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

DHARJAMGA-1 (4D5B7G1c) MICROWATERSHED

Gulbarga Taluk, Gulbarga District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

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

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

Nagpur
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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

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

The present study covers an area of 830 ha in Dharjamga-1 microwatershed in Gulbarga taluk of Gulbarga district, Karnataka. The climate is semiarid and categorized as drought-prone with an average annual rainfall of 740 mm, of which about 540 mm is received during south–west monsoon, 126 mm during north-east and the remaining 74 mm during the rest of the year. An area of about 97 per cent is covered by soils, three per cent by waterbodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 9 soil series and 22 soil phases (management units) and 5 land use classes.*
- *The length of crop growing period is about 120-150 days starting from the 3rd week of May to 1rd week of October.*
- *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 major agricultural and horticultural crops was assessed and maps showing degree of suitability along with constraints were generated.*
- *About 87 per cent area is suitable for agriculture and 13 per cent is not suitable for agriculture but well suited for forestry, pasture, agro-forestry, silvi-pasture, recreation, installation of wind mills and as habitat for wildlife.*
- *About 13 per cent of the soils are moderately deep to deep (75-150 cm), 66 per cent are shallow to moderately shallow (25-75 cm) and about 20 per cent are very shallow (<25 cm) soils.*
- *About 97 per cent of the area has clayey soils at the surface.*
- *About 30 per cent of the area has non-gravelly soils, 66 per cent gravelly to very gravelly soils (15-60 % gravel) and 1 per cent of the area has extremely gravelly soils.*
- *About 3 per cent area is very high (>200mm/m) in available water capacity, 41 per cent medium (100-150 mm/m) and about 53 per cent low (51-100 mm/m) and very low (<50 mm/m).*

- *About 78 per cent of the area has very gently sloping (1-3%) lands, about 9 per cent gently (3-5%) sloping lands and 10 per cent moderately sloping (5-10%) lands.*
- *An area of about 6 per cent slightly eroded (e1), 67 per cent moderately eroded (e2) and 24 per cent severely eroded (e3).*
- *An area of about 29 per cent has soils that are slightly alkaline (pH 7.3 to 7.8), about 36 per cent moderately alkaline (pH 7.8-8.4) and 32 per cent area is neutral (pH 6.5-7.3) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 6 per cent medium (0.5-0.75%) and 91 per cent high (>0.75%) in organic carbon.*
- *An area of 8 per cent has soils that are low (<23 kg/ha) and 89 per cent medium (23-57 kg/ha) in available phosphorus.*
- *About 77 per cent medium (145-337 kg/ha), 20 per cent high (>337 kg/ha) and about 1 per cent low (<145 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in about 42 per cent area, medium (10-20 ppm) in 51 per cent and 4 per cent high (>20 ppm).*
- *Available boron is low (<0.5 ppm) in about 39 per cent area, 59 per cent medium (0.5-1.0 ppm).*
- *About 4 per cent area has soils that are deficient (<4.5 ppm) in available iron and 93 per cent sufficient (>4.5 ppm).*
- *Available manganese and copper are sufficient in all the soils.*
- *About 56 per cent deficient (<0.6 ppm) in available zinc and 41 per cent sufficient (>0.6 ppm).*
- *The land suitability for 19 major crops grown in the microwatershed was assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, 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	94 (11)	267 (32)		Guava	-	-
Maize	-	-		Jackfruit	-	-
Red gram	-	361 (43)		Jamun	-	23(3)
Sunflower	23 (3)	71 (9)		Musambi	23 (3)	71(9)
Cotton	23 (3)	338 (41)		Lime	23 (3)	71(9)
Sugarcane	-	-		Cashew	-	-
Soybean	76(9)	285 (34)		Custard apple	94 (11)	267(32)
Bengalgram	361(43)	282 (34)		Amla	94 (11)	267(32)
Mango	-	-		Tamarind	-	23 (3)
Sapota	-	-				

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 5 identified LUCs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fibre and horticulture crops that helps sustained production and also in maintaining the ecological balance in microwatershed

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

Chapter 1

INTRODUCTION

Soil being a vital natural resource on whose proper use depends the life supporting systems of a country and the socioeconomic development of its people. Soils provide food, fodder, fibre and fuel for meeting the basic human and animal needs. With the ever increasing growth in human and animal population, the demand on soil for more food and fodder production is on the increase. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agroclimatic setting, and, use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. The soils have been degrading at an estimated rate of one million hectares per year and ground water levels have been receding at an alarming rate resulting in decline in the ground water resource. 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 (>3.5 lakh ha) in the irrigated areas of the State. Nutrient depletion and declining factor productivity is common in both rainfed and irrigated areas. The degradation is continuing at an alarming rate and there appears to be no systematic effort among the stakeholders to contain this process. In recent times, an aberration of weather due to climate change phenomenon has added another dimension leading to unpredictable situations to be tackled by the farmers.

In this critical juncture, the challenge before us is not only to increase the productivity per unit area which is steadily declining and showing a fatigue syndrome, but also to prevent or at least reduce the severity of degradation. If the situation is not reversed at the earliest, then the sustainability of the already fragile crop production system and the overall ecosystem will be badly affected in the state. Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and use potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis.

The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate detailed site-

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

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

The land resource inventory aims to provide site specific database for Dharjamga-1 microwatershed in Gulbarga Taluk, Gulbarga 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.

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 study area of Dharjamga-1 microwatershed (Sonath subwatershed) is located in the northern part of Karnataka in Gulbarga Taluk, Gulbarga District, Karnataka State (Fig.2.1). It comprises parts of Dongargaon, Kinhi, Bhimnalli, Sonath, Wahali and Gobbarwadi villages. It lies between 17^0 37' and 17^0 39' north latitude and between 77^0 3' and 77^0 5' east longitudes and covers an area of 830 ha. It is about 50 km from Gulbarga and is surrounded by Dongargaon on west, Kinhi on northwest, Bhimnalli on southwest, Sonath on southeast, Wahali on east and Gobbarwadi village on northeast side.

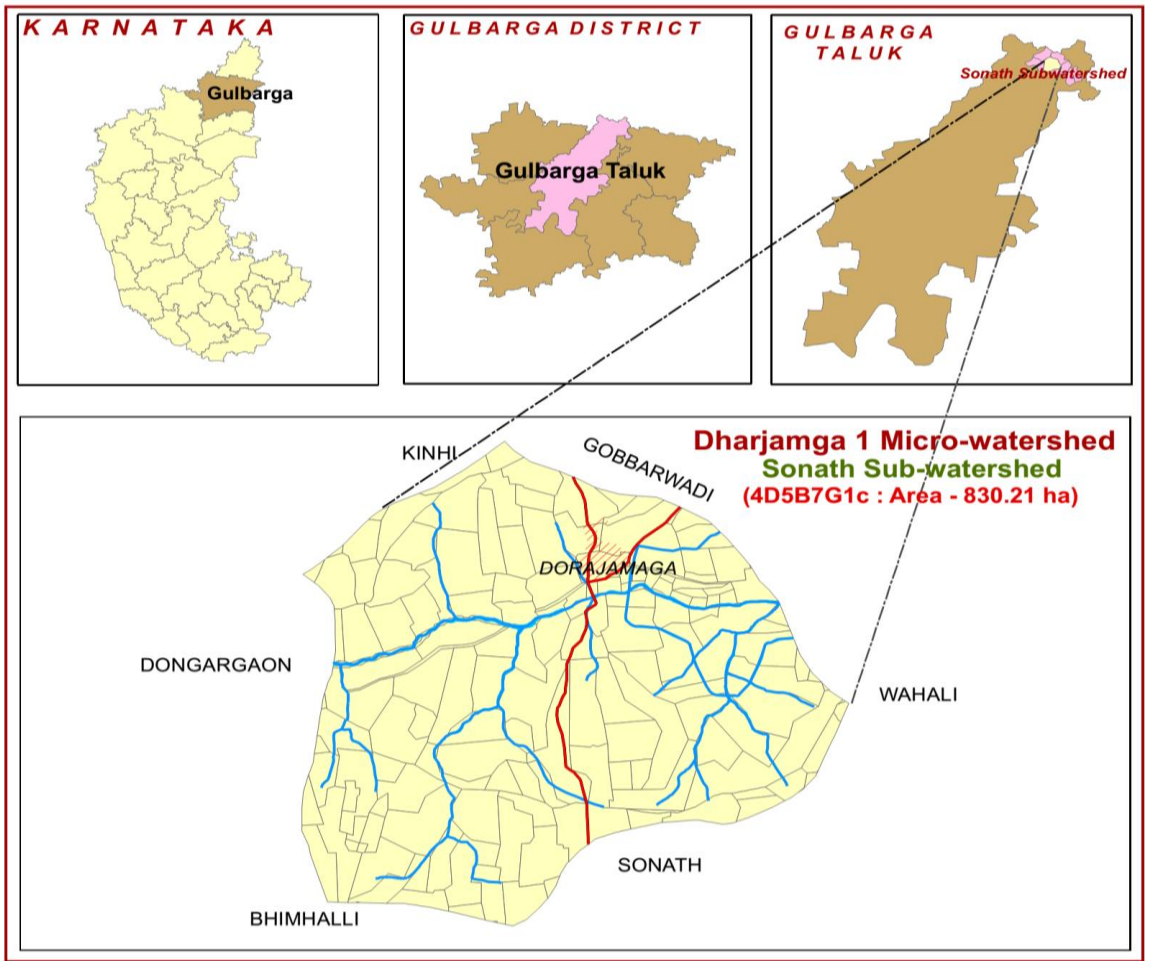


Fig.2.1 Location map of Dharjamga-1 Microwatershed

2.2 Geology

Major rock formation observed in the microwatershed are Basalt (Fig.2.2) or Deccan Trap and Laterites. The Deccan Traps cover the whole of Bidar, parts of Gulbarga, Bijapur and Belgaum districts. In all, eight lava flows have been identified in Karnataka horizontally overlying the older formations. The thickness of the individual flows averages about five meters. It is relatively uniform in petrographic character. The most

common type is augite basalt. Dominant colour is grayish green and texture ranges from cryptocrystalline to glassy. The rock is often vesicular and scoriaceous filled up with secondary minerals like coloured agate, quartz, calcite and a large variety of zeolites. The Deccan Traps form an excellent building material and also used as road-metal and railway ballast.

Fig. 2.2 Basalt rocks

2.3 Physiography

Physiographically, the area has been identified as basalt and laterite landscapes based on geology. The area has been further subdivided into four landforms, viz; mounds/ridges, summits, side slopes and very gently sloping uplands based on slope and its relief features. The elevation ranges from 566 to 639 m. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

The area is drained by several small parallel streams that join Monia nala which further downstream joins Awarja river along its course. Though, it is not a perennial one, during rainy season it carries large quantities of rain water. The microwatershed has only few small tanks which are not capable of storing the water that flows during the rainy season. Due to this, the ground water recharge is very much affected. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing new 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 parallel to sub parallel and dendritic.

2.5 Climate

The Gulbarga district lies in the northern plains of Karnataka and falls under semiarid tract of the state and is categorized as drought -prone with average annual rainfall of 740 mm (Table 2.1). Of the total rainfall, maximum of 540 mm is received during the south–west monsoon period from June to September, the north-east monsoon from October to early December contributes about 126 mm, and the remaining 74 mm during the rest of the year. December is the coldest month with mean daily maximum and minimum temperatures being 29.5^{0}C and 15^0 to 10^{0}C respectively. During peak summer, temperatures shoot up to 45^{0}C. Relative humidity varies from 26 per cent in summer to 62 per cent in winter. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo-Transpiration (PET) is 159 mm and varies from a low of 115 mm in December to 232 mm in the month of May. The PET is always higher than precipitation in all the months except August and September. Generally, the Length of crop Growing Period (LGP) is 120-150 days and starts from 3rd week of May to first week of October.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET at Gulbarga Taluk

Sl.No.	Months	Rainfall	PET	1/2 PET
1	January	5.7	126.8	63.40
2	February	3.6	143.9	71.95
3	March	13.2	189.9	94.95
4	April	17.4	209.8	104.9
5	May	33.6	232.2	116.1
6	June	90.4	186.4	93.2
7	July	138.0	152.8	76.4
8	August	150.4	147.6	73.8
9	September	161.2	131.7	65.85
10	October	102.8	145.5	72.75
11	November	18.7	129.8	64.9
12	December	4.4	114.8	57.4
Total		**740**	**159.2**	

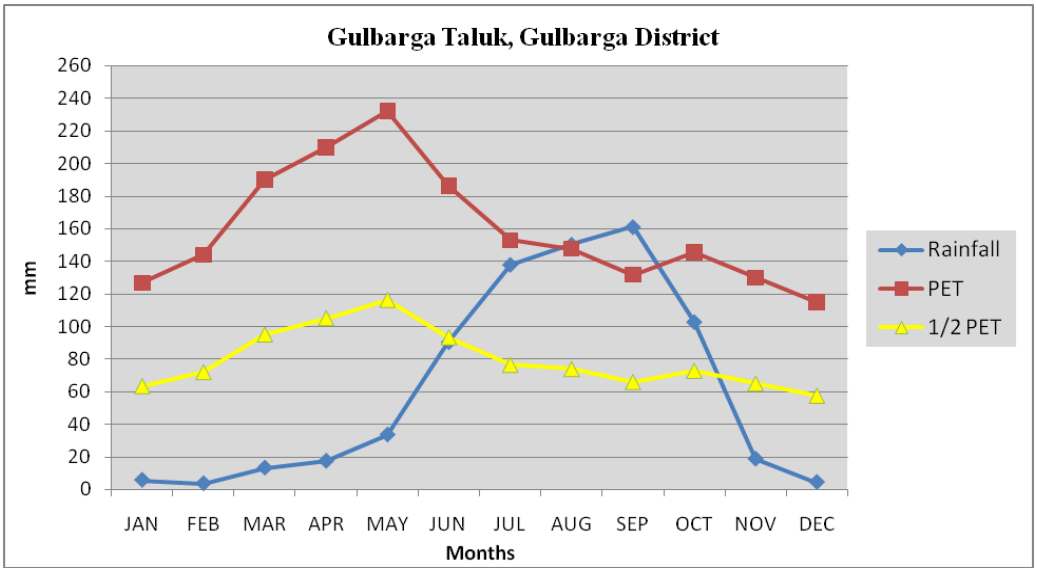


Fig 2.3 Rainfall distribution in Gulbarga Taluk

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy very sizeable area which is 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 that eventually result in the heavy siltation of tanks and reservoirs in the microwatershed.

