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

DANAKANADODDI-1 (4D3A9E2a) 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.

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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 Danakkanadoddi-1microwatershed in KoppalTaluk and District, Karnataka" for integrated development was taken up in collaboration with theState 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: 29.12.2018

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Danakkanadoddi-1microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and the delineated physiographic boundaries 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 631 ha in Koppaltaluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 86 per cent is covered by soils, 13 per cent by rock outcrops and one per cent by settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 13 soil series and 27 soil phases (management units) and 5 land use classes.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- *Land suitability for growing 28 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 6per cent of the soils are shallow (25-50 cm), 30 per cent moderately shallow (50-75 cm). 12 per cent moderately deep(75-100 cm) and about 38 per cent are deep to very deep soils (100->150 cm).*
- *About 6 per cent of the area is having sandy soils at the surface,62 per cent loamy and 18 per cent of the area has clayey soils at the surface.*
- *About 26 per cent of the area has non-gravelly (<15 %) soils, 49 per cent gravelly (15-35%), <1 per cent very gravelly (35-60%) and 10 per cent has extremely gravelly soils (60-80 %).*

- *With respect to available water capacity 39 per cent of the area has very low (<50mm/m), 38 per cent of the area has low (51-100 mm/m), 5 per cent medium (101-150 mm/m) and 4 per cent area is very high (>200mm/m) in available water capacity.*
- *An area of about 72 per cent has very gently sloping (1-3%) and 13per cent has gently sloping lands.*
- *An area of about 10 per cent is slightly eroded (e1) and 76 per cent is moderately eroded (e2) lands.*
- *An area of about <1 per cent has soils that are slightlyacid (pH 6.0 to 6.5), 45 per cent neutral (pH 6.5 to 7.3), 12 per cent slightly alkaline (pH 7.3 to 7.8), about 17 per cent moderately alkaline (pH 7.8 to 8.4), 12 per cent strongly alkaline (pH 8.4 to 9.0).*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1}indicating that the soils are non-saline.*
- *Organic carbon is medium (0.5-0.75%) in 82per cent and high (>0.75%) in 3 per cent area of the soils.*
- *Available phosphorus is low (<23 kg/ha) in <1 per cent, medium (23-57 kg/ha) in 15 per cent and high (>57 kg/ha) in 70 per cent of the soils.*
- *Available potassium is low (<145 kg/ha) in 36 per cent, medium (145-337 kg/ha) in 37 per cent and high (>337 kg/ha) in 13 per cent of the soils.*
- *Available sulphur is low(<10 ppm) in 74 per cent and medium (10-20 ppm) in 12 per cent area of the soils.*
- *Available boron is low (0.5 ppm) in about 41 per cent area and medium (0.5-1.0 ppm) in 45 per cent area.*
- *Available iron is deficient in 10 per cent of the area and sufficient (>4.5 ppm) in 76 per cent of the area.*
- *Available zinc is deficient (<0.6 ppm) in 73 per cent and sufficient (>0.6 ppm) in 12 per cent of the soils.*
- *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	*29(5)*	*138 (22)*		*Pomegranate*	*29(5)*	*83(13)*
Maize	-	*167 (26)*		*Guava*	*29(5)*	*59(9)*
Bajra	*63 (10)*	*179 (28)*		*Jackfruit*	*29(5)*	*58(9)*
Redgram	*29(5)*	*79 (12)*		*Jamun*	*29(5)*	*83(13)*
Bengalgram	-	*235 (37)*		*Musambi*	*29(5)*	*83(13)*
Groundnut	*63 (10)*	*289 (46)*		*Lime*	*29(5)*	*83(13)*
Sunflower	*29 (5)*	*79 (12)*		*Cashew*	*29(5)*	*76 (12)*
Cotton	*29(5)*	*138(22)*		*Custard apple*	*82(13)*	*361 (57)*
Chilli	*29(5)*	*113(18)*		*Amla*	*63(10)*	*381(60)*
Tomato	*29(5)*	*113 (18)*		*Tamarind*	*29(5)*	*59(9)*
Drumstick	*29 (5)*	*263(42)*		*Marigold*	*29(5)*	*138(22)*
Mulbery	*29(5)*	*286(45)*		*Chrysanthemum*	*29(5)*	*138(22)*
Mango	*29(5)*	*25 (4)*		*Jasmine*	*29(5)*	*113(18)*
Sapota	*29(5)*	*58 (9)*		*Crossandra*	*29(5)*	*113(18)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the fiveidentified 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 for these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment and drainage line treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass which in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

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

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

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

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

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

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

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

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

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Danakkanadoddi-1 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig 2.1). It lies between $15^0$23' and $15^0$25' North latitudes and $76^0$16'and $76^0$18' East longitudes and covers an area of about 631 ha. It comprises parts of Kukanapalli, Tavarageri, Danakanadoddi and Halalli. It is about 40 km north of Koppal town and is surrounded by Kukanapalli on the north, Tavarageri on the west and Danakkanadoddi on the eastern and southern side of the microwatershed.

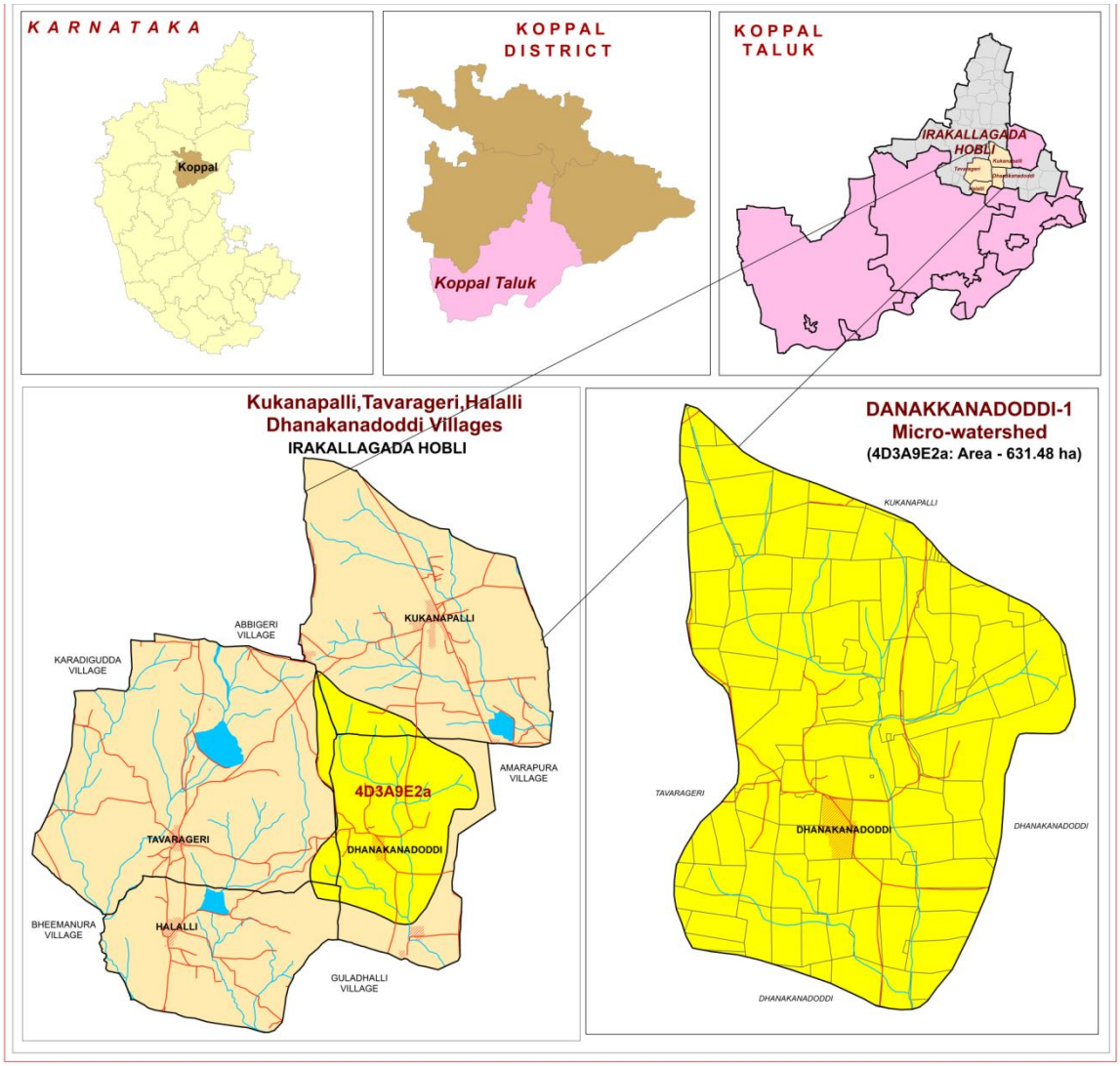

Fig.2.1 Location map of Danakkanadoddi-1 Microwatershed

2.2 Geology

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

10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Danakkanadoddi-1 village. The soil thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent paleo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2 a Granite and granite gneiss rocks

Fig.2.2 b Alluvium

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss and Alluvial landscapes based on geology. The microwatershed area has been further divided into mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level

plains based on slope and its relief features. The elevation ranges from 511 to 532 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

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

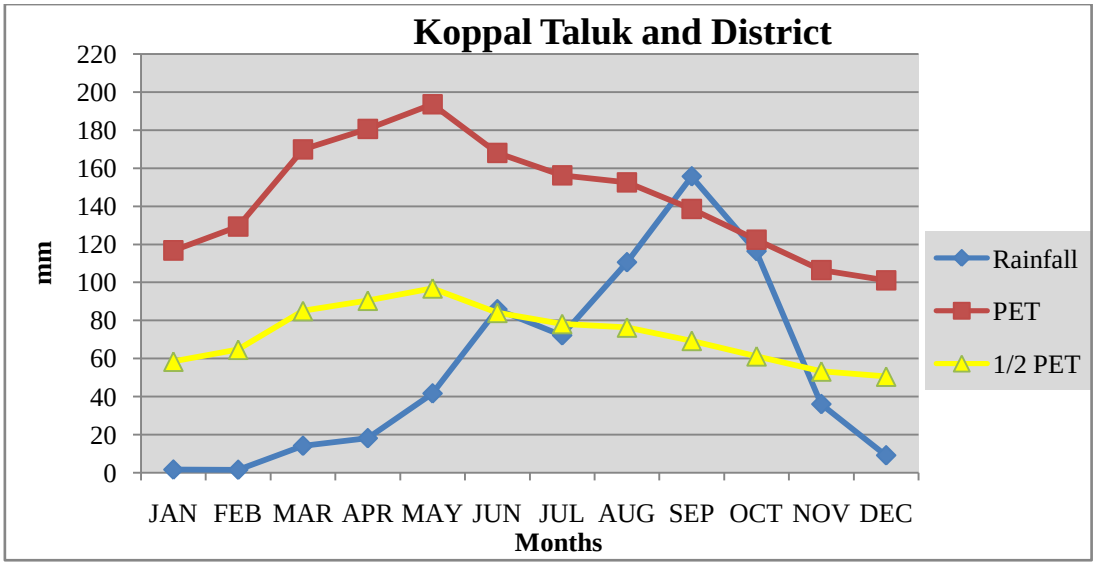

Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Danakkanadoddi-1 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5 a & b). While carrying out land resource inventory, the land use/land cover particulars are collected from all the survey numbers and a current land use map of the microwatershed is prepared. The current land use map prepared shows the arable and non-arable lands, other land uses and different types of crops grown in the area. The current land use map of Danakkanadoddi-1 microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and conservation structures in Danakkanadoddi-1 microwatershed is given Fig. 2.7.

Table 2.2 Land Utilization in Koppal District

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

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

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

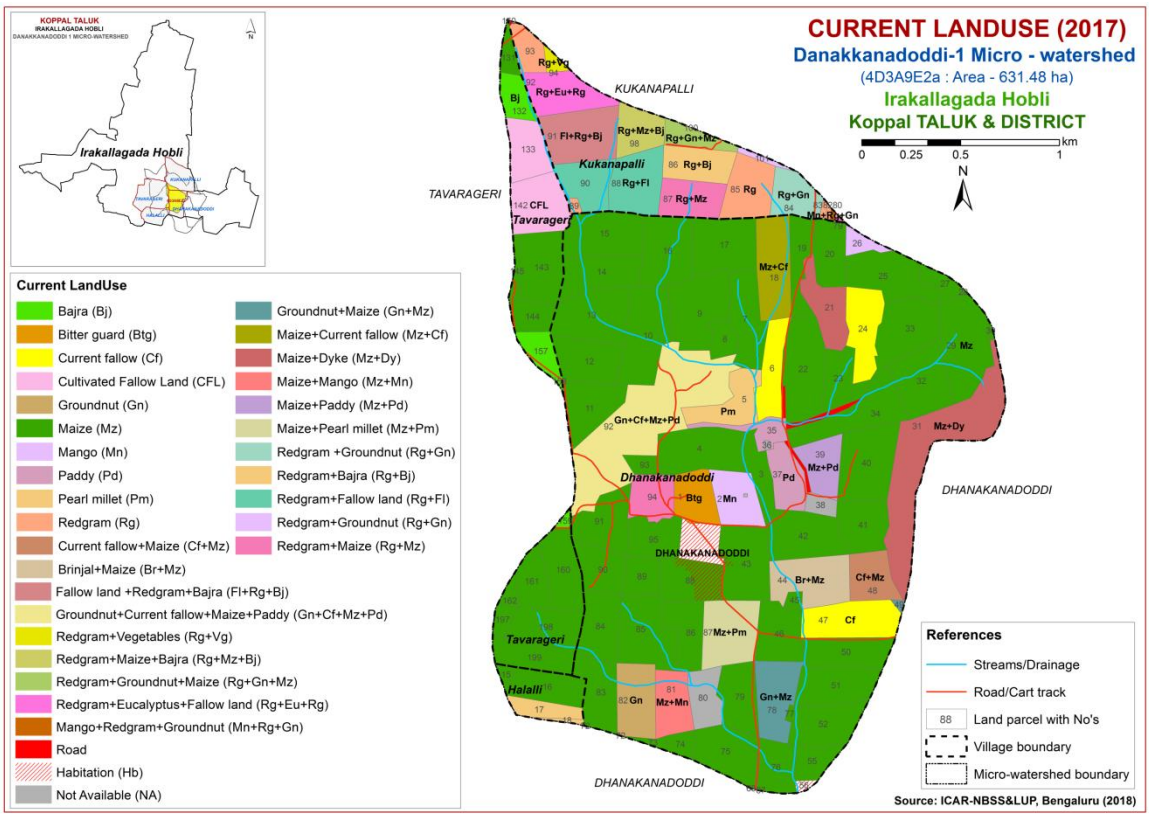

Fig.2.6 Current Land Use – Danakkanadoddi-1 Microwatershed

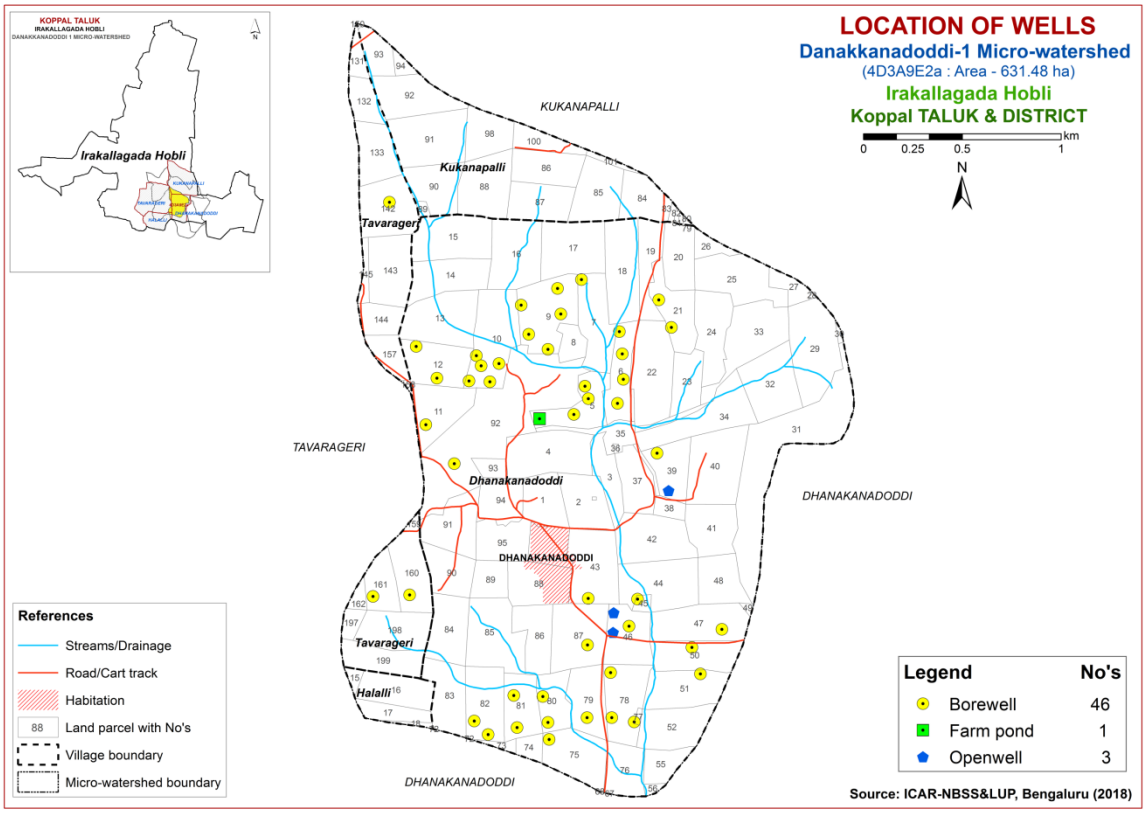

Fig.2.6 Location of wells and conservation structures Danakkanadoddi-1 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Danakkanadoddi-1 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site (slope, erosion, drainage, occurrence of rock fragments etc.) and 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 631 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, uplands, very gently sloping lands based on slope. They were further subdivided into physiographic/ image interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

G1 Hills/ Ridges/ Mounds
- G11 Summits
- G12 Side slopes
  - G121 Side slopes with dark grey tones

G2 Uplands
- G21 Summits
- G22 Gently sloping uplands
  - G221 Gently sloping uplands, yellowish green (eroded)
  - G222 Gently sloping uplands, yellowish white (severely eroded)
- G23 Very gently sloping uplands
  - G231 Very gently sloping uplands, yellowish green
  - G232 Very gently sloping uplands, medium green and pink
  - G233 Very gently sloping uplands, pink and green (scrub land)
  - G234 Very gently sloping uplands, medium greenish grey
  - G235 Very gently sloping uplands, yellowish white (eroded)
  - G236 Very gently sloping uplands, dark green
  - G237 Very gently sloping uplands, medium pink (coconut garden)
  - G238 Very gently sloping uplands, pink and bluish white (eroded)

DSe- Alluvial landscape

DSe 1 Summit
- DSe 11 Nearly level Summit with dark grey tone
- DSe 12 Nearly level Summit with medium grey tone
- DSe 13 Nearly level Summit with whitish grey tone
- DSe 14 Nearly level Summit with whitish tone (Calcareousness)
- DSe 15 Nearly level Summit with pinkish grey tone
- DSe 16 Nearly level Summit with medium pink tone
- DSe 17 Nearly level Summit with bluish white tone
- DSe 18 Nearly level Summit with greenish grey tone

DSe 2 Very genetly sloping
- DSe 21 Very gently sloping, whitish tone
- DSe 22 Very gently sloping, greyish pink tone
- DSe 23 Very gently sloping, whitish grey tone
- DSe 24 Very gently sloping, medium grey tone
- DSe 25 Very gently sloping, medium pink tone
- DSe 26 Very gently sloping, dark grey tone
- DSe 27 Very gently sloping, bluish grey tone
- DSe 28 Very gently sloping, greenish grey tone
- DSe 29 Very gently sloping, Pinkish grey

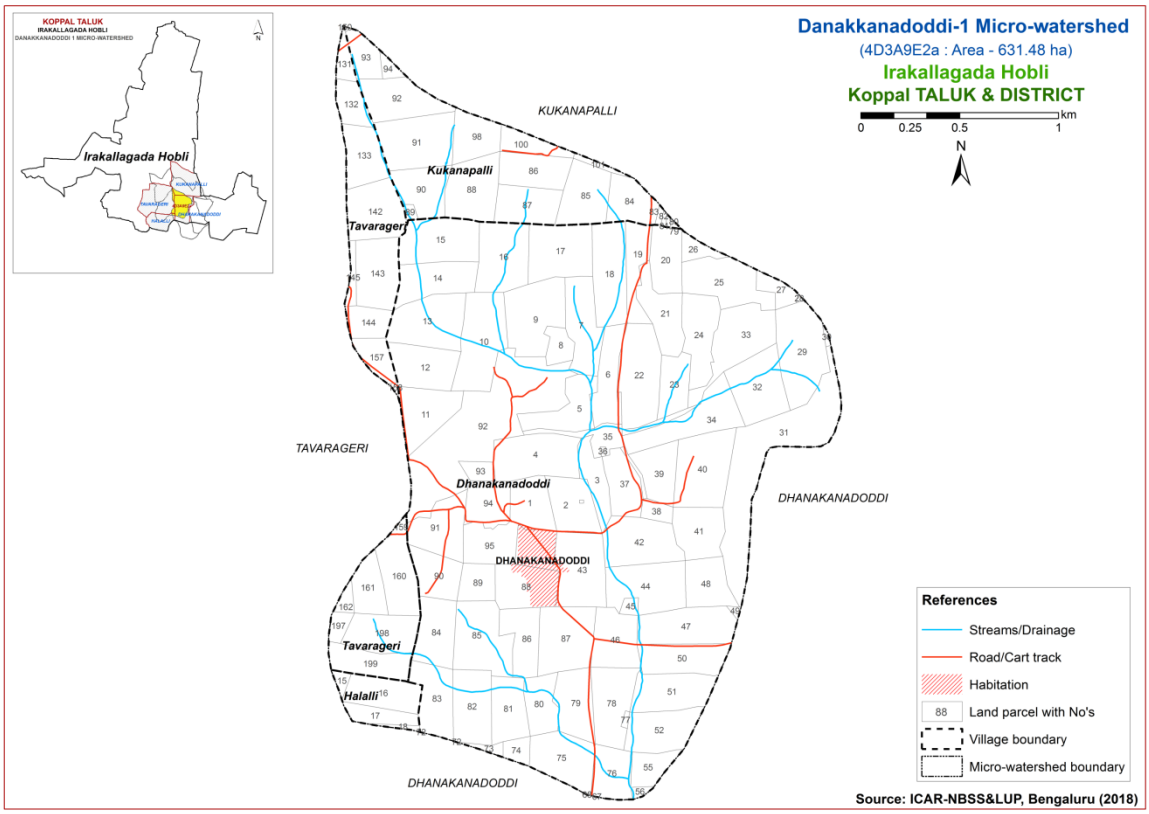

Fig 3.1 Scanned and Digitized Cadastral map of Danakkanadoddi-1 Microwatershed

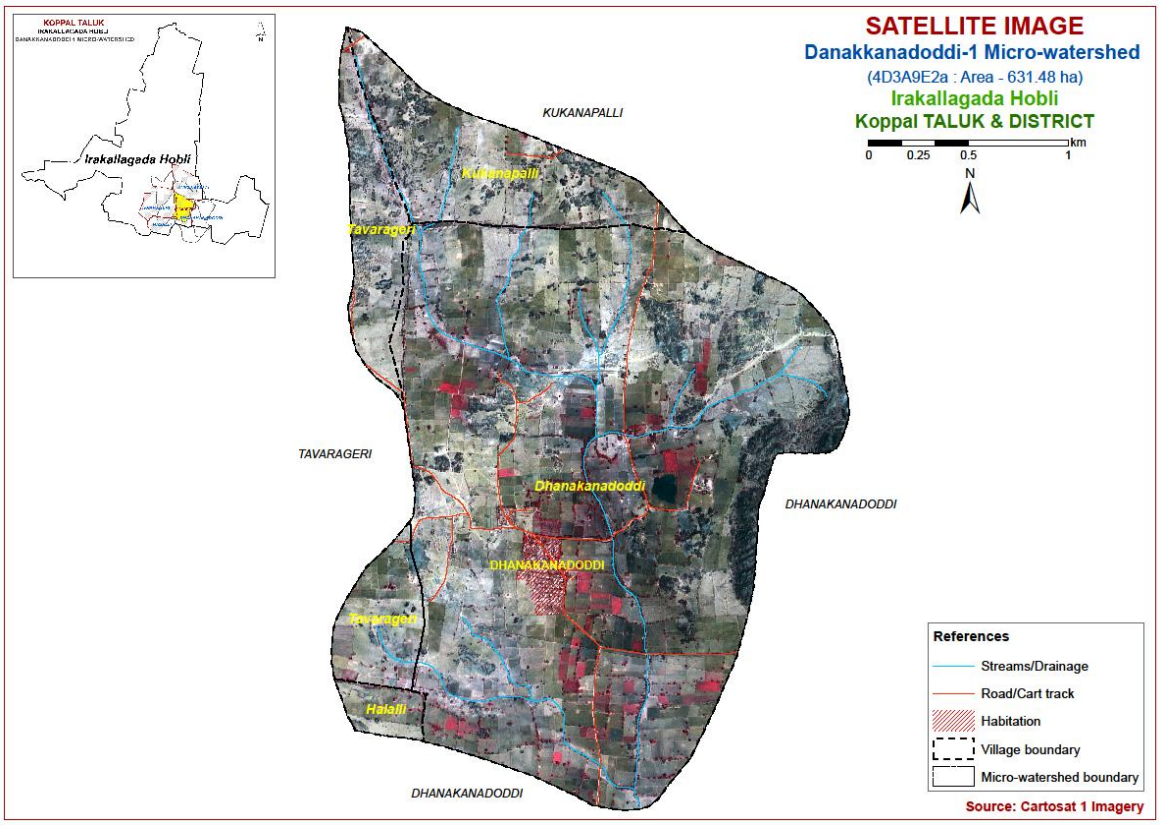

Fig.3.2 Satellite Image of Danakkanadoddi-1 Microwatershed

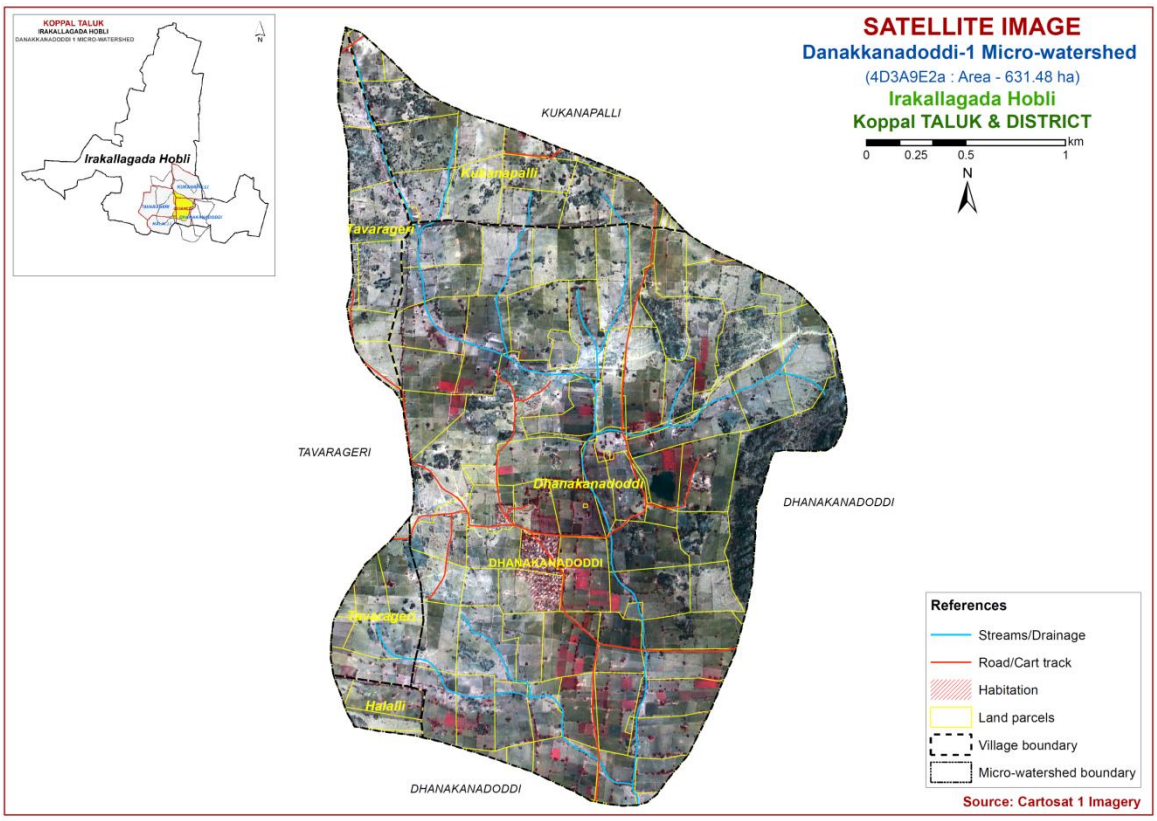

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Danakkanadoddi-1 Microwatershed

3.3 Field Investigation

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

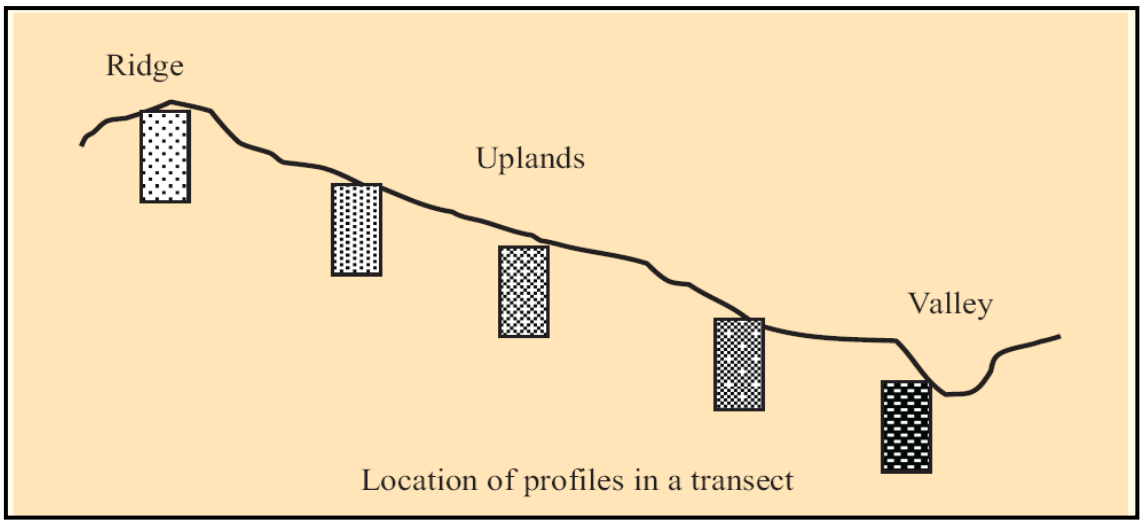

Fig: 3.4. Location of profiles in a transect

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

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, calcareousness, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 13 soil series were identified in Danakkanadoddi-1 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour(moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo -usness**
1	Harve (HRV)	25-50	2.5YR 3/4,3/6 5YR 3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr	-
2	Kaggalipura (KGP)	25-50	2.5YR2.5/4,3/4, 3/6	gscl-gsc	15-35	Ap-Bt-Cr	-
3	Hatti (HTI)	50-75	5 YR 3/3, 3/4,	gsc	15-35	Ap-Bt-Cr	-
4	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
5	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gscl	>35	Ap-Bt-Cr	-
6	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5YR3/4	gc	35-60	Ap-Bt-Cr	-
7	Bisarahalli (BSR)	75-100	5 YR 3/3, 3/4	gsc	15-35	Ap-Bt-Cr	-
8	Gollarahatti (GHT)	75-100	2.5YR3/4,3/6, 4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
9	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4, 3/6	gsc-gc	>35	Ap-Bt-Cr	
10	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
11	Nagalapur (NGP)	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc-gc	>35	Ap-Bt-Cr	-
12	Ranatur (RTR)	>150	2.5YR2.5/3,2.5/4, 3/3,4/6	c	-	Ap-Bt	-
Soils of Alluvial Landscape							
13	Kavalur (KVR)	100-150	10 YR 2/2, 3/1, 3/2, 3/3, 4/4	c	-	Ap-Bss-Bck-Cr	es-ev

3.4 Soil Mapping

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

The soil map shows the geographic distribution of 27 mapping units representing 13 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution

of 27 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Land Use Classes

The 27 soil phases identified and mapped in the microwatershed were regrouped into 5 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Use Classes (LUC's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LUCs. For Danakkanadoddi-1 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

3.5 Laboratory Characterization

Soil samples of each series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from farmer's fields in Danakkanadoddi-1 microwatershed (60 samples) for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Danakkanadoddi-1 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay loamy soils occurring on nearly level to gently sloping uplands under cultivation		**35 (5.55)**
465		HRVcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	35 (5.55)
	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		**2 (0.29)**
18		KGPhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	2 (0.29)
	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		**2 (0.36)**
94		HTIhB1g1	Sandy clay loam surface, slight erosion, gravelly (15-35%)	2 (0.36)
	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		**131 (20.73)**
43		LKRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	34 (5.4)
452		LKRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	21 (3.28)
49		LKRhC2g3	Sandy clay loam surface, slope 3-5%, moderate erosion, extremely gravelly (60-80%)	61 (9.68)
53		LKRiB2	Sandy clay surface, slope 1-3%, moderate erosion	15 (2.37)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly red sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**57 (9.01)**
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	13 (2.05)
85		MKHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	44 (6.96)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly red clay soils		**17 (2.77)**

		occurring on nearly level to gently sloping uplands under cultivation		
187		BDGhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	2 (0.38)
188		BDGhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	15 (2.39)
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown gravelly red sandy clay soils occurring on very gently sloping uplands under cultivation		**20 (3.1)**
158		BSRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	20 (3.1)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red gravelly sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**34 (5.42)**
140		GHThB1	Sandy clay loam surface, slope 1-3%, slight ersoion	34 (5.42)
	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		**5 (0.76)**
111		HDHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	2 (0.27)
122		HDHhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	1 (0.15)
123		HDHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	2 (0.34)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**95 (14.95)**
216		BPRbB2	Loamy sand surface, slope 1-3%, moderate erosion	17 (2.67)
224		BPRcB2	Sandy loam surface, slope 1-3%, moderate erosion	14 (2.15)
231		BPRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	34 (5.39)
239		BPRiB2	Sandy clay surface, slope 1-3%, moderate erosion	30 (4.74)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		**90 (14.23)**
251		NGPcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	36 (5.73)
460		NGPhC2g1	Sandy clay loam surface, slope 3-5%,	23 (3.59)

			moderate erosion, gravelly (15-35%)	
265		NGPiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	31 (4.91)
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on nearly level to very gently sloping uplands under cultivation		**29 (4.51)**
285		RTRcB2	Sandy loam surface, slope 1-3%, moderate erosion	18 (2.78)
288		RTRiB2	Sandy clay surface, slope 1-3%, moderate erosion	11 (1.73)
Soils of Alluvial landscape				
	KVR	Kavalur soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to very dark grayish brown, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**25 (3.91)**
388		KVRmB1	Clay surface, slope 1-3%, slight erosion	25 (3.91)
1000		Others	Habitation	**7 (1.16)**
999		Rock outcrops	Rock lands, both massive and bouldery	**84 (13.26)**

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

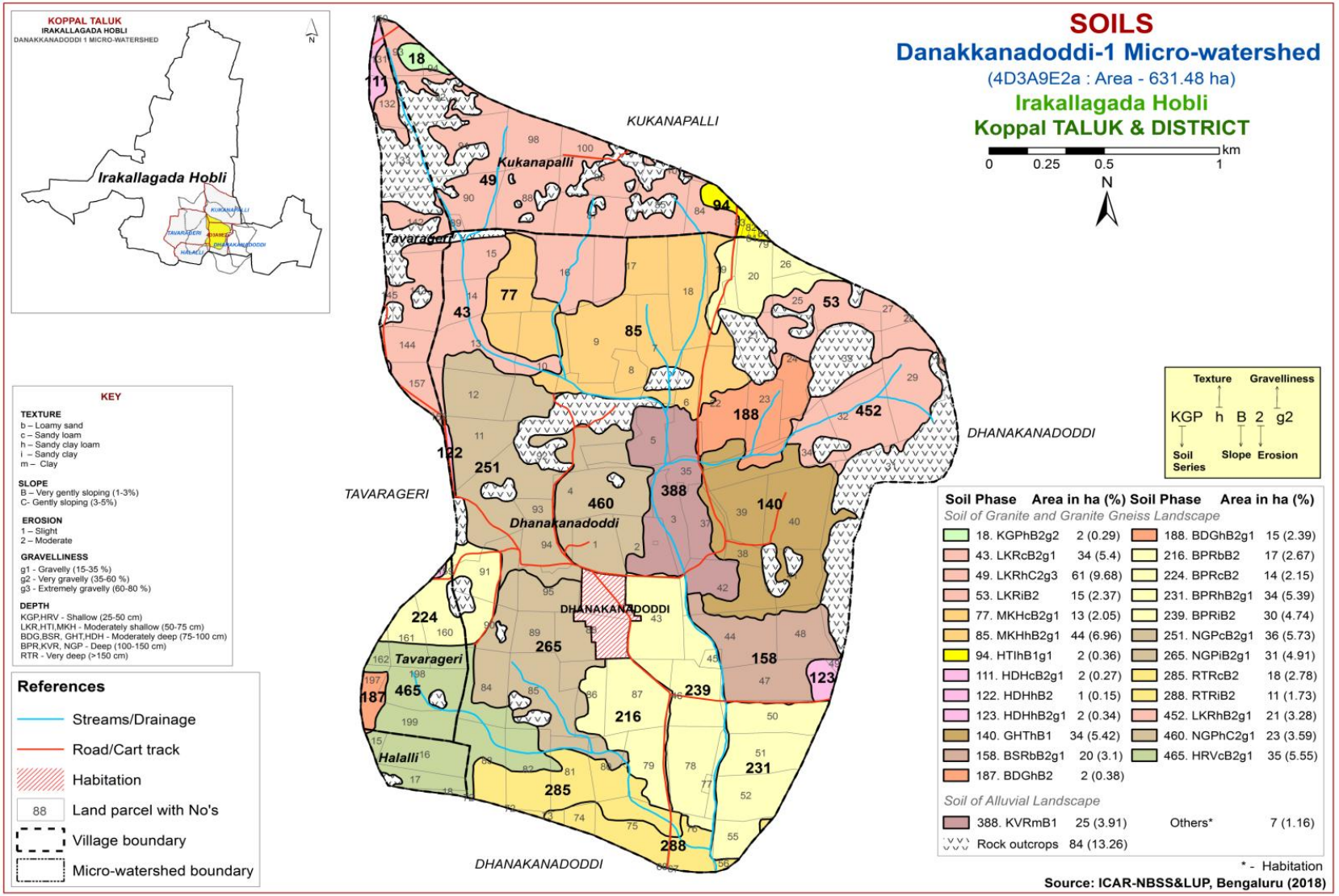

Fig 3.5 Soil Phase or Management Units- Danakkanadoddi-1 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Danakkanadoddi-1 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 13 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 13 soil series identified followed by 27 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified and their classification in Danakkanadoddi-1 microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 12 soil series were identified and mapped. Of these series, Lakkur (LKR) series occupies maximum area of 131 ha (21%) followed by Balapur (BPR) 95 ha (15%). The brief description of soil series along with the soil phases identified and mapped is given below.

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

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

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.2 Kaggalipura (KGP) Series: Kaggalipura soils are shallow (25-50 cm), well drained, have brown to dark reddish brown gravelly sandy clay loam to sandy clay soils. They have developed from 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). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

4.1.3 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). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Hatti (HTI) Series

4.1.4 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). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Lakkur (LKR) Series

4.1.5 Mukhadahalli (MKH) Series: Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown gravelly sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands. The Mukhadahalli series has been classified as a member of 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). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

4.1.6 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).Two soil phases were identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

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

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

4.1.8 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

4.1.9 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). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

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

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

Landscape and soil profile characteristics of Balapur (BPR) Series

4.1.11 Nagalapur (NGP) Series: Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 105 to 145 cm. The thickness of A-horizon ranges from 14 to 20 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam to sandy clay with 10 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 128 cm. Its colour is in 2.5 YR, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 80 per cent gravel. The available water capacity is low (51-100 mm/m). Three soil phases were identified and mapped.

