households respectively.

The results indicated that, Lower fertility status of the soil was the constraint experienced by 81.08 per cent of the households, wild animal menace on farm field (83.78%), frequent incidence of pest and diseases (62.16%), inadequacy of irrigation water (29.73%), high cost of Fertilizers and plant protection chemicals (70.27%), high rate of interest on credit (35.14%), low price for the agricultural commodities (72.97%), lack of marketing facilities in the area (56.76%), inadequate extension services (10.81%), lack of transport for safe transport of the agricultural produce to the market (67.57%), less rainfall (13.51%) and Source of Agri-technology information(Newspaper/TV/Mobile (5.41%).