Fig. 2.4 Natural Vegetation (Scrub) of Dharjamga-1 Microwatershed

2.7 Land Utilization

About 77 per cent area (Table 2.2) in Gulbarga taluk is cultivated at present. An area of about 2 per cent is permanently under pasture, 11 per cent under current fallows and 5 per cent under nonagricultural land and 2 per cent under currently barren. Forests occupy an area of about 2 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, sugarcane, red gram and sapota. 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 Dharjamga-1 microwatershed is presented in Fig.2.5. Simultaneously, enumeration of wells (bore wells

and open wells) in the microwatershed was made and their location in different survey numbers is located on the cadastral map. Map showing the location of wells and other water bodies in the Dharjamga-1 microwatershed is given in Fig.2.6.

Table 2.2 Land Utilization in Gulbarga Taluk

Sl. No.	Agricultural land use	Area (ha)	Per cent
1.	Total geographical area	173165	
2.	Total cultivated area	132954	76.77
3.	Area sown more than once	2510	1.44
4.	Trees and grooves	67	0.038
5.	Forest	4121	2.37
6.	Cultivable wasteland	78	0.045
7.	Permanent Pasture land	4322	2.49
8.	Barren land	4223	2.43
9.	Non- Agriculture land	8150	4.70
10.	Current Fallows	18760	10.8

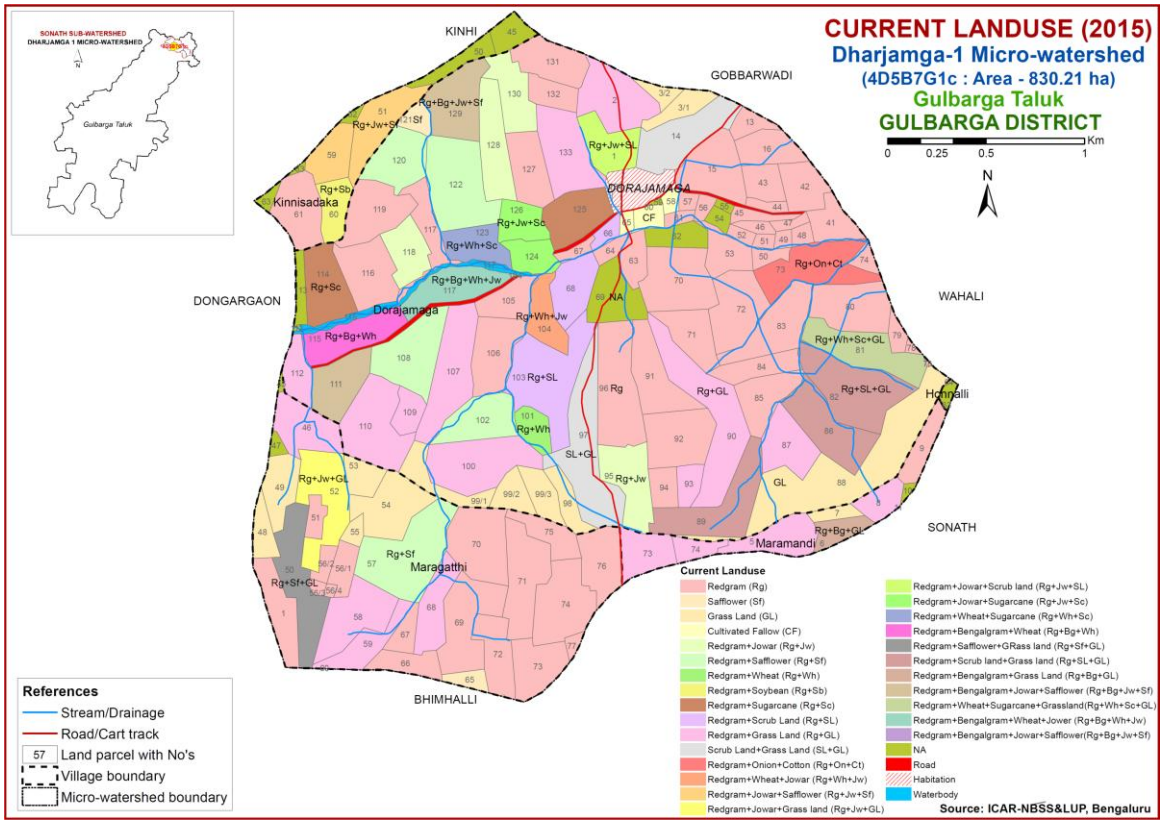


Fig.2.5 Current Land Use map of Dharjamga-1 Microwatershed

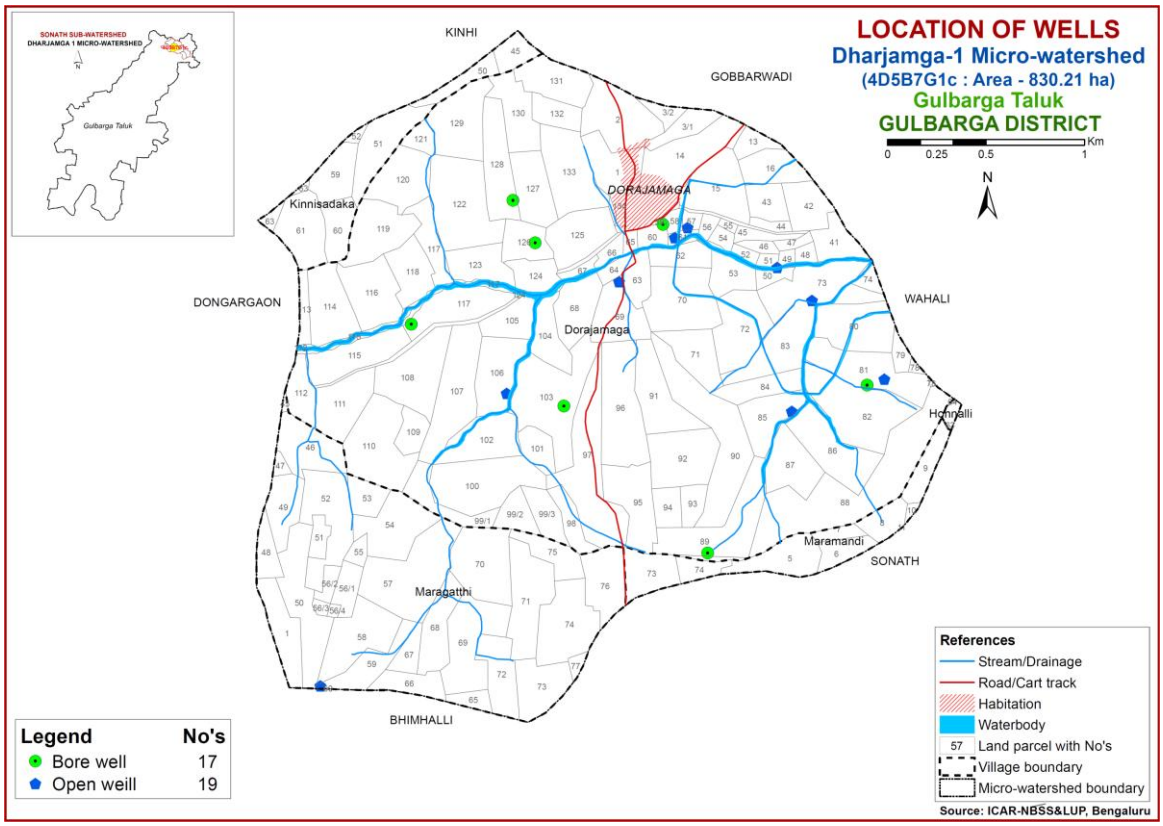


Fig.2.6 Location of Wells in Dharjamga-1 Microwatershed

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 to a given level of management. This was achieved in Dharjamga-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 of the land, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing their area extent and geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in 830 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 as a base. 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 rock types, the 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 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 (FCCs) of Cartosat-I and LISS-IV merged satellite data covering 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 basalt and laterite landscapes. It was identified into three landforms, *viz;* ridges and mounds, uplands and lowlands based on slope and image characteristics. They were further subdivided into physiographic/image interpretation units based on image characteristics.