Landscape Soil Profile Characteristics of Nagalapur (NGP) Series

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

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

Landscape and soil profile characteristics of Ranatur (RTR) Series

4.2 Soils of Alluvial Landscape

In this landscape, only one soil series was identified and mapped. The brief description of soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum is 113 to 143 cm. The thickness of A horizon ranges from 9 to 24 cm. Its colour is in 10 YR hue with value 3 and chroma 1. The texture is clay with no gravel. The thickness of B horizon ranges from 89 to 134 cm. Its colour is in 10 YR hue with value 3 and chroma 1. Its texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). One soil phase was identified and mapped.

Landscape and soil profile characteristics of Kavalur (KVR) Series

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

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

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

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

Contd…

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

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

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

Contd…

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

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

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

Contd…

Soil Series: Hooradhahalli (HDH), Pedon: RM-69
Location: $13^0$24'31"N, $76^0$33'41"E, (4D3D8G2d), Hesarahalli village, Chikkanayakanahalli taluk, Tumukura 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…

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

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

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

Contd…

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

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

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

Contd…

Series Name: Kavalura (KVR), Pedon:A2/RM-9
Location: $15^0$18'86.8"N, $75^0$56'56.3"E, Kavalura village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine, smectitic, isohyperthermic (calc) Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-24	Ap	36.18	17.80	46.02	7.04	7.47	6.62	9.28	5.76	10	c	28.20	18.75
24-50	Bss1	38.79	15.36	45.85	6.25	6.25	9.70	10.67	5.93	05	c	27.16	18.81
50-85	Bss2	36.80	14.66	48.54	9.63	8.23	7.03	7.58	4.33	<5	c	30.16	22.17
85-124	Bss3	22.66	17.24	60.09	4.18	3.85	5.28	5.06	4.29	<5	c	40.34	31.42

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}							%	%
0-24	8.4	-	-	0.265	0.2	8.04	-	-	0.97	0.65		43.25	0.94		1.50
24-50	9.27	-	-	0.23	0.37	8.04	-	-	0.31	3.21		41.66	0.91		7.70
50-85	9.44	-	-	0.297	0.41	8.64	-	-	0.35	6.43		43.99	0.91		14.63
85-124	9.37	-	-	0.46	0.41	11.40	-	-	0.42	7.99		51.09	0.85		15.65

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

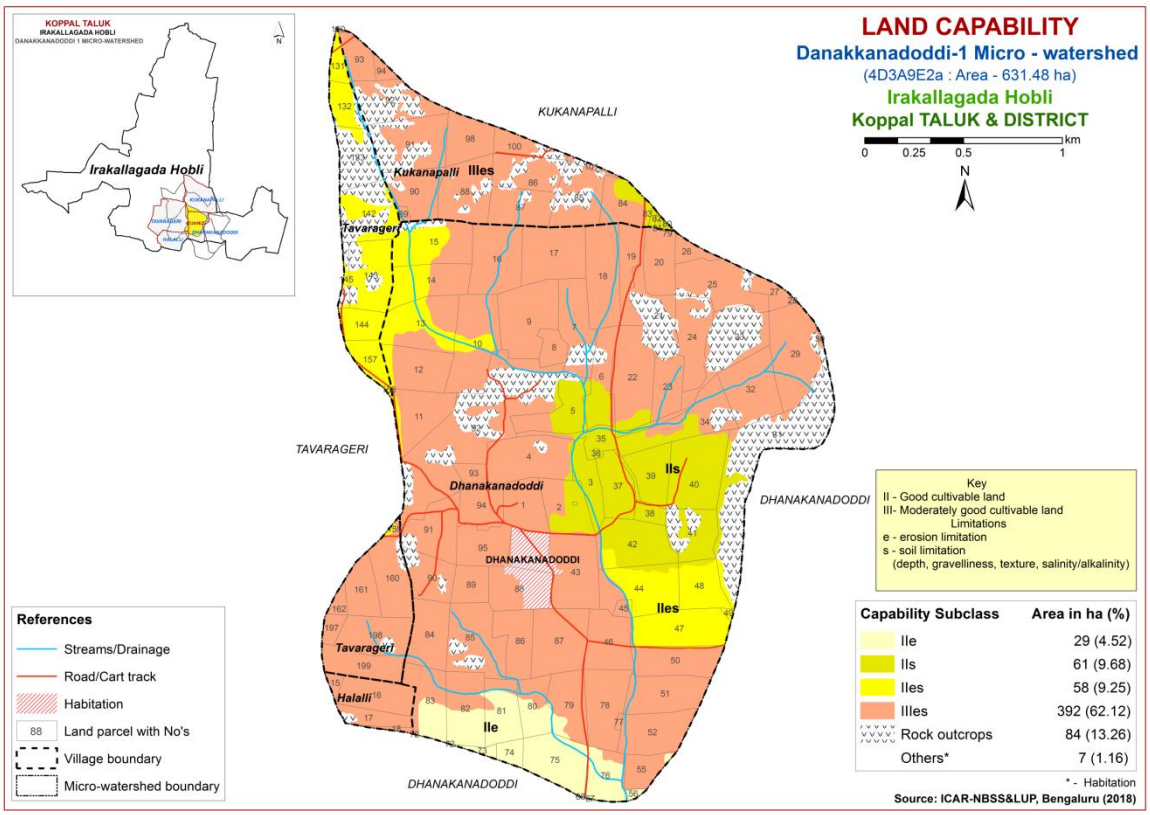

Fig. 5.1 Land Capability map of Danakkanadoddi-1 Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good lands (Class II) cover an area of about 148 ha (23%) and distributed in the western, eastern and southern part of the microwatershed. They have minor problems of soil and erosion. Moderately good lands (Class III) cover a maximum area of about 392 ha (62%) and distributed in the major part with severe problems of erosion and soil.

5.2 Soil Depth

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

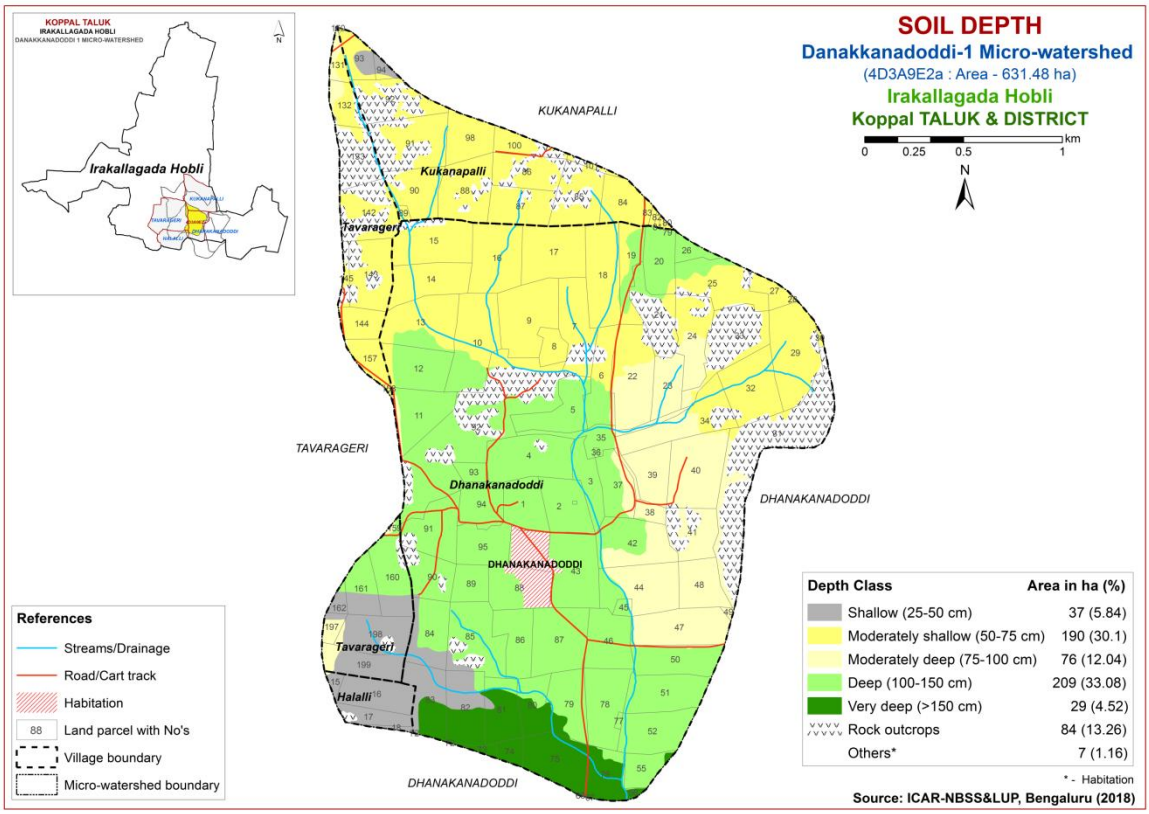

Fig. 5.2 Soil Depth map of Danakkanadoddi-1 Microwatershed

Shallow (25-50 cm) soils occupy an area of about 37 ha (6 %) and are distributed in the southwestern part of the microwatershed. Moderately shallow (50-75cm) soils cover an area of about 190 ha (30%) and distributed in the northern and northeastern part of the microwatershed. Moderately deep soils (75-100 cm) occupy an area of about 76 ha

(12 %) and occur in the eastern part of the microwatershed. Deep (100-150 cm) to very deep (>150 cm) soils occupy a maximum area of about 238 ha (38 %) and distributed in the major part of the microwatershed.

The most productive lands cover about 238 ha (38%) where all climatically adopted long duration crops be grown. The problem lands cover about 37 ha (6%) where only short duration crops can be grown. The probability of crop failure is very high.

5.3 Surface Soil Texture

Texture is an expression to indicate the coarseness or fineness of the soil as determined by the relative proportion of primary particles of sand, silt and clay. It has a direct bearing on the structure, porosity, adhesion and consistence. The surface layer of a soil to a depth of about 25 cm is the layer that is most used by crops and plants. The surface soil textural class provides a guide to understanding soil-water retention and availability, nutrient holding capacity, infiltration, workability, drainage, physical and chemical behavior, microbial activity and crop suitability. The textural classes used for LRI were used to classify and a surface soil texture map was generated. The area extent and their geographical distribution in the microwatershed is shown in Fig 5.3.

An area of about 36 ha (6%) is sandy at the surface and distributed in the southern part of the microwatershed. Maximum area of about 392 ha (62%) is loamy at the surface and distributed in the major part of the microwatershed. An area of about 112 ha (18 %) is clayey at the surface and distributed in the central, southern and northeastern part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils (18%) that have high potential for soil-water retention and availability and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other productive lands area loamy (62%) 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 6% area that have moisture and nutrient constraints.

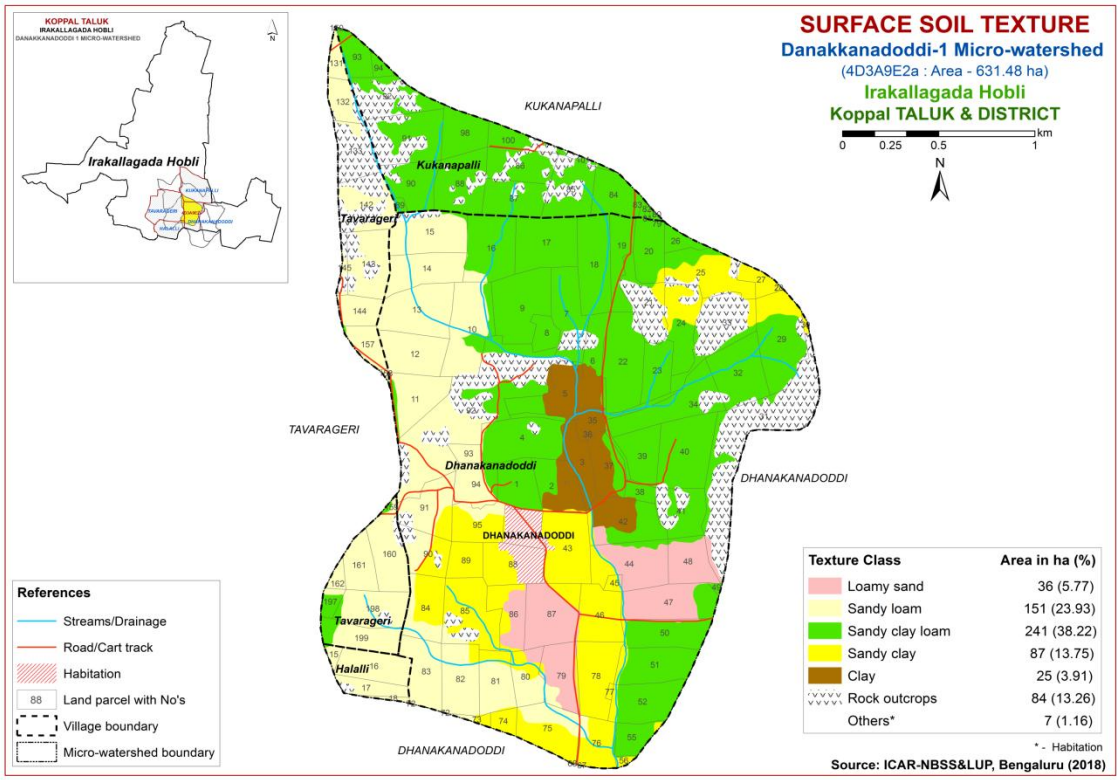

Fig. 5.3 Surface Soil Texture map of Danakkanadoddi-1 Microwatershed

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover an area of about 166 ha (26 %) and are distributed in the southern, eastern and southwestern part of the microwatershed. Maximum area of about 311 ha (49 %) is covered by gravelly (15-35% gravel) soils and are distributed in the major part of the microwatershed. A small area of about 2 ha (<1 %) has soils that are very gravelly (35-60% gravel) and distributed in the northern part of the microwatershed. Extremely gravelly (60-80%) soils cover an area of about 61 ha (10%) and distributed in the northern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 26 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 to extremely gravelly (35-80%) where only short duration crops can be grown cover about 10 per cent area.

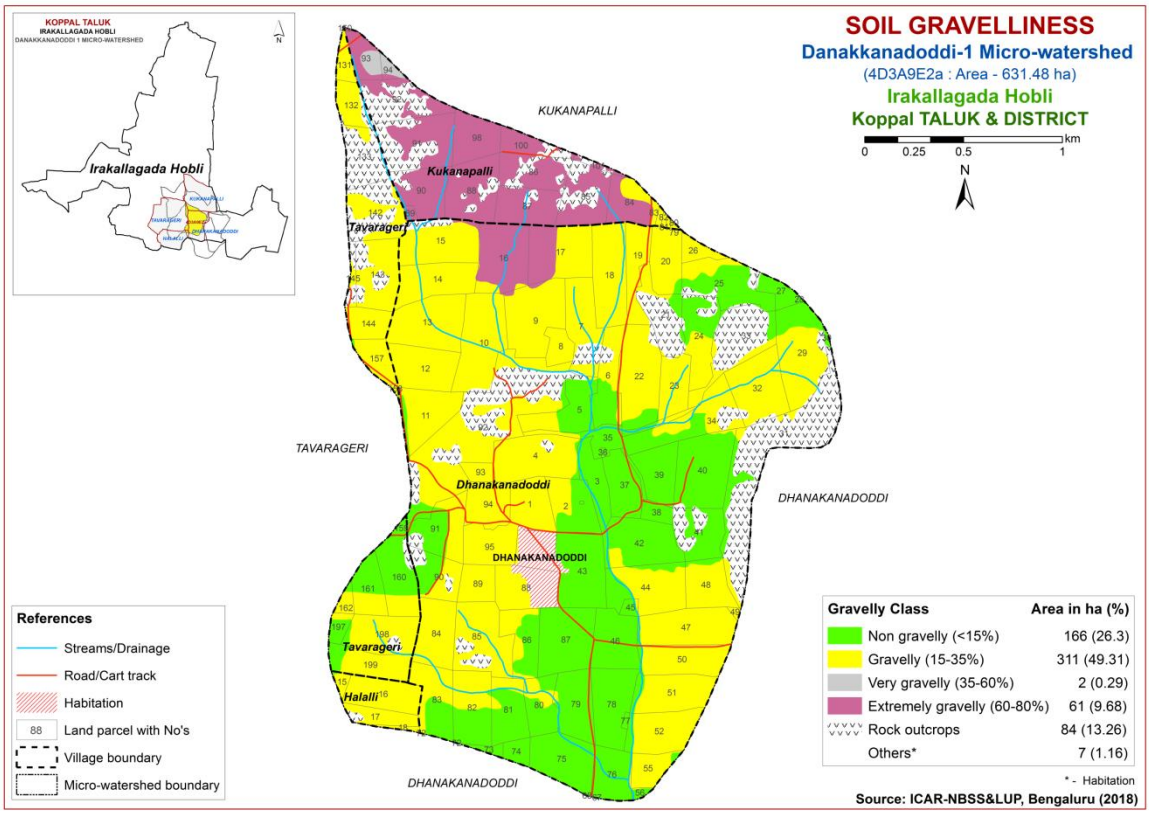

Fig. 5.4 Soil Gravelliness map of Danakkanadoddi-1 Microwatershed

5.5 Available Water Capacity

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

An area of about 247 ha (39%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northern, northeastern and southwestern part of the microwatershed. An area of about 240 ha (38 %) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the western, eastern, central and southern part of the microwatershed. An area of about 29 ha (5%) is high (151-150 mm/m) in available water capacity and are distributed in the southern part of the microwatershed. About 25 ha (4%) area is very high (>200mm/m) in available water capacity and distributed in the central part of the microwatershed.

An area of about 247 ha (39%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 54 ha (8 %) has soils that have high potential (>200

mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

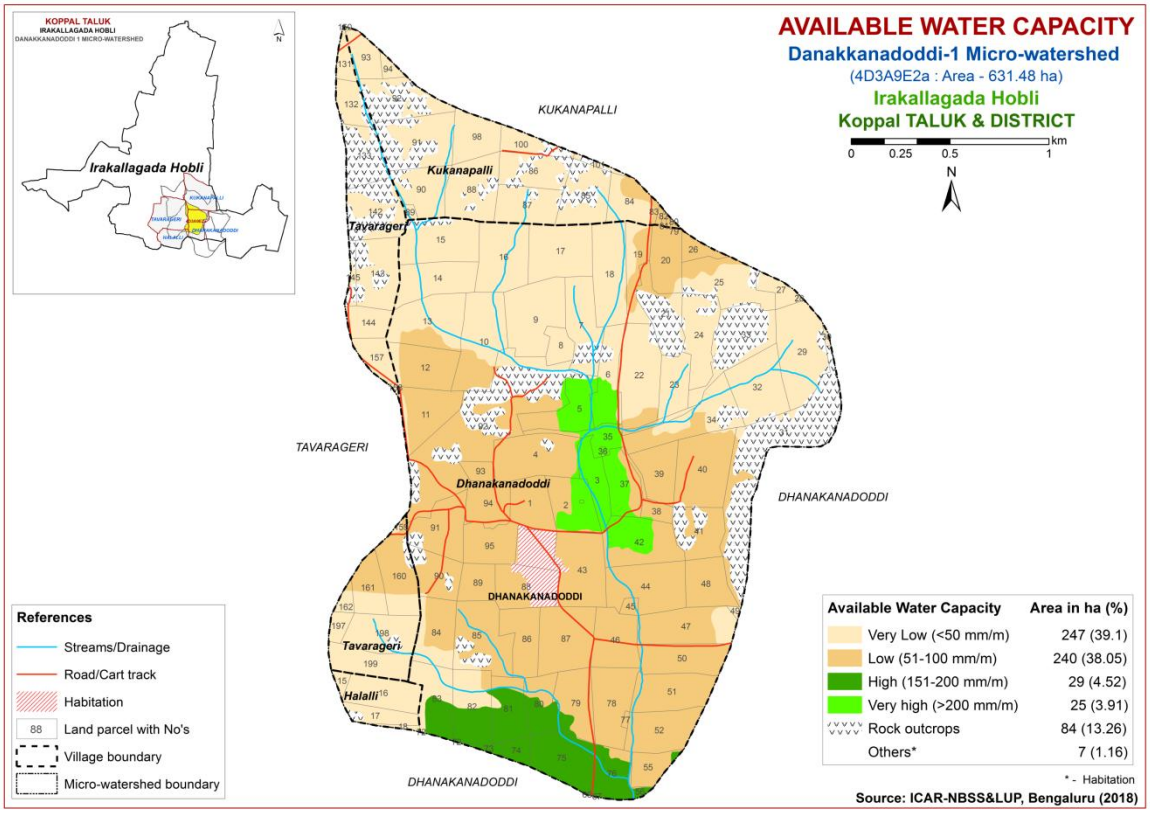

Fig. 5.5 Soil Available Water Capacity map of Danakkanadoddi-1 Microwatershed

5.6 Soil Slope

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

Very gently sloping (1-3% slope) lands cover maximum area of about 457 ha (72 %) and distributed in the major part of the microwatershed. Gently sloping lands cover an area of about 84 ha (13%) and distributed in the central and northern part of the microwatershed.

In all these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

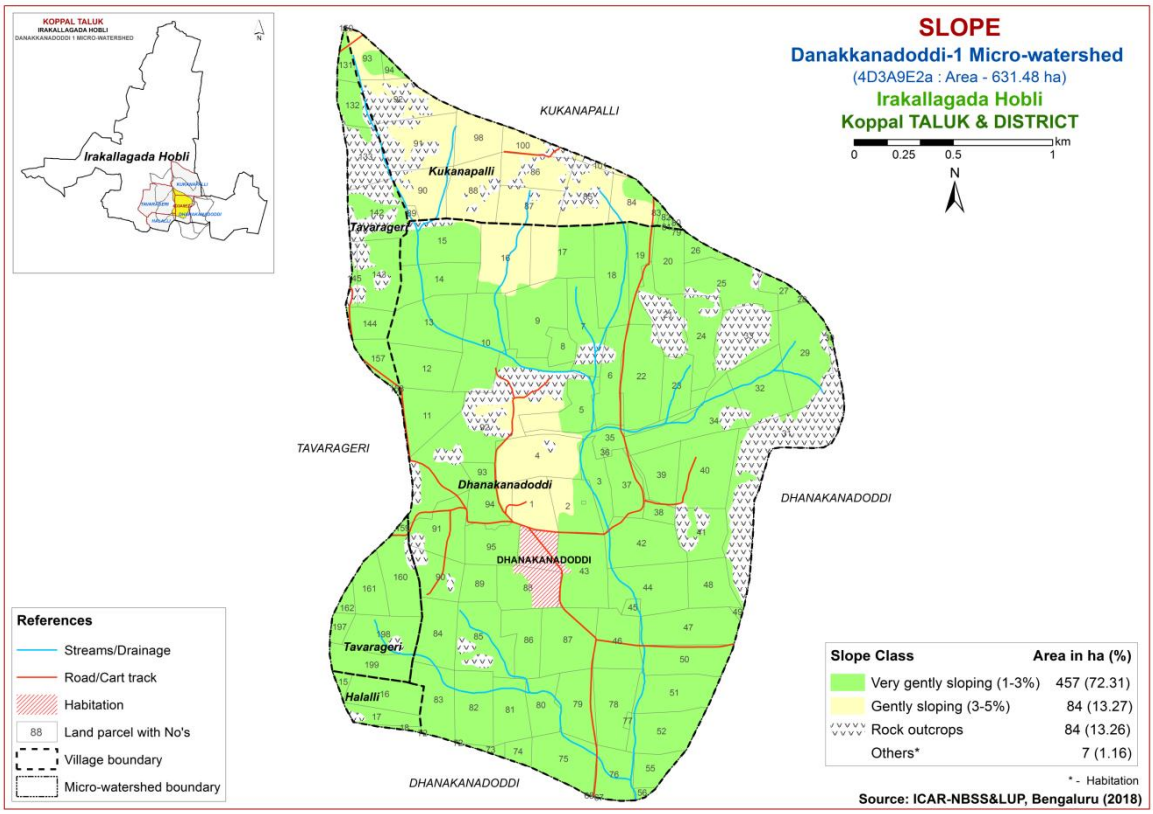

Fig. 5.6 Soil Slope map of Danakkanadoddi-1 Microwatershed

5.7 Soil Erosion

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

Slightly eroded lands cover an area of about 61 ha (10%) and distributed in the eastern part of the microwatershed. Maximum area of about 479 ha (76%) has moderately eroded (e2 class) soils 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.

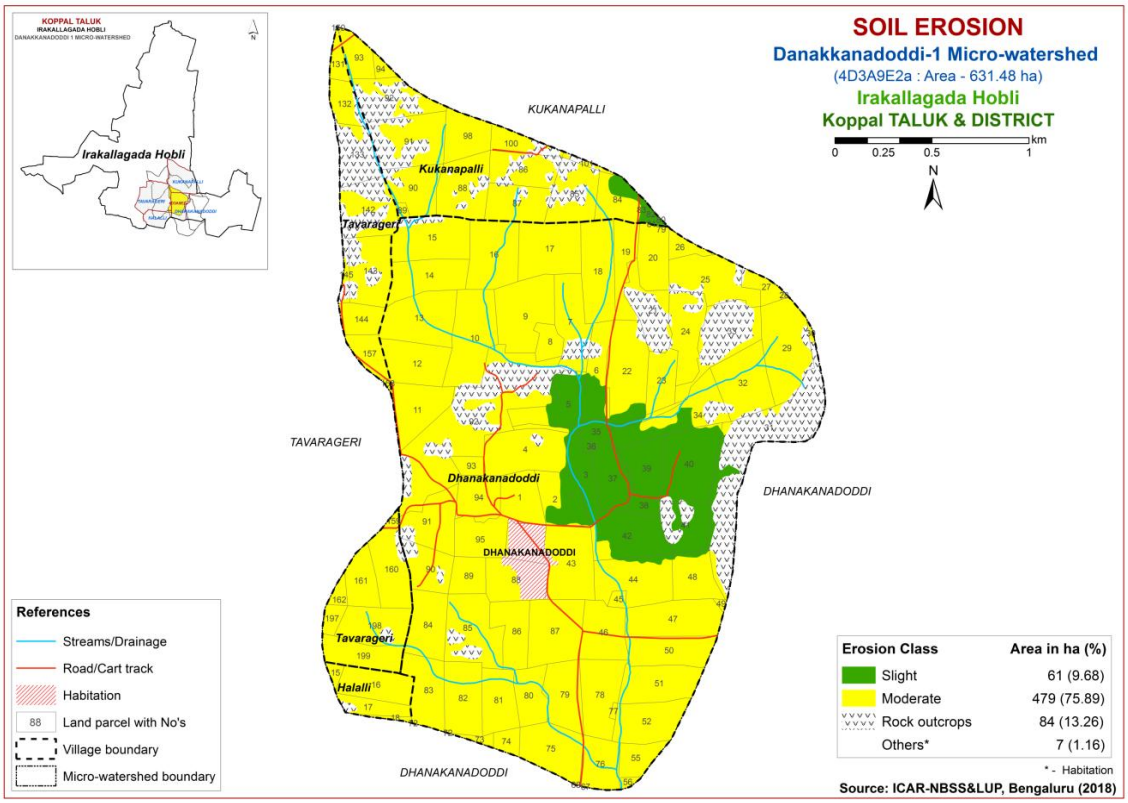

Fig. 5.7 Soil Erosion map of Danakkanadoddi-1 Microwatershed

Chapter 6

FERTILITY STATUS

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

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

6.1 Soil Reaction (pH)

The soil analysis of the Danakkanadoddi-1 microwatershed for soil reaction (pH) showed that a small area of about 1 ha (<1%) is slightly acid (pH 6.0 – 6.5) and are distributed in the southwestern part of the microwatershed. Maximum area of about 282 ha (45%) is neutral (pH 6.5 – 7.3) in reaction and distributed in the major part of the microwatershed. Slightly alkaline (pH 7.3-7.8) soils cover about 73 ha (12%) and distributed in the northern and southern part of the microwatershed. Moderately alkaline (pH 7.8 - 8.4) soils cover an area of about 109 ha (17%) and distributed in the central part of the microwatershed. An area of about 75 ha (12 %) is under strongly alkaline (pH 8.4-9.0) and is distributed in the central part of the microwatershed. (Fig.6.1). Thus major portion of soils in the microwatershed are both neutral and alkaline in reaction.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) of the microwatershed is medium (0.5-0.75%) in maximum area of about 520 ha (82 %) and distributed in the major part of the microwatershed. An area of about 21 ha (3%) is high (>0.75%) in organic carbon content and occur in the northern part of the microwatershed (Fig.6.3).

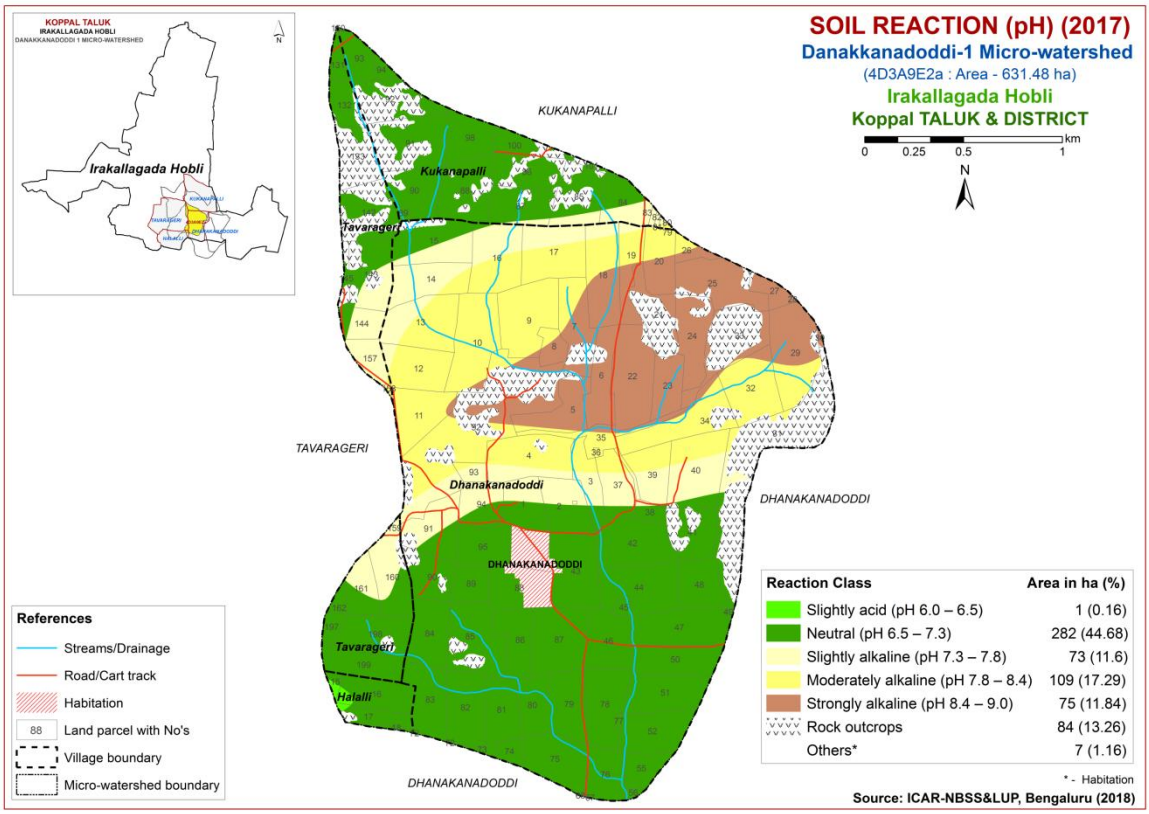

Fig.6.1 Soil Reaction (pH) map of Danakkanadoddi-1 Microwatershed

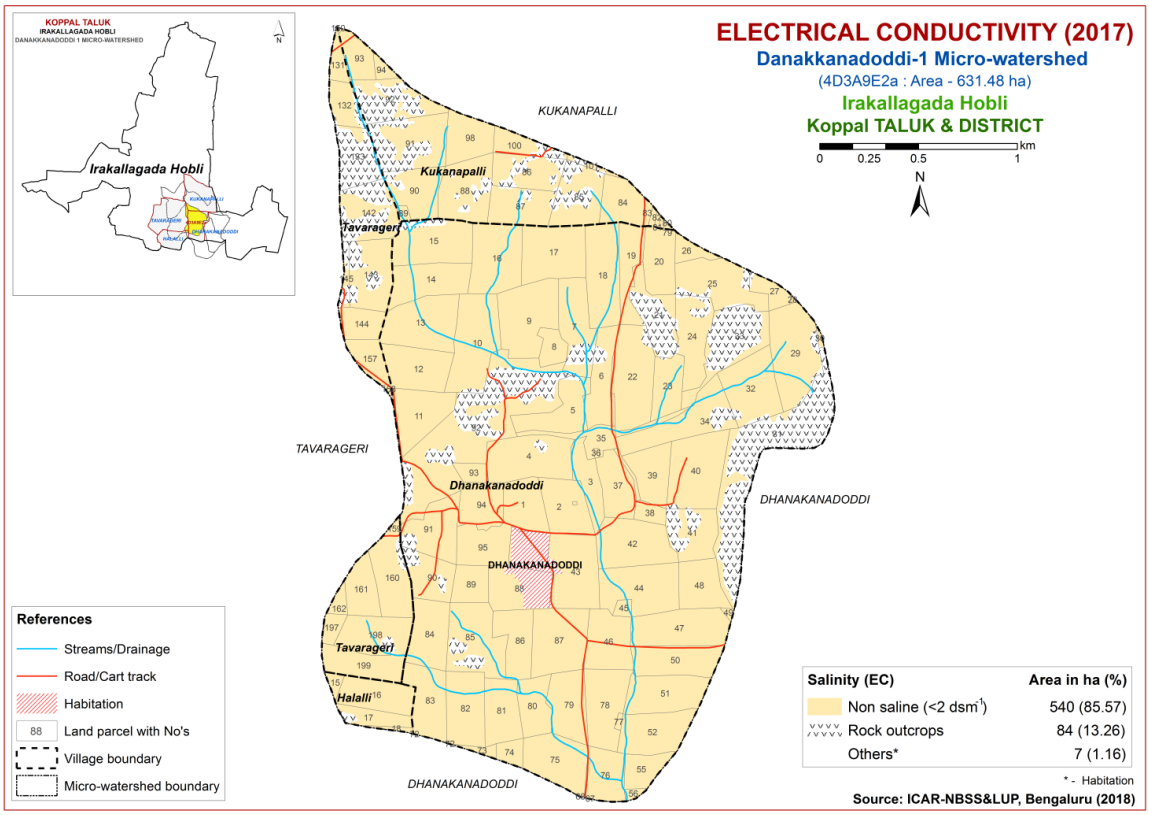

Fig.6.2 Electrical Conductivity (EC) map of Danakkanadoddi-1 Microwatershed

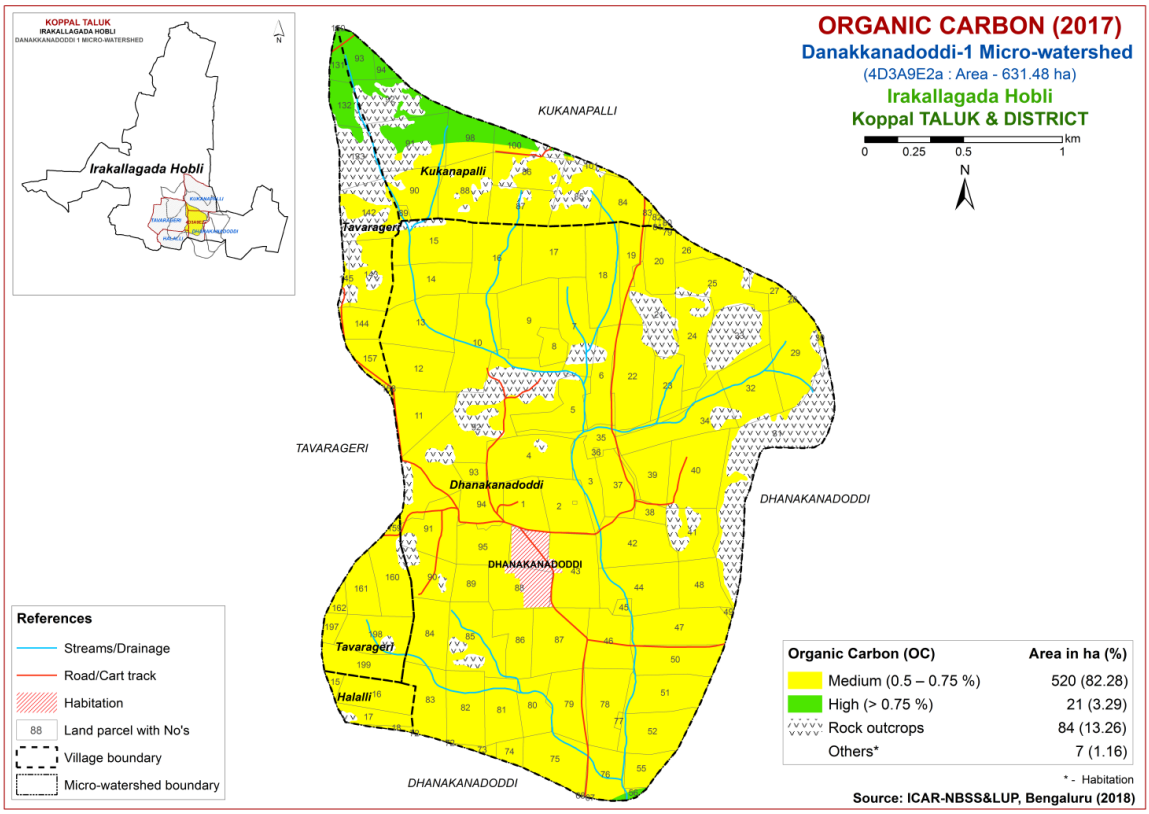

Fig.6.3 Soil Organic Carbon map of Danakkanadoddi-1 Microwatershed

6.4 Available Phosphorus

An area of about 3 ha (<1%) is low (<23 kg/ha) in available phosphorus and distributed in the western part of the microwatershed. Available phosphorus is medium (23-57 kg/ha) in an area of about 94 ha (15 %) and distributed in the western and eastern part of the microwatershed. Maximum area of about 443 ha (70 %) is high in available phosphorous and distributed in the major part of the microwatershed (Fig 6.4). The areas with high phosphorous content may reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorous in areas where it is low and medium (Fig 6.4).

6.5 Available Potassium

An area of about 227 ha (36 %) is low in available potassium (<145 kg/ha) and distributed in the northern, eastern and western part of the microwatershed. An area of about 233 ha (37%) is medium (145-33 7 kg/ha) and distributed in the major part of the microwatershed. An area of about 80 ha (13 %) is high (>337 kg/ha) in available potassium and distributed in the southern part of the microwatershed. The areas with high potassium content may reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium (Fig 6.5).