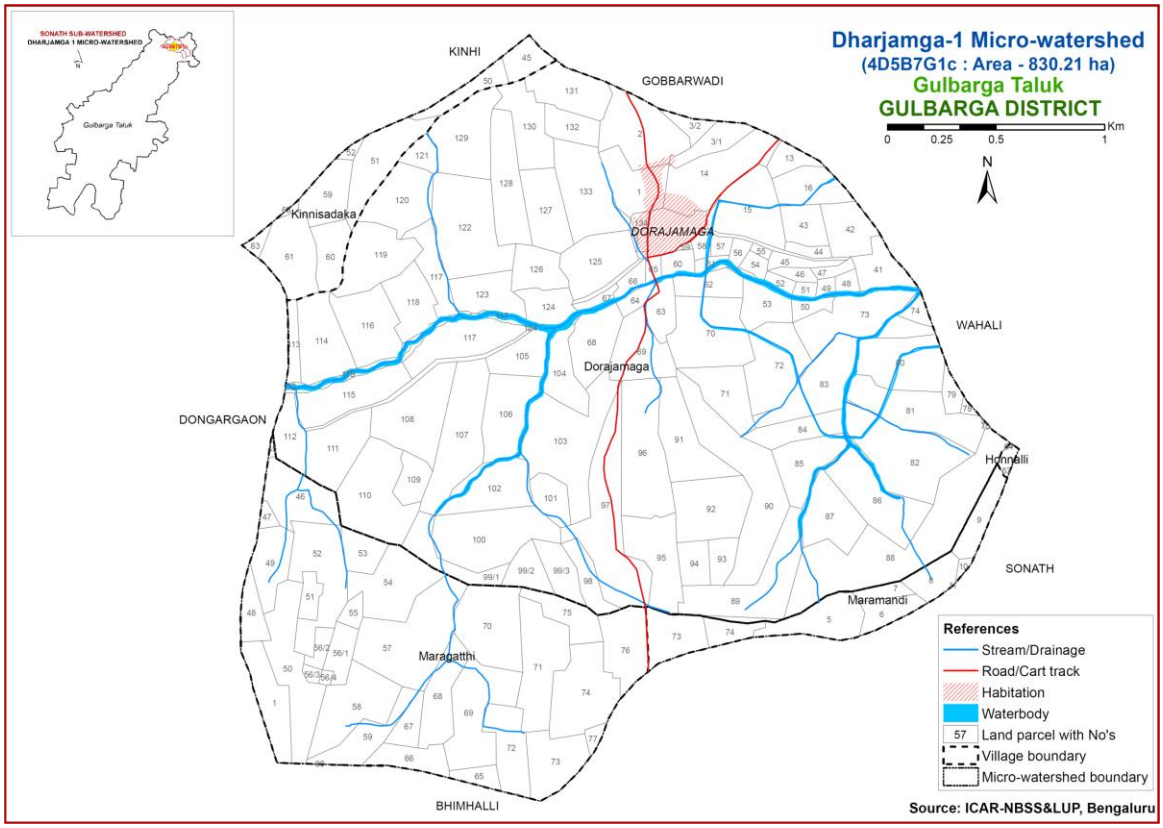


Fig 3.1 Scanned and Digitized Cadastral map of Dharjamga-1 Microwatershed

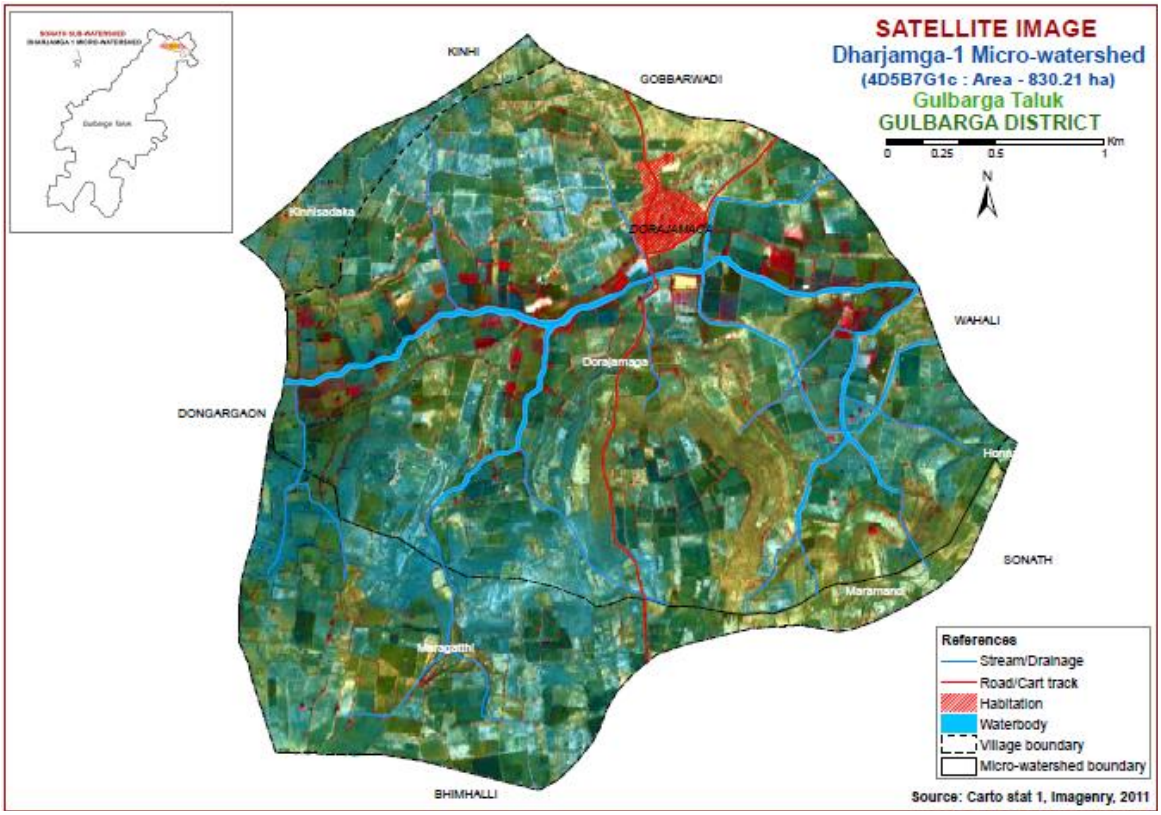


Fig.3.2 Satellite Image of Dharjamga-1 Microwatershed

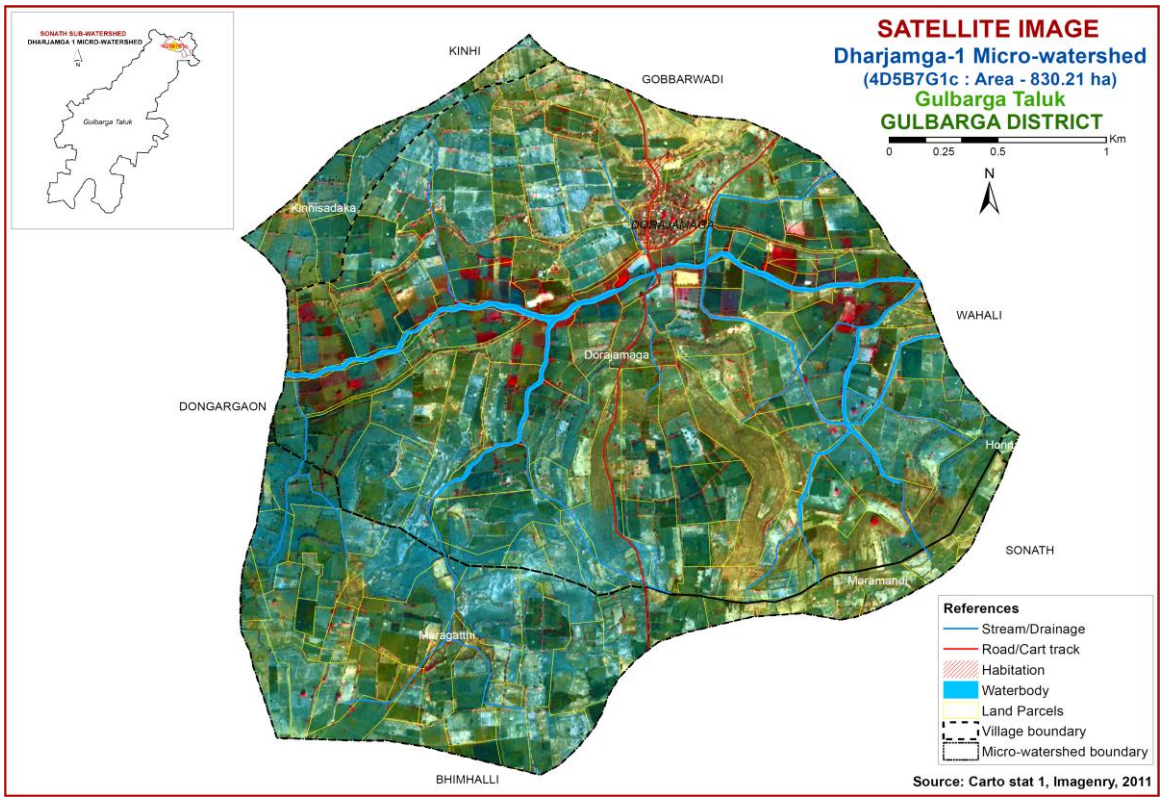


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Dharjamga-1 Microwatershed

3.3 Field Investigation

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 a few selected places. 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. Then, intensive traversing of each physiographic unit like hills, ridges and uplands was carried out. Based on the variability observed on the surface, transects were selected across the slope covering all the landform units in the microwatershed (Natarajan and Dipak Sarkar, 2010).

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

Based on the soil-site 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, nature of substratum, calcareousness etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying soil series are given in Table 3.1. Based on the above characteristics, 9 soil series were identified in the Dharjamga-1 microwatershed, of which 8 soil series are developed on basalt and one on laterite.

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

SOILS OF BASALT LANDSCAPE							
Sl. No.	**Soil Series**	**Depth (cm)**	**Colour**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareousness**
1	Margutti (MGT)	<25	10YR3/3,4/3,5/ 7.5YR4/3	c	15-35	Ap- cr	-
2	Matki (MAT)	<25	5YR3/2, 3/3, 3/4	c-sc	15-35	Ap-R	-
3	Novinihala (NHA)	25-50	10YR3/2,3/1,4/2 7.5YR3/4	c	<15	Ap-Bw-cr/R	-
4	Bhimanahalli (BHI)	25-50	10YR3/2,3/3,3/1 7.5YR3/2,4/3	c	15-35	Ap-Bw-cr	-
5	Dinsi (DSI)	50-75	10YR3/2,3/3,4/3 3/2	c	<15	Ap-BA-Bss	-
6	Gutti (GTT)	50-75	10YR3/2,3/1 7.5YR3/3,4/3	c	15-35	Ap-BA-Bss-cr	
7	Kamalapur (KMP)	75-100	10YR3/2,3/1	c	<15	Ap-BA-Bss-cr	-
8	Dimal (DIM)	100-150	10YR3/2, 3/1	c	<15	Ap-Bw-Bss-cr	**e- es**
SOILS OF LATERITE LANDSCAPE							
9	Kinhi (KNH)	<25	2.5YR3/3, 5YR4/6	c	35-60	Ap-R	-

3.4 Laboratory Characterization

Soil samples 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 from farmers fields (132 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 using kriging method, soil fertility maps for 11 elements including pH and EC were generated for the microwatershed.

3.5 Finalization of Soil Maps

The area under each soil series was further separated and mapped as 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.3.4) in the form of symbols. During the survey about 10 profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. All the profile locations are indicated on the village cadastral map in the form of a triangle. 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 22 mapping units representing 9 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2.

The soil phase map (management units) shows the distribution of 22 phases identified and 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.

The 22 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 (LUCs) based on the management needs. One or more than one soil site characteristic having influence on the management have been choosen for identification and delineation of LUCs. For Dharjamga-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 management units are expected to behave similarly for a given level of management.

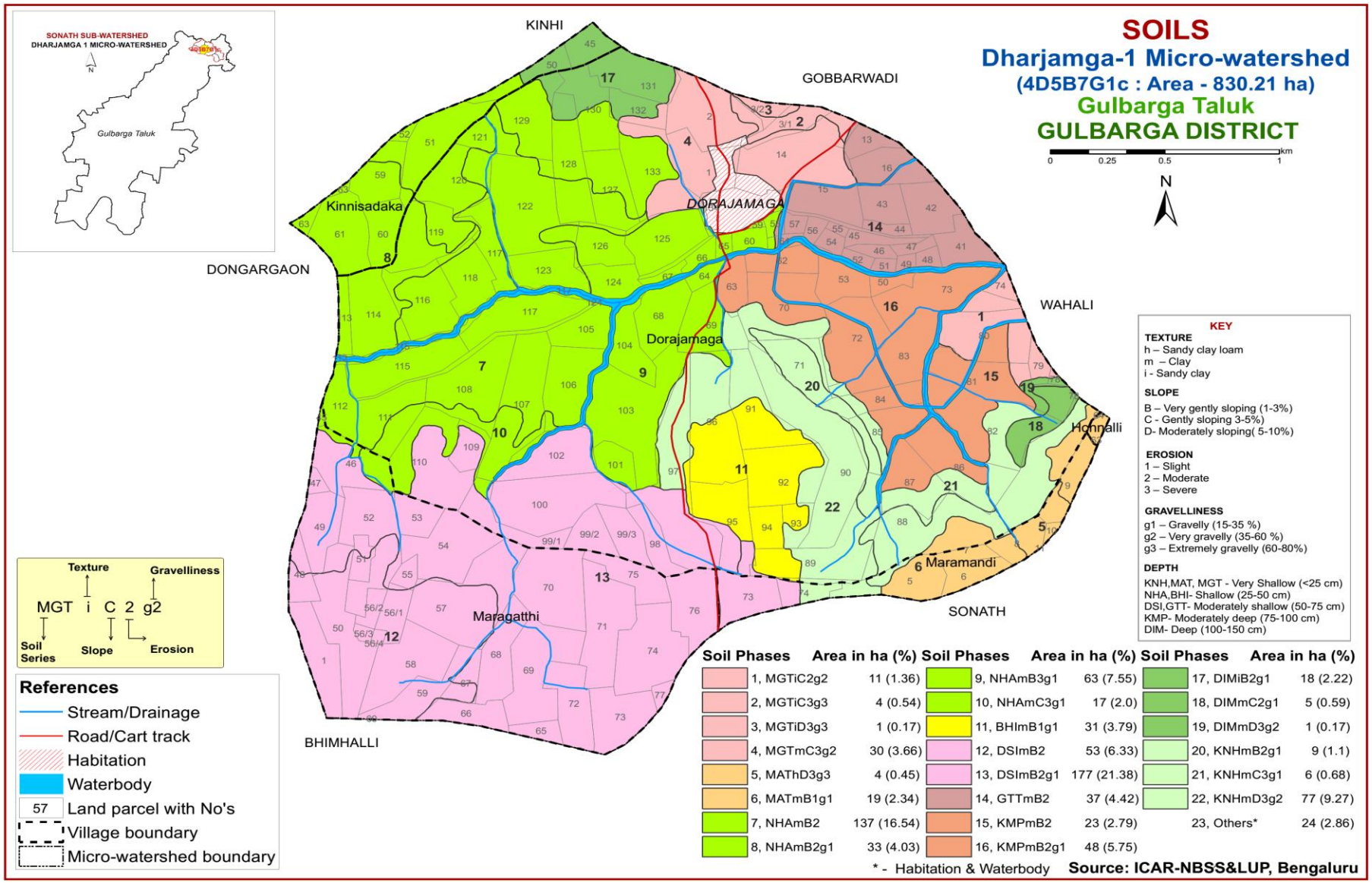


Fig 3.4 Soil phase or management units map of Dharjamga-1 Microwatershed

Table 3.2 Soil Map Unit Description of Dharjamga-1 Microwatershed

Sl. No.	Soil Series	Soil Phases	Mapping Unit description	Area in ha (%)
Soils of Basalt Landscape				
	MGT	Margutti soils are very shallow (<25cm), well drained, have very dark grayish brown to dark brown clay soils occurring on gently sloping to moderately sloping uplands.		**47.55 (5.73)**
1		MGTiC2g2	Sandy clay surface, 3-5 % slope, moderate erosion, very gravelly (35-60 %)	11.32 (1.36)
2		MGTiC3g3	Sandy clay surface, 3-5 % slope, severe erosion, extremely gravelly (60-80 %)	4.47 (0.54)
3		MGTiD3g3	Sandy clay surface, 5-10 % slope, severe erosion, extremely gravelly (60-80 %)	1.40 (0.17)
4		MGTmC3g2	Clay surface, 3-5 % slope, severe erosion, very gravelly (60-80 %)	30.36 (3.66)
	MAT	Matki soils are very shallow (<25cm), well drained, have dark reddish brown to dark reddish gray clay soils, occurring on very gently sloping to moderately sloping uplands		**23.18 (2.79)**
5		MAThD3g3	Sandy clay loam surface, 5-10 % slope, severe erosion, extremely gravelly (60-80 %)	3.76 (0.45)
6		MATmB1g1	Clay surface, 1-3% slope, slight erosion, gravelly (15-35%)	19.42 (2.34)
	NHA	Novinihala soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown clay soils, occurring on very gently sloping to gently sloping uplands.		**250.1 (30.12)**
7		NHAmB2	Clay surface, 1-3% slope, moderate erosion	137.30 (16.54)
8		NHAmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35%)	33.49 (4.03)
9		NHAmB3g1	Clay surface, 1-3% slope, severe erosion, gravelly (15-35%)	62.69 (7.55)
10		NHAmC3g1	Clay surface, 3-5% slope, severe erosion, gravelly (15-35%)	16.64 (2.00)
	BHI	Bhimanahalli soils are shallow (25-50 cm), well drained, have dark brown to very dark brown clay soils, occurring on very gently sloping uplands		**31.47 (3.79)**
11		BHImB1g1	Clay surface, 1-3% slope, slight erosion, gravelly (15-35%)	31.47 (3.79)
	DSI	Dinsi soils are moderately shallow (50-75 cm), moderately well drained, have very dark gray to dark greyish brown clay soils occurring on very gently sloping uplands		**230.03 (27.71)**

12		DSImB2	Clay surface, 1-3% slope, moderate erosion	52.55 (6.33)
13		DSImB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)	177.48 (21.38)
	GTT	Gutti soils are moderately shallow (50-75 cm), moderately well drained , have very dark grayish brown to dark brown clay soils, occurring on very gently sloping uplands		**36.69 (4.42)**
14		GTTmB2	Clay surface, 1-3% slope, moderate erosion	36.69 (4.42)
	KMP	Kamalapur soils are moderately deep (75-100 cm), moderately well drained, have very dark grayish brown to dark reddish brown clay soils, occurring on very gently sloping uplands.		**70.9 (8.54)**
15		KMPmB2	Clay surface, 1-3% slope, moderate erosion	23.12 (2.79)
16		KMPmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)	47.78 (5.75)
	DIM	Dimal soils are deep (100-150 cm), moderately well drained, have very dark grayish brown to very dark gray clay soils, occurring on very gently sloping to moderately sloping uplands		**24.72 (2.98)**
17		DIMiB2g1	Sandy clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)	18.46 (2.22)
18		DIMmC2g1	Clay surface, 3-5% slope, moderate erosion, gravelly (15-35 %)	4.86 (0.59)
19		DIMmD3g2	Clay surface, 5-10 % slope, severe erosion, very gravelly (35-60%)	1.40 (0.17)
SOILS OF LATERITE LANDSCAPE				
	KNH	Kinhi soils are very shallow (<25 cm), well drained, have yellowish red to dark reddish brown clay soils, occurring on very gently sloping to moderately sloping uplands		**91.81 (11.05)**
20		KNHmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)	9.17 (1.10)
21		KNHmC3g1	Clay surface, 3-5% slope, severe erosion, gravelly (15-35 %)	5.66 (0.68)
22		KNHmD3g2	Clay surface, 5-10 % slope, severe erosion, very gravelly (35-60%)	76.98 (9.27)

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Dharjamga-1 microwatershed is provided in this chapter. The microwatershed area has been identified as basalt and laterite landscapes. In all, 9 soil series were identified in these landscapes. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the basalt and laterite landscapes, it is by parent material, time and climate. A brief description of each of the 9 soil series identified followed by 22 soil phases (management units) mapped under each series are furnished below. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristics 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 Basalt Landscape

In this landscape, 8 soil series are identified and mapped. Of these, Novinihala (NHA) soil series occupies maximum area of about 250 ha (30%) followed by Dinsi (DSI) 230 ha (28%). Brief description of each series along with the soil phases identified and mapped is given below.