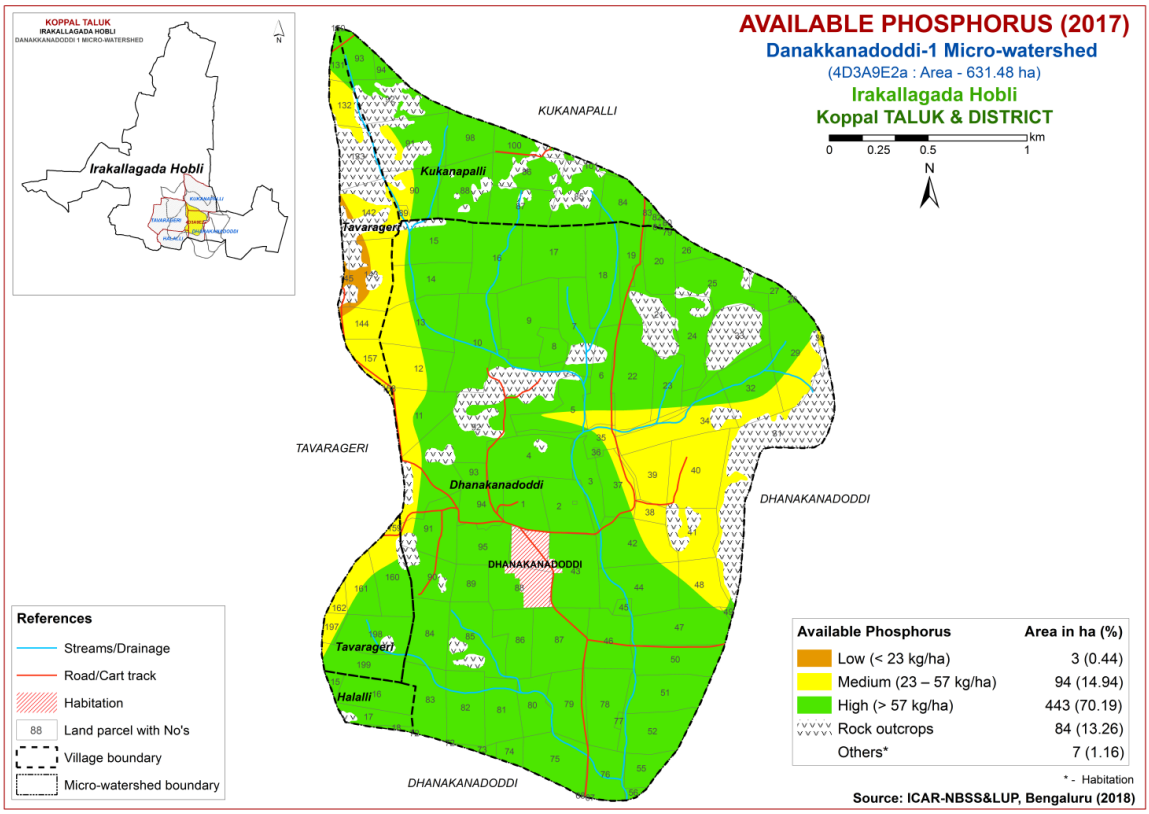

Fig.6.4 Soil Available Phosphorus map of Danakkanadoddi-1 Microwatershed

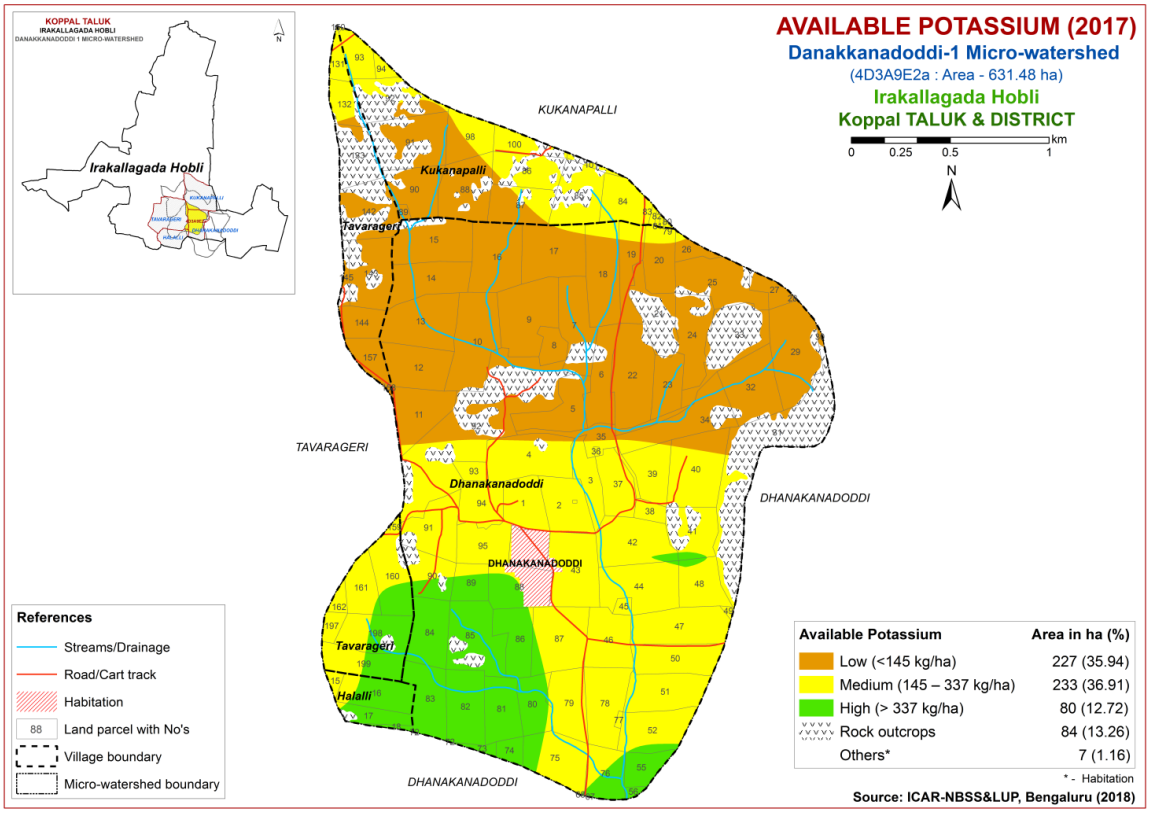

Fig.6.5 Soil Available Potassium map of Danakkanadoddi-1 Microwatershed

6.6 Available Sulphur

Maximum area of about 464 ha (74%) is low (<10 ppm) in available sulphur and distributed in the major part of the microwatershed. An area of about 76 ha (12%) is medium in available sulphur and distributed in the western part (Fig.6.6). The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content is low (<0.5 ppm) in an area of about 258 ha (41 %) and distributed in the southern and central part of the microwatershed. An area of about 283 ha (45%) is medium (0.5-1.0 ppm) in available boron and distributed in the major part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content in the soils of the Danakkanadoddi-1 microwatershed is deficient (<4.5 ppm) in an area of about 61 ha (10 %) and distributed in the northeastern and central part. Maximum area of about 479 ha (76 %) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the major part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content in the soils of the Danakkanadoddi-1 microwatershed is deficient (<0.6 ppm) in maximum area of about 462 ha (73 %) and distributed in the major part of the microwatershed. An area of about 79 ha (12 %) showed sufficiency (>4.5 ppm) with respect to zinc content and distributed in the northeastern, central and southeastern part of the microwatershed (Fig 6.11).

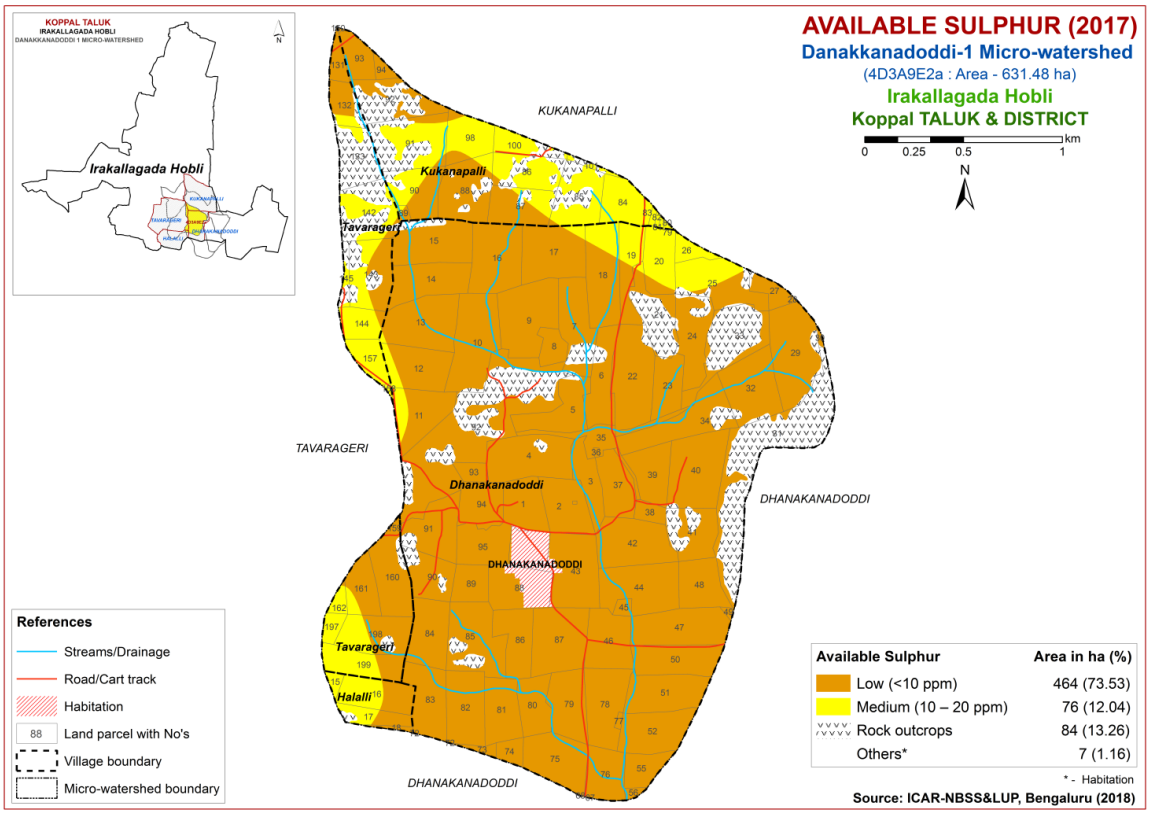

Fig.6.6 Soil Available Sulphur map of Danakkanadoddi-1 Microwatershed

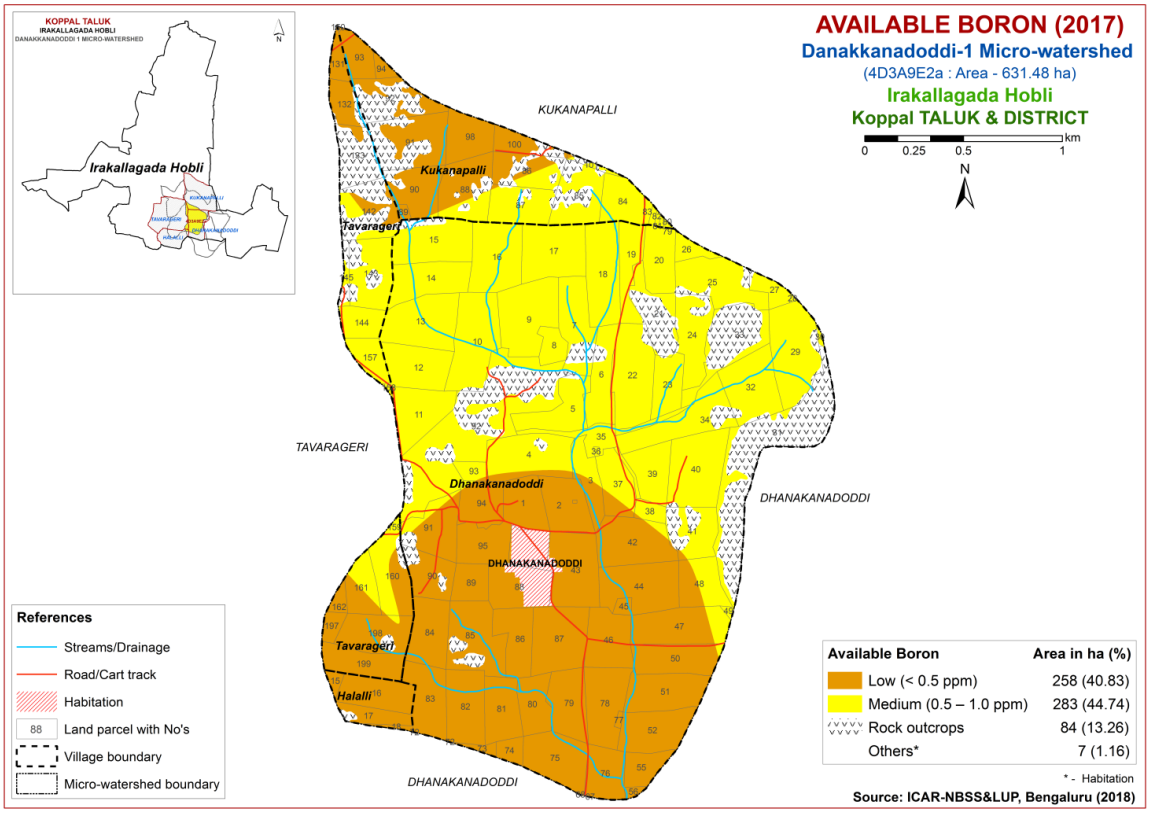

Fig.6.7 Soil Available Boron map of Danakkanadoddi-1 Microwatershed

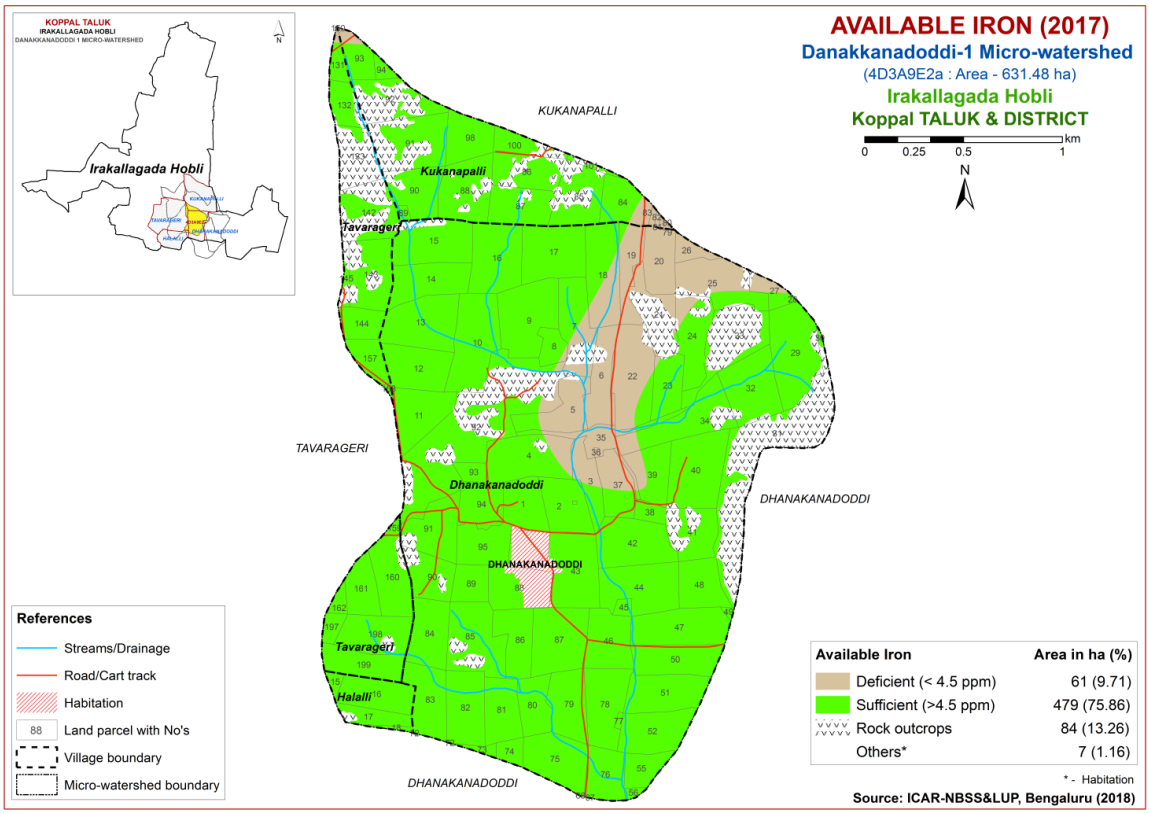

Fig.6.8 Soil Available Iron map of Danakkanadoddi-1 Microwatershed

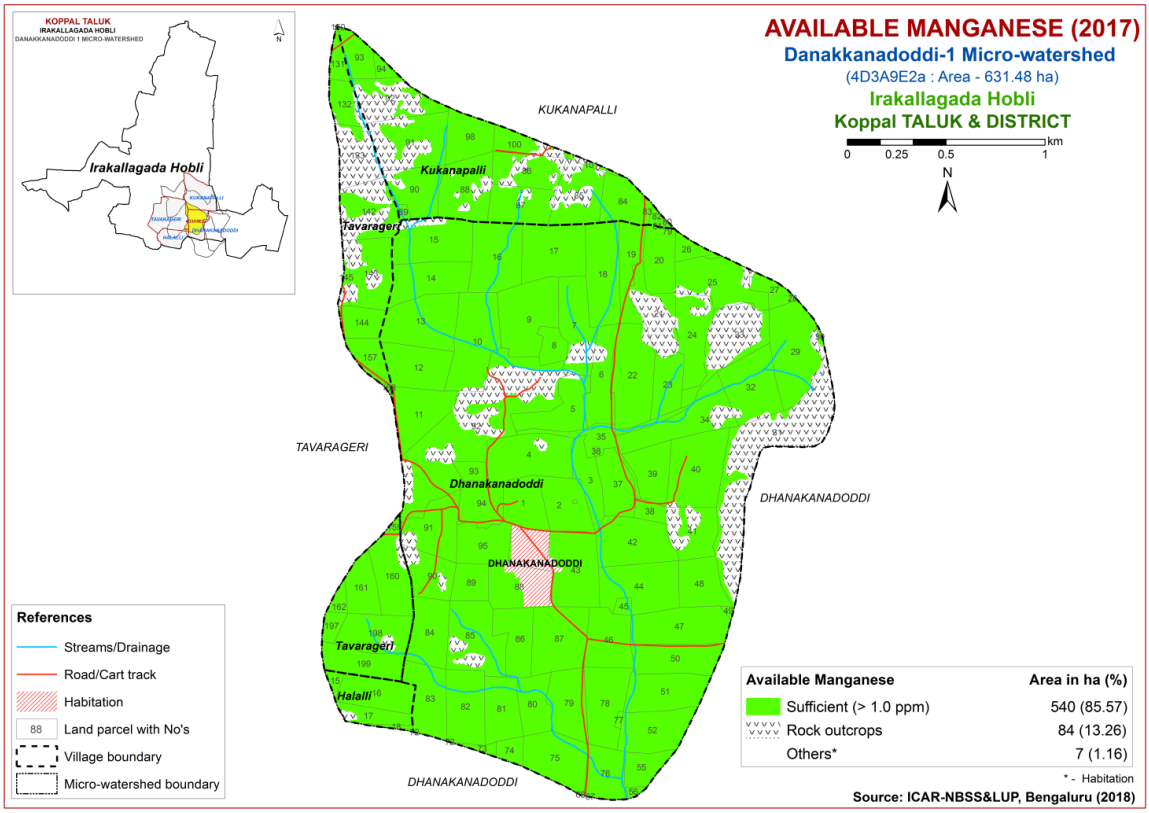

Fig.6.9 Soil Available Manganese map of Danakkanadoddi-1 Microwatershed

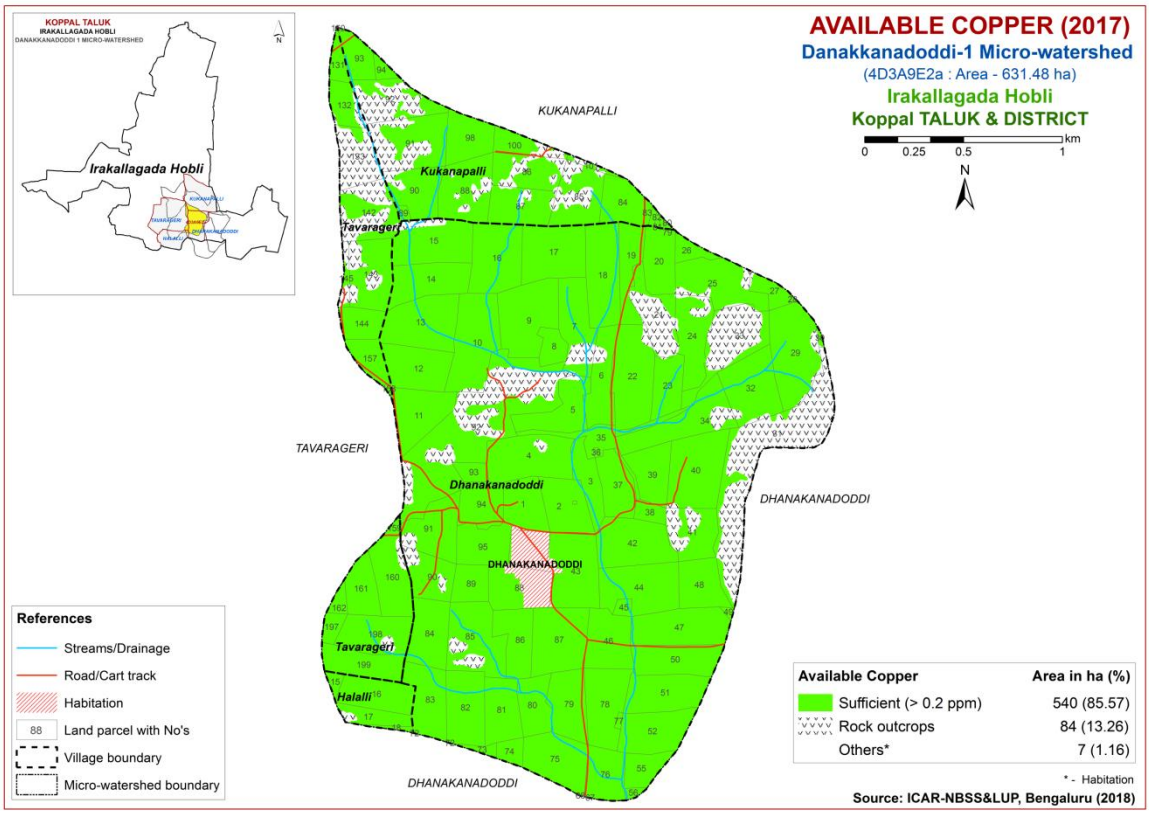

Fig.6.10 Soil Available Copper map of Danakkanadoddi-1 Microwatershed

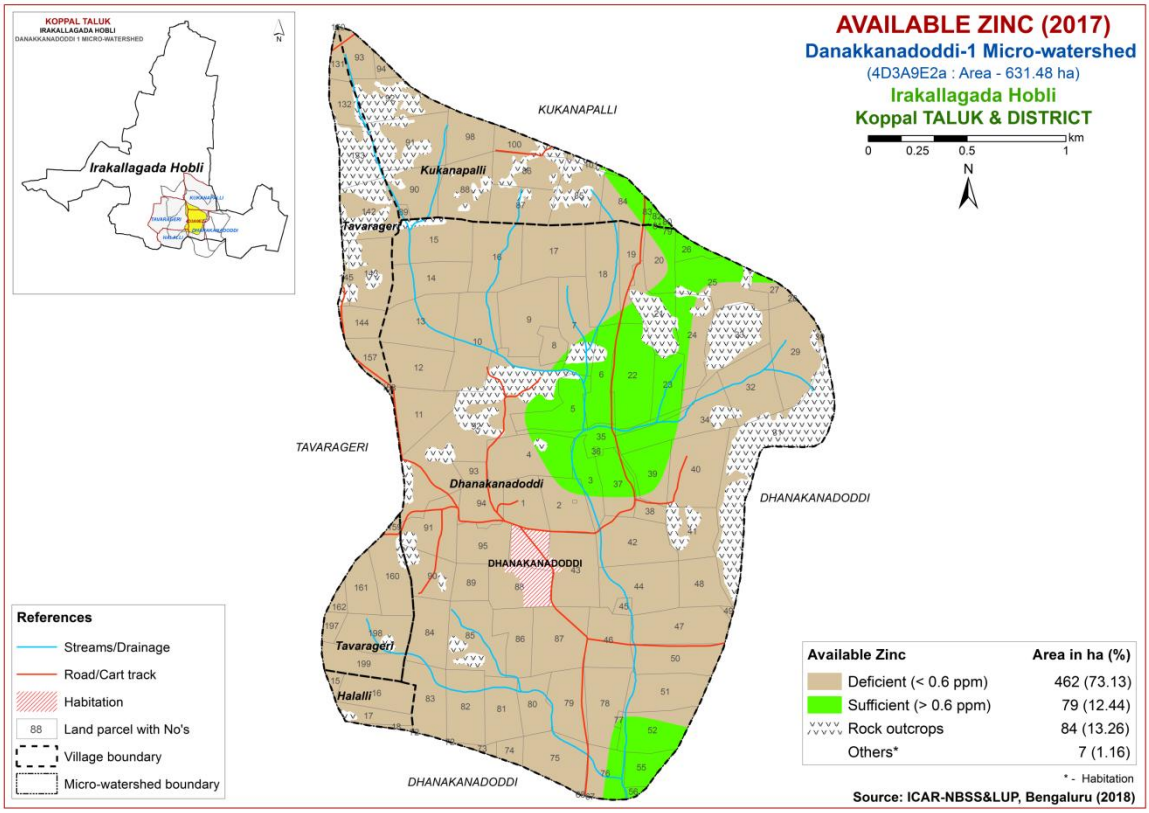

Fig.6.11 Soil Available Zinc map of Danakkanadoddi-1 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Danakkanadoddi-1 microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1- Highly Suitable, Class S2- Moderately Suitable and Class S3- Marginally Suitable. Order N has two Classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 and N1 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 's' for sodium, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

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

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Highly suitable (Class S1) lands occupy an area of about 29 ha (5%) for growing sorghum and occur in the southern part of the microwatershed. An area of about 138 ha

Table 7.1 Soil-Site Characteristics of Danakkanadoddi-1 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p^+)kg^{-1}]	BS (%)
					Surface	Sub-surface	Surface	Sub-surface								
HRViB1g2	662	<90	WD	25-50	sc	gscl	35-60	>35	<50	1-3	slight	-	-	-	-	-
KGPhB2g2	662	<90	WD	25-50	scl	gscl-gsc	35-60	15-35	51-100	1-3	moderate	-	-	-	-	-
HTIhB1g1	662	<90	WD	50-75	scl	gsc	15-35	15-35	51-100	1-3	slight	-	-	-	-	-
LKRcB2g1	662	<90	WD	50-75	sl	gsc	15-35	40-60	51-100	1-3	moderate	8.18	0.30	4.51	12.19	100
LKRhB2g1	662	<90	WD	50-75	scl	gsc	15-35	40-60	51-100	1-3	moderate	8.18	0.30	4.51	12.19	100
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
LKRiB2	662	<90	WD	50-75	sc	gsc	-	40-60	51-100	1-3	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
BDGhB2	662	<90	WD	75-100	scl	gc	-	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	52.56
BDGhB2g1	662	<90	WD	75-100	scl	gc	15-35	35-60	<50	1-3	moderate	6.24	0.06	0.35	3.76	52.56
BSRbB2g1	662	<90	WD	75-100	ls	gsc	15-35	15-35	51-100	1-3	moderate					
GHThB1	662	<90	WD	75-100	scl	gscl	-	15-35	100-150	1-3	slight	5.70	0.06	4.10	3.17	73
HDHcB2g1	662	<90	WD	75-100	sl	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.07
HDHhB2	662	<90	WD	75-100	scl	gsc-gc	-	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.07
HDHhB2g1	662	<90	WD	75-100	scl	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.07
BPRbB2	662	<90	WD	100-150	ls	gsc-gc	-	>35	100-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
BPRcB2	662	<90	WD	100-150	sl	gsc-gc	-	>35	100-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
BPRhB2g1	662	<90	WD	100-150	scl	gsc-gc	15-35	>35	100-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
BPRiB2	662	<90	WD	100-150	sc	gsc-gc	-	>35	100-150	1-3	moderate	6.64	0.03	0.51	5.45	63.48
NGPcB2g1	662	<90	WD	100-150	sl	gsc-gc	15-35	>35	51-100	1-3	moderate	-	-	-	-	-
NGPhC2g1	662	<90	WD	100-150	scl	gsc-gc	15-35	>35	51-100	3-5	moderate	-	-	-	-	-
NGPiB2g1	662	<90	WD	100-150	sc	gsc-gc	15-35	>35	51-100	1-3	moderate	-	-	-	-	-
RTRcB2	662	<90	WD	>150	sl	c	-	-	151-200	1-3	moderate	5.08	0.03	2.06	9.21	50.50
RTRiB2	662	<90	WD	>150	sc	c	-	-	151-200	1-3	moderate	5.08	0.03	2.06	9.21	50.50
KVRmB1	662	<90	MWD	100-150	c	c	-	-	>200	1-3	slight	8.4	0.26	1.50	43.25	-

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

(22 %) is moderately suitable (Class S2) for growing sorghum and distributed in the eastern and central part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Maximum area of about 313 ha (50 %) is marginally suitable (Class S3) for growing sorghum and occur in the major part of the microwatershed with moderate limitations of gravelliness and rooting depth. Area not suitable (Class N1) for growing sorghum cover about 61 ha (10%) 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

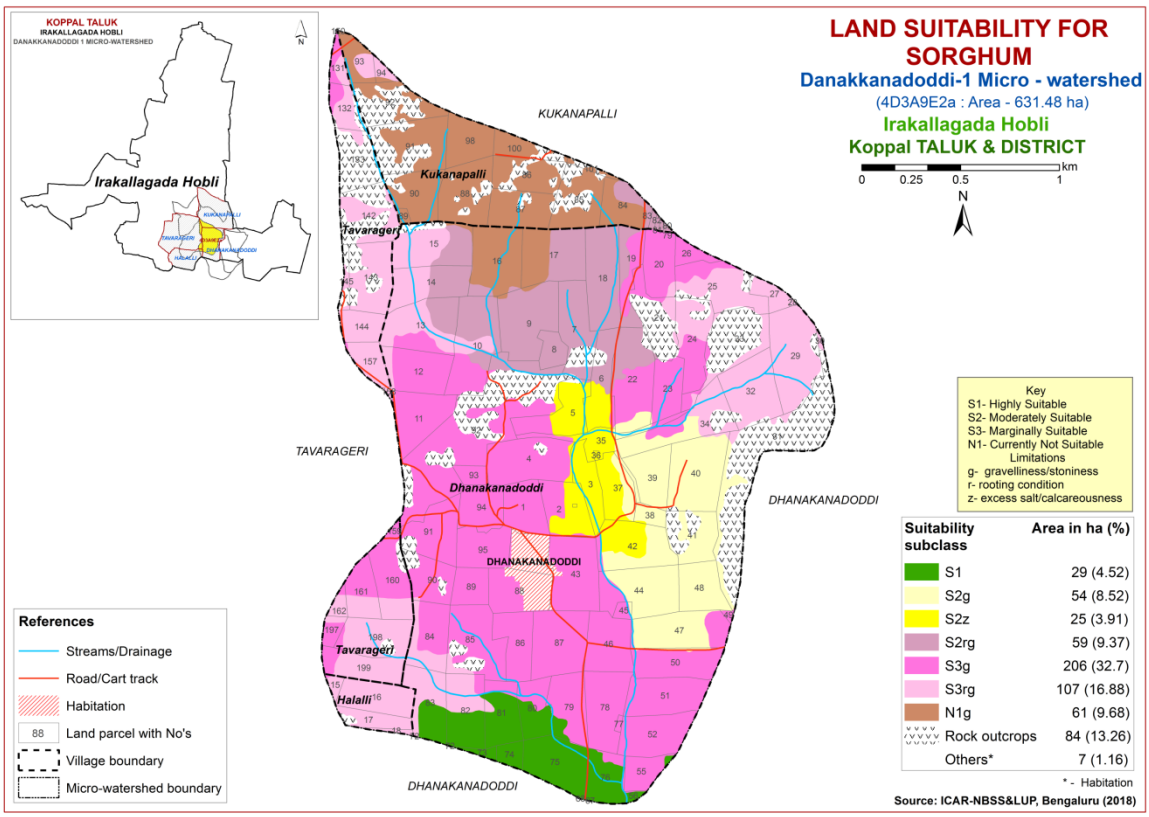

Fig. 7.1 Land Suitability map of Sorghum

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 is given in Figure 7.2.

Table 7.3 Crop suitability criteria for Maize

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

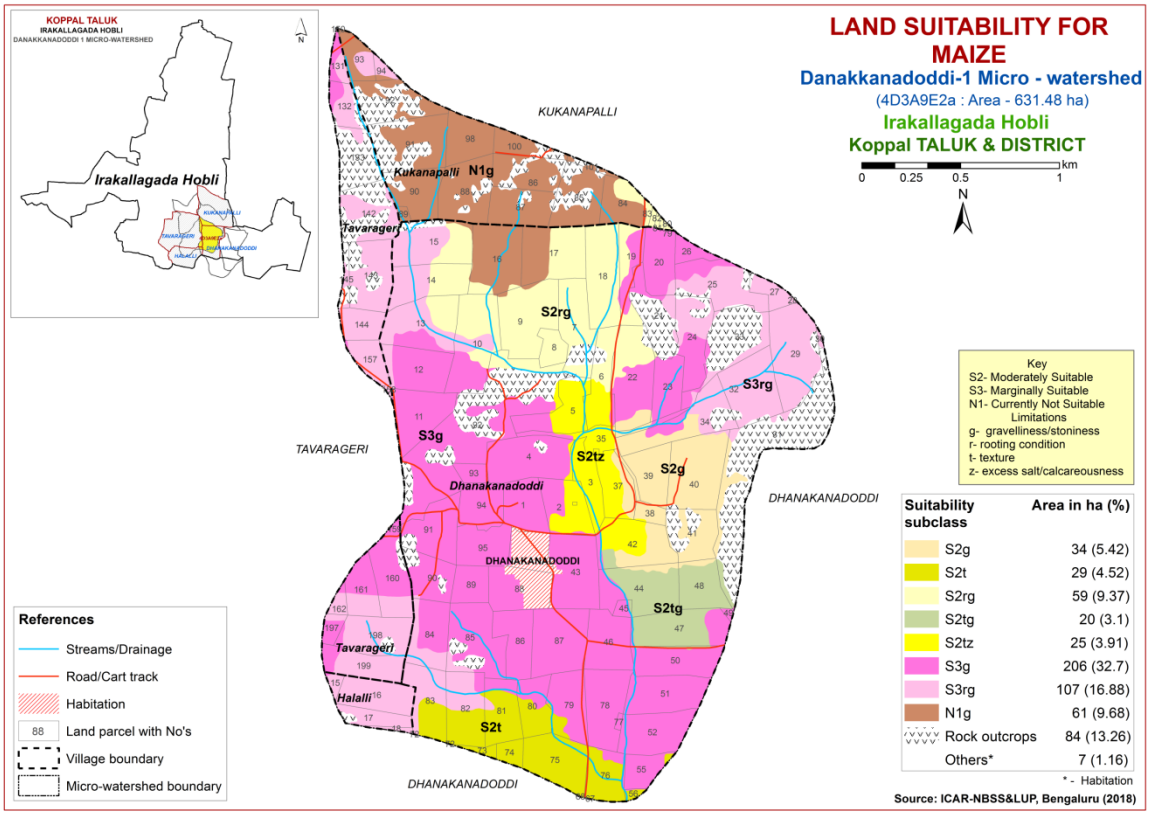

Fig. 7.2 Land Suitability map of Maize

An area of about 167 ha (26%) is moderately suitable (Class S2) for growing maize and are distributed in the southern, eastern and central part of the microwatershed. They have minor limitations of gravelliness, texture, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy maximum area of about 313 ha (50%) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness and rooting depth. An area of about 61 ha (10%) is not suitable (Class N1) and distributed in the northern part of the microwatershed with severe lilmitation 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 land suitability map for growing bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

An area of about 63 ha (10%) is highly suitable (Class S1) for growing bajra and distributed in the eastern and southern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 179 ha (28%) and are distributed in the eastern, central and northern part of the microwatershed. They have minor limitations of gravelliness, texture, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy maximum area of about 300 ha (47%) and are distributed in the major part of the microwatershed with moderate limitations of gravelliness and rooting depth.

Table 7.4 Crop suitability criteria for Bajra

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

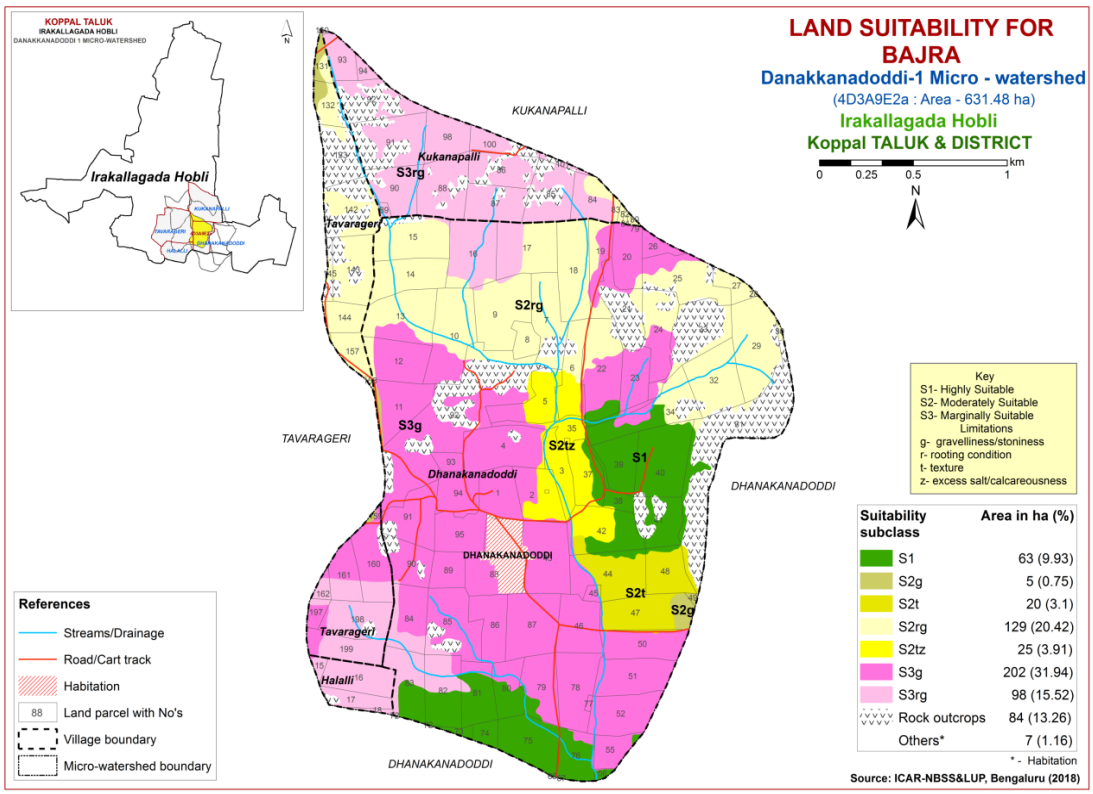

Fig. 7.3 Land Suitability map of Bajra

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.

Highly suitable (Class S1) lands for growing redgram cover an area of about 29 ha (5%) and distributed in the southern part of the microwatershed.. An area of about 79 ha (12%) is moderately suitable (Class S2) for growing redgram and occur in the eastern and central part of the microwatershed. They have minor limitations of texture, gravelliness, rooting depth and calcareousness. Marginally suitable lands (Class S3) occupy an area of about 335 ha (53%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. An area of about 98 ha (16%) is not suitable for growing redgram and occur in the northern and southwestern part of the microwatersherd. They have severe limitations of gravelliness and rooting depth.

Table 7.5 Land suitability criteria for Red gram

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

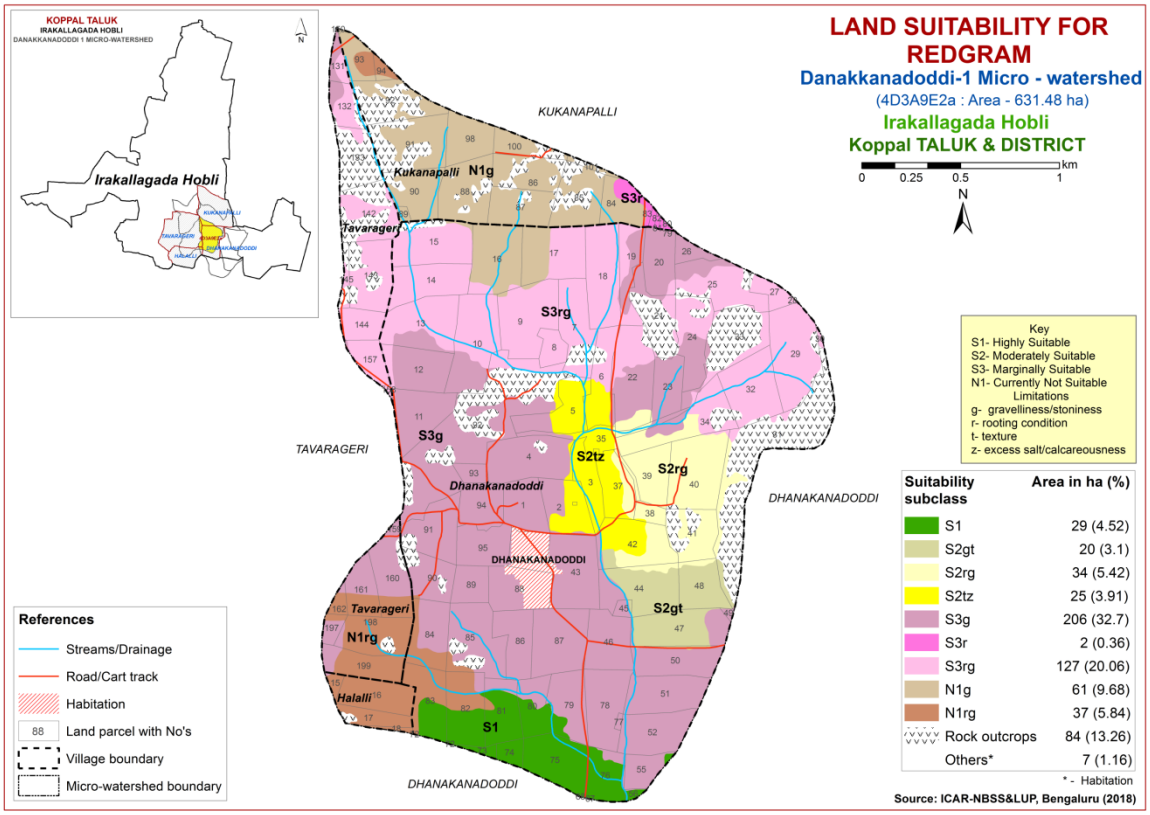

Fig. 7.4 Land Suitability map of redgram

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

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

An area of about 235 ha (37 %) in the microwatershed has soils that are moderately suitable (Class S2) for growing bengalgram and distributed in the southern, eastern and northern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 245 ha (39%) and are distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth. Area not suitable (Class N1) for growing bengal gram cover about 61 ha (10%) and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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 Imperfectly drained	Poorly drained; excessively drained	V.Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.77.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l,scl,sil,cl,	sicl, sic, c	Sl, c>60%	S,fragmental
Soil depth	cm	>75	51-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

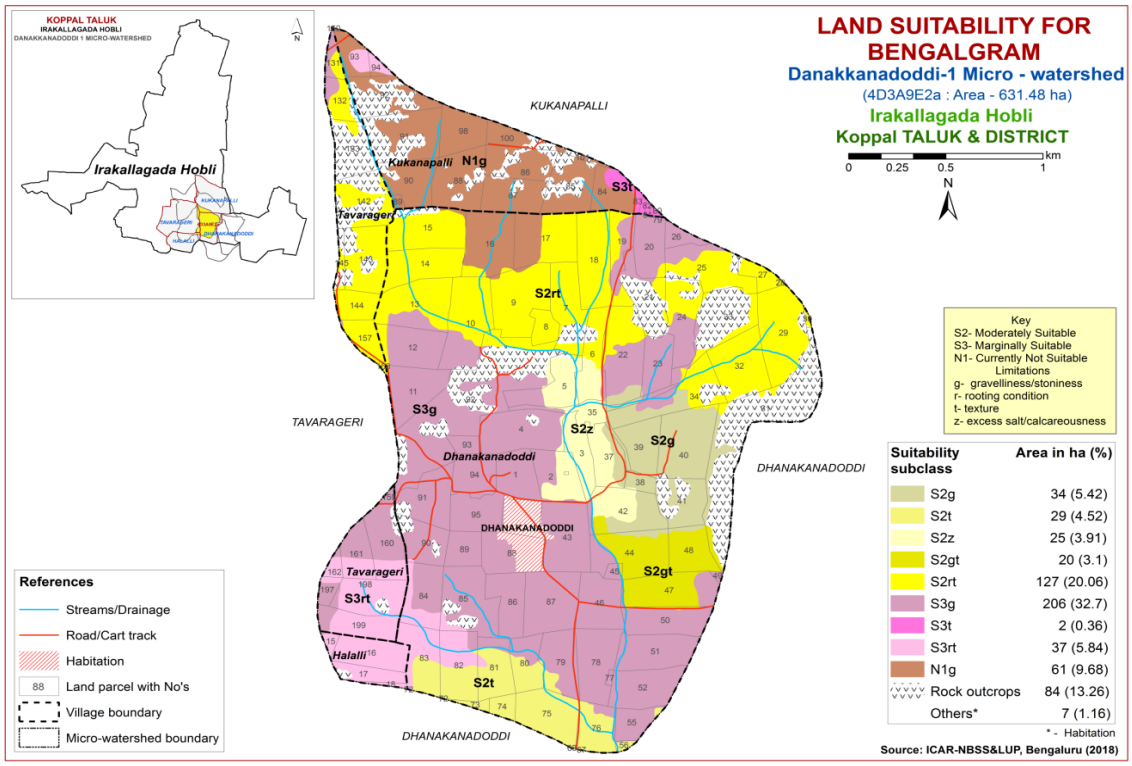

Fig. 7.5 Land Suitability map of bengalgram

7.6 Land Suitability for Groundnut (*Arachis hypogaea*)

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

Table 7.7 Crop suitability criteria for Groundnut

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

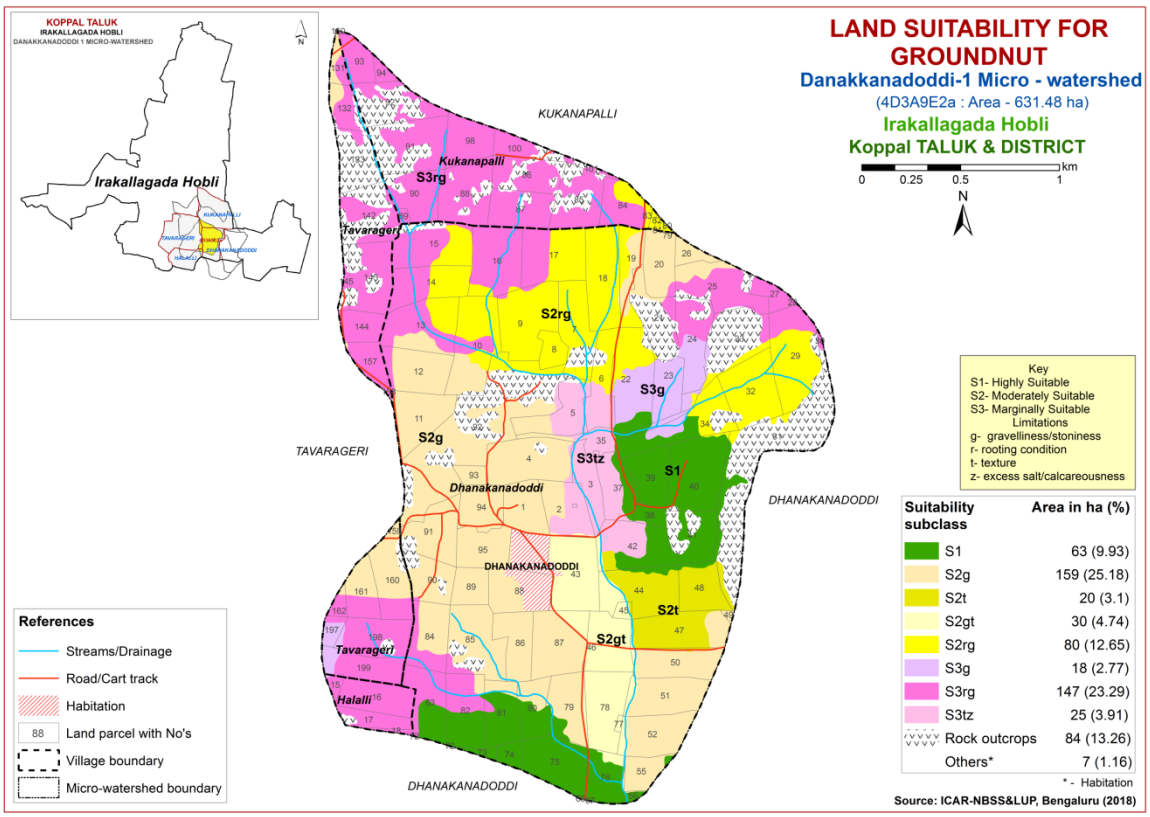

Fig. 7.6 Land Suitability map of Groundnut

Highly suitable lands cover an area of about 63 ha (10%) and distributed in the eastern and southern part of the microwatershed. Maximum area of about 289 ha (46%) is moderately suitable (Class S2) for groundnut and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands occupy an area of about 190 ha (30%) and are distributed in the southern, northeastern, northern and western part of the microwatershed with moderate limitations of gravelliness, rooting depth, texture and calcareousness.

7.7 Land Suitability for Sunflower (*Helianthus annus*)

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

An area of about 29 ha (5%) is highly suitable (Class S1) for growing sunflower and are distributed in the southern part of the microwatershed. An area of about 79 ha (12 %) is moderately suitable (Class S2) and are distributed in the eastern and central part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy maximum area of about 337 ha (53 %) and are distributed in the major part of the microwatershed with moderate limitations of rooting depth and gravelliness. An area of about 96 ha (15%) is not suitable (Class N1) for growing sunflower and distributed in the northern and southern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.8 Crop suitability criteria for Sunflower

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

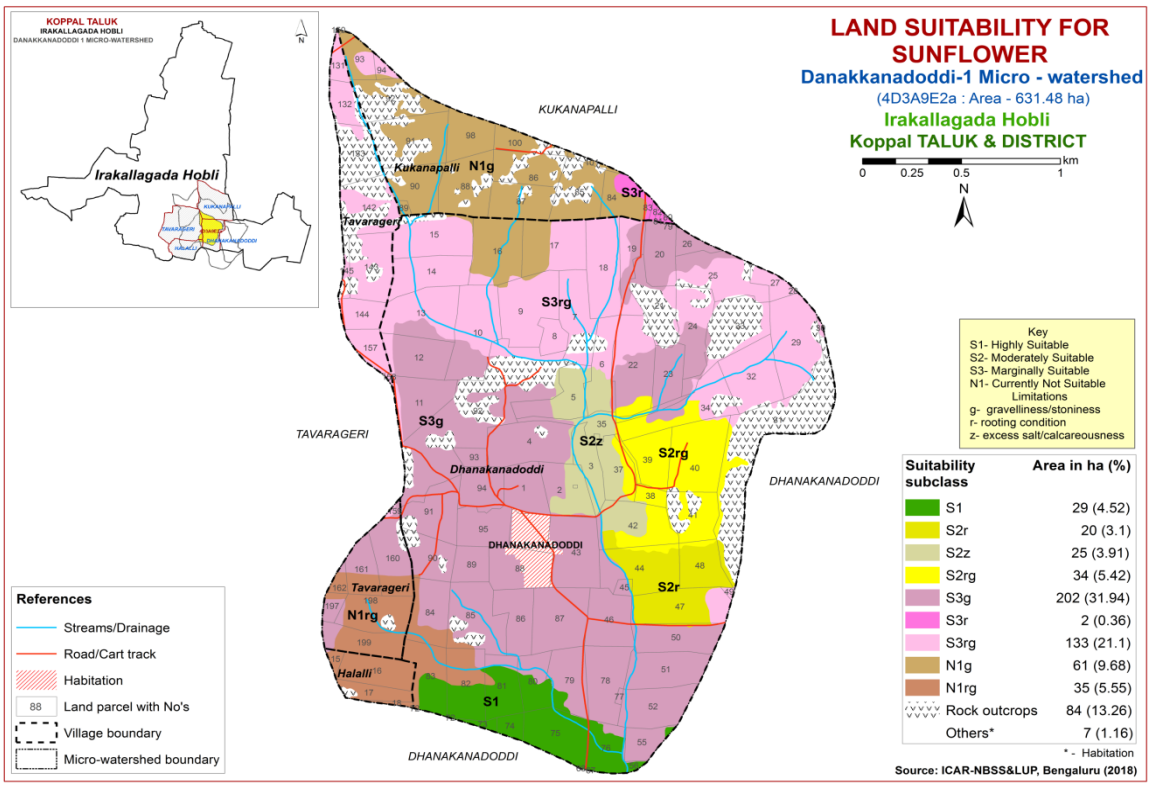

Fig. 7.7 Land Suitability map of Sunflower

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

Table 7.9 Crop suitability criteria for Cotton

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

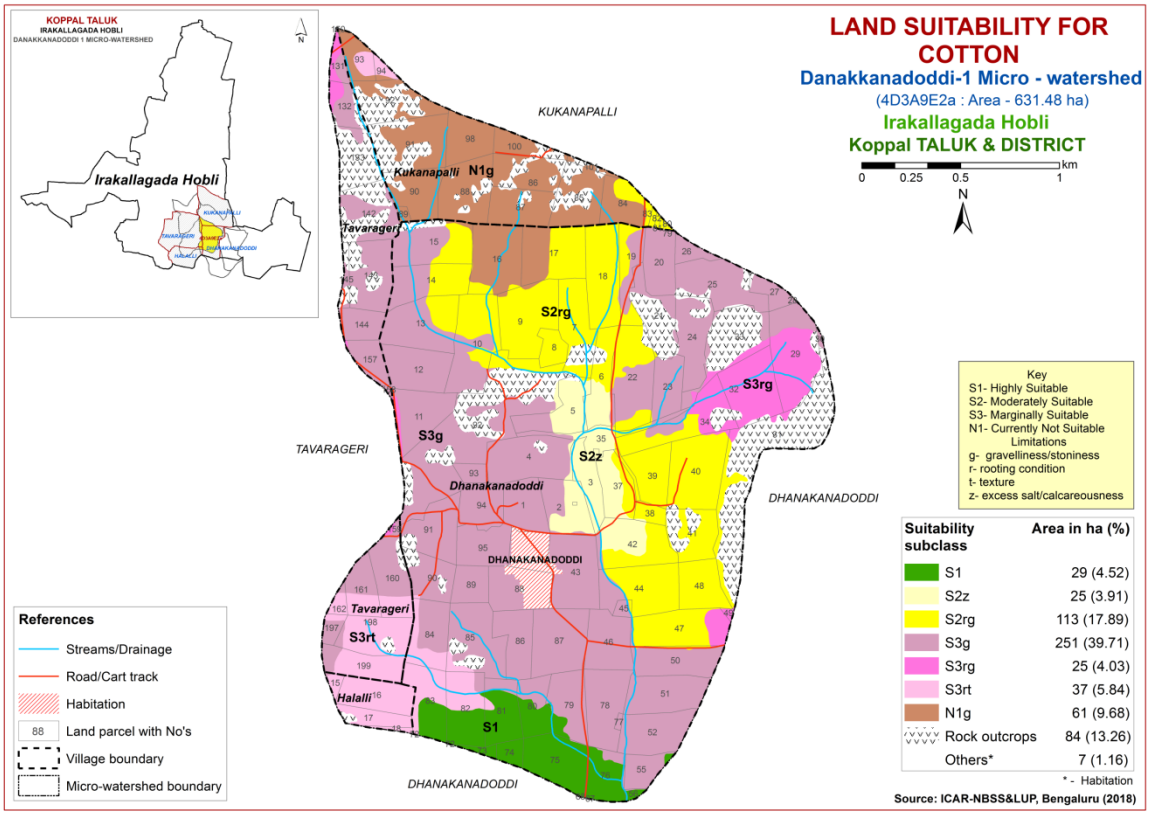

Fig. 7.8 Land Suitability map of Cotton

An area of about 29 ha (5%) is highly suitable (Class S1) for growing cotton and are distributed in the southern part of the microwatershed. An area of about 138 ha (22 %) is moderately suitable (Class S2) for cotton and are distributed in the eastern, central and northern part of the microwatershed. They have minor limitations of calcareousness, gravelliness and rooting depth. Marginally suitable (Class S3) lands cover a maximum area of about 313 ha (50 %) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and texture. An area of about 61 ha (10%) is not suitable (Class N1) for growing cotton and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

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

Chilli is one of the major fruit and spice crop grown in an area of 0.42 lakh ha in Karnataka State. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing chilli was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.9.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing chilli and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 113 ha (18%) and distributed in the northern, central and eastern

part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 339 ha (53%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 61 ha (10%) is not suitable (Class N1) for growing chilli 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	

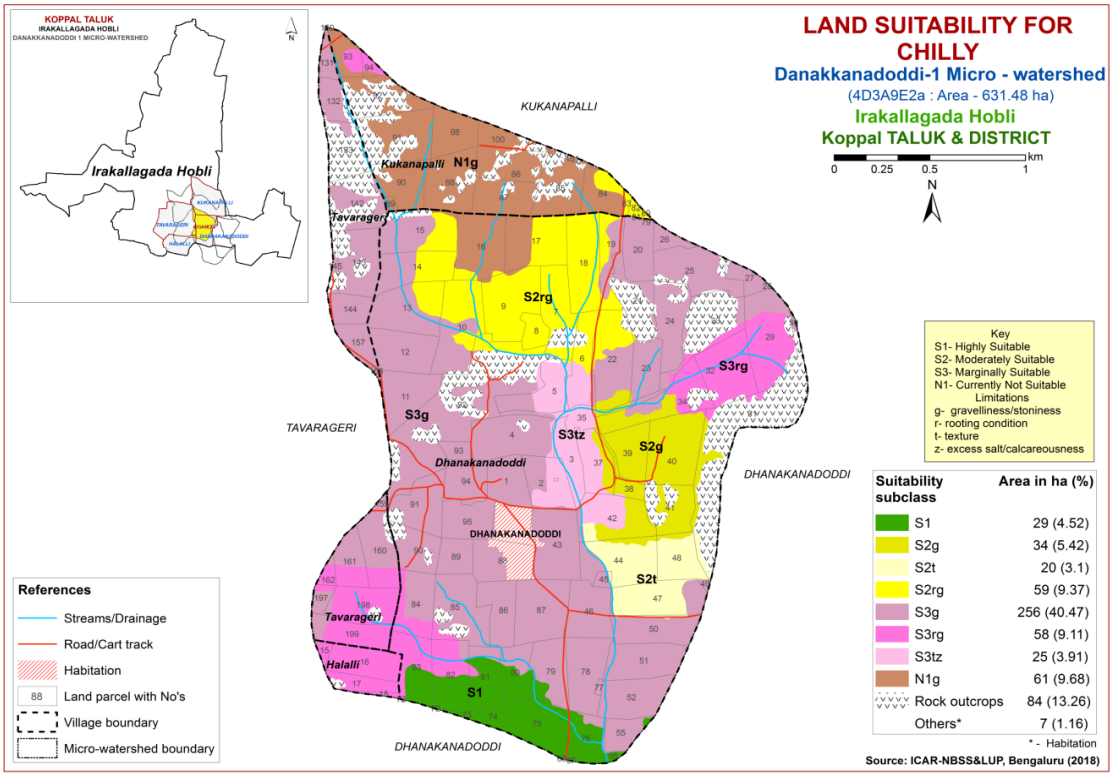

Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable and fruit crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements (Table 7.11) for growing tomato were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tomato was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing tomato and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 113 ha (18%) and distributed in the northern, central and eastern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 339 ha (53%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 61 ha (10%) is not suitable (Class N1) for growing tomato 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 suitabl(N)**
Climate	Temperature in growing season	^{0}c	25-28	29-32 20-24	15-19 33-36	<15 >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	Sic,sicl,sc,c(m/k)	C (ss)	ls, s
	pH	1:2.5	6.0-7.0	5.0-5.9:7.1-8.5	<5;>8.5	
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slight	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

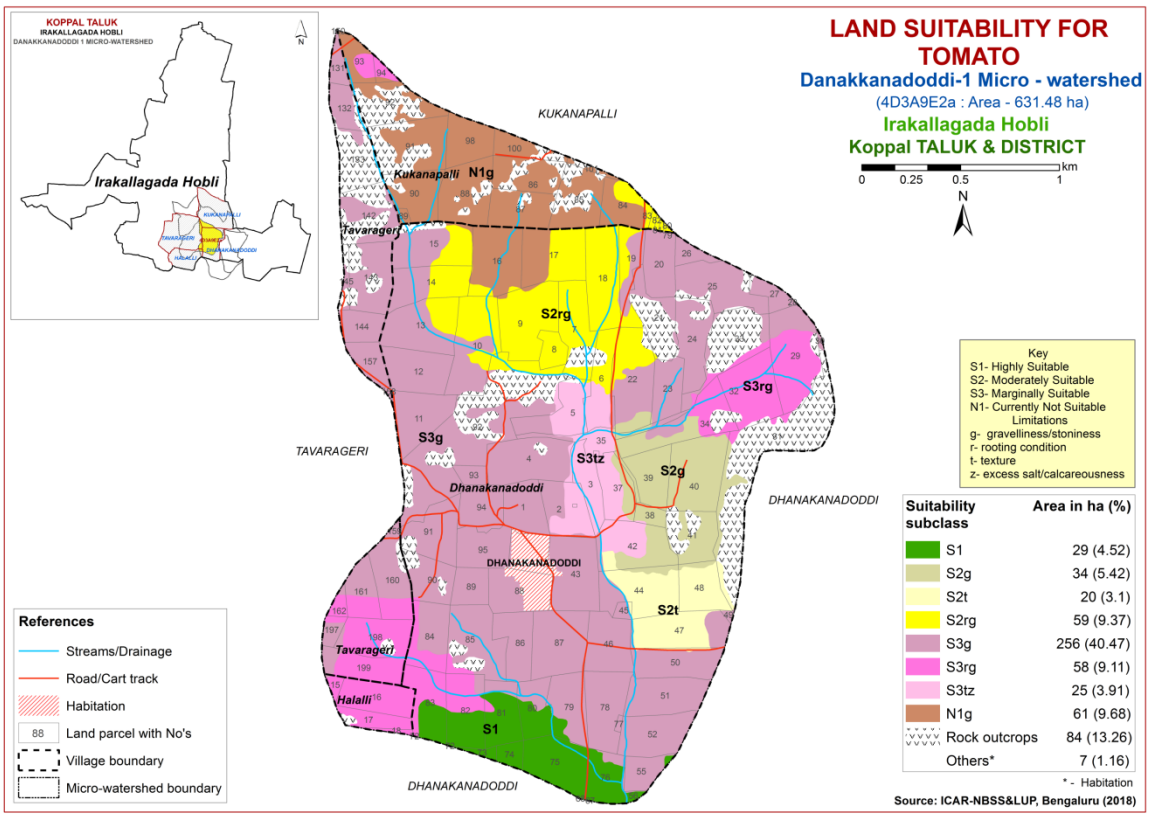

Fig. 7.7 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera)*

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

Table 7.12 Land suitability criteria for Drumstick

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

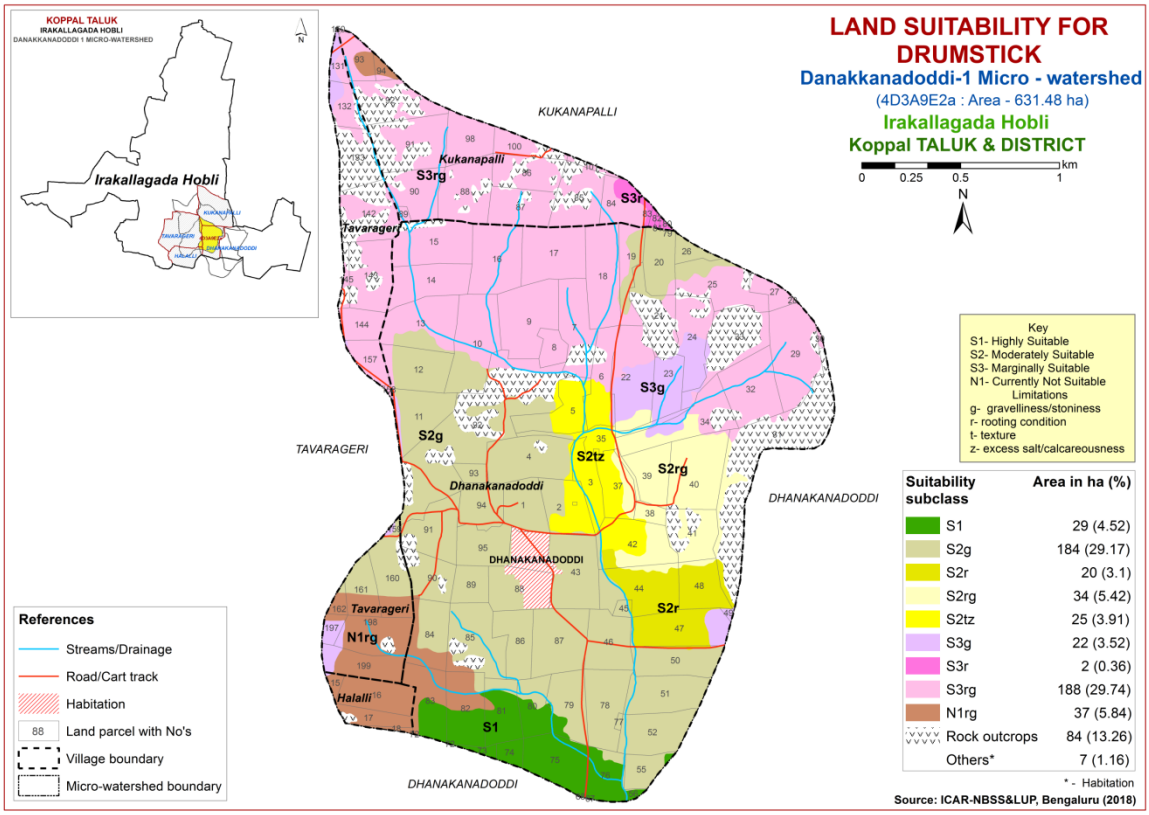

Fig. 7.11 Land Suitability map of Drumstick

An area of about 29 ha (5%) is highly suitable (Class S1) for growing drumstick and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover a maximum area of about 263 ha (42%) and distributed in the major part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 212 ha (34%) and distributed in the northern and northeastern part of the microwatershed. They have moderate limitations of gravelliness and. rooting depth. An area of about 37 ha (6 %) is not suitable (Class N1) for growing drumstick and distributed in the southwestern and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

7.12 Land Suitability for Mulbery (*Morus nigra*)

Mulberry is one of the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the state. The crop requirements for growing 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 29 ha (5%) is highly suitable (Class S1) for growing mulberry and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover a maximum area of about 286 ha (45%) and distributed in the major part of

the microwatershed with minor limitations of rooting depth, calcareousness, texture and gravelliness. Marginally suitable (Class S3) lands cover an area of about 190 ha (30%) and occur in the northern and northeastern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 37 ha (6%) is not suitable (Class N1) for growing mulberry and distributed in the southern part of the microwatershed with severe limitation of gravelliness and rooting depth.

Table 7.13 Land suitability criteria for Mulberry

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

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

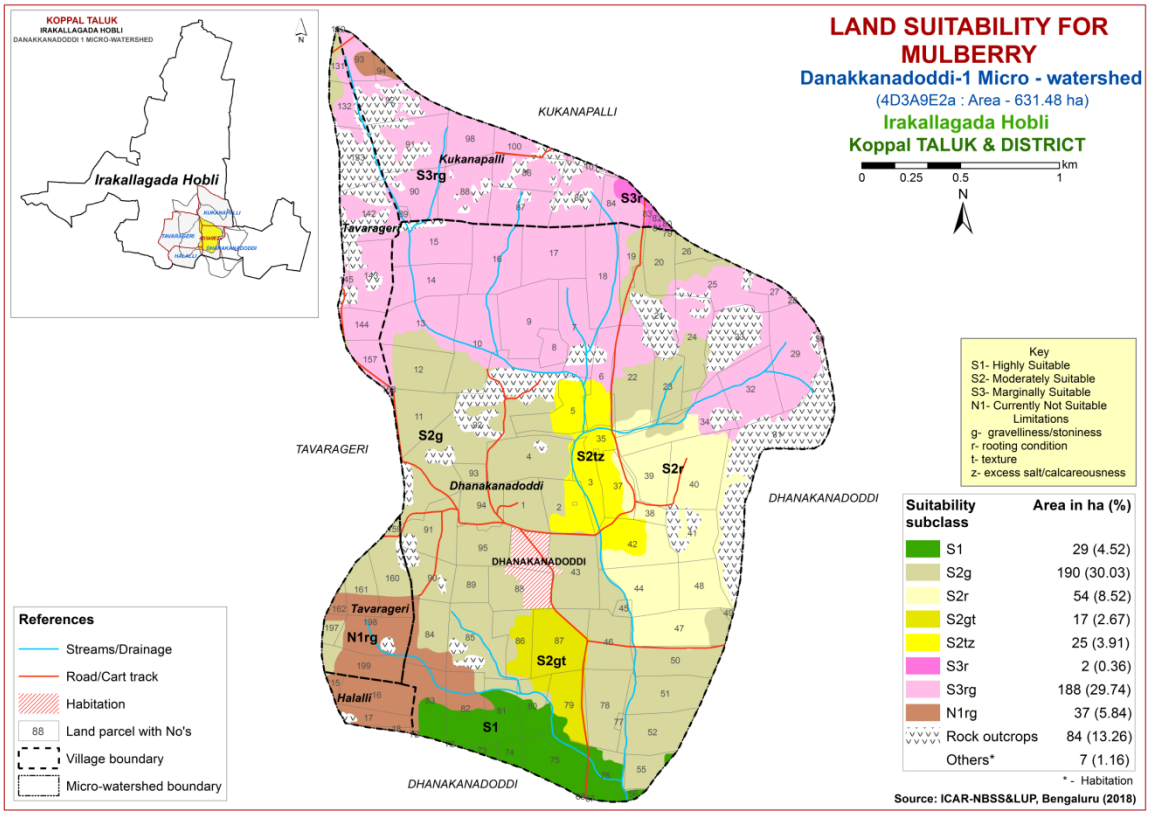

Fig. 7.12 Land Suitability map of Mulberry

7.13 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.13.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing mango and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 25 ha (4%) and distributed in the central part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of about 261 ha (41%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 227 ha (36%) is not suitable (Class N1) for growing mango and distributed in the southern, northern, western and eastern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.14 Crop suitability criteria for Mango

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

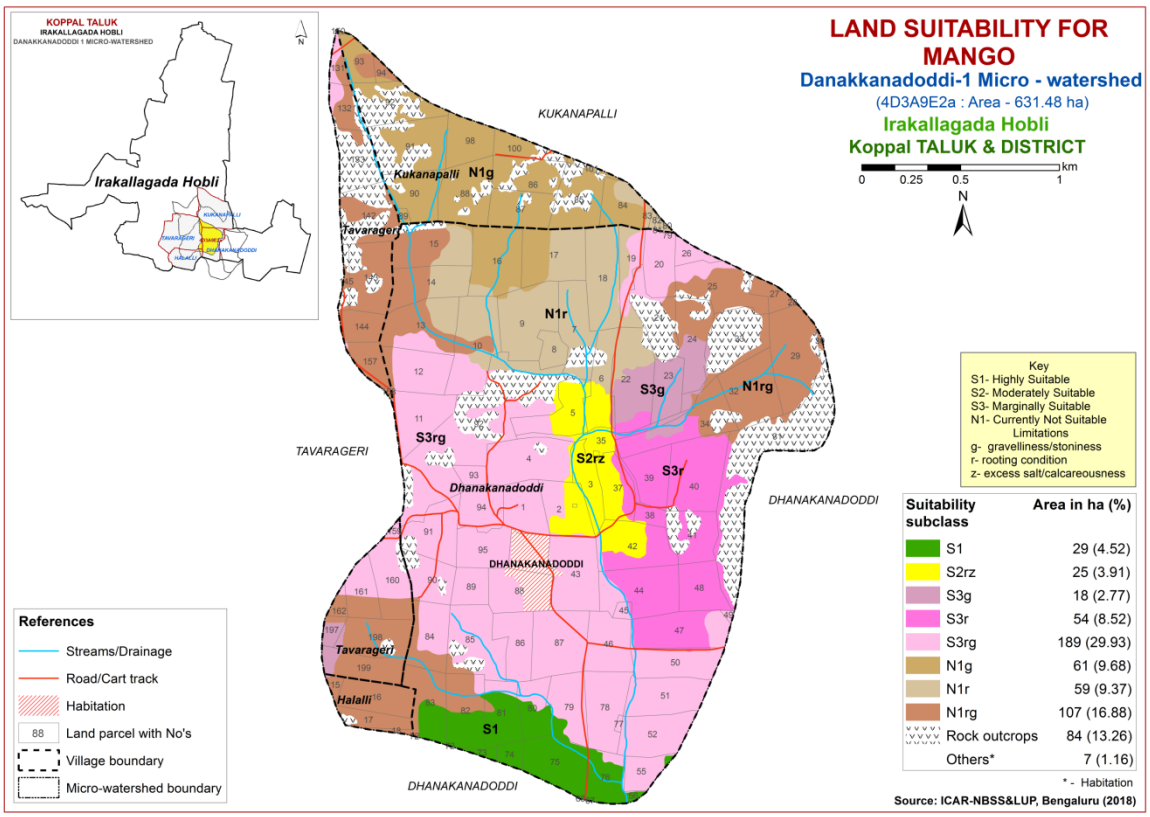

Fig. 7.13Land Suitability map of Mango

7.14 Land suitability for Sapota (*Manilkara zapota*)

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

An area of about 29 ha (5%) is 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 58 ha (9%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 356 ha (56%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 98 ha (16%) is not suitable (Class N1) for growing sapota and distributed in the southern and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.15 Crop suitability criteria for Sapota

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

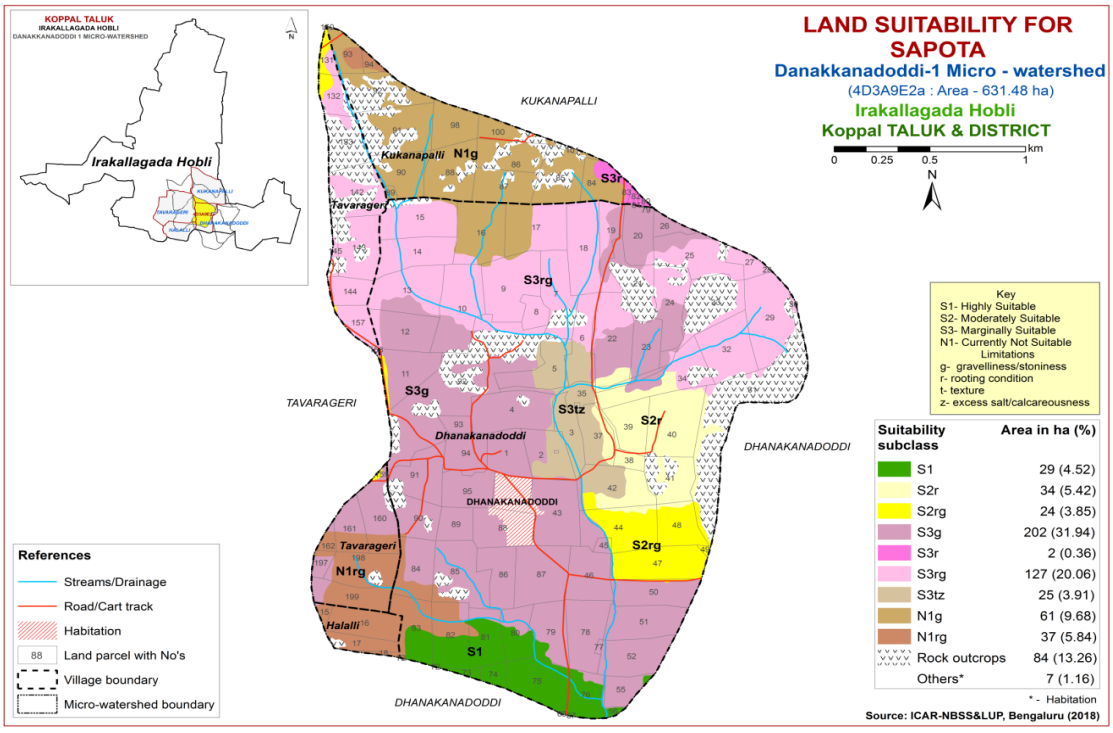

Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the 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.

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	

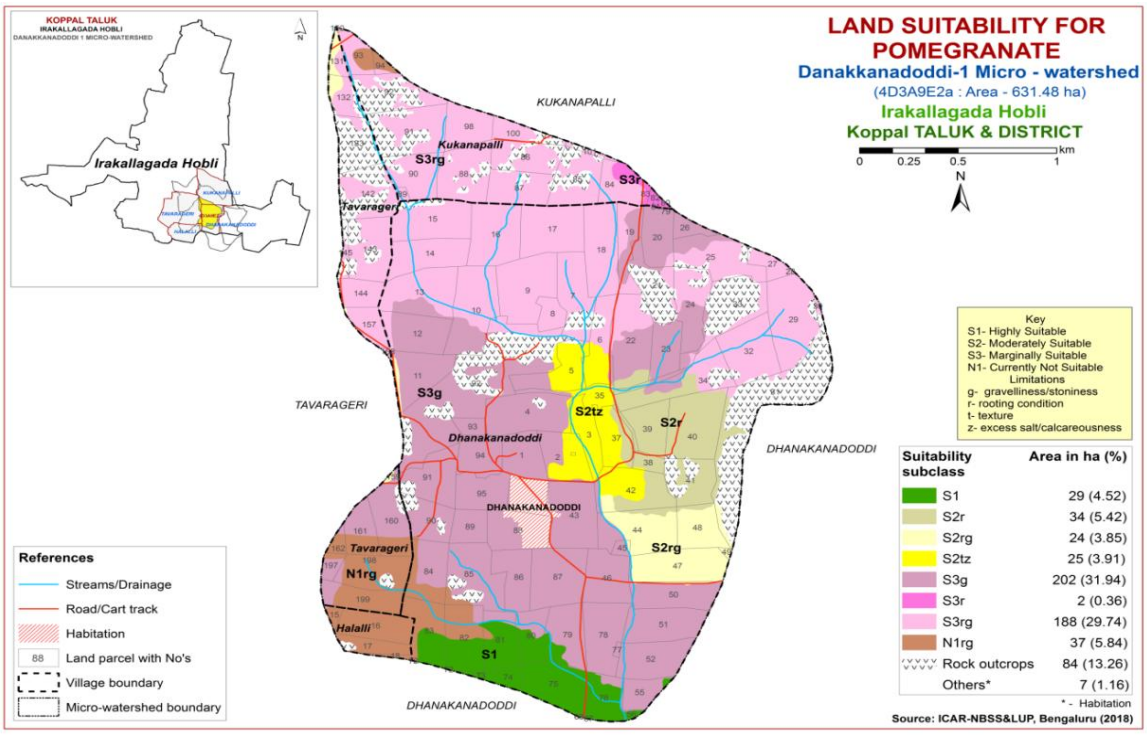

Fig. 7.15 Land Suitability map of Pomegranate

An area of about 29 ha (5%) is highly suitable (Class S1) for growing pomegranate and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 83 ha (13%) and distributed in the central and

eastern part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 392 ha (62%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 37 ha (6%) is not suitable (Class N1) for growing pomegranate and distributed in the southern part of the microwatershed with severe limitations of gravelliness and rooting depth.

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 6558 ha in almost all the districts of the state. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing guava and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 59 ha (9%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 356 ha (56%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 98 ha (16%) is not suitable (Class N1) for growing guava and distributed in the northern and southern part of the microwatershed with severe limitations of gravelliness and rooting depth.