4.1.1 Margutti (MGT) Series: Margutti soils are very shallow (<25cm), well drained, have very dark grayish brown to dark brown clay soils. They have developed from basalt and occur on gently sloping to moderately sloping uplands.

The total depth of the soil ranges from 10 to 21 cm. The thickness of A horizon ranges from 7 to 18 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 3. The texture is sandy clay to clay with 15 to 35 per cent gravel. The available water capacity is very low (<50 mm/m).

Four phases were identified and mapped:

MGTiC2g2	Sandy clay surface, 3-5 % slope, moderate erosion, very gravelly (35-60 %)
MGTiC3g3	Sandy clay surface, 3-5 % slope, severe erosion, extremely gravelly (60-80 %)
MGTiD3g3	Sandy clay surface, 5-10 % slope, severe erosion, extremely gravelly (60-80 %)
MGTmC3g2	Clay surface, 3-5 % slope, severe erosion, very gravelly (60-80 %)

Landscape and Soil Profile Characteristics of Margutti (MGT) Series

4.1.2 Matki (MAT) Series: Matki soils are very shallow (<25cm), well drained, have dark reddish brown to dark reddish gray clay soils. They have developed from basalt and occur on very gently sloping to moderately sloping uplands.

The total depth of the soil is < 25 cm. The thickness of A horizon ranges from 7 to 20 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 2 to 4. The texture is clay with 15-80% gravel. The available water capacity is very low (<50 mm/m).

Two phases were identified and mapped:

MAThD3g3	Sandy clay loam surface, 5-10 % slope, severe erosion, extremely gravelly (60-80 %)
MATmB1g1	Clay surface, 1-3% slope, slight erosion, gravelly (15-35%)

Landscape and Soil Profile Characteristics of Matki (MAT) Series

4.1.3 Novanihala (NHA) Series: Novinihala soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown clay soils. They have developed from basalt and occur on very gently sloping to gently sloping uplands.

The thickness of the solum ranges from 27 to 48 cm. The thickness of A horizon ranges from 12 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from sandy clay to clay with 10 to 20 per cent gravel. The thickness of B horizon ranges from 22 to 37 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 4. Its texture is clay with gravel content of 10-15 per cent. The available water capacity is low (51-100 mm/m).

Four phases were identified and mapped:

NHAmB2	Clay surface, 1-3% slope, moderate erosion
NHAmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35%)
NHAmB3g1	Clay surface, 1-3% slope, severe erosion, gravelly (15-35%)
NHAmC3g1	Clay surface, 3-5% slope, severe erosion, gravelly (15-35%)

Landscape and Soil Profile Characteristics of Novanihala (NHA) Series

4.1.4 Bhimanahalli (BHI) Series: Bhimanahalli soils are shallow (25-50 cm), well drained, dark brown to very dark brown clay soils. They have developed from basalt and occur on very gently sloping uplands.

The thickness of the solum ranges from 25 to 50 cm. The thickness of A horizon ranges from 15 to 20 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 and 4 and chroma 2 to 4. The texture is clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 12 to 34 cm. Its colour is in 10 YR and 7.5YR hue with value 3 to 4 and chroma 2 to 4. Its texture is clay with gravel content of 15 to 35 per cent. The available water capacity is very low (<50 mm/m).

Only one phase was identified and mapped:

BHImB1g1	Clay surface, 1-3% slope, slight erosion, gravelly (15-35%)

Landscape and Soil Profile Characteristics of Bhimanahalli (BHI) Series

4.1.5 Dinsi (DSI) Series: Dinsi soils are moderately shallow (50-75 cm), moderately well drained, have very dark gray to dark greyish brown clay soils. They have developed from basalt and occur on very gently sloping uplands.

The thickness of the solum ranges from 51 to 71 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 to 3. The texture is clay with 5 to 10 per cent gravel. The thickness of B horizon ranges from 27 to 62 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 4. Its texture is clay with gravel content of less than 15 per cent. The available water capacity is medium (101-150 mm/m).

Two phases were identified and mapped:

DSImB2	Clay surface, 1-3% slope, moderate erosion
DSImB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)

Landscape and Soil Profile Characteristics of Dinsi (DSI) Series

4.1.6 Gutti (GTT) Series: Gutti soils are moderately shallow (50-75 cm), moderately well drained, have very dark grayish brown to dark brown clay soils. They have developed from basalt and occur on very gently sloping uplands.

The thickness of the solum ranges from 50 to 75 cm. The thickness of A horizon ranges from 7 to 18 cm. Its colour is in 10 YR and 7.5YR hue with value 3 and 4 and chroma 2 to 3. The texture is clay with 5 to 10 per cent gravel. The thickness of B horizon ranges from 47 to 64 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 4. Its texture is clay with gravel content of less than 15 per cent. The available water capacity is low (51-100 mm/m).

Only one phase was identified and mapped:

GTTmB2	Clay surface, 1-3% slope, moderate erosion

Landscape and Soil Profile Characteristics of Gutti (GTT) Series

4.1.7 Kamalapur (KMP) Series: Kamalapur soils are moderately deep (75-100 cm), moderately well drained, have very dark grayish brown to dark reddish brown clay soils. They have developed from basalt and occur on very gently sloping uplands.

The thickness of the solum ranges from 75 to 95 cm. The thickness of A horizon ranges from 10 to 30 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 1 to 4. The texture is clay with less than 10 per cent gravel. The thickness of B horizon ranges from 45 to 84 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 4. Its texture is clay with gravel content of less than 15 per cent. The available water capacity is medium (101-150 mm/m).

Two phases were identified and mapped:

KMPmB2	Clay surface, 1-3% slope, moderate erosion
KMPmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)

Landscape and Soil Profile Characteristics of Kamalapur (KMP) Series

4.1.8 Dimal (DIM) Series: Dimal soils are deep (100-150 cm), moderately well drained, have very dark grayish brown to very dark gray clay soils. They have developed from basalt and occur on very gently sloping to moderately sloping uplands.

The thickness of the solum ranges from 101 to 148 cm. The thickness of A horizon ranges from 5 to 11 cm. Its colour is in 10 YR hue with value 3 and chroma 2 to 1. The texture is clay with less than 10 per cent gravel. The thickness of B horizon ranges from 103 to 128 cm. Its colour is in 10 YR hue with value 3 and chroma 2 to 1. Its texture is clay with gravel content of less than 15 per cent. The available water capacity is very high (>200 mm/m).

Three phases were identified and mapped:

DIMiB2g1	Sandy clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)
DIMmC2g1	Clay surface, 3-5% slope, moderate erosion, gravelly (15-35 %)
DIMmD3g2	Clay surface, 5-10 % slope, severe erosion, very gravelly (35-60%)

Landscape and Soil Profile Characteristics of Dimal (DIM) Series

4.2 Soils of Laterite Landscape

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

4.2.1 Kinhi (KNH) Series: Kinhi soils are very shallow (<25 cm), well drained, have yellowish red to dark reddish brown clay soils. They have developed from weathered laterite and occur on very gently sloping to moderately sloping uplands.

The total thickness of the soil is <25 cm. The thickness of A horizon ranges from 9 to 16 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 and 4 and chroma 3 and 6. The texture is clay with gravel content of 35-60 per cent. The available water capacity is very low (<50 mm/m).

Three phases were identified and mapped:

KNHmB2g1	Clay surface, 1-3% slope, moderate erosion, gravelly (15-35 %)
KNHmC3g1	Clay surface, 3-5% slope, severe erosion, gravelly (15-35 %)
KNHmD3g2	Clay surface, 5-10 % slope, severe erosion, very gravelly (35-60%)

Landscape and Soil Profile Characteristics of Kinhi (KNH) Series

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, 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

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 moderate 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 wind mills.

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

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

The 22 soil map units identified in the Dharjamga-1 microwatershed are grouped under 4 land capability classes and 5 land capability subclasses. About 87 per cent area in the microwatershed is suitable for agriculture (Fig. 5.1) and 13 per cent is not suitable for agriculture.

Good cultivable lands (Class II) cover about 3 per cent area and are distributed in the northwestern part of the micowatershed with minor problems of soil and erosion. Moderately good cultivable lands (Class III) cover an area of about 9 per cent and are distributed in the eastern and central part of the microwatershed with moderate problems of erosion and soil. The fairly good cultivable lands (Class IV) cover an area of about 76 per cent and distributed in all parts of the microwatershed. They have severe limitations of erosion and soil. Non agricultural lands cover an area of about 10 per cent and are distributed in the eastern and central part of the microwatershed. They are well suited for pasture, foresty, wild life and recreation with severe limitations of soil and erosion.

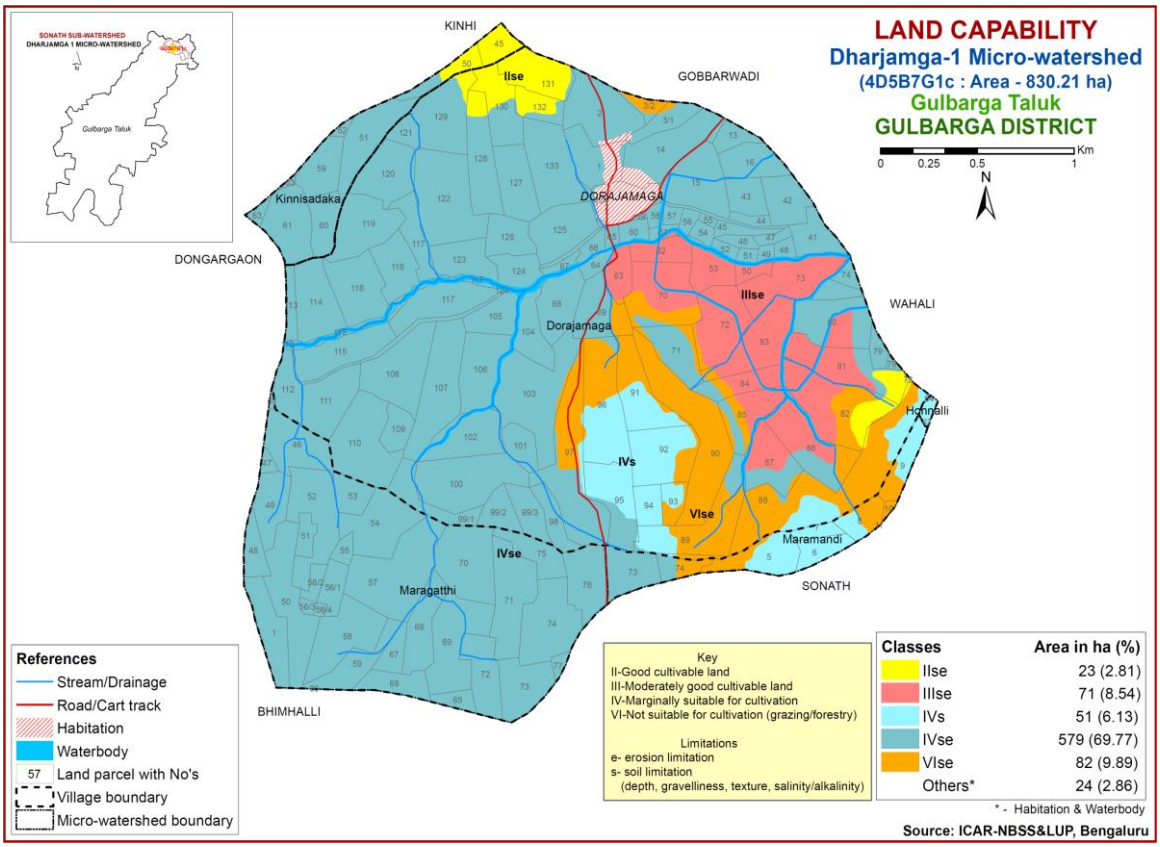


Fig. 5.1 Land Capability map of Dharjamga-1 Microwatershed

5.2 Soil Depth

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

Moderately deep (75-100 cm) soils occupy an area of about 71 ha (9%) and are distributed in the central and eastern part of the microwatershed. Deep soils (100-150 cm) occur in about 25 ha (3%) and are distributed in the northwestern and eastern part of the microwatershed. Maximum area of about 282 ha (34%) is shallow soils (25-50 cm) and are distributed in the western, central and northwestern part of the microwatershed. Very shallow soils (<25 cm) occupy an area of about 163 ha (20%) distributed in the northern, northeastern, central and eastern part of the microwatershed. Moderately shallow soils (50-75 cm) occupy an area of about 267 ha (32%) and are distributed in the southern, southwestern, southeastern and central part of the microwatershed.