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	cC (<60%)	c(>60%)
	pH	1:2.5	6.0-7.5	7.6-8.0:5.0-5.9	8.1-8.5:4.5-4.9	>8.5:<4.5
	$CaCO_3$ in root zone	%	Non calcareous	<10	10-15	>15
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	dS/m	<2.0	2.0-4.0	4.0-6.0	
	Sodicity	%	Non sodic	10-15	15-25	>25
Erosion	Slope	%	<3	3-5	5-10	>10

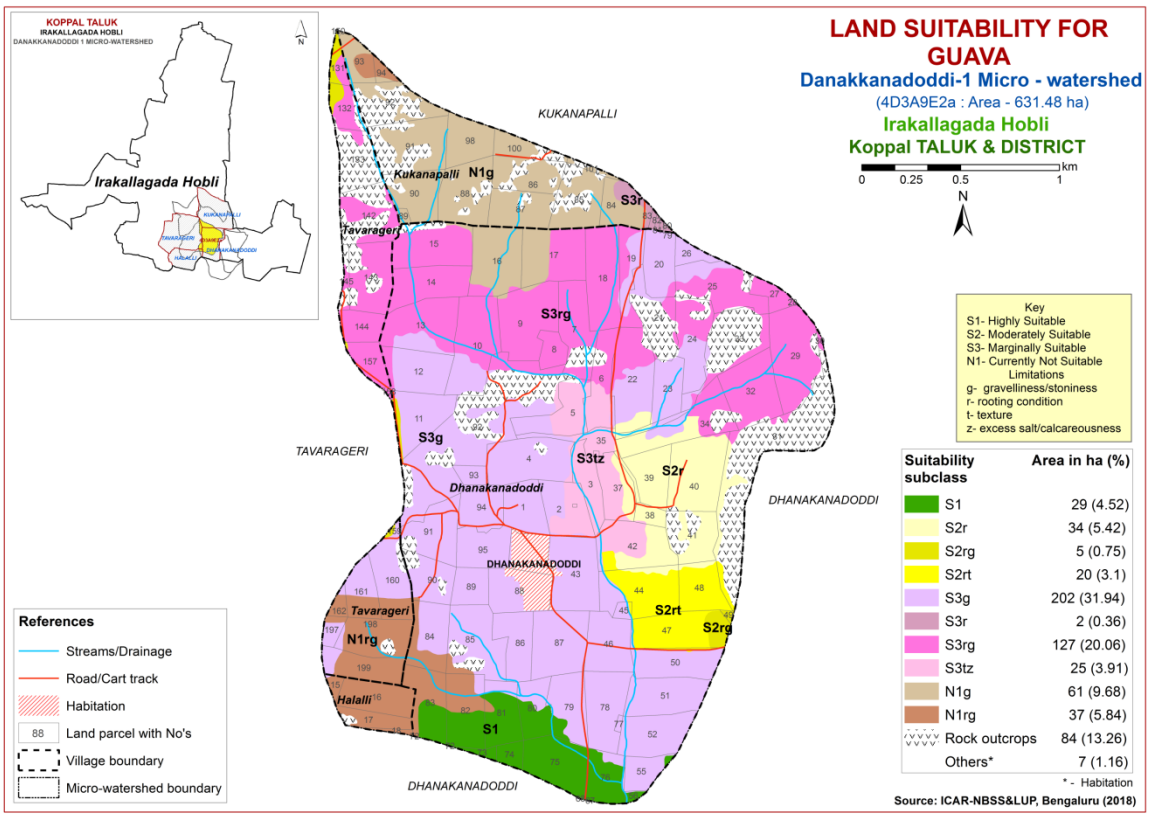

Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the state. The crop requirements (Table 7.18) for growing jackfruit were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in figure 7.17.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing jackfruit and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 58 ha (9%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 356 ha (56%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 98 ha (16%) is not suitable (Class N1) for growing jackfruit and distributed in the northern and southern part of the microwatershed with severe limitations of gravelliness and rooting depth.

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Table 7.18 Land suitability criteria for Jackfruit

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

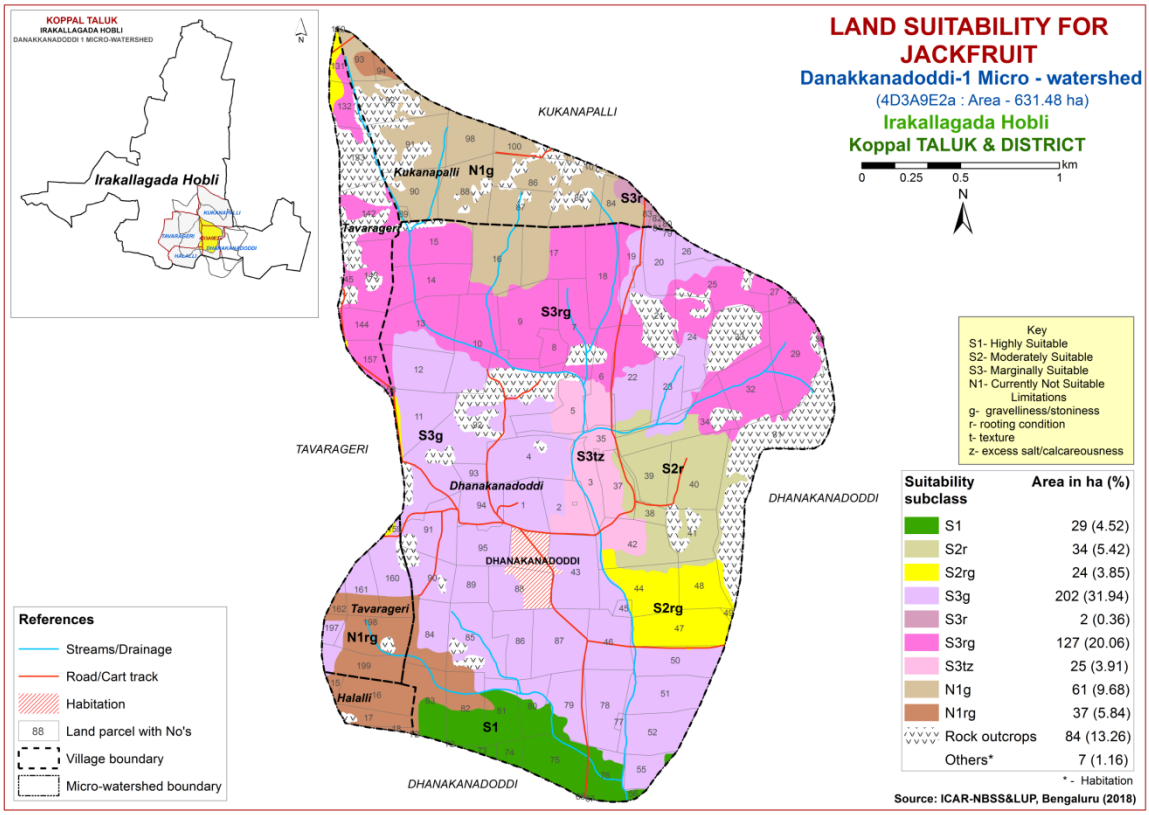


Fig. 7.17 Land Suitability map of Jackfruit

7.18 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the state. The crop requirements (Table 7.19) for growing jamun were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

Highly suitable (Class S1) lands for growing jamun cover an area of about 29 ha (5%) and are distributed in the southern part of the microwatershed. Moderately suitable

(S2) lands cover an area of about 83 ha (13%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 331 ha (52%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 98 ha (16%) is not suitable (Class N1) for growing jamun and distributed in the southern and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

Table 7.19 Land suitability criteria for Jamun

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

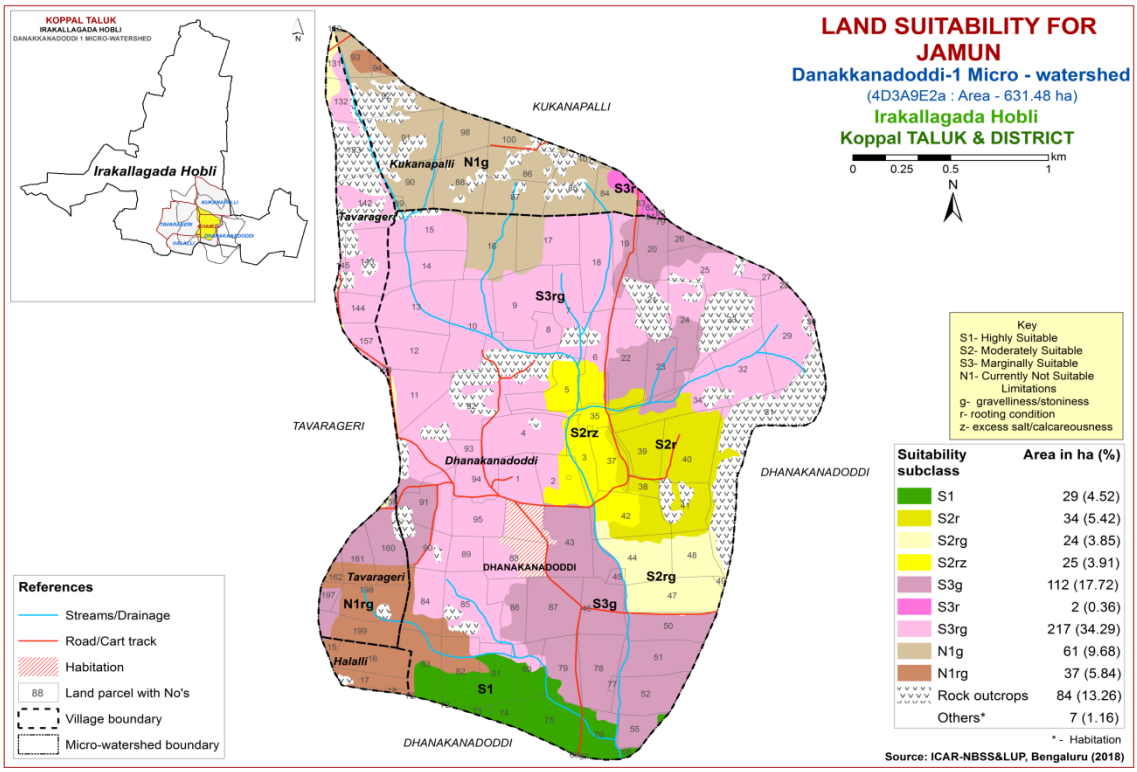


Fig. 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements (Table 7.20) for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability

map for growing musambi was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

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 imp.drained	Poorly	Very poorly
Nutrient availability	Texture	Class	scl,l,sicl,cl,s	sc, sc, c	c(>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.47.6-8.0	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	

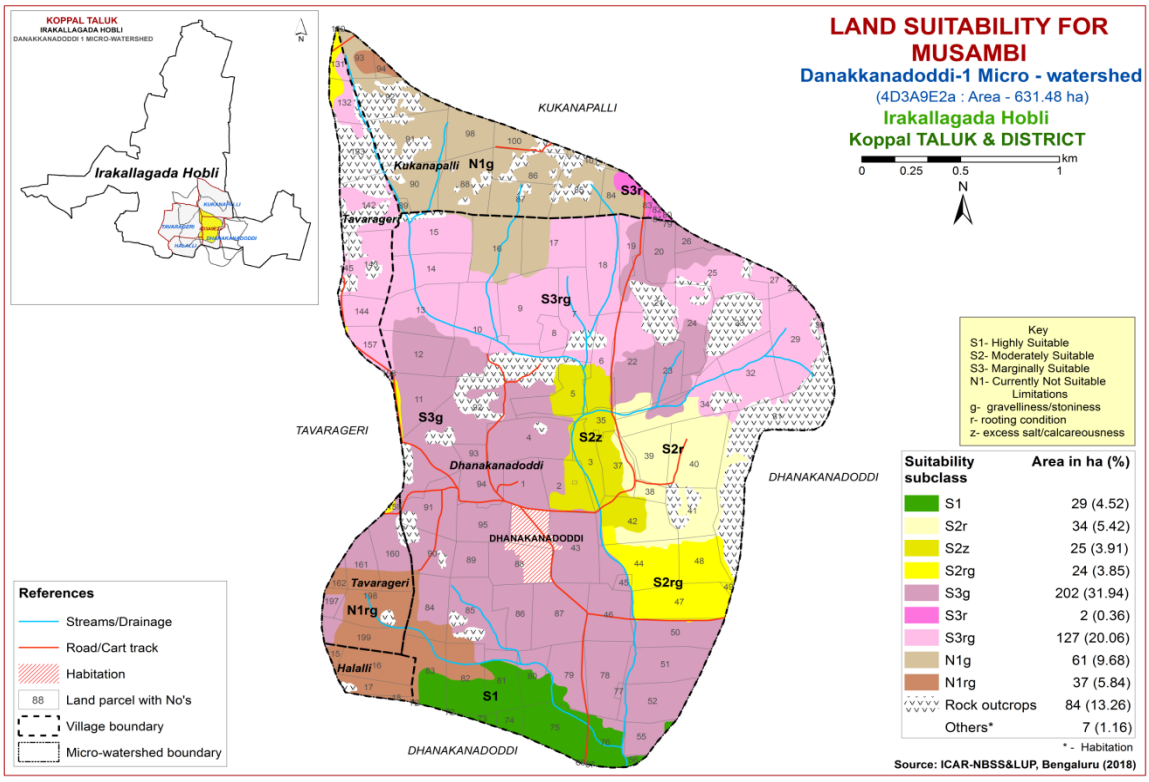


Fig. 7.19 Land Suitability map of Musambi

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 29 ha (5%) is highly suitable (Class S1) for growing lime and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 83 ha (13%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 331 ha (52%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting. An area of about 98 ha (16%) is not suitable (Class N1) for growing lime and distributed in the western and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

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	

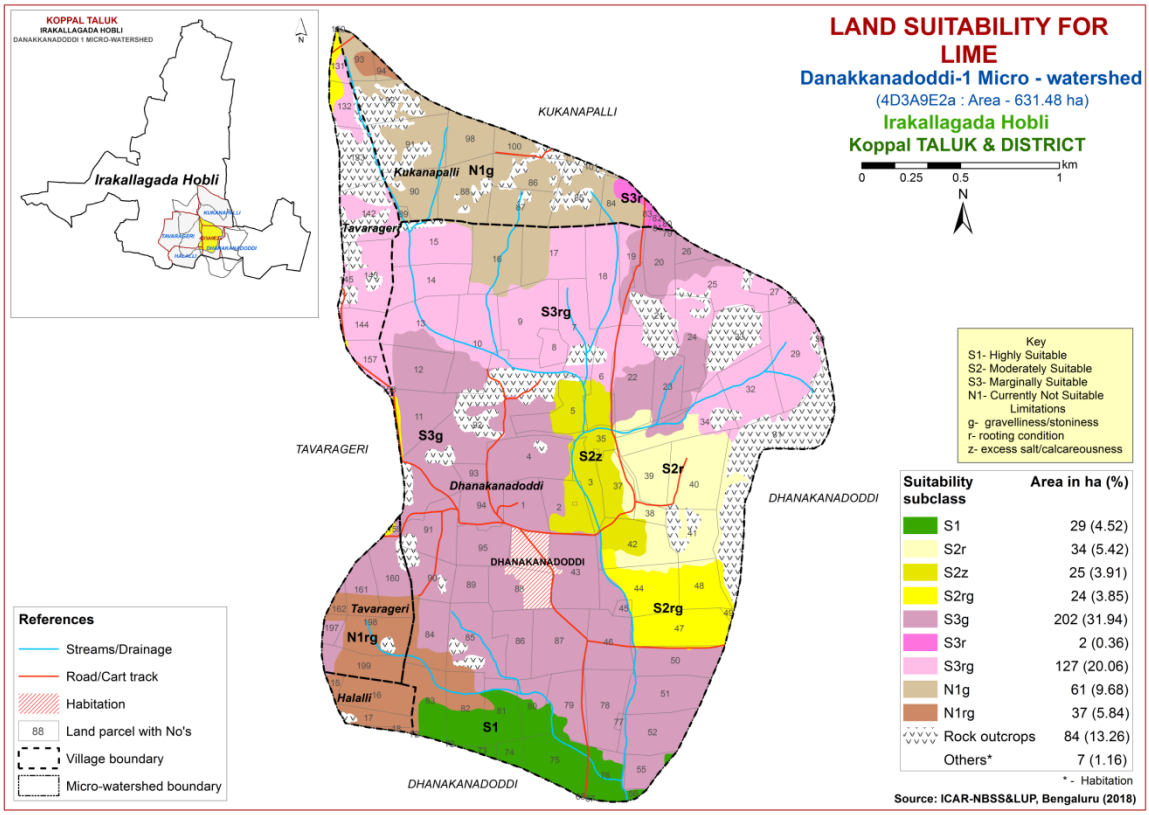


Fig. 7.20 Land Suitability map of Lime

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 (Table 7.22) for growing cashew were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

Table 7.22 Land suitability criteria for Cashew

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

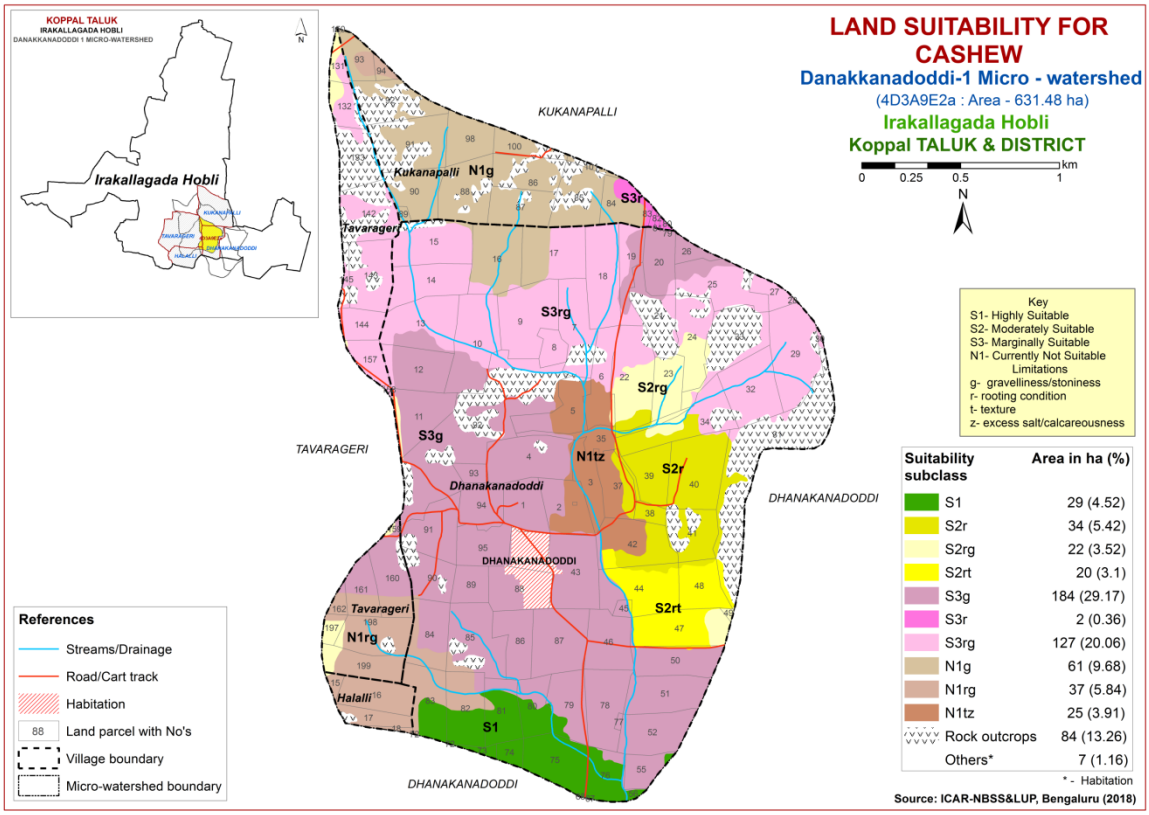


Fig. 7.21 Land Suitability map of Cashew

An area of about 29 ha (5%) is highly suitable (Class S1) for growing cashew and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 76 ha (12%) and distributed in the eastern part of the microwatershed with minor limitations of rooting depth, texture and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 313 ha (50%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 123 ha (19%) is not suitable (Class N1) for growing cashew and distributed in the central, northern and southern part of the microwatershed with severe limitations of gravelliness, rooting depth, calcareousness and texture.

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 82 ha (13%) is highly suitable (Class S1) for growing custard apple and distributed in the eastern and southern part of the microwatershed. Maximum area of about 361 ha (57 %) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 98 ha (16%) is marginally suitable (Class S3) for

growing custard apple and are distributed in the northern and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

Table 7.23 Land suitability criteria for Custard apple

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	Scl, cl, sc, c (red), c(black)	-	Sl, ls	-
	pH	1:2.5	6.0-7.3	7.3-8.4	5.0-5.5,8.4-9.(	>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	-

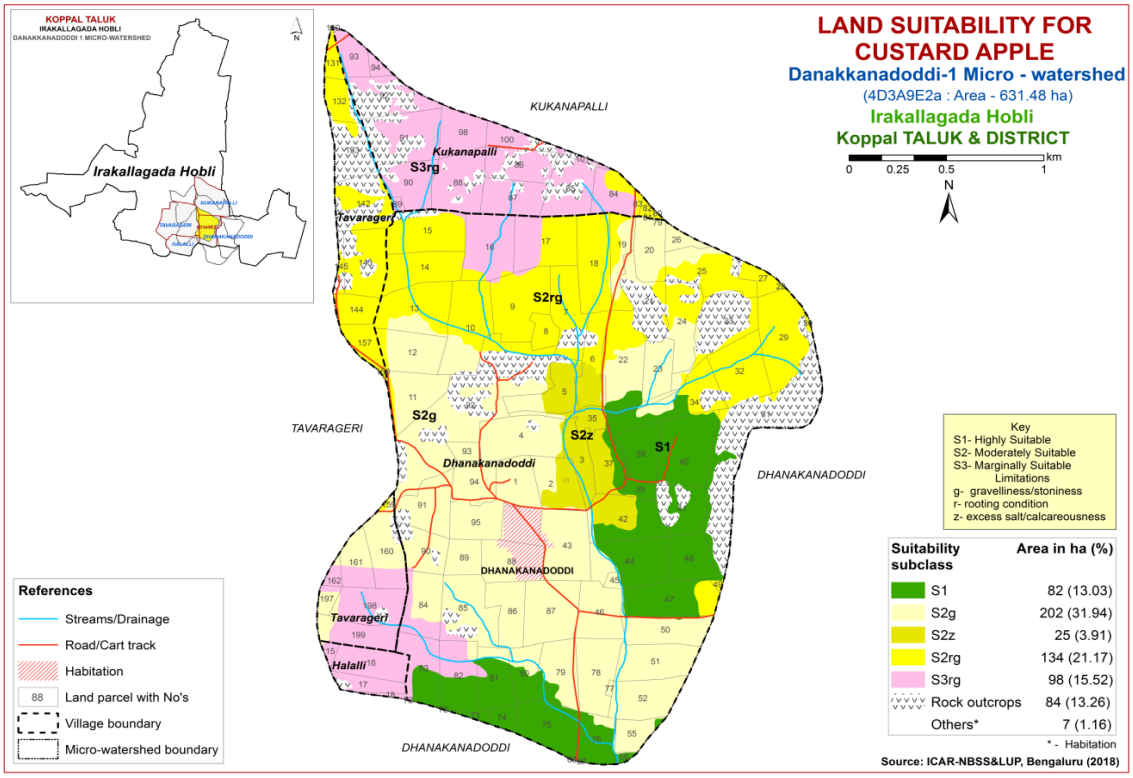


Fig. 7.19 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements (Table 7.24) for growing amla were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.23.

Highly suitable lands for growing amla cover an area of about 63 ha (10 %) and distributed in the southern and eastern part of the microwatershed. Maximum area of about 381 ha (60 %) has soils that are moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 98 ha (16 %) and occur in the central and northern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

Table 7.24 Land suitability criteria for Amla

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

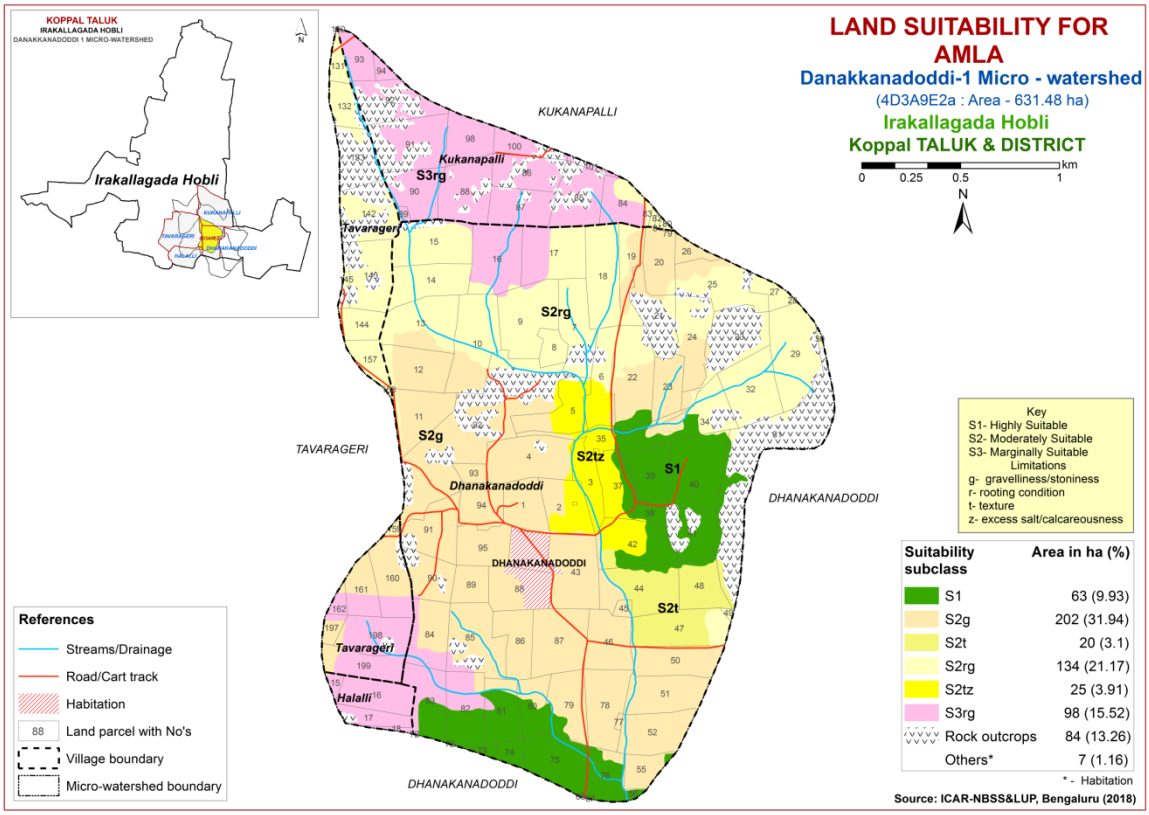


Fig. 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in all the districts of the state. The crop requirements (Table 7.25) for growing tamarind were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.24.

Table 7.25 Land suitability criteria for Tamarind

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

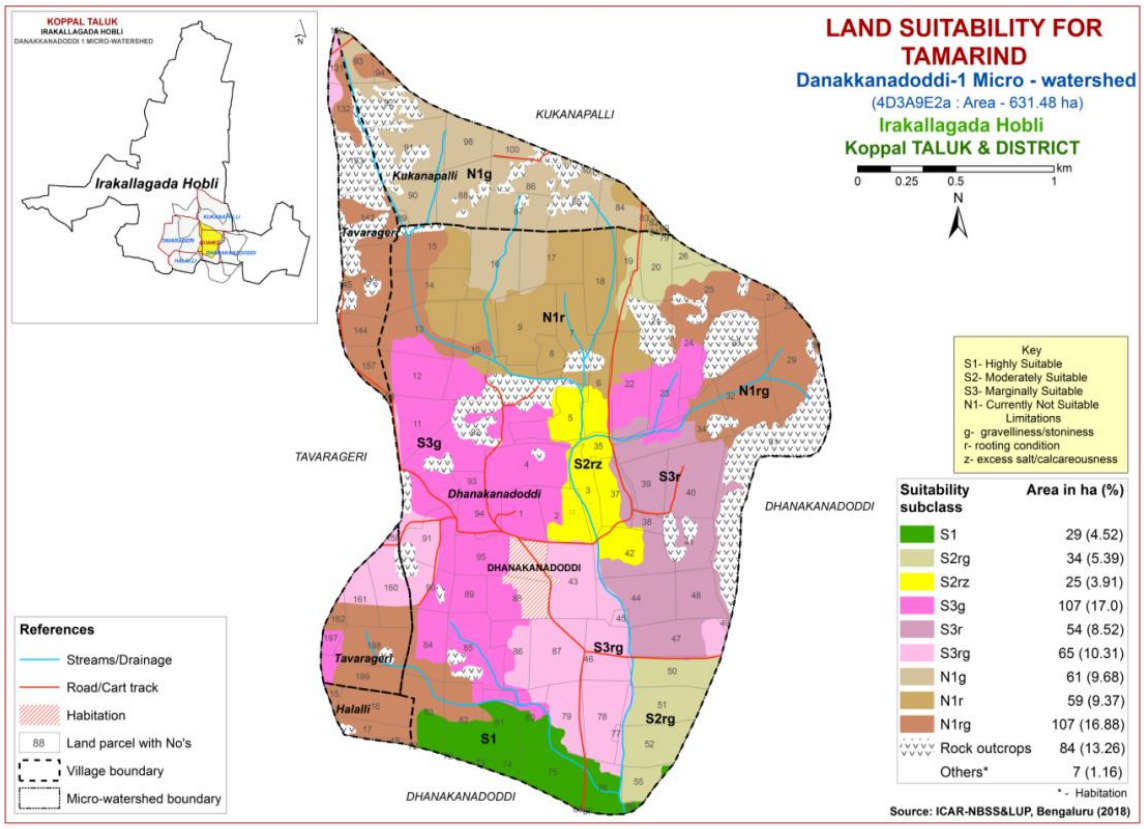


Fig. 7.24 Land Suitability map of Tamarind

Highly suitable lands (Class S1) for growing tamarind cover an area of about 29 ha (5%) and distributed in the southern part of the microwatershed. An area of about 59 ha (9 %) is moderately suitable (Class S2) and occur in the southeastern and central part

of the microwatershed with minor limitations of rooting depth, gravelliness and calcareousness. An area of about 226 ha (36 %) is marginally suitable (Class S3) and occur in the eastern, central and western part of the microwatershed. They have moderate limitations of rooting depth and gravelliness. Area not suitable (Class N1) for growing tamarind is about 227 ha (36%) and are distributed in the northern, southwestern and northeastern part of the microwatershed. They have severe limitations of rooting depth and gravelliness.

7.25 Land Suitability for Marigold (*Tagetes erecta*)

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

An area of about 29 ha (5%) is highly suitable (Class S1) for growing marigold and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 138 ha (22%) and distributed in the northern, central and eastern part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 314 ha (50%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 61 ha (10%) is not suitable (Class N1) for growing marigold and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

. **Table 7.26 Land suitability criteria for Marigold**

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

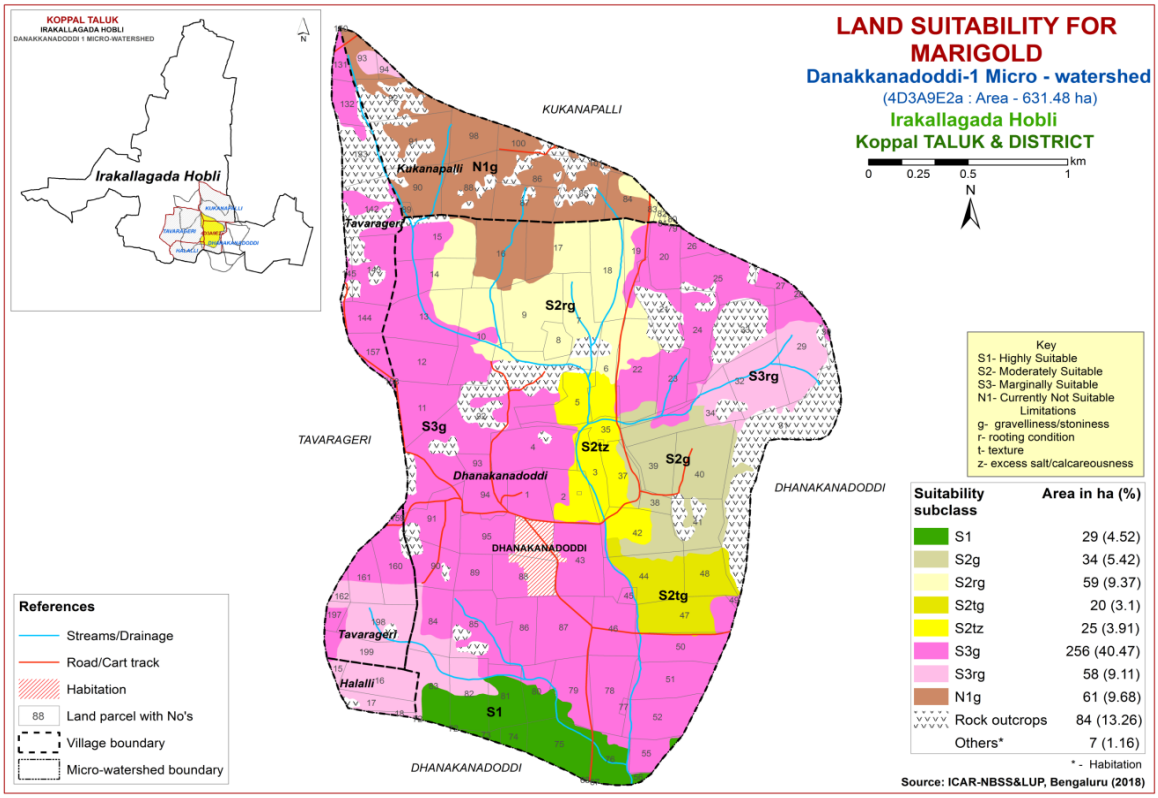


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*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 29 ha (5%) is highly suitable (Class S1) for growing chrysanthemum and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 138 ha (22%) and distributed in the northern, central and eastern part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 314 ha (50%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 61 ha (10%) is not suitable (Class N1) for growing chrysanthemum and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

Table 7.27 Land suitability criteria for Chrysanthemum

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

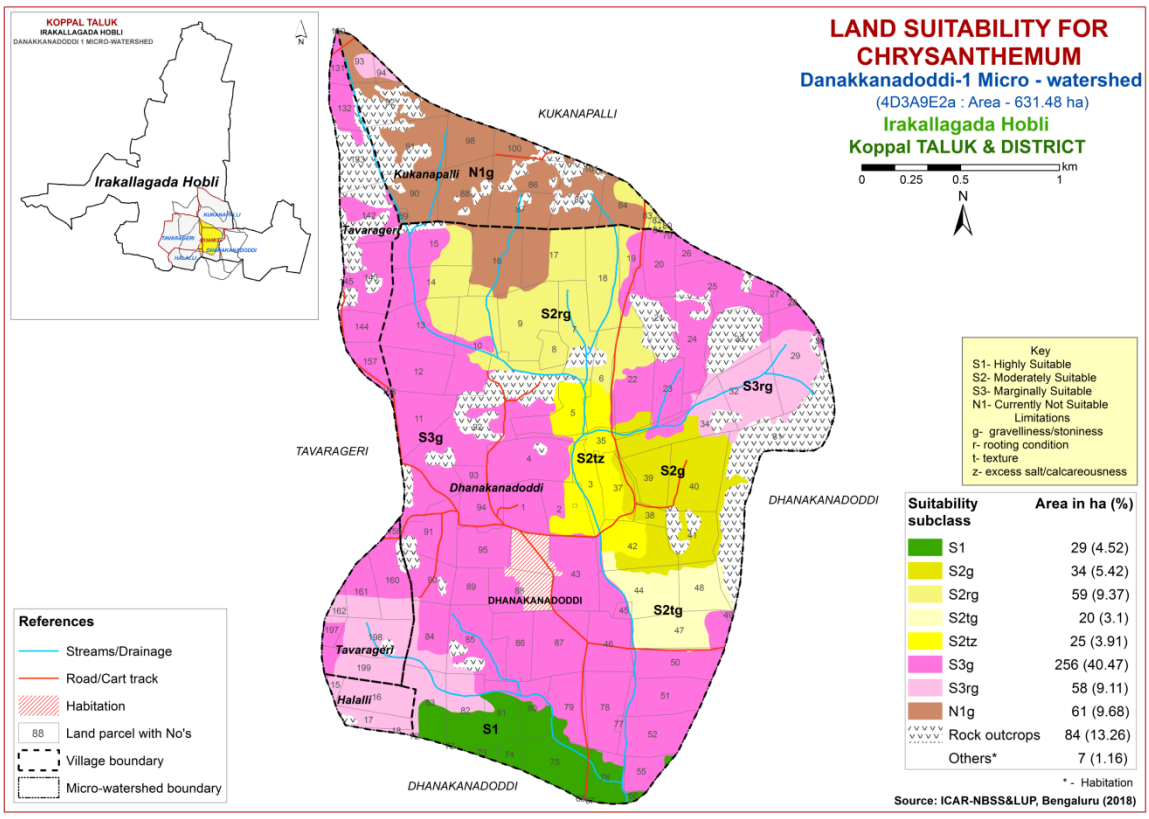


Fig. 7.26 Land Suitability map of Chrysanthemum

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 Land suitability criteria for jasmine (irrigated)

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

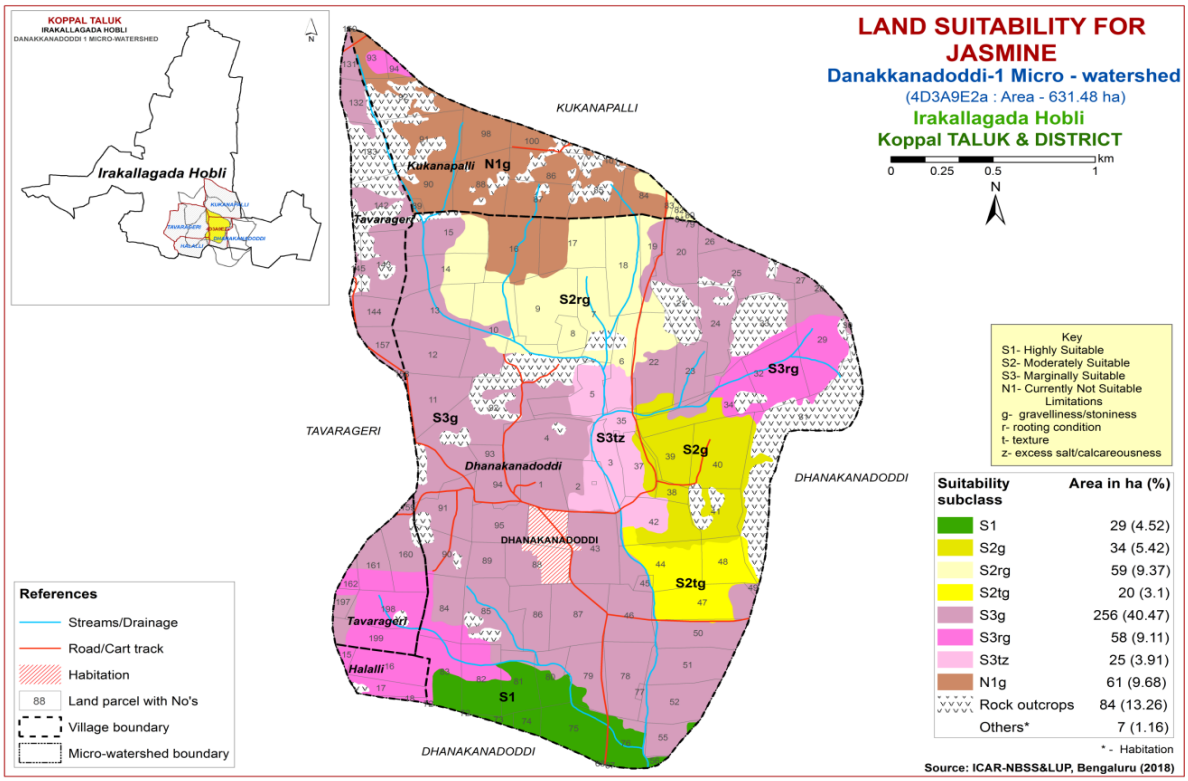


Fig. 7.27 Land Suitability map of Jasmine

An area of about 29 ha (5%) is highly suitable (Class S1) for growing jasmine and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 113 ha (18%) and distributed in the northern, central and eastern part of the microwatershed with minor limitations of rooting depth, texture, and

gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 339 ha (53%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 61 ha (10%) is not suitable (Class N1) for growing jasmine and 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. The crop requirements for growing crossandra were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was given. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

An area of about 29 ha (5%) is highly suitable (Class S1) for growing crossandra and are distributed in the southern part of the microwatershed. Moderately suitable (S2) lands cover an area of about 113 ha (18%) and distributed in the northern, central and eastern part of the microwatershed with minor limitations of rooting depth, texture, and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 339 ha (53%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 61 ha (10%) is not suitable (Class N1) for growing crossandra and distributed in the northern part of the microwatershed with severe limitation of gravelliness.

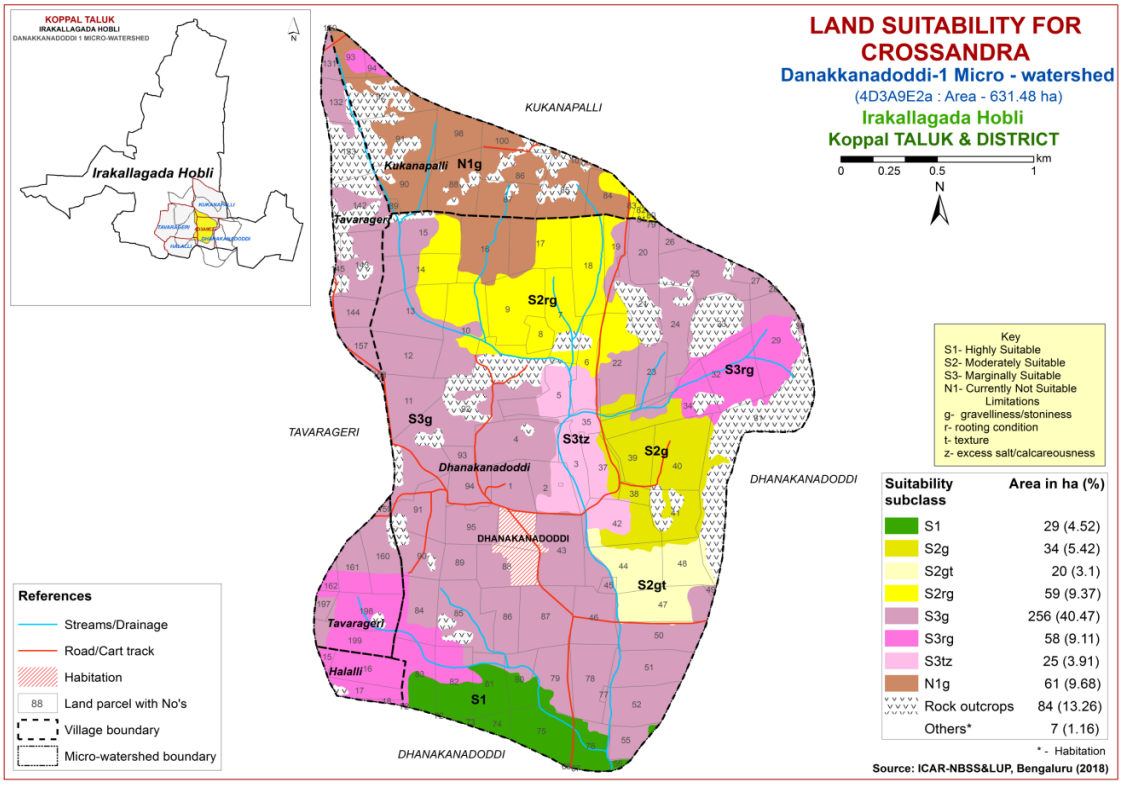


Fig. 7.28 Land Suitability map of Crossandra

7.29 Land Management Units (LMU)

The 27 soil map units identified in Danakkanadoddi-1 microwatershed have been grouped into five Land Management Units (LMU) for the purpose of preparing a Proposed Crop Plan. Five Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig.7.25) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

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

LMU	Mapping unit	Soil and site characteristics
1	RTRcB2, RTRiB2, BSRbB2g1, GHThB1	Moderately deep to very deep, red sandy clay to sandy clay loam soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
2	BPRbB2, BPRcB2, BPRhB2g1, BPRiB2, NGPcB2g1, NGPhC2g1, NGPiB2g1, BDGhB2, BDGhB2g1 HDHcB2g1, HDHhB2, HDHhB2g1	Moderately deep to deep, red gravelly sandy clay to clay soils with slopes of 1-5%, moderate erosion, gravelly (15-35%)
3	KVRmB1	Deep, black calcareous clayey soils with slopes of 1-3%, slight erosion
4	HTIhB1g1, LKRcB2g1, LKRhB2g1, LKRhC2g3, LKRiB2, ,MKHcB2g1 ,MKHhB2g1	Moderately shallow, red gravelly sandy clay to sandy clay loam soils, with slopes of 1-5%, slight to moderate erosion, gravelly (15-80%)
5	HRVcB2g1 KGPhB2g2	Shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-3%, moderate erosion, gravelly to very gravelly (15-60%)

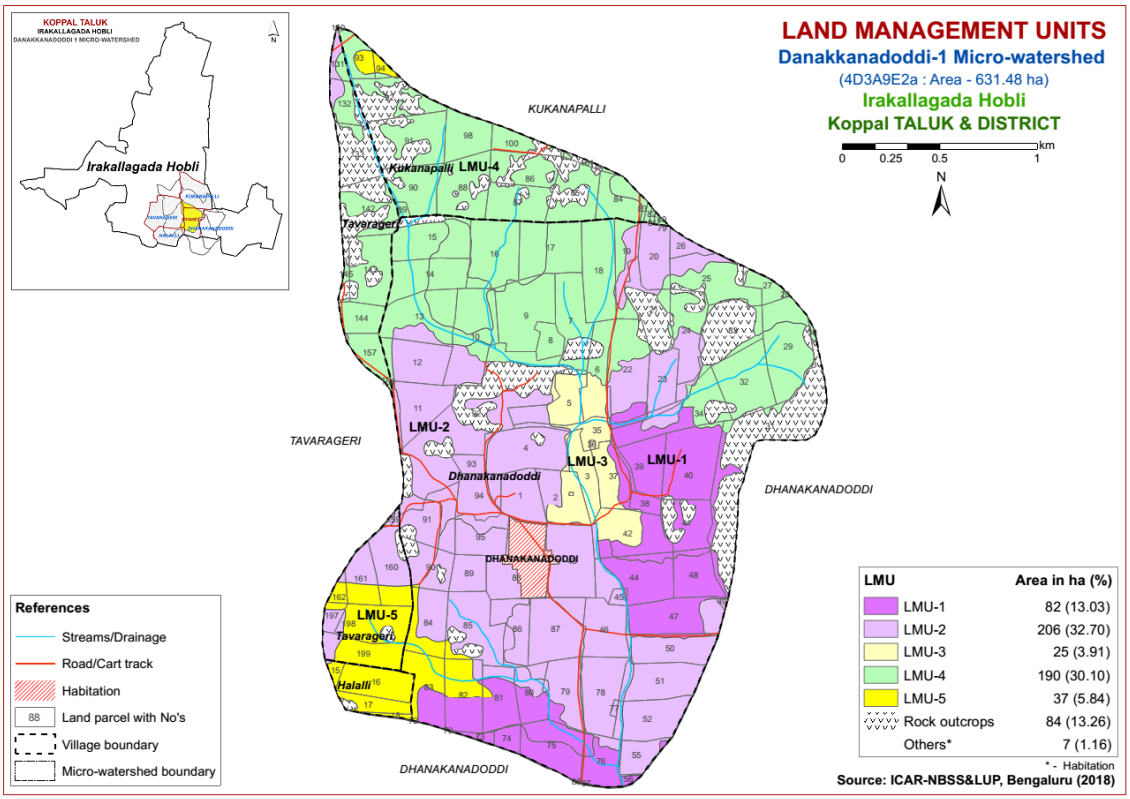


Fig 7.29 Land Management Units map of Danakkanadoddi-1 microwatershed

7.30 Proposed Crop Plan for Danakkanadoddi-1 Microwatershed

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

Table 7.29 Proposed Crop Plan for Danakkanadoddi-1 Microwatershed

Proposed Land use Class	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	285.RTRcB2 288.RTRiB2 158.BSRbB2g1 140.GHThB1 (Moderately deep to very deep, red sandy clay to sandy clay loam soils)	**Dhanakanadoddi:**38,39,40,41,44,47,48,56,67,68,72,73,74,75,76,80,81,82	Maize, Sorghum, Bajra, Groundnut, Redgram, Castor	**Fruit crops:** Pomegranate, Guava, Sapota, Jackfruit, Amla, Tamarind, Musambi, Lime, Custard apple **Vegetable crops:** Drumstick, Tomato, Chilli, Brinjal **Flower crops:** Marigold, Chrysanthemum, Jasmine , Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)
2	216.BPRbB2 224.BPRcB2 231.BPRhB2g1 239.BPRiB2 251.NGPcB2g1 460.NGPhC2g1 265.NGPiB2g1 187.BDGhB2 188.BDGhB2g1 111.HDHcB2g1 122.HDHhB2 123.HDHhB2g1 (Moderately deep to deep, red gravelly sandy clay to clay soils)	**Dhanakanadoddi:**1,4,11,12,19,20,22,23,24,26,43,45,46,49,50,51,52,55,77,78,79,84,85,86,87,88,89,90, 91,93,94,95 **Tavarageri:**131,159,160,161,197	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)

3	388.KVRmB1 (Deep, black calcareous clayey soils)	**Dhanakanadoddi:**2,3,5,6,35,36,37,42	Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Jamun, Musambi, Tamarind, Amla, Custard apple **Vegetable crops:** Drumstick, Chilli, Coriander, Bhendi **Flower crops:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
4	94.HTIhB1g1 43.LKRcB2g1 452.LKRhB2g1 49.LKRhC2g3 53.LKRiB2 77.MKHcB2g1 85.MKHhB2g1 (Moderately shallow, red gravelly sandy clay to sandy clay loam soils)	**Dhanakanadoddi:**7,8,9,10,13,14,15,16,17,18,25,27,28 ,29,30,32,34 **Kukanapalli:**79,80,81,82,83,84,85,86,87,88,89,90,91,93,98,100,101,150 **Tavarageri:**132,143,144,157,158	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)
5	465.HRVcB2g1 18.KGPhB2g2 (Shallow, red gravelly sandy clay to sandy clay loam soils)	**Dhanakanadoddi :**83 **Halalli:**15,16,17,18 **Kukanapalli:** 94 **Tavarageri:**162,198,199	Horse gram	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, Styloxanthes hamata, Glyricidia, Styloxanthes scabra	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Danakkanadoddi-1 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of LKR (131 ha), BPR (95 ha), NGP (90 ha), MKH (57 ha), HRV (35 ha), GHT (34ha), RTR(29 ha), KVR (25 ha), BSR(20 ha), BDG (17 ha), HDH(5ha), HTI (2 ha) and KGP (2ha).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, an area of about 1 ha (<1 %) is slightly acid (pH 6.0-6.5), 282 ha (45%) neutral (pH 6.5-7.3), 73 ha (12%) slightly alkaline (pH 7.3-7.8), 109 ha

(17 %) moderately alkaline (pH 7.8-8.4) 75 ha (12%) under strongly alkaline (pH 8.4-9.0).

Soil Health Management

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

Acid soils

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

Liming materials:

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

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

Alkaline soils

(Slightly alkaline to strongly alkaline soils)

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area of about 479 ha (76%) is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

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

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

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface Soil Texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, radish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dry land Agriculture, Vijayapura, Karnataka can be adopted.
- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Danakkanadoddi-1 microwatershed.

- **Organic Carbon:** An area of about 520 ha (82 %) is medium in OC content and 21 ha (3 %) is high in organic carbon content. The areas that are medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 520 ha (82 %) area where OC is less than 0.75%. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Available phosphorus is low (<23 kg/ha) in 3 ha (<1%), medium (23-57 kg/ha) in 94 ha (15%) and high (>57 kg/ha) in 443 ha (70%) of the soils. The areas where phosphorus content is high reduce 25 % from the RDF to avoid the excess application of fertilizer and apply additional 25% phosphorus in areas where it is low or medium.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 227 ha (36%), medium (145-337 kg/ha) in 233 ha (37 %) and high in 80 ha (13 %) area of the microwatershed. The areas where potassium content is high reduce 25 % from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low or medium.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10 ppm) in 464 ha (74%) area and medium (10-20 ppm) in 76 ha (12%) of the microwatershed. The areas with low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.
- **Available iron:** It is deficient (<4.5 ppm) in 61 ha (10%) and sufficient (>4.5ppm) in 479 ha (76%) area of the microwatershed. To manage iron deficiency iron sulphate @25 kg/ha needs to be applied for 2-3 years.
- **Available Manganese:** It is sufficient in the entire area of the microwatershed.
- **Available Copper:** It is sufficient in the entire area of the microwatershed.
- **Available Zinc:** It is deficient (<0.6 ppm) in 462 ha (73%) and sufficient (>0.6 ppm) in 79 ha (12%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low (<0.5 ppm) in 258 ha (41 %) and medium (0.5-1.0 ppm) in 283 ha (45 %) area of the microwatershed. The areas with low and medium need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Soil acidity:** The microwatershed has a small area of 1 ha (<1%) with soils that are slightly acid. These areas need application of lime (Calcium Carbonate).

- **Soil alkalinity:** The 257 ha (41%) area 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.

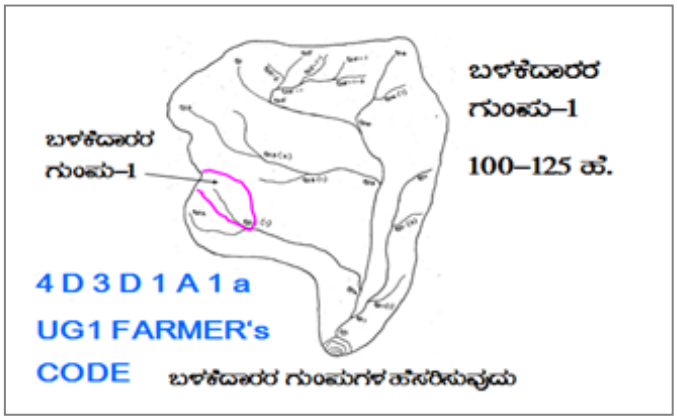
  Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content,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

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



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

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

Steps for Survey and Preparation of Treatment Plan

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

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

9.1 Treatment Plan

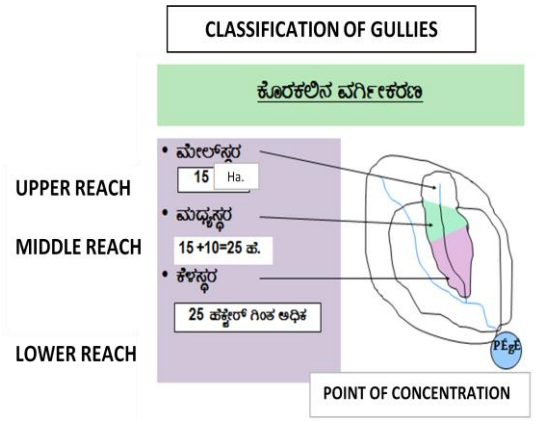
The treatment plan recommended for arable lands is briefly described below.

9.1.1 Arable Land Treatment

A. BUNDING

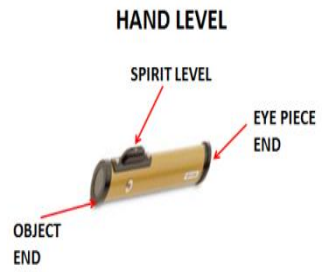
Steps for Survey and Preparation of Treatment Plan	
Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale Drainage lines are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

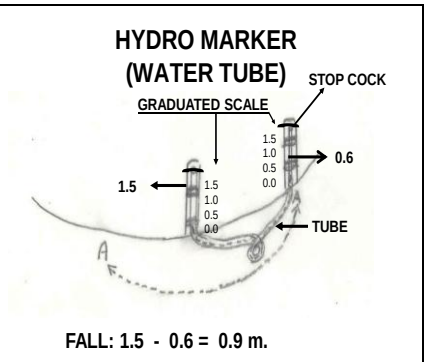
USER GROUP-1



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.

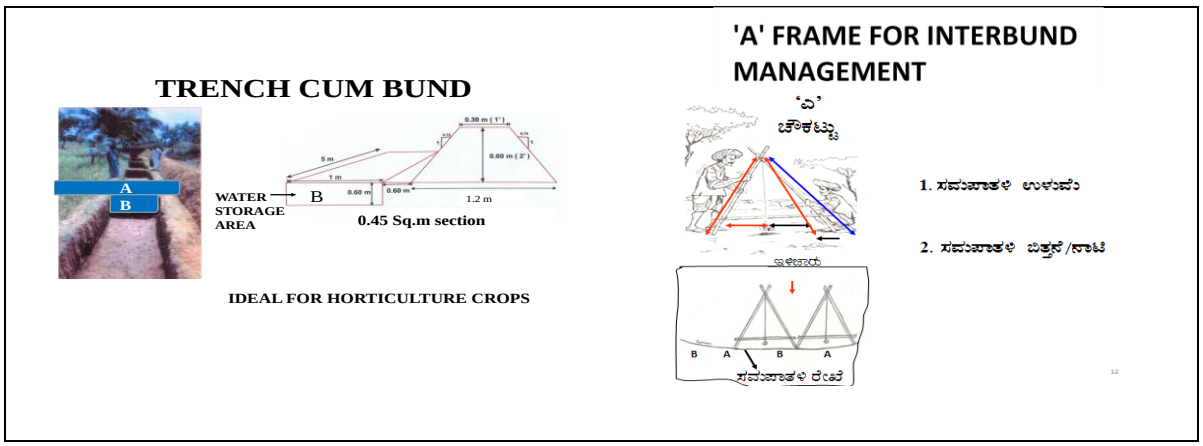
Recommended Bund Section

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

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

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

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

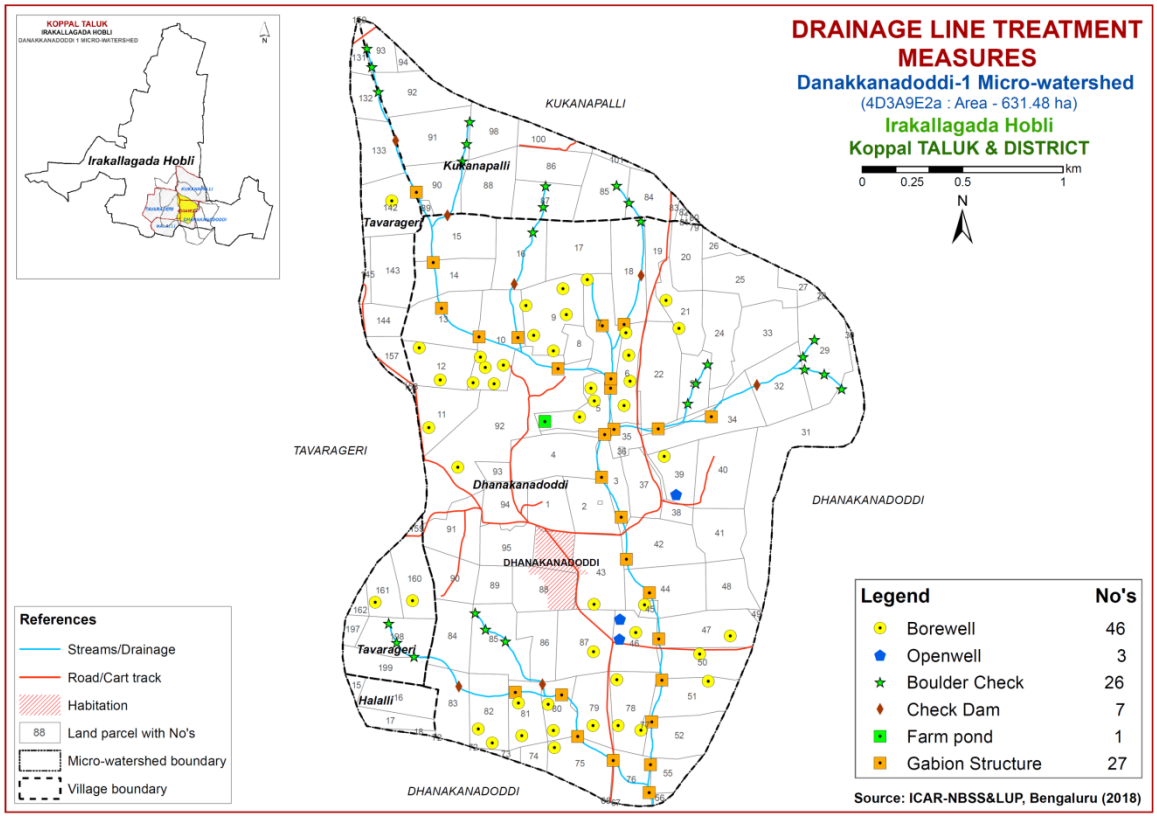


Fig. 9.1 Drainage line treatment measures map of Danakkanadoddi-1 Microwatershed

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.2) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. Maximum area of about 516 ha (82%) needs trench cum bunding and an area of about 25 ha (4 %) needs 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.

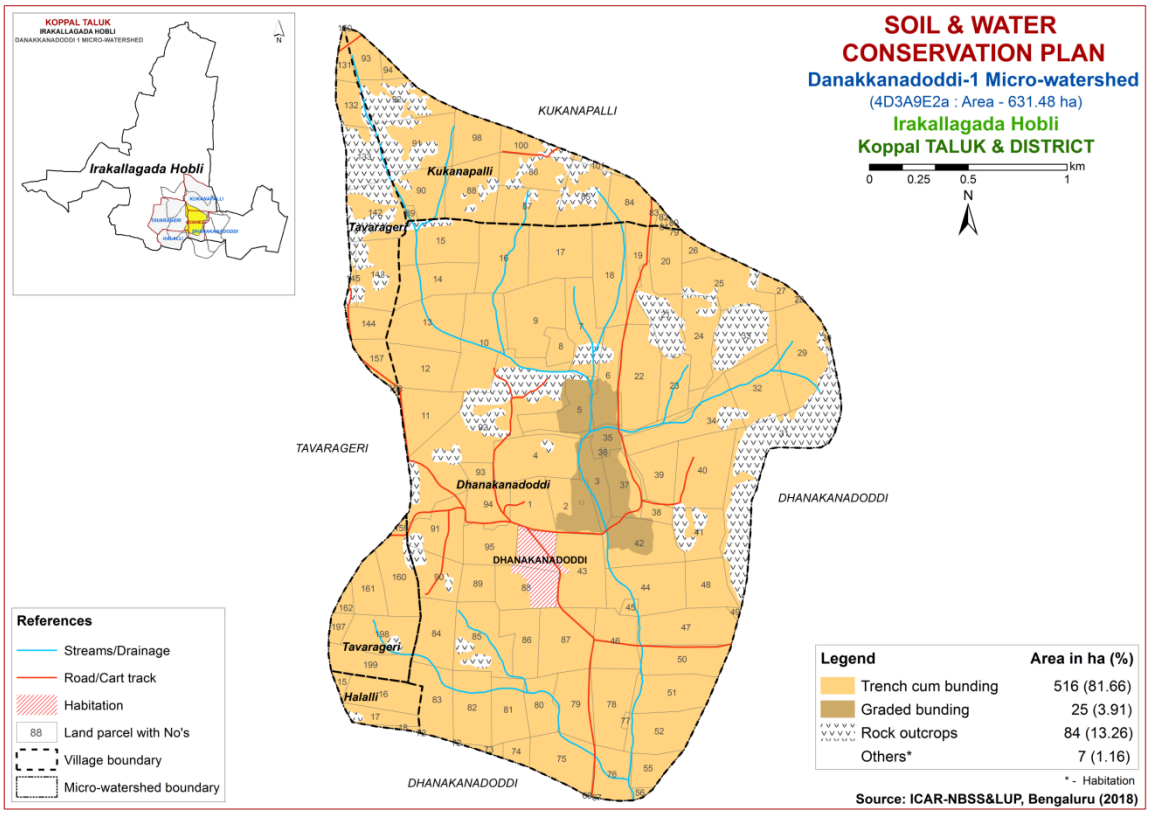


Fig. 9.2 Soil and Water Conservation Plan map of Danakkanadoddi-1 Microwatershed

9.3 Greening of Microwatershed

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

VII and VIII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The method of planting these trees is given below.

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

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

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

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Appendix I

Danakkanadoddi-1 Microwatershed

Soil Phase Information

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Dhanakana doddi	1	5.25	NGPhC2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Bitter guard (Btg)	Not Available	TCB
Dhanakana doddi	2	6.1	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Mango (Mn)	Not Available	Graded bunding
Dhanakana doddi	3	4.08	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Maize (Mz)	Not Available	Graded bunding
Dhanakana doddi	4	9.21	NGPhC2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	5	6.07	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Pearl millet (Pm)	1 Farm pond, 3 Borewell	Graded bunding
Dhanakana doddi	6	5.61	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Current fallow (Cf)	4 Borewell	Graded bunding
Dhanakana doddi	7	7.44	MKHhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	8	2.25	MKHhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	9	9.67	MKHhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	5 Borewell	TCB
Dhanakana doddi	10	10.3	MKHcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	5 Borewell	TCB
Dhanakana doddi	11	6.86	NGPcB2g1	LMU-2	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	12	6.83	NGPcB2g1	LMU-2	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	2 Borewell	TCB
Dhanakana doddi	13	9.09	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	14	6.85	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	15	8.66	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	16	8.76	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	17	8.75	MKHhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	18	8.7	MKHhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize+Current fallow (Mz+Cf)	Not Available	TCB
Dhanakana doddi	19	4.77	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	20	5.23	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	21	6.14	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	NA	2 Borewell	Rock outcrops
Dhanakana doddi	22	9.93	BDGhB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Dhanakana doddi	23	4.46	BDGhB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	24	6.95	BDGhB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Current fallow (Cf)	Not Available	TCB
Dhanakana doddi	25	8.47	LKRiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	26	1.72	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Mango (Mn)	Not Available	TCB
Dhanakana doddi	27	2.05	LKRiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	28	0.09	LKRiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	29	10.73	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	30	0.22	LKRiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	31	21.29	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	NA	Not Available	Rock outcrops
Dhanakana doddi	32	8.49	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	33	9.15	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	NA	Not Available	Rock outcrops
Dhanakana doddi	34	8.78	LKRhB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	35	2.96	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Paddy (Pd)	Not Available	Graded bunding
Dhanakana doddi	36	0.13	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Not Available (NA)	Not Available	Graded bunding
Dhanakana doddi	37	5.08	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Paddy (Pd)	Not Available	Graded bunding
Dhanakana doddi	38	1.48	GHThB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Not Available (NA)	Not Available	TCB
Dhanakana doddi	39	5.19	GHThB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Maize+Paddy (Mz+Pd)	1 Openwell,1 Borewell	TCB
Dhanakana doddi	40	10.13	GHThB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Maize (Mz)	Not Available	TCB
Dhanakana doddi	41	6.13	GHThB1	LMU-1	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Maize (Mz)	Not Available	TCB
Dhanakana doddi	42	8.54	KVRmB1	LMU-3	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Maize (Mz)	Not Available	Graded bunding
Dhanakana doddi	43	9.13	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	44	9.06	BSRbB2g1	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Brinjal+Maize (Br+Mz)	Not Available	TCB
Dhanakana doddi	45	0.71	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	46	6.53	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	2 Openwell,1 Borewell	TCB

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Dhanakana doddi	47	8.57	BSRbB2g1	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Current fallow (Cf)	1 Borewell	TCB
Dhanakana doddi	48	5.36	BSRbB2g1	LMU-1	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Currentfallow+Maize (Cf+Mz)	Not Available	TCB
Dhanakana doddi	49	0.25	HDHhB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Groundnut+Maize (Gn+Mz)	Not Available	TCB
Dhanakana doddi	50	6.57	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	51	7.27	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	52	7	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	55	3.18	BPRhB2g1	LMU-2	Deep (100-150 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	56	0.46	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Habitation (Hb)	Not Available	TCB
Dhanakana doddi	67	0.03	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	68	0.02	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	72	0	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	73	0.69	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	74	1.56	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	75	7.48	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	76	5.01	RTRiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize (Mz)	Not Available	TCB
Dhanakana doddi	77	0.24	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	78	7.51	BPRiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Groundnut+Maize (Gn+Mz)	2 Borewell	TCB
Dhanakana doddi	79	6.25	BPRbB2	LMU-2	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Dhanakana doddi	80	4.55	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Not Available (NA)	2 Borewell	TCB
Dhanakana doddi	81	5.66	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Maize+Mango (Mz+Mn)	2 Borewell	TCB
Dhanakana doddi	82	7.24	RTRcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	IIe	Groundnut (Gn)	2 Borewell	TCB
Dhanakana doddi	83	6.58	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	84	6.45	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	85	9.46	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Dhanakana doddi	86	5.49	BPRbB2	LMU-2	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	87	8.98	BPRbB2	LMU-2	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize+Pearl millet (Mz+Pm)	1 Borewell	TCB
Dhanakana doddi	88	6.56	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	89	3.36	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	90	5.14	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	91	6.9	BPRcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	92	28.33	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	NA	1 Borewell	Rock outcrops
Dhanakana doddi	93	1.47	NGPcB2g1	LMU-2	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Dhanakana doddi	94	4.92	NGPcB2g1	LMU-2	Deep (100-150 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Redgram+Maize (Rg+Mz)	Not Available	TCB
Dhanakana doddi	95	5.37	NGPiB2g1	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Kukanapalli	79	0.13	HTIhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Redgram+Maize (Rg+Mz)	Not Available	TCB
Kukanapalli	80	0.13	HTIhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Mango+Redgram+Groundnut(Mn+Rg+Gn)	Not Available	TCB
Kukanapalli	81	0.16	HTIhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Redgram (Rg)	Not Available	TCB
Kukanapalli	82	0.26	HTIhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Redgram (Rg)	Not Available	TCB
Kukanapalli	83	0.44	HTIhB1g1	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	IIs	Redgram +Groundnut (Rg+Gn)	Not Available	TCB
Kukanapalli	84	4.63	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram +Groundnut (Rg+Gn)	Not Available	TCB
Kukanapalli	85	7	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram (Rg)	Not Available	TCB
Kukanapalli	86	5.87	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Bajra (Rg+Bj)	Not Available	TCB
Kukanapalli	87	5.94	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Maize (Rg+Mz)	Not Available	TCB
Kukanapalli	88	7.95	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Fallow land (Rg+Fl)	Not Available	TCB
Kukanapalli	89	0.44	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram (Rg)	Not Available	TCB
Kukanapalli	90	5.89	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Fallow land (Rg+Fl)	Not Available	TCB
Kukanapalli	91	9.57	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Fallow land +Red gram+Bajra(Fl+Rg+Bj)	Not Available	TCB
Kukanapalli	92	7.18	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	NA	Not Available	Rock outcrops

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Kukanapalli	93	3.19	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram (Rg)	Not Available	TCB
Kukanapalli	94	0.92	KGPhB2g2	LMU-5	Shallow (25-50 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Redgram+Vegetables (Rg+Vg)	Not Available	TCB
Kukanapalli	98	5.08	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Maize+Bajra (Rg+Mz+Bj)	Not Available	TCB
Kukanapalli	100	3.15	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Groundnut +Maize (Rg+Gn+Mz)	Not Available	TCB
Kukanapalli	101	0.68	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Groundnut (Rg+Gn)	Not Available	TCB
Kukanapalli	150	0.01	LKRhC2g3	LMU-4	Moderately shallow (50-75 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	IIIes	Redgram+Groundnut (Rg+Gn)	Not Available	TCB
Tavarageri	131	1.66	HDHcB2g1	LMU-2	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Tavarageri	132	3.21	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Bajra (Bj)	Not Available	TCB
Tavarageri	133	5.65	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Cultivated Fallow Land (CFL)	Not Available	Rock outcrops
Tavarageri	142	7.82	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Cultivated Fallow Land (CFL)	1 Borewell	Rock outcrops
Tavarageri	143	7.52	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Tavarageri	144	3.29	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Maize (Mz)	Not Available	TCB
Tavarageri	145	1.22	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Maize (Mz)	Not Available	Rock outcrops
Tavarageri	157	3.14	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Bajra (Bj)	Not Available	TCB
Tavarageri	158	0.18	LKRcB2g1	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIes	Bajra (Bj)	Not Available	TCB
Tavarageri	159	0.45	BPRcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Bajra (Bj)	Not Available	TCB
Tavarageri	160	6.78	BPRcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Tavarageri	161	4.27	BPRcB2	LMU-2	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	1 Borewell	TCB
Tavarageri	197	1.38	BDGhB2	LMU-2	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Tavarageri	198	6.65	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Tavarageri	199	5.41	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Halalli	15	0.73	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Halalli	16	5.73	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Maize (Mz)	Not Available	TCB
Halalli	17	2.87	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Pearl millet (Pm)	Not Available	TCB

Village	SY NO	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Land Capability	Current Land Use	WELLS	Conservation Plan
Halalli	18	0.42	HRVcB2g1	LMU-5	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	IIIes	Pearl millet (Pm)	Not Available	TCB

Appendix II

Danakkanadoddi-1 Microwatershed

Soil Fertility Information

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dhanakan adoddi	1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	3	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	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)
Dhanakan adoddi	4	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	5	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Dhanakan adoddi	6	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Dhanakan adoddi	7	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	8	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	9	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	10	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	11	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	12	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	13	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	14	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	15	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	16	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	17	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	18	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	19	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	20	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	21	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakan adoddi	22	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dhanakan adoddi	23	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Dhanakan adoddi	24	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	25	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	26	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	27	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	28	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	29	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	30	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	31	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakan adoddi	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	33	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakan adoddi	34	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 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)
Dhanakan adoddi	36	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	37	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	38	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	39	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	40	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	41	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	43	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	44	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	45	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	46	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dhanakan adoddi	47	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	48	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	49	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	50	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	51	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	52	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	55	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dhanakan adoddi	56	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)
Dhanakan adoddi	67	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	68	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	72	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	73	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	74	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	75	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	76	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	77	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	78	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	79	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	80	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	81	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	82	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	83	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	85	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dhanakan adoddi	86	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	87	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	88	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Others	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	89	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	90	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	91	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	92	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakan adoddi	93	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	94	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dhanakan adoddi	95	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	79	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukana palli	80	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukana palli	81	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukana palli	82	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukana palli	83	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kukana palli	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	85	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	86	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	87	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	88	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	89	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	90	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	91	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	92	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kukana palli	93	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	94	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	98	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	100	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kukana palli	101	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Rock outcrops
Kukana palli	150	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)
Tavarageri	131	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	132	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	133	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	142	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	143	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	144	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	145	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	157	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	158	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	159	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	160	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	161	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	162	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	197	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	198	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Tavarageri	199	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	15	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey no	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Halalli	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halalli	18	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Appendix III

Danakkanadoddi-1 Microwatershed

Soil Suitability Information

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Dhanakanadoddi	1	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	2	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	3	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	4	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	5	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	6	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	7	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
Dhanakanadoddi	8	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
Dhanakanadoddi	9	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
Dhanakanadoddi	10	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
Dhanakanadoddi	11	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	12	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	13	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	14	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	15	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	16	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
Dhanakanadoddi	17	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
Dhanakanadoddi	18	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
Dhanakanadoddi	19	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	20	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Dhanakanadoddi	21	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakanadoddi	22	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Dhanakanadoddi	23	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Dhanakanadoddi	24	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g
Dhanakanadoddi	25	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	26	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	27	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	28	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	29	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Dhanakanadoddi	30	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Dhanakanadoddi	31	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakanadoddi	32	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Dhanakanadoddi	33	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakanadoddi	34	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg
Dhanakanadoddi	35	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	36	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	37	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	38	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Dhanakanadoddi	39	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Dhanakanadoddi	40	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r
Dhanakanadoddi	41	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S2g	S2rg	S2r

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Dhanakanadoddi	42	S2rz	S2tz	S3tz	S2z	S3tz	S2z	S2rz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2rz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S3tz	S2tz	S2tz
Dhanakanadoddi	43	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	44	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2gt	S2r	S2gt	S2t	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2t	S2t	S2tg	S2tg	S2rg	S2t	S2tg	S2gt	S2r	S2r
Dhanakanadoddi	45	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	46	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	47	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2gt	S2r	S2gt	S2t	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2t	S2t	S2tg	S2tg	S2rg	S2t	S2tg	S2gt	S2r	S2r
Dhanakanadoddi	48	S3r	S2tg	S2rg	S2g	S2rt	S2rg	S3r	S2rg	S2gt	S2r	S2gt	S2t	S2rg	S1	S2rt	S2rg	S2rg	S2t	S2t	S2t	S2tg	S2tg	S2rg	S2t	S2tg	S2gt	S2r	S2r
Dhanakanadoddi	49	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
Dhanakanadoddi	50	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	51	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	52	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	55	S3rg	S3g	S3g	S3g	S3g	S3g	S2rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	56	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	67	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	68	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	72	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	73	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	74	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	75	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	76	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	77	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	78	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2gt	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Dhanakanadoddi	79	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Dhanakanadoddi	80	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	81	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	82	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Dhanakanadoddi	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
Dhanakanadoddi	84	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	85	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	86	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Dhanakanadoddi	87	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2gt
Dhanakanadoddi	88	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	89	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	90	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	91	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	92	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Dhanakanadoddi	93	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	94	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Dhanakanadoddi	95	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Kukanapalli	79	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2rg	S3r	S3r
Kukanapalli	80	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2rg	S3r	S3r
Kukanapalli	81	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2rg	S3r	S3r
Kukanapalli	82	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2rg	S3r	S3r
Kukanapalli	83	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S3t	S3r	S3r	S2rg	S3r	S2rg	S3r	S3r	S3r	S2rg	S2rg	S2rg	S2rg	S2rg	S3r	S2rg	S2rg	S2rg	S3r	S3r

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Kukanapalli	84	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	85	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	86	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	87	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	88	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	89	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	90	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	91	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	92	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kukanapalli	93	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	94	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Kukanapalli	98	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	100	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	101	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	150	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
Tavarageri	131	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
Tavarageri	132	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Tavarageri	133	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	142	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	143	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Tavarageri	144	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg

Village	Survey No.	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pome granate	Bajra	Jasmine	Crossandra	Drumstick	Mulberry
Tavarageri	145	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Tavarageri	157	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Tavarageri	158	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Tavarageri	159	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Tavarageri	160	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Tavarageri	161	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Tavarageri	162	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
Tavarageri	197	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
Tavarageri	198	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
Tavarageri	199	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	15	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	16	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	17	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg
Halalli	18	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	N1rg	N1rg

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 104 (57.14%) men and 78 (42.86%) were women among the sampled households.*
- *The average family size of landless farmers was 3.8, marginal farmers' was 3.6, small farmers' was 5.75, semi medium farmers' was 6, medium farmers' was 5.17 and large farmers' was 8. The data indicated that, 28 (15.38%) people were in 0-15 years of age, 90 (49.45%) were in 16-35 years of age, 51 (28.02%) were in 36-60 years of age and 13 (7.14 %) were above 61 years of age.*
- *The results indicated that Danakanadoddi-1 had 32.42 per cent illiterates, 0.55 per cent functional literates, 28.02 per cent of them had primary school education, 10.44 per cent of them had middle school education, 12.09 per cent of them had high school education, 6.59 per cent of them had PUC education, 1.10 per cent of them did diploma, 5.49 per cent of them had degree education and 3 persons were doing masters.*
- *The results indicate that, 65.71 per cent of households practicing agriculture, 20 per cent of the households were agricultural laborers, 5.71 per cent were general laborers, 2.86 per cent were housewives and 5.71 per cent of the household heads were involved in other occupation.*
- *The results indicate that agriculture was the major occupation for 44.51 per cent of the household members, 18.68 per cent were agricultural labourers, 3.85 per cent were general laborers, 22.53 per cent of them were student, 4.40 per cent of them were housewife, 1.10 per cent of them were in private services, 1.10 per cent government service and 1.10 per cent were involved in trade and business.*
- *The results show that 0.55 per cent of the households participated in self help group and 99.45 per cent of them have not participated in any local institutions.*
- *The results indicate that 17.14 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house, 40 per cent of them possess pucca house.*
- *The results shows that 97.14 per cent of the households possess TV, 88.57 per cent of the households possess Mixer grinder, 31.43 per cent of the households possess bicycle, 62.86 per cent of the households possess motor cycle, 2.86 per cent of the households possess tempo, 2.86 per cent of the households possess auto, and 97.14 per cent of the households possess mobile phones.*
- *The results shows that the average value of television was Rs.5617, mixer grinder was Rs.1629, motor cycle was Rs.29000, mobile phone was Rs.1147, Auto was Rs.50000, tempo was Rs.100000, mobile phone was Rs.1147 and bicycle was Rs.1545.*
- *About 34.29 per cent of the households possess bullock cart, 40 per cent of them possess plough, 14.29 per cent of them possess tractor, 20 per cent of them posses*

sprayer, 20 per cent of them possess chaff cutter and 94.29 per cent of them possess weeder.