The most productive lands are about 25 ha (3%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep (100-150 cm) occurring in the northwestern and eastern part of the microwatershed.

The most problem lands with an area of about 445 ha (52%) having very shallow (<25 cm) and shallow (25-50 cm) rooting depth occur in all parts except southern part of the microwatershed. They are not suitable for growing agricultural crops but well suited for pasture, forestry or other recreational purposes. Occasionally, short duration crops may be grown if rainfall is normal.

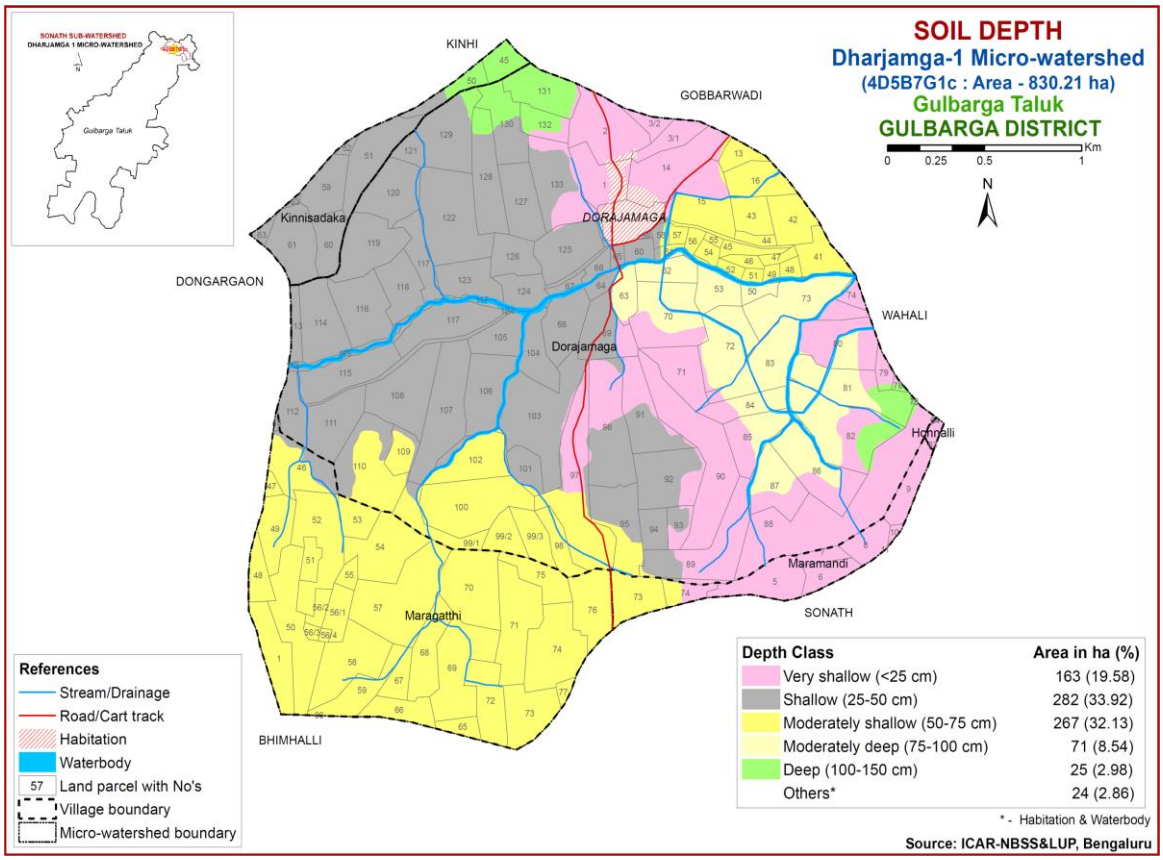


Fig. 5.2 Soil Depth map of Dharjamga-1 Microwatershed

5.3 Surface Soil Texture

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

Maximum area of about 803 ha (97%) is clayey soils and are distributed in all parts of the microwatershed. Loamy soils occupy a very small area of about 4 ha (<1%)and are distributed in the eastern part of the microwatershed.

The most productive lands (97%) with respect to surface soil texture are the clayey soils (Fig. 5.3) that have high potential for soil-water retention and availability, and nutrient retention and availability, but have problems of drainage, infiltration, workability and other physical problems.

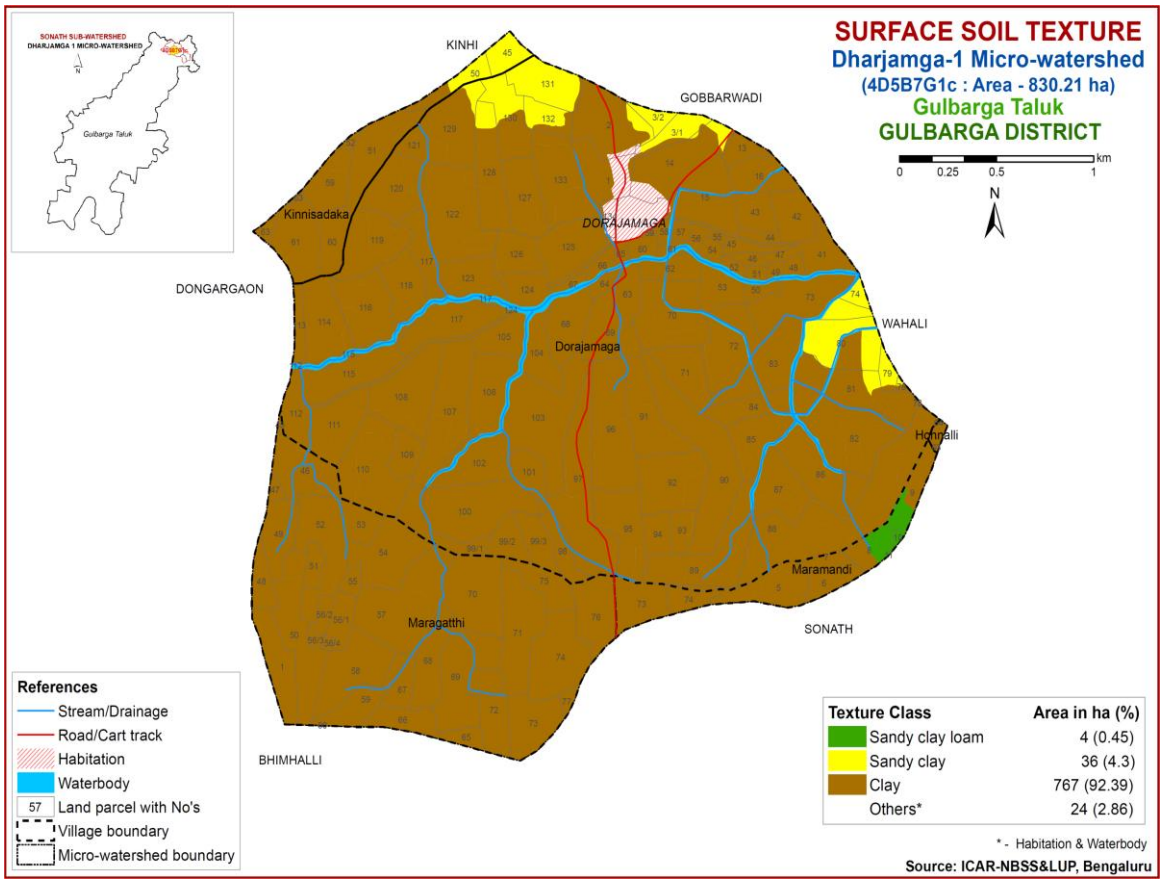


Fig. 5.3 Surface Soil Texture map of Dharjamga-1 Microwatershed

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 geographical distribution in the microwatershed is shown in Figure 5.4.

Maximum area has soils that are gravelly (15-35%) covering about 427 ha (51%) and are distributed in all parts of the microwatershed (Fig.5.4). About 250 ha (30%) area

in the micro watershed has soils that are non gravelly (<15%) and are distributed in the southern, central, western, northwestern, northeastern and northern part of the microwatershed followed by soils that are very gravelly (35-60%) covering about 120 ha (14%) and are distributed in the eastern, central, northeastern and northern part of the microwatershed. An area has soil that are extremely gravelly (60-80%) covering about only 10 ha (3%) and are distributed in the northern and eastern part of the microwatershed.

The most productive lands with respect to gravelliness are found to be 30 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%) are found to cover about 16 per cent area, where only short duration crops can be grown.

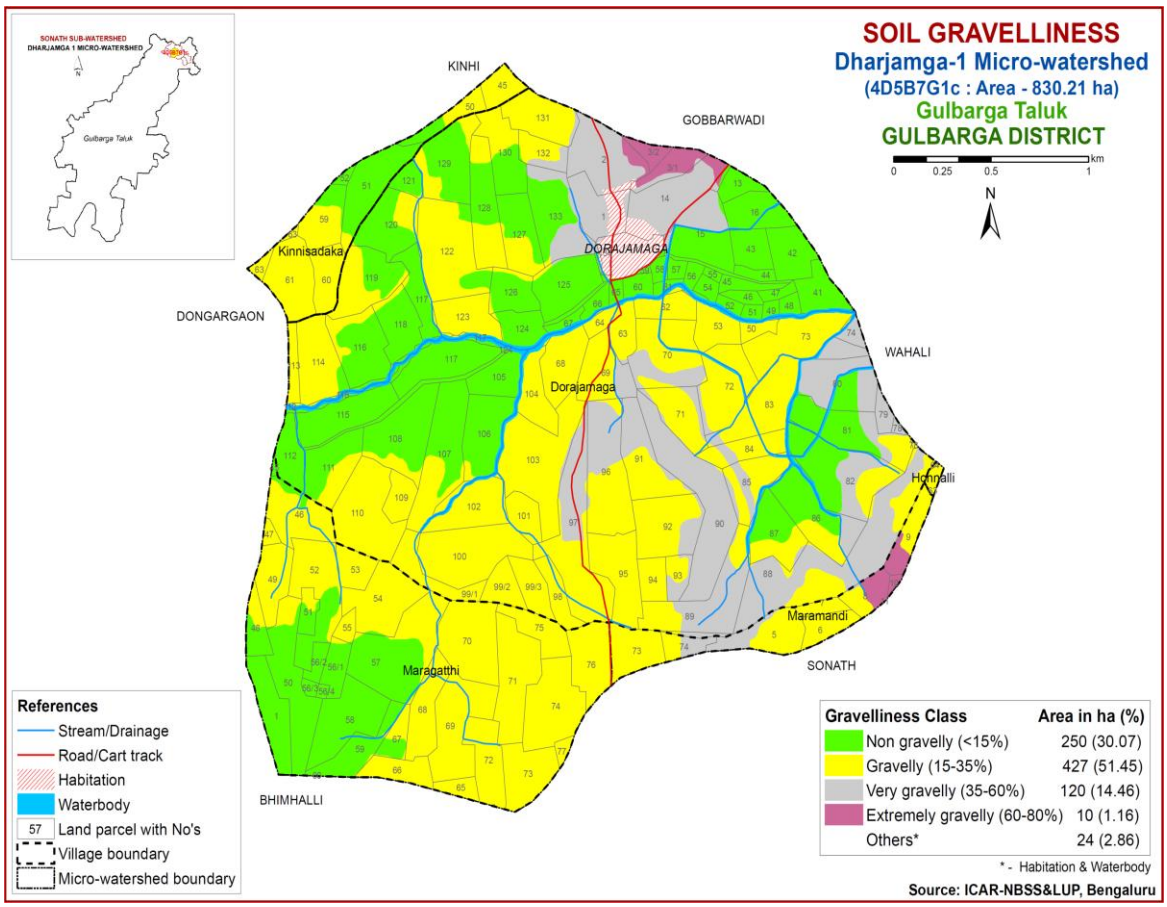


Fig. 5.4 Soil Gravelliness map of Dharjamga-1 Microwatershed

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. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.5.

An area of about 163 ha (20%) has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northern, eastern and central part of the microwatershed. An area of about 282 ha (34%) has soils that are low (51-100 mm/m) in available water capacity and are distributed in the western, northwestern and central part of the microwatershed. Major area in the microwatershed has soils that are medium (101-150 mm/m) in available water capacity. They occur in about 338 ha (41%) and are distributed in the southern, southwestern, southeastern, central and northeastern part of the microwatershed. The soils that are very high (>200 mm/m) in AWC covering a small area of about 25 ha (3%) and are distributed in the northwestern and eastern part of the microwatershed.

An area of about 25 ha (3%) has soils that have very high potential (>200 mm/m) with regard to available water capacity and are distributed in the northwestern and eastern part of the microwatershed. In these areas, if the rainfall is normal and well distributed, all climatically adapted long duration annual and perennial crops can be grown. About 445 ha (54%) area in the microwatershed has soils that are problematic with regard to available water capacity. Here, only the short or medium duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses.