- *The results show that the average value of plough was Rs.892, the average value of tractor was Rs. 420000 and the average value of sprayer was Rs.4000, the average value of bullock cart Rs.19416, and the average value of weeder Rs.56.*
- *The results indicate that, 48.57 per cent of the households possess bullocks, 45.71 per cent of the households possess local cow, 8.57 per cent of the households possess local cow and buffalo, 11.43 per cent of the households possess poultry birds.*
- *The results indicate that, average own labour men available in the micro watershed was 2.10, average own labour (women) available was 1.50, average hired labour (men) available was 10.13 and average hired labour (women) available was 8.70.*
- *The results indicate that, 85.71 per cent of the household opined that hired labour was adequate. About 100 per cent of the marginal farmers, 100 per cent of small, 100 per cent of semi medium, 100 per cent of medium and large farmers have opined that hired labour was adequate.*
- *The results indicate that, households of the Danakanadoddi-1 micro watershed possess 22.29 ha (38.40%) of dry land and 35.76 ha (61.60%) of irrigated land. Marginal farmers possess 4.37 ha (100%) of dry land. Small farmers possess 8.20 ha (76.02%) of dry land and 2.59 ha (23.98%) of irrigated land. Semi medium possess 6.07 ha (38.95%) of dry land and 9.51 ha (61.05%) of irrigated land. Medium farmers possess 19.21 ha (100%) of irrigated land, large farmers possess 3.64 ha 45%) of dry land and 4.45 ha (55%) of irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 339,989.27 and average value of irrigated was Rs.509,201.*
- *The results indicate that, there were 17 functioning and 4 de-functioning bore wells in the micro watershed.*
- *Bore well was the major irrigation source in the micro water shed for 48.57 per cent of the farmers. The depth of bore well was found to be 47.46 meters.*
- *The results indicate that, marginal farmers had irrigated area of 1.21 hectares, small farmers had 1.62 hectares, semi medium farmers had 10.81 hectares and medium farmers had 12.15 hectares.*
- *The results indicate that, farmers have grown Bajra (6.88 ha), chilly (0.40 ha), groundnut (10.57 ha), ladies finger (0.81 ha), maize (25.13 ha), mango (0.81 ha), paddy (5.75 ha) and tomato (1.21 ha).*
- *Marginal farmers have grown groundnut and maize. Small farmers have grown bajra, groundnut, maize and mango.*
- *Semi medium farmers have grown bajra, groundnut, maize and paddy.*
- *Medium farmers have grown bajra, chilly, ladies finger, maize, paddy, tomato and bajra.*
- *Large farmers have grown groundnut and maize.*

- *The cropping intensity in Danakanadoddi-1 micro watershed was found to be 54.50 per cent. In case of marginal farmers it was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 93.66 per cent, medium farmers had cropping intensity of 28.38 per cent and for large farmers it was 45.45 per cent.*
- *The results indicate that, 94.29 per cent of the households possess bank account and 48.57 per cent of the households possess savings.*
- *The results indicate that, 20 per cent of landless, 100 per cent of marginal, 62.50 per cent of small, 10 per cent of semi medium, 50 per cent of medium and 100 per cent of large farmers have borrowed credit from different sources.*
- *The results indicate that, 13.04 per cent have availed loan from commercial, 4.35 per cent have availed loan from cooperative banks, 13.04 per cent of have availed loan from friends and relatives, 4.35 per cent have availed loan from SHGs/CBOs and 69.57 per cent have availed loan from grameena bank.*
- *The results indicate that, marginal, small, semi medium, medium and large farmers have availed Rs.66000, Rs.93000, Rs.166428, Rs.85000 and Rs.100652 respectively.*
- *The results indicate that, 95 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production and 5 per cent have borrowed for animal husbandry.*
- *The results indicate that, the main purpose of borrowing credit from private sources was agricultural production.*
- *The results indicate that, the total cost of cultivation for maize was Rs. 23568.38. The gross income realized by the farmers was Rs. 25247.75. The net income from Maize cultivation was Rs. 1679.36, thus the benefit cost ratio was found to be 1:1.07.*
- *The total cost of cultivation for mango was Rs. 63221.62. The gross income realized by the farmers was Rs. 44460. The net income from mango cultivation was Rs. -18761.62. Thus the benefit cost ratio was found to be 1:0.7.*
- *The total cost of cultivation for paddy was Rs. 24133.01. The gross income realized by the farmers was Rs. 32595.49. The net income from paddy cultivation was Rs. 8462.47. Thus the benefit cost ratio was found to be 1:1.35.*
- *The total cost of cultivation for groundnut was Rs. 42148.93. The gross income realized by the farmers was Rs. 58198.83. The net income from groundnut cultivation was Rs. 16049.90. Thus the benefit cost ratio was found to be 1:1.38.*
- *The total cost of cultivation for ladies finger was Rs. 15822.57. The gross income realized by the farmers was Rs. 200070. The net income from ladies finger cultivation was Rs. 184247.43, thus the benefit cost ratio was found to be 1:12.64.*
- *The total cost of cultivation for chilly was Rs. 67264.06. The gross income realized by the farmers was Rs. 49400. The net income from chilly cultivation was Rs. -17864.06. Thus the benefit cost ratio was found to be 1:0.73.*

- *The total cost of cultivation for tomato was Rs. 71430.86. The gross income realized by the farmers was Rs. 67925. The net income from tomato cultivation was Rs. -3505.86. Thus the benefit cost ratio was found to be 1:0.95.*
- *The results indicate that, 51.43 per cent of the households opined that dry fodder was adequate and 60 per cent of the households opined that green fodder was adequate.*
- *The results indicate that the average annual gross income was Rs.120800 for landless farmers, for marginal farmers it was Rs.96510, for small farmers it was Rs.76403, for semi medium farmers it was Rs.120400, for medium farmers it was Rs.79000 and large farmers it was Rs.118000.*
- *The results indicate that the average annual expenditure is Rs. 11425.24. For landless households it was Rs.15333.33, for marginal farmers it was Rs 15,500, for small farmers it was Rs. 4520.83, for semi medium farmers it was Rs. 13590, for medium farmers it was Rs. 5608.33 and for large farmers it was Rs.40000.*
- *The results indicate that, sampled households have grown 19 coconut, and 167 mango trees in their field. Farmers have also grown 3 coconut trees in their backyard.*
- *Households have planted 115 neem trees, 11 tamarind trees, 3 pongamia trees and 9 banyan trees.*
- *The results indicate that, households have an average investment capacity of Rs. 5628.57 for land development, Rs. 2600 for irrigation facility, Rs. 2514.29 for improved crop production and Rs. 1142.86 for improved livestock management.*
- *The results indicate that, loan from bank is the major source of investment for 42.86 per cent of households and soft loan were the source of investment for 2.86 per cent for land development. For irrigation facility 22.86 per cent of the households depend on loan from bank, 17.14 per cent depend on own funds and 2.86 per cent depend on soft loan. For improved crop production 17.14 per cent of the households depend on bank loan, 8.57 per cent depend on own funds, 17.14 per cent depend on soft loans. For improved livestock management 11.43 per cent of households depend on loan from bank, 17.14 per cent depend on own funds, and 2.86 per cent depend on soft loan.*
- *The results indicated that, bajra, chilly, groundnut, ladies finger, mango, paddy, tomato were sold to the extent of 100 per cent. Maize was sold to the extent of 93.38 per cent.*
- *The results indicated that, about 74.29 per cent of the households sold their produce to local/village, another 22.86 per cent have sold their produce in cooperative marketing society, and 25.71 per cent have sold in regulated markets.*
- *The results indicated that 28.57 per cent have used cart, 71.43 per cent have used tractor and 22.86 per cent of the farmers have used truck as a mode of transport.*
- *The results indicated that, 45.71 per cent of the households have experienced the soil and water erosion problems.*

- *Around 85.71 per cent of the households are interested in soil testing.*
- *The results indicated that, only 8.57 per cent have adopted field bunding.*
- *The results indicated that 33.33 per cent of the structures were in good condition and 66.67 per cent of the soil conversation structures needed full replacement required.*
- *The results indicated that, piped supply was the major source of drinking water for 68.57 per cent of the households and bore well was the source of drinking water for 31.43 per cent of the households.*
- *The results indicated that, 85.71 percent used fire wood, and another 17.14 percent of the households used LPG.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 45.71 per cent of the households possess sanitary toilet i.e. 40 per cent of landless, 20 per cent of marginal, 100 per cent of small, 10 per cent of semi medium, 50 per cent of medium farmers and 100 per cent of large farmers had sanitary toilet facility.*
- *The results indicated that, 97.14 per cent of the sampled households possessed BPL card, and 2.86 per cent did not possess PDS card.*
- *The results indicated that, 51.43 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 91.43 per cent of the households, pulses were adequate for 88.57 per cent, oilseeds were adequate for 22.86 per cent, vegetables were adequate for 45.71 per cent, fruits were adequate for 34.29 per cent, milk was adequate for 77.14 per cent, eggs were adequate for 82.86 per cent and meat was adequate for 65.71 per cent of the households.*
- *Oilseeds were inadequate for 68.57 per cent, vegetables were inadequate for 40 per cent, fruits were inadequate for 48.57 per cent, milk were inadequate for 11.43 per cent, eggs were inadequate for 8.57 per cent and meat was inadequate for 22.86 per cent of the households.*
- *The results indicated that, vegetables were market surplus for 2.86 per cent, and fruits were market surplus for 5.71 per cent of the households.*
- *The results indicated that, lower fertility status of the soil was the constraint experienced by 82.86 per cent of the households, wild animal menace on farm field (82.86%), frequent incidence of pest and diseases (62.86%), inadequacy of irrigation water (34.29%), high cost of fertilizers and plant protection chemicals (60%), high rate of interest on credit (62.86%), low price for the agricultural commodities (68.57%), lack of marketing facilities in the area (74.29%), lack of transport for safe transport of the agricultural produce to the market (57.14%), less rainfall (2.86%) and inadequate extension services (51.43%).*

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

Description of the study area

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

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

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

Description of the micro watershed

Danakanadoddi-1 micro-watershed (Kerehalli sub-watershed, Koppal Taluk and District) is located at North latitude 15^0 25’ 30.219’’ to 15^0 23’ 29.99 and East longitude 76^0 18’ 4.297’’ to 76^0 16’ 37.103’’ covering an area of 631.67 ha and spread across Tavaregere, Kukanapalli, Dhanakanadoddi and Halalli villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 35 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 Danakanadoddi-1 micro watershed is presented in Table 1 and it indicated that 35 farmers were sampled in Danakanadoddi-1 micro watershed among them 5 (14.29%) were landless, 5 (14.29%) were marginal farmers, 8 (22.86%) were small farmers, 10 (28.57%) were semi medium farmers, 6 (17.14%) were medium farmers and 1 (2.86%) was small farmer.

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

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	14.29	5	14.29	8	22.86	10	28.57	6	17.14	1	2.86	35	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Danakanadoddi-1 micro watershed is presented in Table 2. The data indicated that there were 104 (57.14%) men and 78 (42.86%) were women among the sampled households. The average family size of landless farmers was 3.8, marginal farmers' was 3.6, small farmers' was 5.75, semi medium farmers' was 6, medium farmers' was 5.17 and large farmers' was 8.

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

Sl.No.	Particulars	LL (19)		MF (18)		SF (46)		SMF (60)		MDF (31)		LF (8)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Male	9	47.37	12	66.67	26	56.52	32	53.33	19	61.29	6	75	104	57.14
2	Female	10	52.63	6	33.33	20	43.48	28	46.67	12	38.71	2	25	78	42.86
Total		19	100	18	100	46	100	60	100	31	100	8	100	182	100
Average		3.8		3.6		5.75		6		5.17		8		5.2	

Age wise classification of population: The age wise classification of household members in Danakanadoddi-1 micro watershed is presented in Table 3. The data indicated that, 28 (15.38%) people were in 0-15 years of age, 90 (49.45%) were in 16-35 years of age, 51 (28.02%) were in 36-60 years of age and 13 (7.14 %) were above 61 years of age.

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

Sl.No.	Particulars	LL (19)		MF (18)		SF (46)		SMF(60)		MDF(31)		LF (8)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	5	26.32	3	16.67	6	13.04	6	10	8	25.81	0	0	28	15.38
2	16-35 years of age	8	42.11	9	50	26	56.52	32	53.33	10	32.26	5	62.50	90	49.45
3	36-60 years of age	6	31.58	6	33.33	12	26.09	15	25	9	29.03	3	37.50	51	28.02
4	> 61 years	0	0	0	0	2	4.35	7	11.67	4	12.90	0	0	13	7.14
Total		19	100	18	100	46	100	60	100	31	100	8	100	182	100

Education level of household members: Education level of household members in Danakanadoddi-1 micro watershed is presented in Table 4. The results indicated that

Danakanadoddi-1 had 32.42 per cent illiterates, 0.55 per cent functional literates, 28.02 per cent of them had primary school education, 10.44 per cent of them had middle school education, 12.09 per cent of them had high school education, 6.59 per cent of them had PUC education, 1.10 per cent of them did diploma, 5.49 per cent of them had degree education and 3 persons were doing masters.

Table 4. Education level of household members in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (19)		MF (18)		SF (46)		SMF(60)		MDF(31)		LF (8)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	8	42.11	6	33.33	13	28.26	16	26.67	14	45.16	2	25	59	32.42
2	Functional Literate	0	0	0	0	1	2.17	0	0	0	0	0	0	1	0.55
3	Primary School	5	26.32	4	22.22	11	23.91	21	35	8	25.81	2	25	51	28.02
4	Middle School	3	15.79	1	5.56	4	8.70	8	13.33	2	6.45	1	12.50	19	10.44
5	High School	2	10.53	6	33.33	4	8.70	5	8.33	4	12.90	1	12.50	22	12.09
6	PUC	1	5.26	1	5.56	5	10.87	4	6.67	0	0	1	12.50	12	6.59
7	Diploma	0	0	0	0	2	4.35	0	0	0	0	0	0	2	1.10
8	ITI	0	0	0	0	1	2.17	0	0	0	0	0	0	1	0.55
9	Degree	0	0	0	0	5	10.87	4	6.67	1	3.23	0	0	10	5.49
10	Masters	0	0	0	0	0	0	1	1.67	1	3.23	1	12.50	3	1.65
11	Others	0	0	0	0	0	0	1	1.67	1	3.23	0	0	2	1.10
Total		19	100	18	100	46	100	60	100	31	100	8	100	182	100

Occupation of household heads: The data regarding the occupation of the household heads in Danakanadoddi-1 micro watershed is presented in Table 5. The results indicate that, 65.71 per cent of households practicing agriculture, 20 per cent of the households were agricultural laborers, 5.71 per cent were general laborers, 2.86 per cent were housewives and 5.71 per cent of the household heads were involved in other occupation.

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

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF(10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	5	100	7	87.50	8	80	3	50	0	0	23	65.71
2	Agricultural Labour	3	60	0	0	1	12.50	0	0	2	33.33	1	100	7	20
3	General Labour	2	40	0	0	0	0	0	0	0	0	0	0	2	5.71
4	Others	0	0	0	0	0	0	1	10	1	16.67	0	0	2	5.71
5	Housewife	0	0	0	0	0	0	1	10	0	0	0	0	1	2.86
Total		5	100	5	100	8	100	10	100	6	100	1	100	35	100

Occupation of the household members: The data regarding the occupation of the household members in Danakanadoddi-1 micro watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 44.51 per cent of the household members, 18.68 per cent were agricultural labourers, 3.85 per cent were general laborers, 22.53 per cent of them were student, 4.40 per cent of them were housewife, 1.10 per cent of them were in private services, 1.10 per cent government service and 1.10 per cent were involved in trade and business. In case of landless farmers, 36.84 per cent were agricultural labour, 26.32 per cent of them were general laborers, 5.26 per cent were doing trade and business, 26.32 per cent were students and 5.26 per cent were housewives. In case of marginal farmers 66.67 per

cent were agriculturists, 5.56 agricultural labourer, 11.11 per cent were private service and 16.67 per cent were students. In case of small farmers 50 per cent were agriculturists, 15.22 agricultural labour, 2.17 per cent were general labour and 32.61 per cent were students. In case of semi medium farmers 58.33 per cent were agriculturists, 11.67 per cent of them were agricultural labour, 1.67 per cent was in government service, 1.67 per cent were involved in trade and business and 16.67 per cent were students. In case of medium farmers 32.26 per cent were agriculturists, 25.81 per cent were agricultural labour, 3.23 per cent were general labours and 22.58 per cent were students. In case of large farmers 12.50 per cent were agriculturists, 50 per cent were agricultural labours, 12.50 per cent were in government service, 12.50 per cent were students and another 12.50 per cent were housewives.

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

Sl.No.	Particulars	LL (19)		MF (18)		SF (46)		SMF (60)		MDF (31)		LF (8)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	12	66.67	23	50	35	58.33	10	32.26	1	12.50	81	44.51
2	Agricultural Labour	7	36.84	1	5.56	7	15.22	7	11.67	8	25.81	4	50	34	18.68
3	General Labour	5	26.32	0	0	1	2.17	0	0	1	3.23	0	0	7	3.85
4	Government Service	0	0	0	0	0	0	1	1.67	0	0	1	12.50	2	1.10
5	Private Service	0	0	2	11.11	0	0	0	0	0	0	0	0	2	1.10
6	Trade & Business	1	5.26	0	0	0	0	1	1.67	0	0	0	0	2	1.10
7	Student	5	26.32	3	16.67	15	32.61	10	16.67	7	22.58	1	12.50	41	22.53
8	Others	0	0	0	0	0	0	3	5	1	3.23	0	0	4	2.20
9	Housewife	1	5.26	0	0	0	0	3	5	3	9.68	1	12.50	8	4.40
10	Children	0	0	0	0	0	0	0	0	1	3.23	0	0	1	0.55
Total		19	100	18	100	46	100	60	100	31	100	8	100	182	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Danakanadoddi-1 micro watershed is presented in Table 7. The results show that 0.55 per cent of the households participated in self help group and 99.45 per cent of them have not participated in any local institutions.

Table 7. Institutional Participation of household members in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (19)		MF (18)		SF (46)		SMF (60)		MDF (31)		LF (8)		All (182)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Self Help Group	1	5.26	0	0	0	0	0	0	0	0	0	0	1	0.55
2	No Participation	18	94.74	18	100	46	100	60	100	31	100	8	100	181	99.45
Total		19	100	18	100	46	100	60	100	31	100	8	100	182	100

Type of house owned: The data regarding the type of house owned by the households in Danakanadoddi-1 micro watershed is presented in Table 8. The results indicate that 17.14 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house, 40 per cent of them possess pucca house. In case of marginal farmers, 25 per cent of the households possess thatched house, 25 per cent of the households possess katcha house, 12.50 per cent of them possess pucca house and 37.50 per cent of the households

possess semi pucca house. In case of landless farmers, 40 per cent of them possess katcha house and 60 per cent possess pucca house. 100 per cent of the marginal and large farmers possess katcha house. In case of small farmers, 12.50 per cent of the households possess thatched house, 50 per cent of them possess katcha and 37.50 per cent of them possess pucca house. In case of semi medium farmers, 20 per cent of them possess thatched house, 30 per cent of the households possess katcha house, and 50 per cent of them possess pucca house. In case of medium farmers, 50 per cent of the households possess thatched house, and 50 per cent possess pucca house.

Table 8. Type of house owned by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0	0	0	1	12.50	2	20	3	50	0	0	6	17.14
2	Katcha	2	40	5	100	4	50	3	30	0	0	1	100	15	42.86
3	Pucca/RCC	3	60	0	0	3	37.50	5	50	3	50	0	0	14	40
Total		5	100	5	100	8	100	10	100	6	100	1	100	35	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Danakanadoddi-1 micro watershed is presented in Table 9. The results shows that 97.14 per cent of the households possess TV, 88.57 per cent of the households possess Mixer grinder, 31.43 per cent of the households possess bicycle, 62.86 per cent of the households possess motor cycle, 2.86 per cent of the households possess tempo, 2.86 per cent of the households possess auto, and 97.14 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Television	5	100	5	100	8	100	9	90	6	100	1	100	34	97.14
2	Mixer/Grinder	5	100	3	60	8	100	9	90	5	83.33	1	100	31	88.57
3	Bicycle	2	40	4	80	3	37.50	2	20	0	0	0	0	11	31.43
4	Motor Cycle	3	60	1	20	6	75	8	80	3	50	1	100	22	62.86
5	Auto	0	0	1	20	0	0	0	0	0	0	0	0	1	2.86
6	Tempo	1	20	0	0	0	0	0	0	0	0	0	0	1	2.86
7	Mobile Phone	5	100	4	80	8	100	10	100	6	100	1	100	34	97.14

Table 10. Average value of durable assets owned by households in Danakanadoddi-1 micro watershed

Average value (Rs.)

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF(10)	MDF(6)	LF (1)	All (35)
1	Television	4,000	5,600	5,250	6,111	6,666	6,000	5,617
2	Mixer/Grinder	1,700	1,333	1,500	1,777	1,700	1,500	1,629
3	Bicycle	1,000	1,250	1,666	2,500	0	0	1,545
4	Motor Cycle	29,333	30,000	30,833	29,250	23,750	35,000	29,000
5	Auto	0	50,000	0	0	0	0	50,000
6	Tempo	100,000	0	0	0	0	0	100,000
7	Mobile Phone	1,155	1,033	1,115	1,160	1,358	750	1,147

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Danakanadoddi-1 micro watershed is presented in Table 10. The

results shows that the average value of television was Rs.5617, mixer grinder was Rs.1629, motor cycle was Rs.29000, mobile phone was Rs.1147, Auto was Rs.50000, tempo was Rs.100000, mobile phone was Rs.1147 and bicycle was Rs.1545.

Farm Implements owned: The data regarding the farm implements owned by the households in Danakanadoddi-1 micro watershed is presented in Table 11. About 34.29 per cent of the households possess bullock cart, 40 per cent of them possess plough, 14.29 per cent of them possess tractor, 20 per cent of them posses sprayer, 20 per cent of them possess chaff cutter and 94.29 per cent of them possess weeder.

Table 11. Farm Implements owned by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	2	40	3	37.50	5	50	1	16.67	1	100	12	34.29
2	Plough	0	0	3	60	3	37.50	6	60	1	16.67	1	100	14	40
3	Power Tiller	0	0	0	0	0	0	2	20	0	0	0	0	2	5.71
4	Tractor	0	0	0	0	1	12.50	3	30	0	0	1	100	5	14.29
5	Sprayer	0	0	2	40	1	12.50	4	40	0	0	0	0	7	20
6	Weeder	4	80	5	100	8	100	10	100	5	83.33	1	100	33	94.29
7	Chaff Cutter	0	0	3	60	1	12.50	3	30	0	0	0	0	7	20
8	Blank	1	20	0	0	0	0	0	0	1	16.67	0	0	2	5.71

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Danakanadoddi-1 micro watershed is presented in Table 12. The results show that the average value of plough was Rs.892, the average value of tractor was Rs. 420000 and the average value of sprayer was Rs.4000, the average value of bullock cart Rs.19416, and the average value of weeder Rs.56.

Table 12. Average value of farm implements owned by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL(5)	MF(5)	SF (8)	SMF(10)	MDF (6)	LF (1)	All (35)
1	Bullock Cart	0	20,000	18,666	20,200	18,000	18,000	19,416
2	Plough	0	666	1,250	846	1,500	1,500	892
3	Power Tiller	0	0	0	25,000	0	0	25,000
4	Tractor	0	0	300,000	433,333	0	500,000	420,000
5	Sprayer	0	4,000	4,000	4,000	0	0	4,000
6	Weeder	65	66	53	66	40	25	56
7	Chaff Cutter	0	3,333	3,000	3,000	0	0	3,142

Livestock possession by the households: The data regarding the Livestock possession by the households in Danakanadoddi-1 micro watershed is presented in Table 13. The results indicate that, 48.57 per cent of the households possess bullocks, 45.71 per cent of the households possess local cow, 8.57 per cent of the households possess local cow and buffalo, 11.43 per cent of the households possess poultry birds.

In case of marginal households, 40 per cent possess bullocks, and 60 per cent possess local cow. In case of small farmers, 50 per cent of the households possess bullock, 50 per

cent possess local cow, and 12.50 buffalo. In case of semi medium farmers, 70 per cent of households possess bullock, 50 per cent of households possess local cow, 10 per cent possess buffalo and 10 per cent possess sheep. In case of medium farmers, 50 per cent of the households possess bullocks and local cow, 16.67 per cent of them buffalo and 33.33 per cent process sheep. Large farmers possess bullock, local cow and sheep.

Table 13. Livestock possession by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF(10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	2	40	4	50	7	70	3	50	1	100	17	48.57
2	Local cow	0	0	3	60	4	50	5	50	3	50	1	100	16	45.71
3	Buffalo	0	0	0	0	1	12.50	1	10	1	16.67	0	0	3	8.57
4	Sheep	0	0	0	0	0	0	1	10	2	33.33	1	100	4	11.43
5	blank	5	100	2	40	3	37.50	1	10	3	50	0	0	14	40

Average Labour availability: The data regarding the average labour availability in Danakanadoddi-1 micro watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 2.10, average own labour (women) available was 1.50, average hired labour (men) available was 10.13 and average hired labour (women) available was 8.70.

In case of marginal farmers, average own labour men available was 1.40, average own labour (women) was 1.20, average hired labour (men) was 9.40 and average hired labour (women) available was 6.20. In case of small farmers, average own labour men available was 1.88, average own labour (women) was 1.63, average hired labour (men) was 10.63 and average hired labour (women) available was 10. In case of semi medium farmers, average own labour men available was 2.60, average own labour (women) was 1.70, average hired labour (men) was 12.20 and average hired labour (women) available was 10.30. In case of medium farmers, average own labour men available was 1.50, average own labour (women) was 1.33, average hired labour (men) was 7.50 and average hired labour (women) available was 7. In case of large farmers, average own labour men available was 6, average own labour (women) was 1, average hired labour (men) was 10.13 and average hired labour (women) available was 8.70.

Table 14. Average Labour availability in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Own labour Male	0.00	1.40	1.88	2.60	1.50	6.00	2.10
2	Own Labour Female	0.00	1.20	1.63	1.70	1.33	1.00	1.50
3	Hired labour Male	0.00	9.40	10.63	12.20	7.50	5.00	10.13
4	Hired labour Female	0.00	6.20	10.00	10.30	7.00	5.00	8.70

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Danakanadoddi-1 micro watershed is presented in Table 15. The results indicate that, 85.71 per cent of the household opined that hired labour was adequate. About 100 per cent of the

marginal farmers, 100 per cent of small, 100 per cent of semi medium, 100 per cent of medium and large farmers have opined that hired labour was adequate.

Table 15. Adequacy of Hired Labour in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	5	100	8	100	10	100	6	100	1	100	30	85.71
2	Inadequate	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Distribution of land (ha): The data regarding the distribution of land (ha) in Danakanadoddi-1 micro watershed is presented in Table 16. The results indicate that, households of the Danakanadoddi-1 micro watershed possess 22.29 ha (38.40%) of dry land and 35.76 ha (61.60%) of irrigated land. Marginal farmers possess 4.37 ha (100%) of dry land. Small farmers possess 8.20 ha (76.02%) of dry land and 2.59 ha (23.98%) of irrigated land. Semi medium possess 6.07 ha (38.95%) of dry land and 9.51 ha (61.05%) of irrigated land. Medium farmers possess 19.21 ha (100%) of irrigated land, large farmers possess 3.64 ha 45%) of dry land and 4.45 ha (55%) of irrigated land.

Table 16. Distribution of land (Ha) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	4.37	100	8.20	76.02	6.07	38.95	0	0	3.64	45	22.29	38.40
2	Irrigated	0	0	0	0	2.59	23.98	9.51	61.05	19.21	100	4.45	55	35.76	61.60
Total		0	100	4.37	100	10.79	100	15.58	100	19.21	100	8.09	100	58.05	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Danakanadoddi-1 micro watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 339,989.27 and average value of irrigated was Rs.509,201. In case of marginal famers, the average land value was Rs. 1,321,586 for dry land and Rs. 1,729,000. In case of small famers, the average land value was Rs. 364,000 for dry land and Rs. 864,500. In case of semi medium famers, the average land value was Rs. 267,027 for dry land and Rs. 473,698 for irrigated land. In case of medium famers, the average land value was Rs. 153,552 for dry land and Rs. 384,320 for irrigated land.

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

Sl.No	Particulars	LL(5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Dry	0.00	502,682.71	231,638.69	214,066.67	0.00	164,666.67	269,112.04
2	Irrigated	0.00	0.00	927,699.55	567,333.05	244,605.98	179,636.36	371,785.88

Status of bore wells: The data regarding the status of bore wells in Danakanadoddi-1 micro watershed is presented in Table 18. The results indicate that, there were 17 functioning and 4 de-functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
		N	N	N	N	N	N	N
1	De-functioning	0	0	2	0	2	0	4
2	Functioning	0	0	3	7	6	1	17

Source of irrigation: The data regarding the source of irrigation in Danakanadoddi-1 micro watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 48.57 per cent of the farmers.

Table 19. Source of irrigation in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	3	37.50	7	70	6	100	1	100	17	48.57

Depth of water (Avg in meters): The data regarding the depth of water in Danakanadoddi-1 micro watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 47.46 meters.

Table 20. Depth of water (Avg in meters) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Bore Well	0.00	45.34	66.45	92.96	76.20	47.46

Irrigated Area (ha): The data regarding the irrigated area (ha) in Danakanadoddi-1 micro watershed is presented in Table 21. The results indicate that, marginal farmers had irrigated area of 1.21 hectares, small farmers had 1.62 hectares, semi medium farmers had 10.81 hectares and medium farmers had 12.15 hectares.

Table 21. Irrigated Area (ha) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF(10)	MDF (6)	LF (1)	All (35)
1	Kharif	0.00	0.00	4.19	8.91	14.17	4.45	31.72
2	Rabi	0.00	0.00	0.00	2.02	1.21	0.00	3.24
Total		0.00	0.00	4.19	10.93	15.38	4.45	34.96

Table 22. Cropping pattern in Danakanadoddi-1 micro watershed (Area in ha)

Sl.No.	Particulars	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Kharif - Bajra	0.00	3.24	2.02	0.40	0.00	5.67
2	Kharif - Chilly	0.00	0.00	0.00	0.40	0.00	0.40
3	Kharif - Groundnut	1.66	1.62	2.02	0.00	2.02	7.33
4	Kharif - Ladies finger	0.00	0.00	0.00	0.81	0.00	0.81
5	Kharif - Maize	2.72	5.00	6.48	8.91	2.02	25.13
6	Kharif - Mango	0.00	0.81	0.00	0.00	0.00	0.81
7	Kharif - Paddy	0.00	0.00	4.05	1.70	0.00	5.75
8	Kharif - Tomato	0.00	0.00	0.00	1.21	0.00	1.21
9	Rabi - Bajra	0.00	0.00	0.00	1.21	0.00	1.21
10	Rabi - Groundnut	0.00	0.00	3.24	0.00	0.00	3.24
Total		4.38	10.67	17.81	14.66	4.05	51.57

Cropping pattern: The data regarding the cropping pattern in Danakanadoddi-1 micro watershed is presented in Table 22. The results indicate that, farmers have grown Bajra (6.88 ha), chilly (0.40 ha), groundnut (10.57 ha), ladies finger (0.81 ha), maize (25.13 ha), mango (0.81 ha), paddy (5.75 ha) and tomato (1.21 ha). Marginal farmers have grown groundnut and maize. Small farmers have grown bajra, groundnut, maize and mango. Semi medium farmers have grown bajra, groundnut, maize and paddy. Medium farmers have grown bajra, chilly,

ladies finger, maize, paddy, tomato and bajra. Large farmers have grown groundnut and maize.

Cropping intensity: The data regarding the cropping intensity in Danakanadoddi-1 micro watershed is presented in Table 23. The results indicate that, the cropping intensity in Danakanadoddi-1 micro watershed was found to be 54.50 per cent. In case of marginal farmers it was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 93.66 per cent, medium farmers had cropping intensity of 28.38 per cent and for large farmers it was 45.45 per cent.

Table 23. Cropping intensity (%) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Cropping Intensity	0.00	100.00	100.00	93.66	28.38	45.45	54.50

Possession of Bank account: The data regarding the possession of Bank account and savings in Danakanadoddi-1 micro watershed is presented in Table 24. The results indicate that, 94.29 per cent of the households possess bank account and 48.57 per cent of the households possess savings.

Table 24. Possession of Bank account and savings in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Account	4	80	5	100	8	100	10	100	5	83.33	1	100	33	94.29
2	Savings	3	60	5	100	4	50	5	50	0	0	0	0	17	48.57

Borrowing status: The data regarding the possession of borrowing status in Danakanadoddi-1 micro watershed is presented in Table 25. The results indicate that, 20 per cent of landless, 100 per cent of marginal, 62.50 per cent of small, 10 per cent of semi medium, 50 per cent of medium and 100 per cent of large farmers have borrowed credit from different sources.

Table 25. Borrowing status in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	1	20.00	5	100.00	5	62.50	1	10.00	3	50.00	1	100.00	16	45.71

Table 26. Source of credit availed by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (2)		MF (5)		SF (5)		SMF (7)		MDF (3)		LF (1)		All (23)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Commercial Bank	0	0	0	0	1	20	1	14.29	1	33.33	0	0	3	13.04
2	Cooperative Bank	0	0	1	20	0	0	0	0	0	0	0	0	1	4.35
3	Friends/Relatives	0	0	0	0	0	0	0	0	3	100	0	0	3	13.04
4	Grameena Bank	0	0	3	60	6	120	5	71.43	1	33.33	1	100	16	69.57
5	SHGs/CBOs	0	0	0	0	0	0	1	14.29	0	0	0	0	1	4.35

Source of credit: The data regarding the source of credit availed by households in Danakanadoddi-1 micro watershed is presented in Table 26. The results indicate that, 13.04 per cent have availed loan from commercial, 4.35 per cent have availed loan from cooperative banks, 13.04 per cent of have availed loan from friends and relatives, 4.35 per

cent have availed loan from SHGs/CBOs and 69.57 per cent have availed loan from grameena bank.

Average credit amount: The data regarding the average credit amount availed by households in Danakanadoddi-1 micro watershed is presented in Table 27. The results indicate that, marginal, small, semi medium, medium and large farmers have availed Rs.66000, Rs.93000, Rs.166428, Rs.85000 and Rs.100652 respectively.

Table 27. Average Credit amount availed by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)	SF (5)	SMF (7)	MDF (3)	LF (1)	All (23)
1	Average Credit	66,000	93,000	166,428.57	85,000	100,000	100,652.17

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed from institutional sources by households in Danakanadoddi-1 micro watershed is presented in Table 28. The results indicate that, 95 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production and 5 per cent have borrowed for animal husbandry.

Table 28. Purpose of credit borrowed (institutional Source) by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (4)		SF (7)		SMF (6)		MDF (2)		LF (1)		All (20)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture production	4	100	6	85.71	6	100	2	100	1	100	19	95
2	Animal husbandry	0	0	1	14.29	0	0	0	0	0	0	1	5

Purpose of credit borrowed (Private Credit): The data regarding the purpose of credit borrowed from private sources by households in Danakanadoddi-1 micro watershed is presented in Table 29. The results indicate that, the main purpose of borrowing credit from private sources was agricultural production.

Table 29. Purpose of credit borrowed (Private Credit) by households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (0)		SF (0)		SMF (1)		MDF (3)		LF (0)		All (4)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture production	0	0	0	0	1	100	3	100	0	0	4	100

Repayment status of households (institutional sources): The data regarding the repayment status of credit borrowed from institutional sources by households in Danakanadoddi-1 micro watershed is presented in Table 30. Results indicated that 90 per cent of the households did not repay their loan.

Table 30. Repayment status of households (institutional sources) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (4)		SF (7)		SMF (6)		MDF (2)		LF (1)		All (20)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Partially paid	0	0	0	0	0	0	0	0	0	0	0	0
2	Un paid	3	75	6	85.71	6	100	2	100	1	100	18	90
3	Fully paid	1	25	1	14.29	0	0	0	0	0	0	2	10

Repayment status of households (institutional sources): The data regarding the repayment status of credit borrowed from institutional sources by households in Danakanadoddi-1 micro watershed is presented in Table 31. Results indicated that 75 per cent of the households did not repay their loan and 25 per cent have partially paid their loans.

Table 31. Repayment status of households (institutional sources) in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (0)		MF (0)		SF (0)		SMF (1)		MDF (3)		LF (0)		All (4)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Partially paid	0	0	0	0	0	0	1	100	0	0	0	0	1	25
2	Un paid	0	0	0	0	0	0	0	0	3	100	0	0	3	75

Opinion on institutional sources of credit: The data regarding the opinion on institutional sources of credit in Danakanadoddi-1 micro watershed is presented in Table 32. The results indicate that, around 35 per cent of the households opined that the rate of interest was higher in institutional sources and another 15 per cent of the households opined that the loan helped them to perform timely agricultural operations.

Table 32. Opinion on institutional sources of credit in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (4)		SF (7)		SMF (6)		MDF (2)		LF (1)		All (20)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	2	50	0	0	1	16.67	0	0	0	0	3	15
2	Easy accessibility of credit	0	0	0	0	0	0	0	0	0	0	0	0
3	Higher rate of interest	0	0	2	28.57	3	50	2	100	0	0	7	35

Opinion on non-institutional sources of credit: The data regarding the opinion on institutional sources of credit in Danakanadoddi-1 micro watershed is presented in Table 33. The results indicate that, around 25 per cent of the households opined that the loan amount was adequate to fulfil the requirement

Table 33. Opinion on non-institutional sources of credit in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (0)		SF (0)		SMF (1)		MDF (3)		LF (0)		All (4)	
		N	%	N	%	N	%	N	%	N	%	N	%
2	Loan amount was adequate to fulfil the requirement	0	0	0	0	1	100	0	0	0	0	1	25

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Danakanadoddi-1 micro watershed is presented in Table 34. The results indicate that, the total cost of cultivation for maize was Rs. 23568.38. The gross income realized by the farmers was Rs. 25247.75. The net income from Maize cultivation was Rs. 1679.36, thus the benefit cost ratio was found to be 1:1.07.

Table 34. Cost of Cultivation of maize in Danakanadoddi-1 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	30.47	4807.92	20.40
2	Bullock		Pairs/day	1.28	765.70	3.25
3	Tractor		Hours	2.56	1586.98	6.73
4	Machinery		Hours	0.62	463.13	1.97
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.00	1700.18	7.21
6	Seed Inter Crop		Kgs.	0.31	0.00	0.00
7	FYM		Quintal	13.42	1630.20	6.92
8	Fertilizer + micronutrients		Quintal	2.85	2350.27	9.97
9	Pesticides (PPC)		Kgs / liters	0.85	905.67	3.84
10	Irrigation		Number	2.63	0.00	0.00
13	Depreciation charges			0.00	2385.18	10.12
14	Land revenue and Taxes			0.00	4.67	0.02
II	**Cost B1**					
16	Interest on working capital				790.38	3.35
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17390.27	73.79
III	**Cost B2**					
18	Rental Value of Land				400.00	1.70
19	**Cost B2 = (Cost B1 + Rental value)**				17790.27	75.48
IV	**Cost C1**					
20	Family Human Labour			17.06	3635.36	15.42
21	**Cost C1 = (Cost B2 + Family Labour)**				21425.63	90.91
V	**Cost C2**					
22	Risk Premium				0.17	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				21425.80	90.91
VI	**Cost C3**					
24	Managerial Cost				2142.58	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				23568.38	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		21.34	21693.69	
		b) Main Crop Sales Price (Rs.)			1016.67	
	By Product	e) Main Product (q)		19.04	3554.06	
		f) Main Crop Sales Price (Rs.)			186.67	
b.	Gross Income (Rs.)				25247.75	
c.	Net Income (Rs.)				1679.36	
d.	Cost per Quintal (Rs./q.)				1104.52	
e.	Benefit Cost Ratio (BC Ratio)				1:1.07	

Cost of cultivation of Mango: The data regarding the cost of cultivation of mango in Danakanadoddi-1 micro watershed is presented in Table 35. The results indicate that, the total cost of cultivation for mango was Rs. 63221.62. The gross income realized by the farmers was Rs. 44460. The net income from mango cultivation was Rs. -18761.62. Thus the benefit cost ratio was found to be 1:0.7.