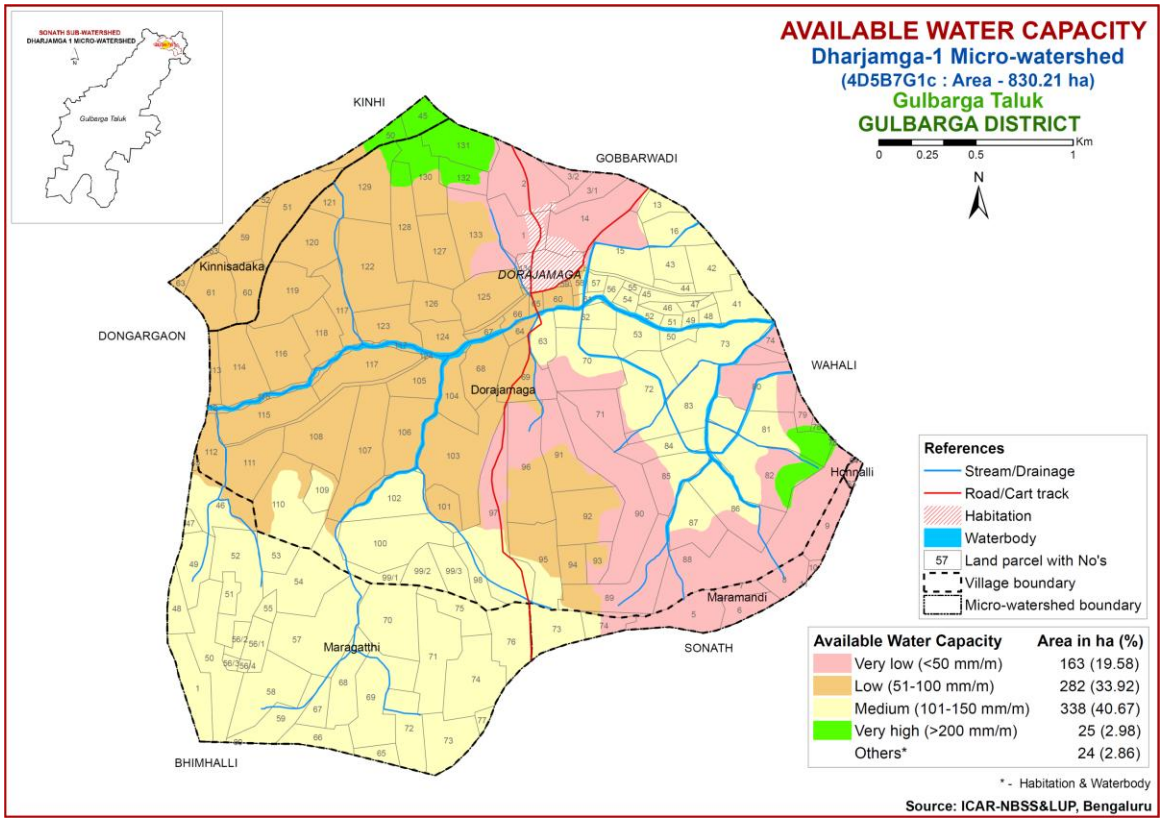


Fig. 5.5 Soil Available Water Capacity map of Dharjamga-1 Microwatershed

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 four slope classes and a slope map was generated. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.6.

Major area of the microwatershed falls under very gently sloping (1-3%) slope class. It covers an area of about 650 ha (78%) and is distributed in all parts of the microwatershed. An area of about 73 ha (9 %) falls under gently sloping (3-5%) lands and is distributed in the northern, eastern, central and northeastern part of the microwatershed. Moderately sloping (5-10%) lands cover an area of about 84 ha (10%) and is distributed in the eastern, central and southeastern part of the microwatershed.

An area of about 650 ha (78%) in the microwatershed has soils that have high potential in respect of soil slope. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

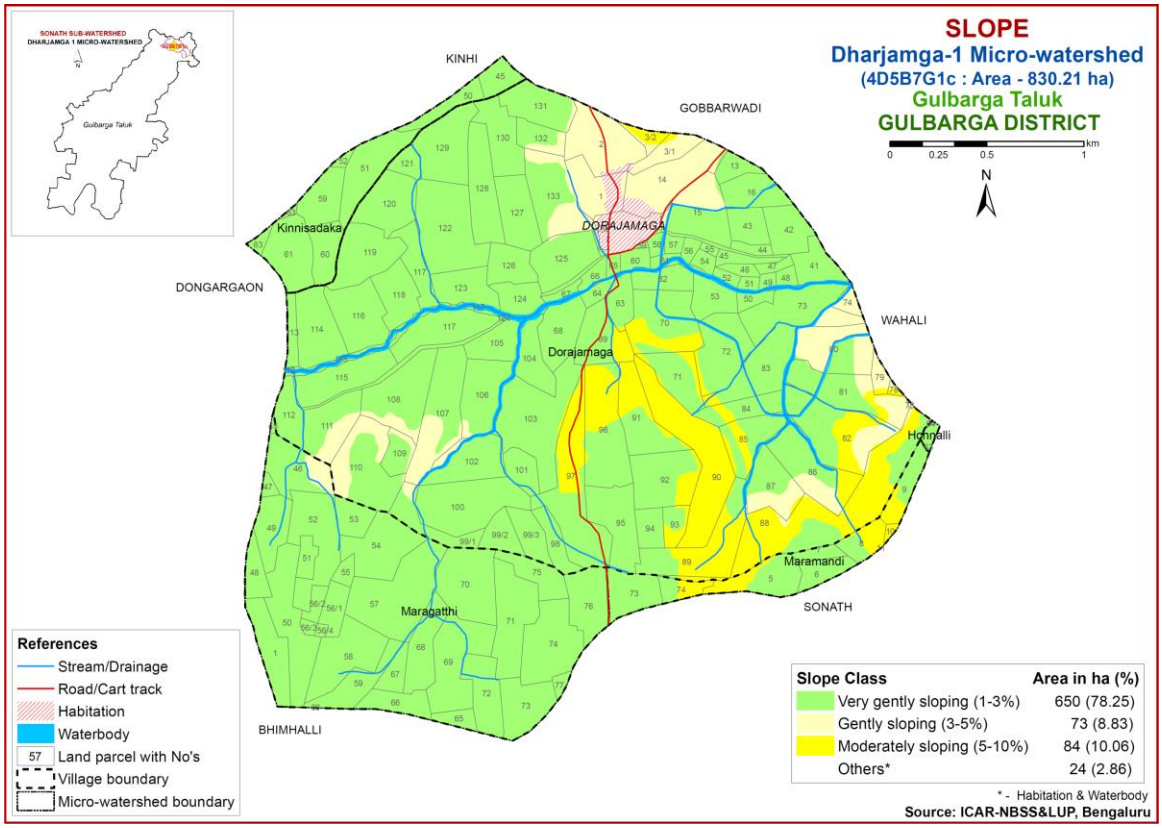


Fig. 5.6 Soil Slope map of Dharjamga-1 Microwatershed

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 was generated. The area extent and their spatial distribution in the microwatershed is given in Figure 5.7.

Soils that are slightly eroded (e1 class) cover about area of about 51 ha (6%) and are distributed in the eastern and central part of the microwatershed. Soils that are moderately eroded (e2 class) cover maximum area of about 552 ha (66%) and are distributed in all parts of the microwatershed. Severely eroded (e3 class) soils cover an area of about 203 ha (24%) and are distributed in the central, eastern, northern and northwestern part of the microwatershed.

Top priority is to be given to 203 ha area where they are severely eroded for taking up soil and water conservation and other land development measures followed by moderately eroded lands that cover about 552 ha.

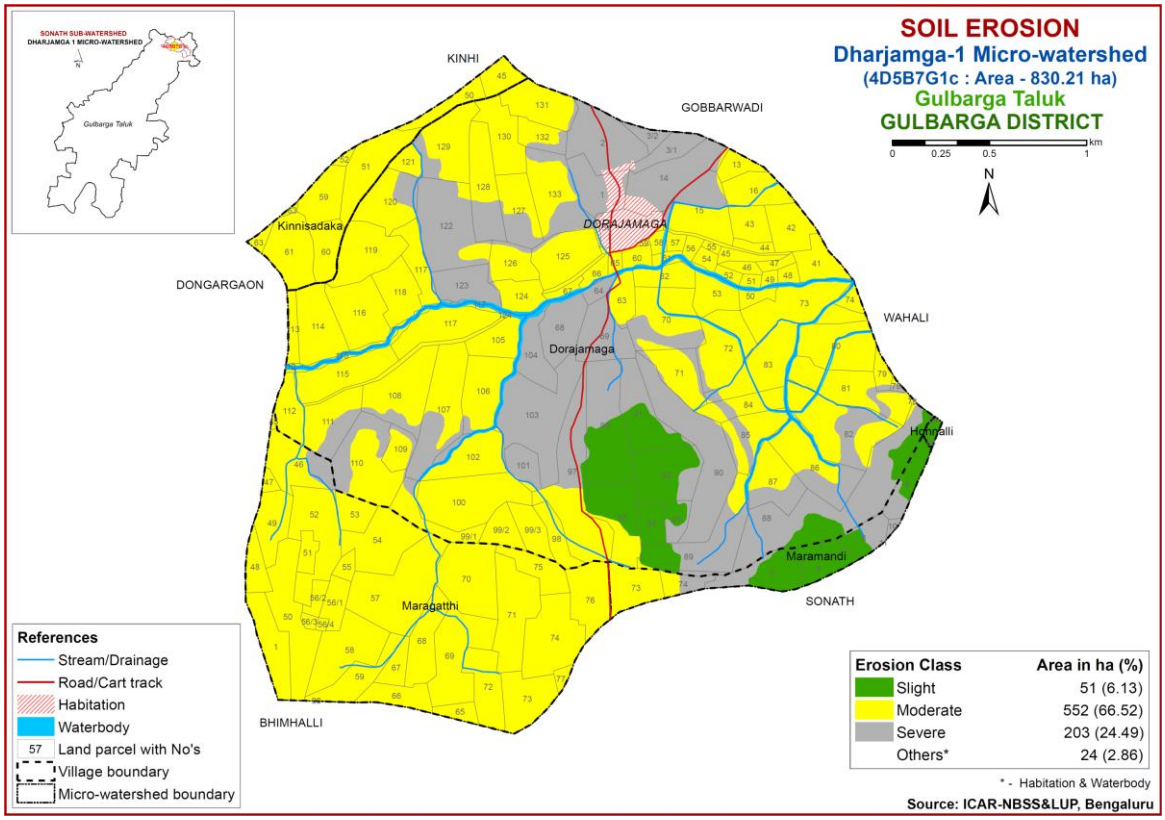


Fig. 5.7 Soil Erosion map of Dharjamga-1 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amount of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as these areas are characterised by low rainfall and high temperatures, hence low fertility. 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 interval) all over the microwatershed through land resource inventory in the year 2015 were analysed for pH, EC, organic carbon, available phosphorus and potassium and for micronutrients like zinc, 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. The village/survey number wise fertility data for the microwatershed is given in Appendix-II.

6.1 Soil Reaction (pH)

The soil fertility analysis of the Dharjamga-1 microwatershed for soil reaction (pH) showed that an area of about 267 ha (32%) is neutral (pH 6.5-7.3) in reaction and is distributed in the southern, central, northern, eastern and southwestern part of the microwatershed (Fig.6.1). Slightly alkaline (pH 7.3-7.8) is around 244 ha (29%) area and is distributed in the southwestern, central, northern, eastern and northwestern part of the microwatershed. Maximum area of about 296 ha (36%) is moderately alkaline (pH 7.8-8.4) and is distributed in the western, central, eastern and northeastern part of the microwatershed.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (Fig.6.3) of the soils in the microwatershed is high (>0.75%) in major area of about 753 ha (91%) and are distributed in all parts of the microwatershed. Medium (0.5-0.75%) organic carbon content accounts for 54 ha (6%) area and is distributed in the northern, northwestern and eastern part of the microwatershed.

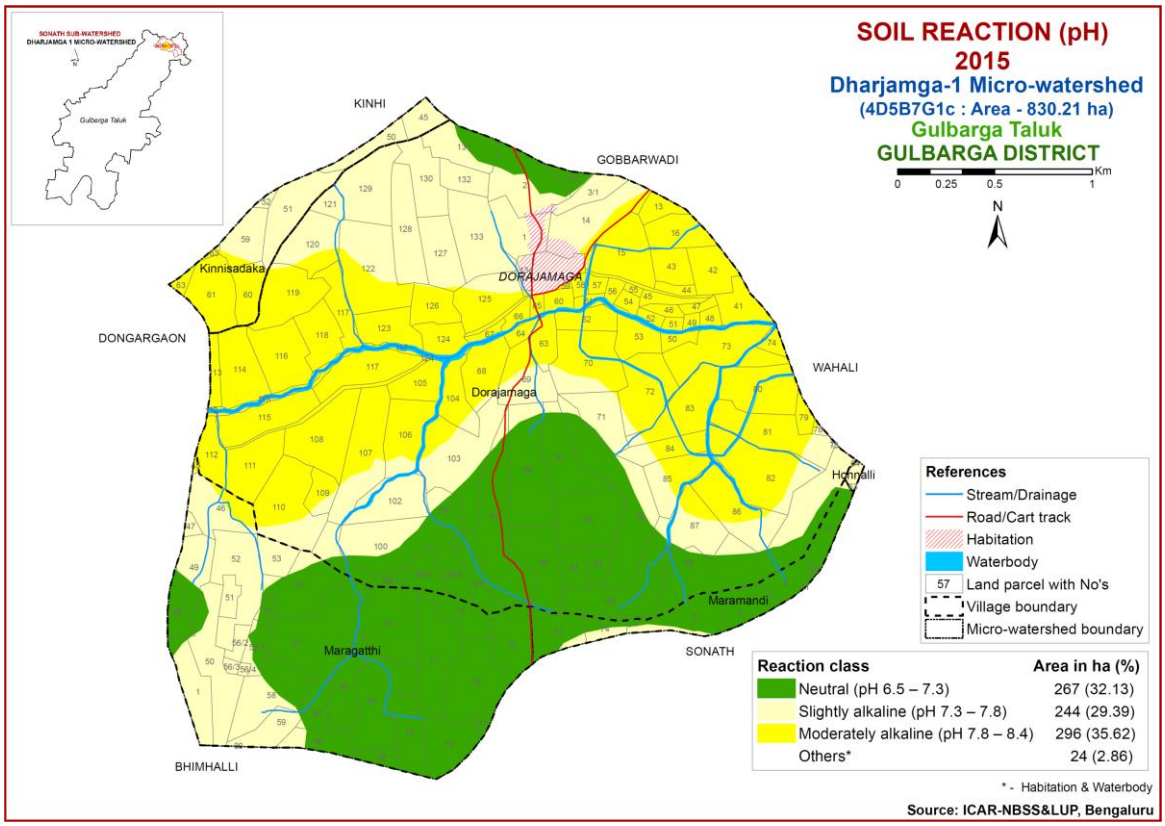


Fig.6.1 Soil Reaction (pH) map of Dharjamga-1 Microwatershed

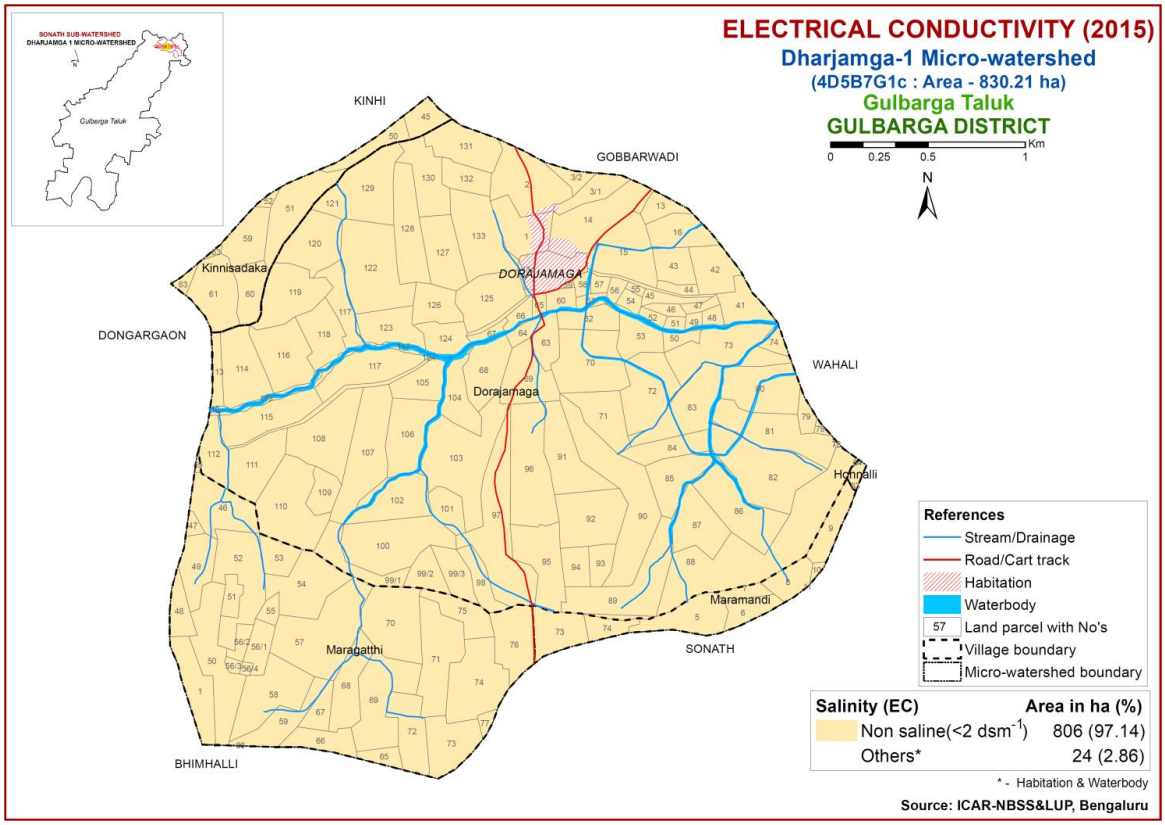


Fig.6.2 Electrical Conductivity (EC) map of Dharjamga-1 Microwatershed

6.4 Available Phosphorus

The soil fertility analysis revealed that available phosphorus (Fig.6.4) is low (<23 kg/ha) in an area of about 69 ha (8%) and is distributed in the central, southern and southwestern part of the microwatershed. There is an urgent need to increase the dose of phosphorous for all the crops by 25 per cent over the recommended dose to realize better crop performance. Major area of about 738 ha (89%) is medium (23-57 kg/ha) in available phosphorus and is distributed in all parts of the microwatershed.

6.5 Available Potassium

Available potassium content (Fig.6.5) is medium (145-337 kg/ha) in major area of about 637 ha (77%) and is distributed in all parts of the microwatershed and high available potassium (>337 kg/ ha) content accounts for an area of 164 ha (20%) and is distributed in the central and northwestern part of the microwatershed. Low available potassium (<145 kg/ha) content accounts for a very small area of 5 ha (1%) and is distributed in the eastern part of the microwatershed.

6.6 Available Sulphur

Available sulphur content is medium (10-20 ppm) in major area of about 424 ha (51%) and is distributed in the southwestern, central, western, northern, northwestern and northeastern part of the microwatershed. A small area of about 30 ha (4%) is high (>20 ppm) in available sulphur and is distributed in the southern part of the microwatershed (Fig.6.6). Available sulphur is low (<10 ppm) in 352 ha (42%) area and is distributed in the western, central, eastern and northwestern part of the microwatershed.

6.7 Available Boron

Available boron content is medium (0.5-1.0 ppm) in major area of about 486 ha (59%) and is distributed in the southern, central, western and eastern part of the microwatershed. An area of about 320 ha (39%) has low (<0.5 ppm) in available boron and are distributed in the western, southeastern, northern, northeastern and northwestern part of the microwatershed (Fig.6.7).