Table 35. Cost of Cultivation of Mango in Danakanadoddi-1 micro watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	22.23	5310.50	8.40
2	Bullock	Pairs/day	1.24	741.00	1.17
3	Tractor	Hours	3.71	2593.50	4.10
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	185.25	27787.50	43.95
6	Seed Inter Crop	Kgs.	0.00	0.00	0.00
7	FYM	Quintal	24.70	2964.00	4.69
8	Fertilizer + micronutrients	Quintal	4.94	4569.50	7.23
9	Pesticides (PPC)	Kgs / ltrs	1.24	1235.00	1.95
10	Irrigation	Number	4.94	0.00	0.00
13	Depreciation charges		0.00	484.12	0.77
14	Land revenue and Taxes		0.00	4.94	0.01
II	**Cost B1**				
16	Interest on working capital			4386.72	6.94
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			50076.78	79.21
III	**Cost B2**				
18	Rental Value of Land			666.67	1.05
19	**Cost B2 = (Cost B1 + Rental value)**			50743.45	80.26
IV	**Cost C1**				
20	Family Human Labour		30.88	6730.75	10.65
21	**Cost C1 = (Cost B2 + Family Labour)**			57474.20	90.91
V	**Cost C2**				
22	Risk Premium			0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**			57474.20	90.91
VI	**Cost C3**				
24	Managerial Cost			5747.42	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			63221.62	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	24.70	44460.00	
		b) Main Crop Sales Price (Rs.)		1800.00	
b.	Gross Income (Rs.)			44460.00	
c.	Net Income (Rs.)			-18761.62	
d.	Cost per Quintal (Rs./q.)			2559.58	
e.	Benefit Cost Ratio (BC Ratio)			1:0.7	

Cost of cultivation of Paddy: The data regarding the cost of cultivation of paddy in Danakanadoddi-1 micro watershed is presented in Table 36. The results indicate that, the total cost of cultivation for paddy was Rs. 24133.01. The gross income realized by the farmers was Rs. 32595.49. The net income from paddy cultivation was Rs. 8462.47. Thus the benefit cost ratio was found to be 1:1.35.

Table 36. Cost of Cultivation of Paddy in Danakanadoddi-1 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	44.20	8028.38	12.05
2	Bullock		Pairs/day	1.76	952.71	1.43
3	Tractor		Hours	3.22	2316.31	3.48
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	80.57	14678.86	22.03
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	106.00	13434.06	20.16
8	Fertilizer + micronutrients		Quintal	7.17	6333.79	9.51
9	Pesticides (PPC)		Kgs /liters	2.41	2481.76	3.72
10	Irrigation		Number	4.73	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	1174.79	1.76
14	Land revenue and Taxes			0.00	4.23	0.01
II	**Cost B1**					
16	Interest on working capital				4431.47	6.65
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				53836.35	80.80
III	**Cost B2**					
18	Rental Value of Land				380.95	0.57
19	**Cost B2 = (Cost B1 + Rental value)**				54217.31	81.37
IV	**Cost C1**					
20	Family Human Labour			29.14	6357.02	9.54
21	**Cost C1 = (Cost B2 + Family Labour)**				60574.32	90.91
V	**Cost C2**					
22	Risk Premium				0.43	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				60574.75	90.91
VI	**Cost C3**					
24	Managerial Cost				6057.48	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				66632.23	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		47.75	80157.38	
		b) Main Crop Sales Price (Rs.)			1678.57	
	By Product	e) Main Product (q)		40.87	10042.99	
		f) Main Crop Sales Price (Rs.)			245.71	
b.	Gross Income (Rs.)				90200.37	
c.	Net Income (Rs.)				23568.14	
d.	Cost per Quintal (Rs./q.)				1395.34	
e.	Benefit Cost Ratio (BC Ratio)				1:1.35	

Cost of cultivation of Groundnut: The data regarding the cost of cultivation of groundnut in Danakanadoddi-1 micro watershed is presented in Table 37. The results indicate that, the total cost of cultivation for groundnut was Rs. 42148.93. The gross income realized by the farmers was Rs. 58198.83. The net income from groundnut cultivation was Rs. 16049.90. Thus the benefit cost ratio was found to be 1:1.38.

Table 37. Cost of Cultivation of Groundnut in Danakanadoddi-1 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	35.17	6075.40	14.41
2	Bullock		Pairs/day	1.56	756.21	1.79
3	Tractor		Hours	2.55	1641.29	3.89
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	113.65	15347.82	36.41
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	16.04	1990.11	4.72
8	Fertilizer + micronutrients		Quintal	3.43	2905.85	6.89
9	Pesticides (PPC)		Kgs / ltrs	1.36	1406.39	3.34
10	Irrigation		Number	3.29	0.00	0.00
13	Depreciation charges			0.00	1831.76	4.35
14	Land revenue and Taxes			0.00	4.63	0.01
II	**Cost B1**					
16	Interest on working capital				2598.05	6.16
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				34557.51	81.99
III	**Cost B2**					
18	Rental Value of Land				508.33	1.21
19	**Cost B2 = (Cost B1 + Rental value)**				35065.84	83.20
IV	**Cost C1**					
20	Family Human Labour			16.26	3251.12	7.71
21	**Cost C1 = (Cost B2 + Family Labour)**				38316.96	90.91
V	**Cost C2**					
22	Risk Premium				0.25	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				38317.21	90.91
VI	**Cost C3**					
24	Managerial Cost				3831.72	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				42148.93	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.91	56274.47	
		b) Main Crop Sales Price (Rs.)			3537.50	
	By Product	e) Main Product (q)		14.39	1924.36	
		f) Main Crop Sales Price (Rs.)			133.75	
b.	Gross Income (Rs.)				58198.83	
c.	Net Income (Rs.)				16049.90	
d.	Cost per Quintal (Rs./q.)				2649.55	
e.	Benefit Cost Ratio (BC Ratio)				1:1.38	

Cost of Cultivation of Ladies finger: The data regarding the cost of cultivation of ladies finger in Danakanadoddi-1 micro watershed is presented in Table 38. The results indicate that, the total cost of cultivation for ladies finger was Rs. 15822.57. The gross income realized by the farmers was Rs. 200070. The net income from ladies finger cultivation was Rs. 184247.43, thus the benefit cost ratio was found to be 1:12.646.

Table 38. Cost of Cultivation of Ladies finger in Danakanadoddi-1 micro watershed

11	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	22.23	4050.80	25.60
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	0.00	0.00	0.00
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.94	2420.60	15.30
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	0.00	0.00	0.00
9	Pesticides (PPC)		Kgs / liters	2.47	2470.00	15.61
10	Irrigation		Number	4.94	0.00	0.00
13	Depreciation charges			0.00	4.94	0.03
14	Land revenue and Taxes			0.00	4.94	0.03
II	**Cost B1**					
16	Interest on working capital				586.87	3.71
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				9538.15	60.28
III	**Cost B2**					
18	Rental Value of Land				400.00	2.53
19	**Cost B2 = (Cost B1 + Rental value)**				9938.15	62.81
IV	**Cost C1**					
20	Family Human Labour			27.17	4446.00	28.10
21	**Cost C1 = (Cost B2 + Family Labour)**				14384.15	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				14384.15	90.91
VI	**Cost C3**					
24	Managerial Cost				1438.42	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				15822.57	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		44.46	200070.00	
		b) Main Crop Sales Price (Rs.)			4500.00	
b.	Gross Income (Rs.)				200070.00	
c.	Net Income (Rs.)				184247.43	
d.	Cost per Quintal (Rs./q.)				355.88	
e.	Benefit Cost Ratio (BC Ratio)				1:12.64	

Cost of Cultivation of Chilly: The data regarding the cost of cultivation of chilly in Danakanadoddi-1 micro watershed is presented in Table 39. The results indicate that, the total cost of cultivation for chilly was Rs. 67264.06. The gross income realized by the farmers was Rs. 49400. The net income from chilly cultivation was Rs. -17864.06. Thus the benefit cost ratio was found to be 1:0.73.

Table 39. Cost of Cultivation of Chilly in Danakanadoddi-1 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	69.16	9583.60	14.25
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	4.94	3458.00	5.14
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12350.00	12350.00	18.36
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	24.70	4940.00	7.34
8	Fertilizer + micronutrients		Quintal	9.88	9509.50	14.14
9	Pesticides (PPC)		Kgs / liters	2.47	2470.00	3.67
10	Irrigation		Number	9.88	0.00	0.00
13	Depreciation charges			0.00	19.76	0.03
14	Land revenue and Taxes			0.00	3.29	0.00
II	**Cost B1**					
16	Interest on working capital				3512.46	5.22
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				45846.61	68.16
III	**Cost B2**					
18	Rental Value of Land				333.33	0.50
19	**Cost B2 = (Cost B1 + Rental value)**				46179.95	68.65
IV	**Cost C1**					
20	Family Human Labour			76.57	14968.20	22.25
21	**Cost C1 = (Cost B2 + Family Labour)**				61148.15	90.91
V	**Cost C2**					
22	Risk Premium				1.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				61149.15	90.91
VI	**Cost C3**					
24	Managerial Cost				6114.91	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				67264.06	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		49.40	49400.00	
		b) Main Crop Sales Price (Rs.)			1000.00	
b.	Gross Income (Rs.)				49400.00	
c.	Net Income (Rs.)				-17864.06	
d.	Cost per Quintal (Rs./q.)				1361.62	
e.	Benefit Cost Ratio (BC Ratio)				1:0.73	

Cost of Cultivation of Tomato: The data regarding the cost of cultivation of tomato in Danakanadoddi-1 micro watershed is presented in Table 40. The results indicate that, the total cost of cultivation for tomato was Rs. 71430.86. The gross income realized by the farmers was Rs. 67925. The net income from tomato cultivation was Rs. -3505.86. Thus the benefit cost ratio was found to be 1:0.95.

Table 40. Cost of Cultivation of Tomato in Danakanadoddi-1 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	79.04	11633.70	16.29
2	Bullock		Pairs/day	2.47	1482.00	2.07
3	Tractor		Hours	4.94	3581.50	5.01
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	11115.00	11115.00	15.56
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	37.05	4940.00	6.92
8	Fertilizer + micronutrients		Quintal	9.88	9571.25	13.40
9	Pesticides (PPC)		Kgs /liters	3.71	3705.00	5.19
10	Irrigation		Number	7.41	0.00	0.00
13	Depreciation charges			0.00	494.00	0.69
14	Land revenue and Taxes			0.00	4.12	0.01
II	**Cost B1**					
16	Interest on working capital				3519.81	4.93
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				50046.38	70.06
III	**Cost B2**					
18	Rental Value of Land				366.67	0.51
19	**Cost B2 = (Cost B1 + Rental value)**				50413.04	70.58
IV	**Cost C1**					
20	Family Human Labour			70.40	14523.60	20.33
21	**Cost C1 = (Cost B2 + Family Labour)**				64936.64	90.91
V	**Cost C2**					
22	Risk Premium				0.50	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				64937.14	90.91
VI	**Cost C3**					
24	Managerial Cost				6493.71	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				71430.86	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		67.93	67925.00	
		b) Main Crop Sales Price (Rs.)			1000.00	
b.	Gross Income (Rs.)				67925.00	
c.	Net Income (Rs.)				-3505.86	
d.	Cost per Quintal (Rs./q.)				1051.61	
e.	Benefit Cost Ratio (BC Ratio)				1:0.95	

Adequacy of fodder: The data regarding the adequacy of fodder in Danakanadoddi-1 micro watershed is presented in Table 41. The results indicate that, 51.43 per cent of the households opined that dry fodder was adequate and 60 per cent of the households opined that green fodder was adequate.

Table 41. Adequacy of fodder in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	3	60	4	50	8	80	3	50	0	0	18	51.43
2	Inadequate-Dry Fodder	0	0	0	0	0	0	0	0	0	0	0	0
3	Adequate-Green Fodder	3	60	4	50	10	100	3	50	1	100	21	60
4	Inadequate-Green Fodder	0	0	0	0	0	0	0	0	0	0	0	0

Average annual gross income: The data regarding the average annual gross income in Danakanadoddi-1 micro watershed is presented in Table 42. The results indicate that the average annual gross income was Rs.120800 for landless farmers, for marginal farmers it was Rs.96510, for small farmers it was Rs.76403, for semi medium farmers it was Rs.120400, for medium farmers it was Rs.79000 and large farmers it was Rs.118000.

Table 42. Average annual gross income in Danakanadoddi-1 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Service/salary	4,000	23,000	0	0	0	0	3,857.14
2	Business	24,000	0	0	15,000	0	0	7,714.29
3	Wage	92,800	33,000	23,750	14,500	10,333.33	15,000	29,742.86
4	Agriculture	0	35,610	48,325	88,125	65,666.67	100,000	55,425.71
5	Dairy Farm	0	4,900	4,328.13	2,775	1,333.33	3,000	2,796.43
6	Goat Farming	0	0	0	0	1,666.67	0	285.71
Income(Rs.)		120,800	96,510	76,403.13	120,400	79,000	118,000	99,822.14

Average annual expenditure: The data regarding the average annual expenditure in Danakanadoddi-1 micro watershed is presented in Table 43. The results indicate that the average annual expenditure is Rs. 11425.24. For landless households it was Rs.15333.33, for marginal farmers it was Rs 15,500, for small farmers it was Rs. 4520.83, for semi medium farmers it was Rs. 13590, for medium farmers it was Rs. 5608.33 and for large farmers it was Rs.40000.

Table 43. Average annual expenditure in Danakanadoddi-1 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Service/salary	5,000	40,000	0	0	0	0	1,285.71
2	Business	70,000	0	0	85,000	0	0	4,428.57
3	Wage	1,666.67	7,500	6,666.67	3,000	1,400	0	3,171.43
4	Agriculture	0	20,000	25,000	42,400	30,000	40,000	26,971.43
5	Dairy Farm	0	10,000	4,500	5,500	1,250	0	1,057.14
6	Goat Farming	0	0	0	0	1,000	0	28.57
Total		76,666.67	77,500	36,166.67	135,900	33,650	40,000	399,883.33
Average		15,333.33	15,500	4,520.83	13,590	5,608.33	40,000	11,425.24

Horticulture species grown: The data regarding horticulture species grown in Danakanadoddi-1 micro watershed is presented in Table 44. The results indicate that, sampled households have grown 19 coconut, and 167 mango trees in their field. Farmers have also grown 3 coconut trees in their backyard.

Table 44. Horticulture species grown in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	2	0	1	1	3	1	2	1	10	0	19	3
2	Mango	0	0	150	0	7	0	10	0	0	0	167	0

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

Forest species grown: The data regarding forest species grown in Danakanadoddi-1 micro watershed is presented in Table 45. The results indicate that, households have planted 115 neem trees, 11 tamarind trees, 3 pongamia trees and 9 banyan trees.

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

Sl.No.	Particulars	MF (9)		SF (9)		SMF (8)		MDF (2)		LF (1)		All (31)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	5	0	0	0	15	0	0	0	0	0	20	0
2	Neem	24	0	16	1	23	0	34	0	10	0	107	1
3	Pongamia	0	0	2	0	1	0	0	0	0	0	3	0

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

Average additional investment capacity: The data regarding average additional investment capacity in Danakanadoddi-1 micro watershed is presented in Table 46. The results indicate that, households have an average investment capacity of Rs. 5628.57 for land development, Rs. 2600 for irrigation facility, Rs. 2514.29 for improved crop production and Rs. 1142.86 for improved livestock management.

Table 46. Average additional investment capacity of households in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)	SF (8)	SMF (10)	MDF (6)	LF (1)	All (35)
1	Land development	0	5,625	5,800	12,333.33	20,000	5,628.57
2	Irrigation facility	0	2,500	3,000	5,833.33	6,000	2,600
3	Improved crop production	0	3,000	2,800	6,000	0	2,514.29
4	Improved livestock management	0	1,250	1,300	2,000	5,000	1,142.86

Source of additional investment: The data regarding source of additional investment in Danakanadoddi-1 micro watershed is presented in Table 47. The results indicate that, loan from bank is the major source of investment for 42.86 per cent of households and soft loan were the source of investment for 2.86 per cent for land development. For irrigation facility 22.86 per cent of the households depend on loan from bank, 17.14 per cent depend on own funds and 2.86 per cent depend on soft loan. For improved crop production 17.14 per cent of the households depend on bank loan, 8.57 per cent depend on own funds, 17.14 per cent depend on soft loans. For improved livestock management 11.43 per cent of households

depend on loan from bank, 17.14 per cent depend on own funds, and 2.86 per cent depend on soft loan.

Table 47. Source of additional investment of households in Danakanadoddi-1 micro watershed

Sl.No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Loan from bank	15	42.86	8	22.86	6	17.14	4	11.43
2	Own funds	0	0.0	6	17.14	3	8.57	6	17.14
3	Soft loan	1	2.86	1	2.86	6	17.14	1	2.86

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Danakanadoddi-1 micro watershed is presented in Table 48. The results indicated that, bajra, chilly, groundnut, ladies finger, mango, paddy, tomato were sold to the extent of 100 per cent. Maize was sold to the extent of 93.38 per cent.

Table 48. Marketing of the agricultural produce in Danakanadoddi-1 micro watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	110	0	110	100	1475
2	Chilly	20	0	20	100	1000
3	Groundnut	159	0	159	100	3537.5
4	Ladies finger (Okra)	18	0	18	100	4500
5	Maize	574	38	536	93.38	11715
6	Mango	20	0	20	100	1800
7	Paddy	327	0	327	100	1678.57
8	Tomato	55	0	55	100	1000

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Danakanadoddi-1 micro watershed is presented in Table 49. The results indicated that, about 74.29 per cent of the households sold their produce to local/village, another 22.86 per cent have sold their produce in cooperative marketing society, and 25.71 per cent have sold in regulated markets.

Table 49. Marketing Channels used for sale of agricultural produce in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	2	40	6	75	6	60	10	166.67	2	200	26	74.29
2	Regulated Market	3	60	1	12.50	5	50	0	0	0	0	9	25.71
3	Cooperative marketing Society	0	0	1	12.50	2	20	5	83.33	0	0	8	22.86

Mode of transport of agricultural produce: The data regarding Mode of transport of agricultural produce in Danakanadoddi-1 micro watershed is presented in Table 50. The

results indicated that 28.57 per cent have used cart, 71.43 per cent have used tractor and 22.86 per cent of the farmers have used truck as a mode of transport.

Table 50. Mode of transport of agricultural produce in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	2	40	1	12.50	2	20	5	83.33	0	0	10	28.57
2	Tractor	3	60	6	75	9	90	5	83.33	2	200	25	71.43
3	Truck	0	0	1	12.50	2	20	5	83.33	0	0	8	22.86

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Danakanadoddi-1 micro watershed is presented in Table 51. The results indicated that, 45.71 per cent of the households have experienced the soil and water erosion problems.

Table 51. Incidence of soil and water erosion problems in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	0	0	4	50	5	50	6	100	1	100	16	45.71

Interest towards soil testing: The data regarding interest shown towards soil testing in Danakanadoddi-1 micro watershed is presented in Table 52. The results indicated that, 85.71 per cent of the households are interested in soil testing.

Table 52. Interest shown towards soil testing in Danakanadoddi-1 micro watershed

Sl.No	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	5	100	8	100	10	100	6	100	1	100	30	85.71

Soil and water conservation practices and structures adopted: The data regarding soil and water conservation practices and structures adopted in Danakanadoddi-1 micro watershed is presented in Table 53. The results indicated that, only 8.57 per cent have adopted field bunding.

Table 53. Soil and water conservation practices and structures adopted in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Field Bunding	2	40.00	1	12.50	0	0.00	0	0.00	0	0.00	3	8.57

Status of soil and water conservation structures: The data regarding Status of soil and water conservation structures in Danakanadoddi-1 micro watershed is presented in Table 54.

The results indicated that 33.33 per cent of the structures were in good condition and 66.67 per cent of the soil conversation structures needed full replacement required.

Table 54. Status of soil and water conservation structures in Danakanadoddi-1 micro watershed

Sl.No	Item	Good		Slightly Damaged		Severely Damaged		Full Replacement Required	
		N	%	N	%	N	%	N	%
1	Field Bunding	1	33.33	0	0.0	0	0.0	2	66.67

Source of drinking water: The data regarding source of drinking water in Danakanadoddi-1 micro watershed is presented in Table 55. The results indicated that, piped supply was the major source of drinking water for 68.57 per cent of the households and bore well was the source of drinking water for 31.43 per cent of the households.

Table 55. Source of drinking water in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100	5	100	5	62.50	7	70	1	16.67	1	100	24	68.57
2	Bore Well	0	0	0	0	3	37.50	3	30	5	83.33	0	0	11	31.43

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Danakanadoddi-1 micro watershed is presented in Table 56. The results indicated that, 85.71 percent used fire wood, and another 17.14 percent of the households used LPG.

Table 56. Usage pattern of fuel for domestic use in Danakanadoddi-1 micro watershed

Sl.No	Particulars	LL(5)		MF(5)		SF (8)		SMF(10)		MDF(6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	2	40	4	80	8	100	9	90	6	100	1	100	30	85.71
2	LPG	3	60	1	20	0	0	2	20	0	0	0	0	6	17.14

Source of light: The data regarding source of light in Danakanadoddi-1 micro watershed is presented in Table 57. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 57. Source of light in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100	5	100	8	100	10	100	6	100	1	100	35	100

Table 58. Existence of Sanitary toilet facility in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF(10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	2	40	1	20	8	100	1	10	3	50	1	100	16	45.71

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Danakanadoddi-1 micro watershed is presented in Table 58. The results indicated that, 45.71 per cent of the households possess sanitary toilet i.e. 40 per cent of landless, 20 per

cent of marginal, 100 per cent of small, 10 per cent of semi medium, 50 per cent of medium farmers and 100 per cent of large farmers had sanitary toilet facility.

Possession of PDS card: The data regarding possession of PDS card in Danakanadoddi-1 micro watershed is presented in Table 59. The results indicated that, 97.14 per cent of the sampled households possessed BPL card, and 2.86 per cent did not possess PDS card.

Table 59. Possession of PDS card in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	BPL	5	100	5	100	8	100	9	90	6	100	1	100	34	97.14
3	Not Possessed	0	0	0	0	0	0	1	10	0	0	0	0	1	2.86

Participation in NREGA program: The data regarding participation in NREGA programme in Danakanadoddi-1 micro watershed is presented in Table 60. The results indicated that, 51.43 per cent of the households participated in NREGA programme.

Table 60. Participation in NREGA programme in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL(5)		MF(5)		SF(8)		SMF(10)		MDF(6)		LF(1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	1	20	5	100	8	100	1	10	2	33.33	1	100	18	51.43

Adequacy of food items: The data regarding adequacy of food items in Danakanadoddi-1 micro watershed is presented in Table 61. The results indicated that, cereals were adequate for 91.43 per cent of the households, pulses were adequate for 88.57 per cent, oilseeds were adequate for 22.86 per cent, vegetables were adequate for 45.71 per cent, fruits were adequate for 34.29 per cent, milk was adequate for 77.14 per cent, eggs were adequate for 82.86 per cent and meat was adequate for 65.71 per cent of the households.

Table 61. Adequacy of food items in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100	5	100	6	75	9	90	6	100	1	100	32	91.43
2	Pulses	5	100	5	100	6	75	8	80	6	100	1	100	31	88.57
3	Oilseed	0	0	1	20	2	25	2	20	3	50	0	0	8	22.86
4	Vegetables	1	20	3	60	3	37.50	5	50	3	50	1	100	16	45.71
5	Fruits	0	0	2	40	3	37.50	5	50	2	33.33	0	0	12	34.29
6	Milk	4	80	4	80	4	50	9	90	6	100	0	0	27	77.14
7	Egg	5	100	4	80	4	50	9	90	6	100	1	100	29	82.86
8	Meat	2	40	2	40	5	62.50	7	70	6	100	1	100	23	65.71

Response on Inadequacy of food items: The data regarding inadequacy of food items in Danakanadoddi-1 micro watershed is presented in Table 62. The results indicated that, oilseeds were inadequate for 68.57 per cent, vegetables were inadequate for 40 per cent, fruits were inadequate for 48.57 per cent, milk were inadequate for 11.43 per cent, eggs were inadequate for 8.57 per cent and meat was inadequate for 22.86 per cent of the households.

Table 62. Response on Inadequacy of food items in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	LL (5)		MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	5	100	4	80	5	62.50	6	60	3	50	1	100	24	68.57
2	Vegetables	4	80	2	40	3	37.50	3	30	2	33.33	0	0	14	40
3	Fruits	5	100	3	60	2	25	3	30	3	50	1	100	17	48.57
4	Milk	1	20	1	20	2	25	0	0	0	0	0	0	4	11.43
5	Egg	0	0	1	20	2	25	0	0	0	0	0	0	3	8.57
6	Meat	3	60	3	60	1	12.50	1	10	0	0	0	0	8	22.86

Response on market surplus of food items: The data regarding market surplus of food items in Danakanadoddi-1 micro watershed is presented in Table 63. The results indicated that, vegetables were market surplus for 2.86 per cent, and fruits were market surplus for 5.71 per cent of the households.

Table 63. Response on Market surplus of food items in Danakanadoddi-1 micro watershed

Sl.No.	Particulars	MF (5)		SF (8)		SMF (10)		MDF (6)		LF (1)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Vegetables	0	0.00	0	0.00	0	0.00	1	16.67	0	0.00	1	2.86
2	Fruits	0	0.00	1	12.50	0	0.00	1	16.67	0	0.00	2	5.71

Farming constraints: The data regarding farming constraints experienced by households in Danakanadoddi-1 micro watershed is presented in Table 64. The results indicated that, lower fertility status of the soil was the constraint experienced by 82.86 per cent of the households, wild animal menace on farm field (82.86%), frequent incidence of pest and diseases (62.86%), inadequacy of irrigation water (34.29%), high cost of fertilizers and plant protection chemicals (60%), high rate of interest on credit (62.86%), low price for the agricultural commodities (68.57%), lack of marketing facilities in the area (74.29%), lack of transport for safe transport of the agricultural produce to the market (57.14%), less rainfall (2.86%) and inadequate extension services (51.43%).

Table 64. Farming constraints Experienced in Danakanadoddi-1 micro watershed

Sl. No.	Particulars	MF(5)		SF(8)		SMF(10)		MDF(6)		LF(1)		All(35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	5	100	7	87.50	10	100	6	100	1	100	29	82.86
2	Wild animal menace on farm field	5	100	7	87.50	10	100	6	100	1	100	29	82.86
3	Frequent incidence of pest and diseases	5	100	5	62.50	7	70	4	66.67	1	100	22	62.86
4	Inadequacy of irrigation water	4	80	3	37.50	3	30	2	33.33	0	0	12	34.29
5	High cost of Fertilizers and plant protection chemicals	4	80	5	62.50	8	80	3	50	1	100	21	60
6	High rate of interest on credit	5	100	5	62.50	7	70	4	66.67	1	100	22	62.86
7	Low price for the agricultural commodities	4	80	4	50	10	100	5	83.33	1	100	24	68.57
8	Lack of marketing facilities in the area	4	80	6	75	8	80	7	116.67	1	100	26	74.29
9	Inadequate extension services	4	80	4	50	6	60	3	50	1	100	18	51.43
10	Lack of transport for safe transport of the Agril produce to the market.	5	100	3	37.50	6	60	5	83.33	1	100	20	57.14
11	Less rainfall	0	0	1	12.50	0	0	0	0	0	0	1	2.86

Chapter 5

SUMMARY

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

The data indicated that there were 104 (57.14%) men and 78 (42.86%) were women among the sampled households. The average family size of landless farmers was 3.8, marginal farmers' was 3.6, small farmers' was 5.75, semi medium farmers' was 6, medium farmers' was 5.17 and large farmers' was 8. The data indicated that, 28 (15.38%) people were in 0-15 years of age, 90 (49.45%) were in 16-35 years of age, 51 (28.02%) were in 36-60 years of age and 13 (7.14 %) were above 61 years of age.

The results indicated that Danakanadoddi-1 had 32.42 per cent illiterates, 0.55 per cent functional literates, 28.02 per cent of them had primary school education, 10.44 per cent of them had middle school education, 12.09 per cent of them had high school education, 6.59 per cent of them had PUC education, 1.10 per cent of them did diploma, 5.49 per cent of them had degree education and 3 persons were doing masters. The results indicate that, 65.71 per cent of households practicing agriculture, 20 per cent of the households were agricultural laborers, 5.71 per cent were general laborers, 2.86 per cent were housewives and 5.71 per cent of the household heads were involved in other occupation.

The results indicate that agriculture was the major occupation for 44.51 per cent of the household members, 18.68 per cent were agricultural labourers, 3.85 per cent were general laborers, 22.53 per cent of them were student, 4.40 per cent of them were housewife, 1.10 per cent of them were in private services, 1.10 per cent government service and 1.10 per cent were involved in trade and business. The results show that 0.55 per cent of the households participated in self help group and 99.45 per cent of them have not participated in any local institutions.

The results indicate that 17.14 per cent of the households possess thatched house, 42.86 per cent of the households possess Katcha house, 40 per cent of them possess pucca house. The results shows that 97.14 per cent of the households possess TV, 88.57 per cent of the households possess Mixer grinder, 31.43 per cent of the households possess bicycle, 62.86 per cent of the households possess motor cycle, 2.86 per cent of the households possess tempo, 2.86 per cent of the households possess auto, and 97.14 per cent of the households possess mobile phones. The results shows that the average value of television was Rs.5617, mixer grinder was Rs.1629, motor cycle was Rs.29000, mobile phone was Rs.1147, Auto was Rs.50000, tempo was Rs.100000, mobile phone was Rs.1147 and bicycle was Rs.1545.

About 34.29 per cent of the households possess bullock cart, 40 per cent of them possess plough, 14.29 per cent of them possess tractor, 20 per cent of them posses sprayer, 20 per cent of them possess chaff cutter and 94.29 per cent of them possess weeder. The results show that the average value of plough was Rs.892, the average value of tractor was Rs. 420000 and the average value of sprayer was Rs.4000, the average value of bullock cart Rs.19416, and the average value of weeder Rs.56.

The results indicate that, 48.57 per cent of the households possess bullocks, 45.71 per cent of the households possess local cow, 8.57 per cent of the households possess local cow and buffalo, 11.43 per cent of the households possess poultry birds.

The results indicate that, average own labour men available in the micro watershed was 2.10, average own labour (women) available was 1.50, average hired labour (men) available was 10.13 and average hired labour (women) available was 8.70. In case of marginal farmers, average own labour men available was 1.40, average own labour (women) was 1.20, average hired labour (men) was 9.40 and average hired labour (women) available was 6.20. In case of small farmers, average own labour men available was 1.88, average own labour (women) was 1.63, average hired labour (men) was 10.63 and average hired labour (women) available was 10. In case of semi medium farmers, average own labour men available was 2.60, average own labour (women) was 1.70, average hired labour (men) was 12.20 and average hired labour (women) available was 10.30. In case of medium farmers, average own labour men available was 1.50, average own labour (women) was 1.33, average hired labour (men) was 7.50 and average hired labour (women) available was 7. In case of large farmers, average own labour men available was 6, average own labour (women) was 1, average hired labour (men) was 10.13 and average hired labour (women) available was 8.70.

The results indicate that, 85.71 per cent of the household opined that hired labour was adequate. About 100 per cent of the marginal farmers, 100 per cent of small, 100 per cent of semi medium, 100 per cent of medium and large farmers have opined that hired labour was adequate. The results indicate that, households of the Danakanadoddi-1 micro watershed possess 22.29 ha (38.40%) of dry land and 35.76 ha (61.60%) of irrigated land. Marginal farmers possess 4.37 ha (100%) of dry land. Small farmers possess 8.20 ha (76.02%) of dry land and 2.59 ha (23.98%) of irrigated land. Semi medium possess 6.07 ha (38.95%) of dry land and 9.51 ha (61.05%) of irrigated land. Medium farmers possess 19.21 ha (100%) of irrigated land, large farmers possess 3.64 ha 45%) of dry land and 4.45 ha (55%) of irrigated land.

The results indicate that, the average value of dry land was Rs. 339,989.27 and average value of irrigated was Rs.509,201. In case of marginal famers, the average land value was Rs. 1,321,586 for dry land and Rs. 1,729,000. In case of small famers, the average land value was Rs. 364,000 for dry land and Rs. 864,500. In case of semi medium famers, the average land value was Rs. 267,027 for dry land and Rs. 473,698 for irrigated land. In case of

medium famers, the average land value was Rs. 153,552 for dry land and Rs. 384,320 for irrigated land.

The results indicate that, there were 17 functioning and 4 de-functioning bore wells in the micro watershed. Bore well was the major irrigation source in the micro water shed for 48.57 per cent of the farmers. The depth of bore well was found to be 47.46 meters. The results indicate that, marginal farmers had irrigated area of 1.21 hectares, small farmers had 1.62 hectares, semi medium farmers had 10.81 hectares and medium farmers had 12.15 hectares.

The results indicate that, farmers have grown Bajra (6.88 ha), chilly (0.40 ha), groundnut (10.57 ha), ladies finger (0.81 ha), maize (25.13 ha), mango (0.81 ha), paddy (5.75 ha) and tomato (1.21 ha). Marginal farmers have grown groundnut and maize. Small farmers have grown bajra, groundnut, maize and mango. Semi medium farmers have grown bajra, groundnut, maize and paddy. Medium farmers have grown bajra, chilly, ladies finger, maize, paddy, tomato and bajra. Large farmers have grown groundnut and maize. The cropping intensity in Danakanadoddi-1 micro watershed was found to be 54.50 per cent. In case of marginal farmers it was 100 per cent, for small farmers it was 100 per cent, in case of semi medium farmers it was 93.66 per cent, medium farmers had cropping intensity of 28.38 per cent and for large farmers it was 45.45 per cent.

The results indicate that, 94.29 per cent of the households possess bank account and 48.57 per cent of the households possess savings. The results indicate that, 20 per cent of landless, 100 per cent of marginal, 62.50 per cent of small, 10 per cent of semi medium, 50 per cent of medium and 100 per cent of large farmers have borrowed credit from different sources. The results indicate that, 13.04 per cent have availed loan from commercial, 4.35 per cent have availed loan from cooperative banks, 13.04 per cent of have availed loan from friends and relatives, 4.35 per cent have availed loan from SHGs/CBOs and 69.57 per cent have availed loan from grameena bank.

The results indicate that, marginal, small, semi medium, medium and large farmers have availed Rs.66000, Rs.93000, Rs.166428, Rs.85000 and Rs.100652 respectively. The results indicate that, 95 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production and 5 per cent have borrowed for animal husbandry. The results indicate that, the main purpose of borrowing credit from private sources was agricultural production.

The results indicate that, the total cost of cultivation for maize was Rs. 23568.38. The gross income realized by the farmers was Rs. 25247.75. The net income from Maize cultivation was Rs. 1679.36, thus the benefit cost ratio was found to be 1:1.07. The total cost of cultivation for mango was Rs. 63221.62. The gross income realized by the farmers was Rs. 44460. The net income from mango cultivation was Rs. -18761.62. Thus the benefit cost ratio was found to be 1:0.7. The total cost of cultivation for paddy was Rs. 24133.01. The gross

income realized by the farmers was Rs. 32595.49. The net income from paddy cultivation was Rs. 8462.47. Thus the benefit cost ratio was found to be 1:1.35. The total cost of cultivation for groundnut was Rs. 42148.93. The gross income realized by the farmers was Rs. 58198.83. The net income from groundnut cultivation was Rs. 16049.90. Thus the benefit cost ratio was found to be 1:1.38. The total cost of cultivation for ladies finger was Rs. 15822.57. The gross income realized by the farmers was Rs. 200070. The net income from ladies finger cultivation was Rs. 184247.43, thus the benefit cost ratio was found to be 1:12.646. The total cost of cultivation for chilly was Rs. 67264.06. The gross income realized by the farmers was Rs. 49400. The net income from chilly cultivation was Rs. -17864.06. Thus the benefit cost ratio was found to be 1:0.73. The total cost of cultivation for tomato was Rs. 71430.86. The gross income realized by the farmers was Rs. 67925. The net income from tomato cultivation was Rs. -3505.86. Thus the benefit cost ratio was found to be 1:0.95.

The results indicate that, 51.43 per cent of the households opined that dry fodder was adequate and 60 per cent of the households opined that green fodder was adequate. The results indicate that the average annual gross income was Rs.120800 for landless farmers, for marginal farmers it was Rs.96510, for small farmers it was Rs.76403, for semi medium farmers it was Rs.120400, for medium farmers it was Rs.79000 and large farmers it was Rs.118000. The results indicate that the average annual expenditure is Rs. 11425.24. For landless households it was Rs.15333.33, for marginal farmers it was Rs 15,500, for small farmers it was Rs. 4520.83, for semi medium farmers it was Rs. 13590, for medium farmers it was Rs. 5608.33 and for large farmers it was Rs.40000.

The results indicate that, sampled households have grown 19 coconut, and 167 mango trees in their field. Farmers have also grown 3 coconut trees in their backyard. Households have planted 115 neem trees, 11 tamarind trees, 3 pongamia trees and 9 banyan trees.

The results indicate that, households have an average investment capacity of Rs. 5628.57 for land development, Rs. 2600 for irrigation facility, Rs. 2514.29 for improved crop production and Rs. 1142.86 for improved livestock management. The results indicate that, loan from bank is the major source of investment for 42.86 per cent of households and soft loan were the source of investment for 2.86 per cent for land development. For irrigation facility 22.86 per cent of the households depend on loan from bank, 17.14 per cent depend on own funds and 2.86 per cent depend on soft loan. For improved crop production 17.14 per cent of the households depend on bank loan, 8.57 per cent depend on own funds, 17.14 per cent depend on soft loans. For improved livestock management 11.43 per cent of households depend on loan from bank, 17.14 per cent depend on own funds, and 2.86 per cent depend on soft loan.

The results indicated that, bajra, chilly, groundnut, ladies finger, mango, paddy, tomato were sold to the extent of 100 per cent. Maize was sold to the extent of 93.38 per cent. The results indicated that, about 74.29 per cent of the households sold their produce to local/village, another 22.86 per cent have sold their produce in cooperative marketing society,

and 25.71 per cent have sold in regulated markets. The results indicated that 28.57 per cent have used cart, 71.43 per cent have used tractor and 22.86 per cent of the farmers have used truck as a mode of transport.

The results indicated that, 45.71 per cent of the households have experienced the soil and water erosion problems. 85.71 per cent of the households are interested in soil testing. The results indicated that, only 8.57 per cent have adopted field bunding. The results indicated that 33.33 per cent of the structures were in good condition and 66.67 per cent of the soil conversation structures needed full replacement required.

The results indicated that, piped supply was the major source of drinking water for 68.57 per cent of the households and bore well was the source of drinking water for 31.43 per cent of the households. The results indicated that, 85.71 percent used fire wood, and another 17.14 percent of the households used LPG. Electricity was the major source of light for 100 per cent of the households in micro watershed.

The results indicated that, 45.71 per cent of the households possess sanitary toilet i.e. 40 per cent of landless, 20 per cent of marginal, 100 per cent of small, 10 per cent of semi medium, 50 per cent of medium farmers and 100 per cent of large farmers had sanitary toilet facility. The results indicated that, 97.14 per cent of the sampled households possessed BPL card, and 2.86 per cent did not possess PDS card. The results indicated that, 51.43 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 91.43 per cent of the households, pulses were adequate for 88.57 per cent, oilseeds were adequate for 22.86 per cent, vegetables were adequate for 45.71 per cent, fruits were adequate for 34.29 per cent, milk was adequate for 77.14 per cent, eggs were adequate for 82.86 per cent and meat was adequate for 65.71 per cent of the households. Oilseeds were inadequate for 68.57 per cent, vegetables were inadequate for 40 per cent, fruits were inadequate for 48.57 per cent, milk were inadequate for 11.43 per cent, eggs were inadequate for 8.57 per cent and meat was inadequate for 22.86 per cent of the households. The results indicated that, vegetables were market surplus for 2.86 per cent, and fruits were market surplus for 5.71 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 82.86 per cent of the households, wild animal menace on farm field (82.86%), frequent incidence of pest and diseases (62.86%), inadequacy of irrigation water (34.29%), high cost of fertilizers and plant protection chemicals (60%), high rate of interest on credit (62.86%), low price for the agricultural commodities (68.57%), lack of marketing facilities in the area (74.29%), lack of transport for safe transport of the agricultural produce to the market (57.14%), less rainfall (2.86%) and inadequate extension services (51.43%).