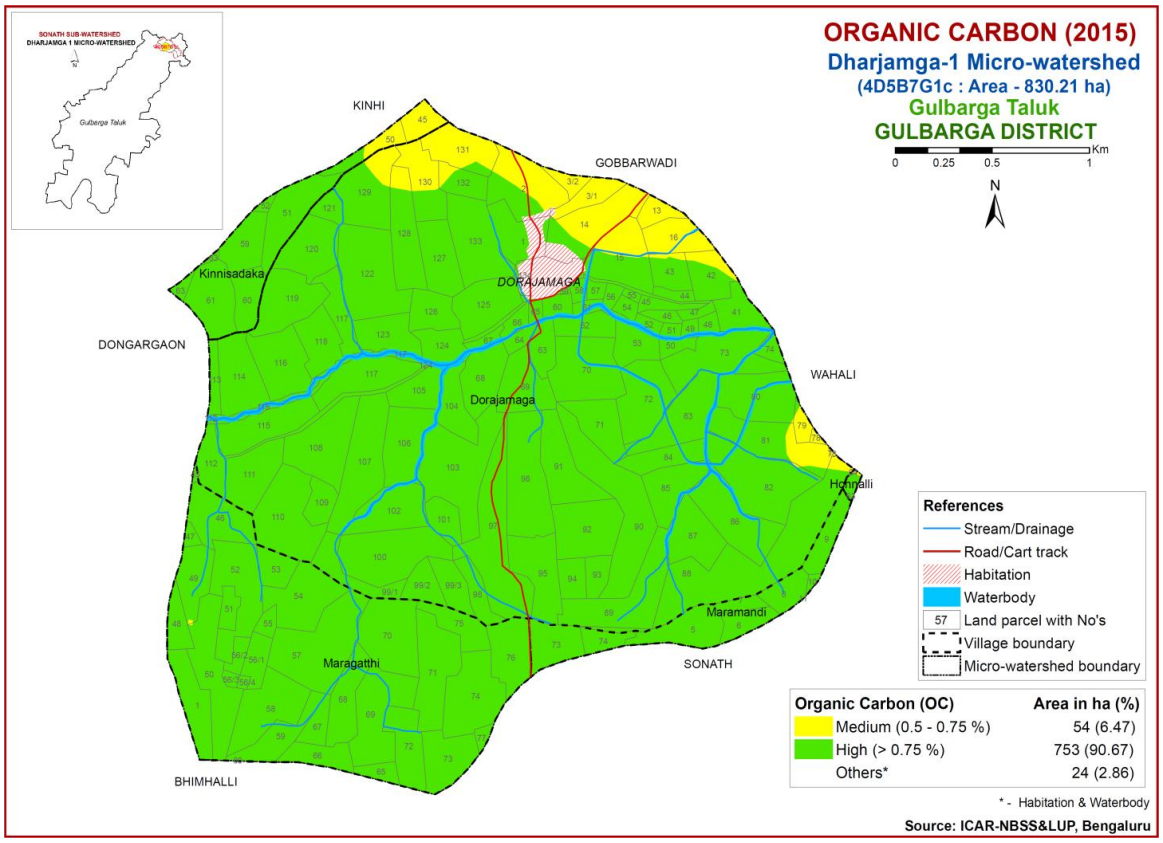


Fig.6.3 Soil Organic Carbon map of Dharjamga-1 Microwatershed

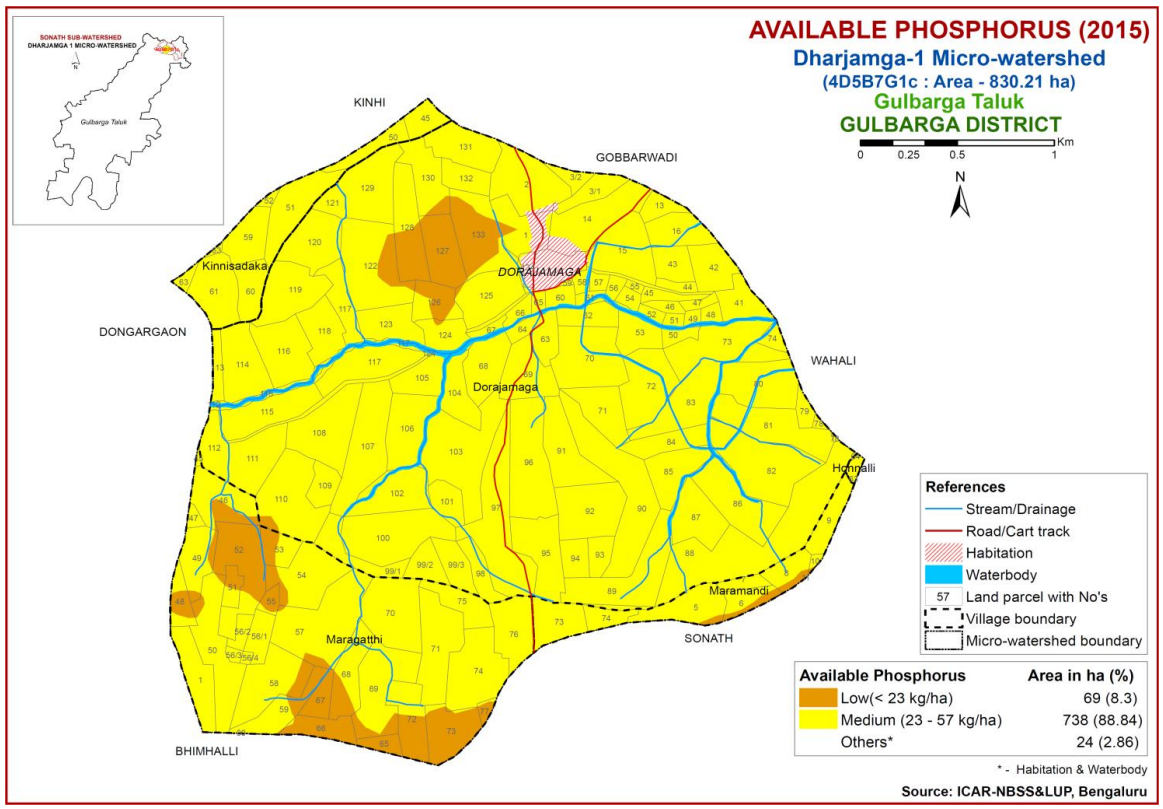


Fig.6.4 Soil available Phosphorus map of Dharjamga-1 Microwatershed

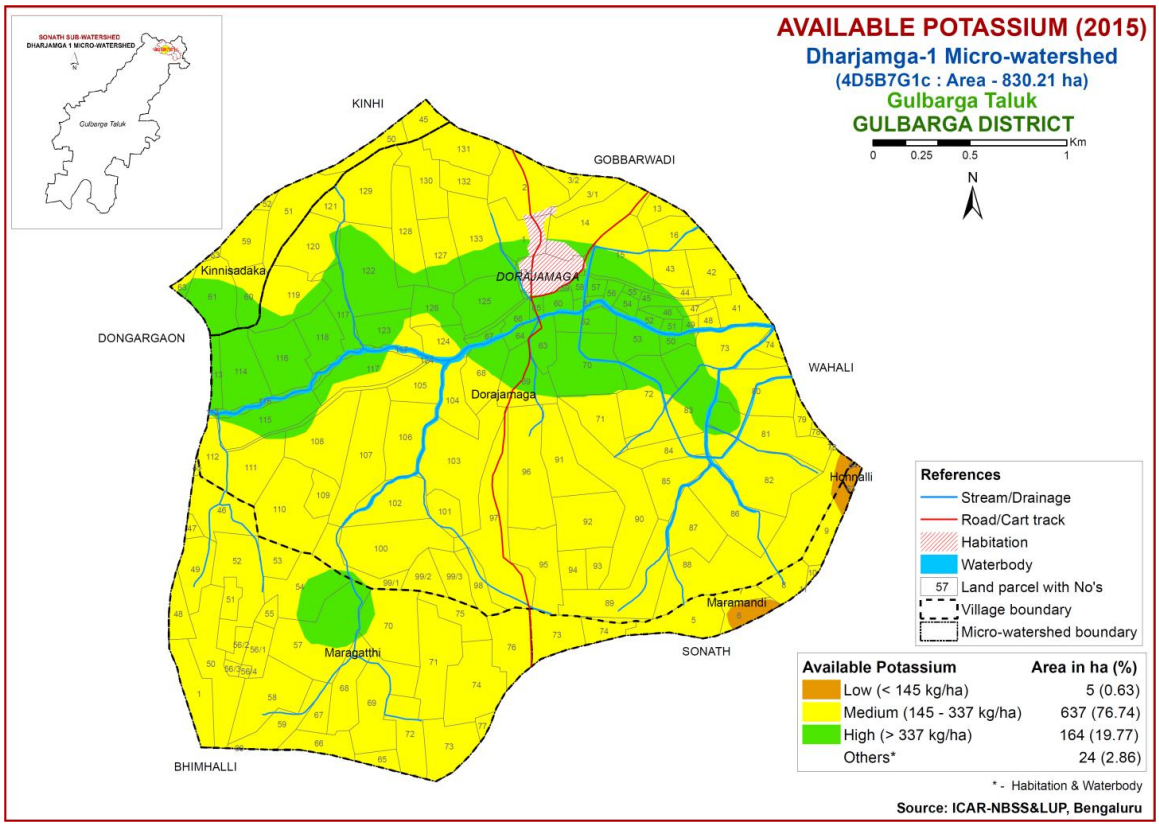


Fig.6.5 Soil available Potassium map of Dharjamga-1 Microwatershed

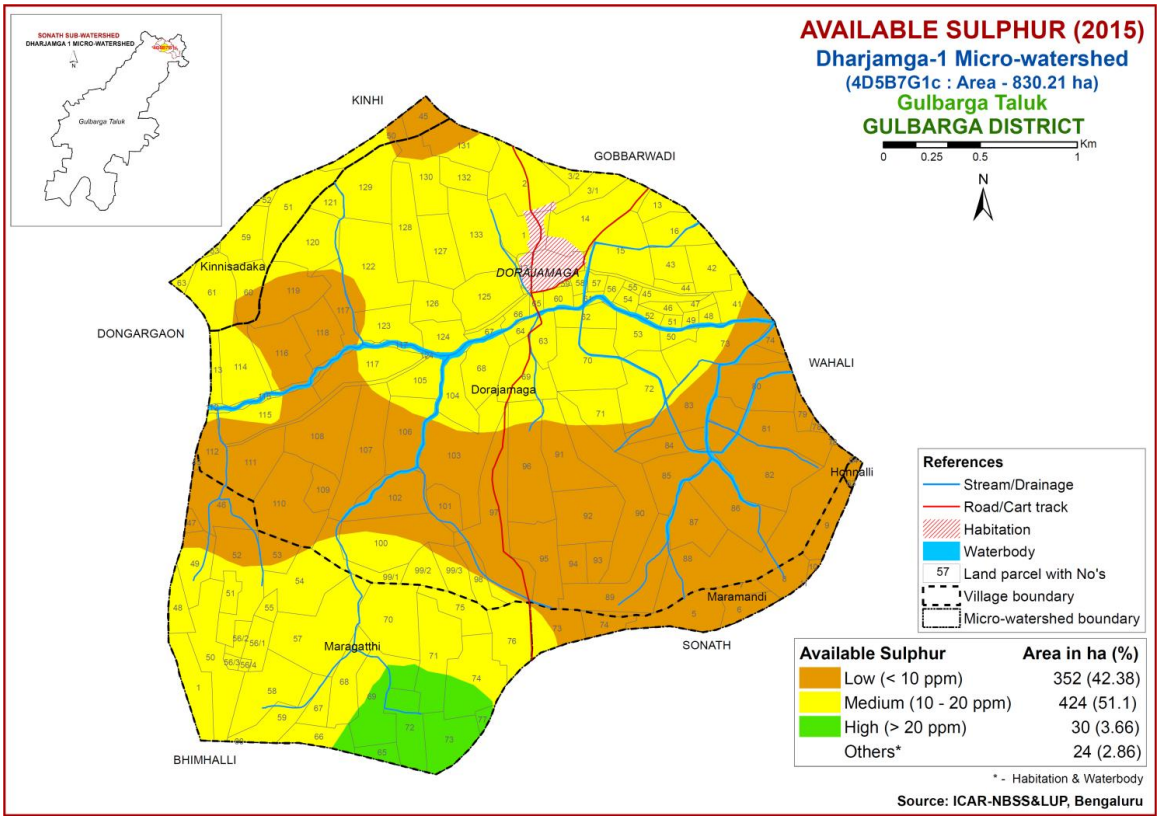


Fig.6.6 Soil available Sulphur map of Dharjamga-1 Microwatershed

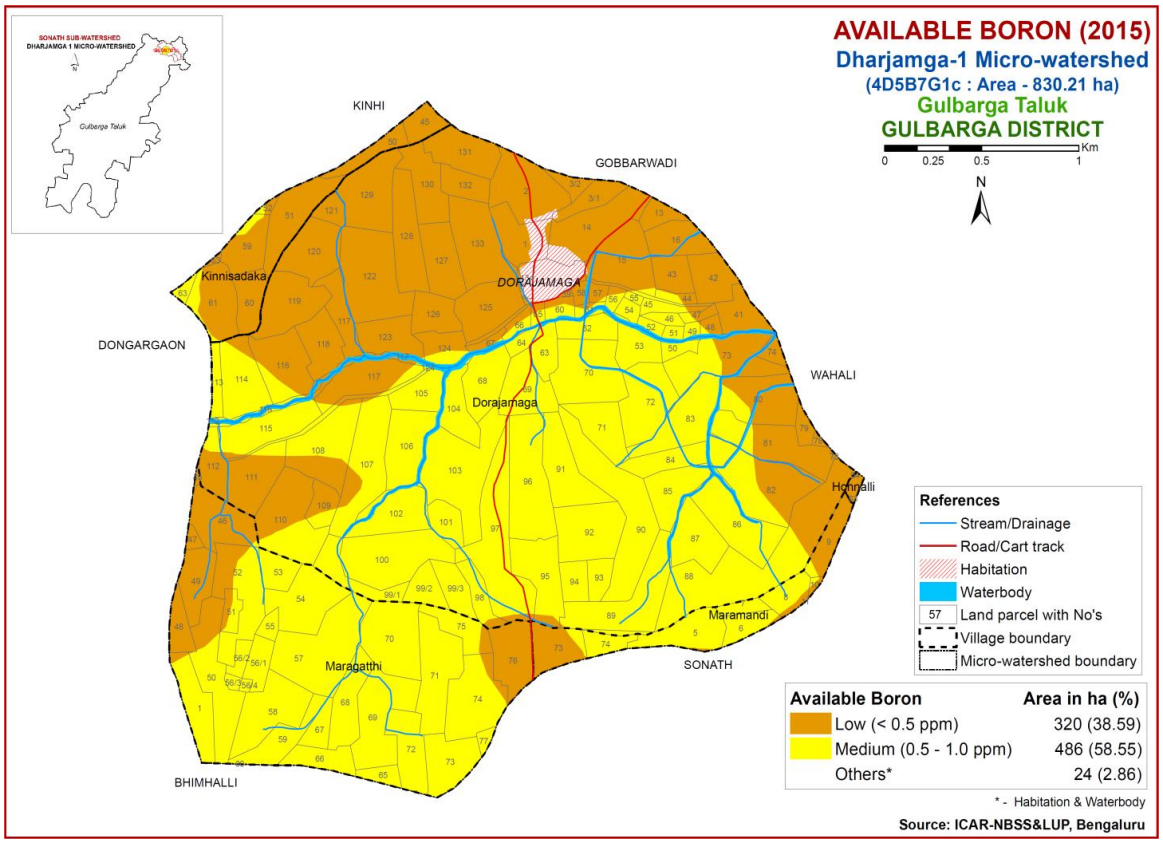


Fig.6.7 Soil available Boron map of Dharjamga-1 Microwatershed

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in small area of about 36 ha (4%) and is distributed in the western and central part of the microwatershed. It is sufficient (>4.5 ppm) in major area of about 770 ha (93%) (Fig 6.8) and is distributed in all parts of the microwatershed.

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in major area of about 469 ha (56%) and is distributed in the western, northern, central and eastern part of the microwatershed. It is sufficient (>0.6 ppm) in an area of about 338 ha (41%) (Fig 6.11) and is distributed in the southern, southeastern, central and eastern part of the microwatershed.

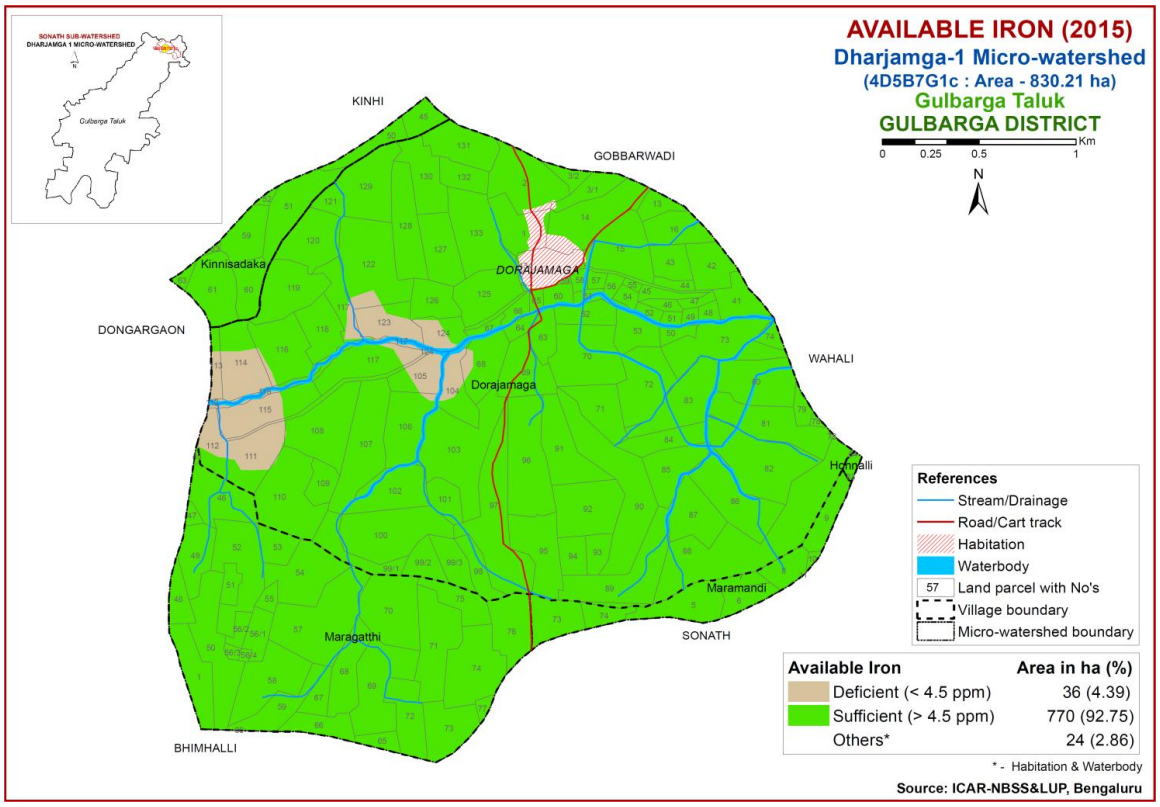


Fig.6.8 Soil available Iron map of Dharjamga-1 Microwatershed

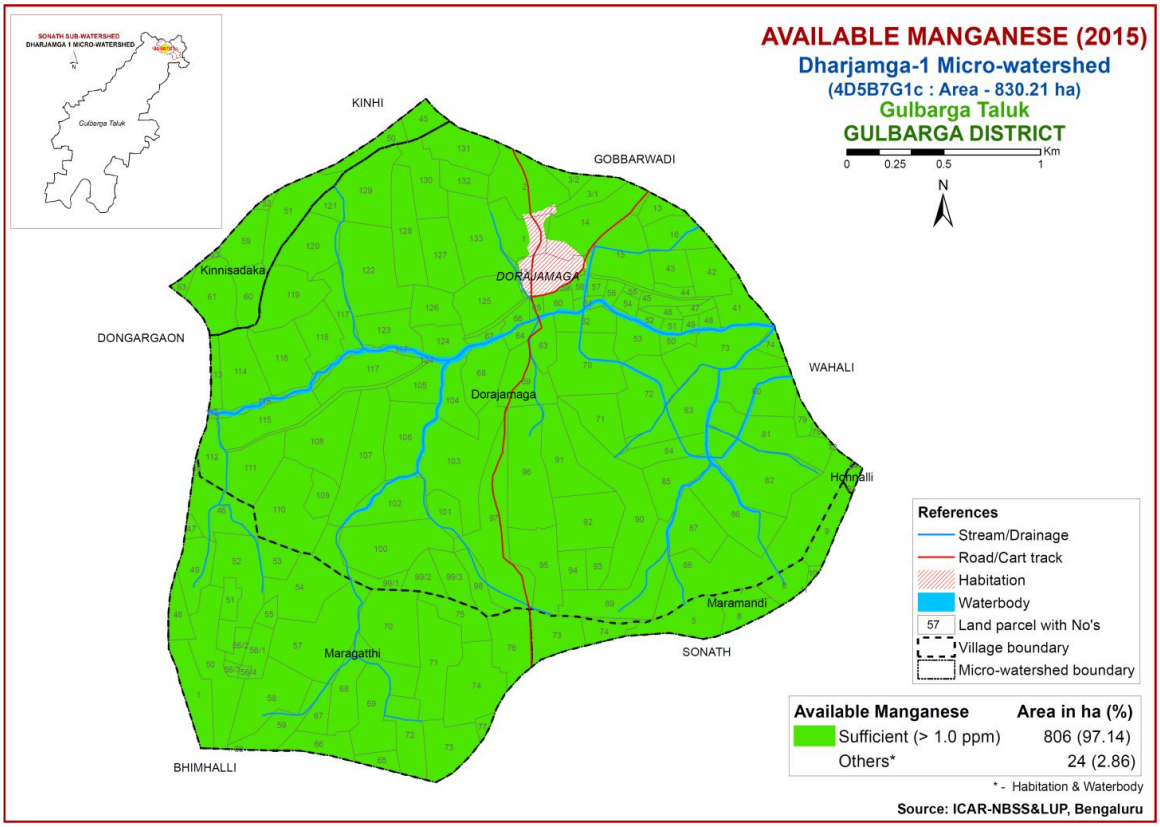


Fig.6.9 Soil available Manganese map of Dharjamga-1 Microwatershed

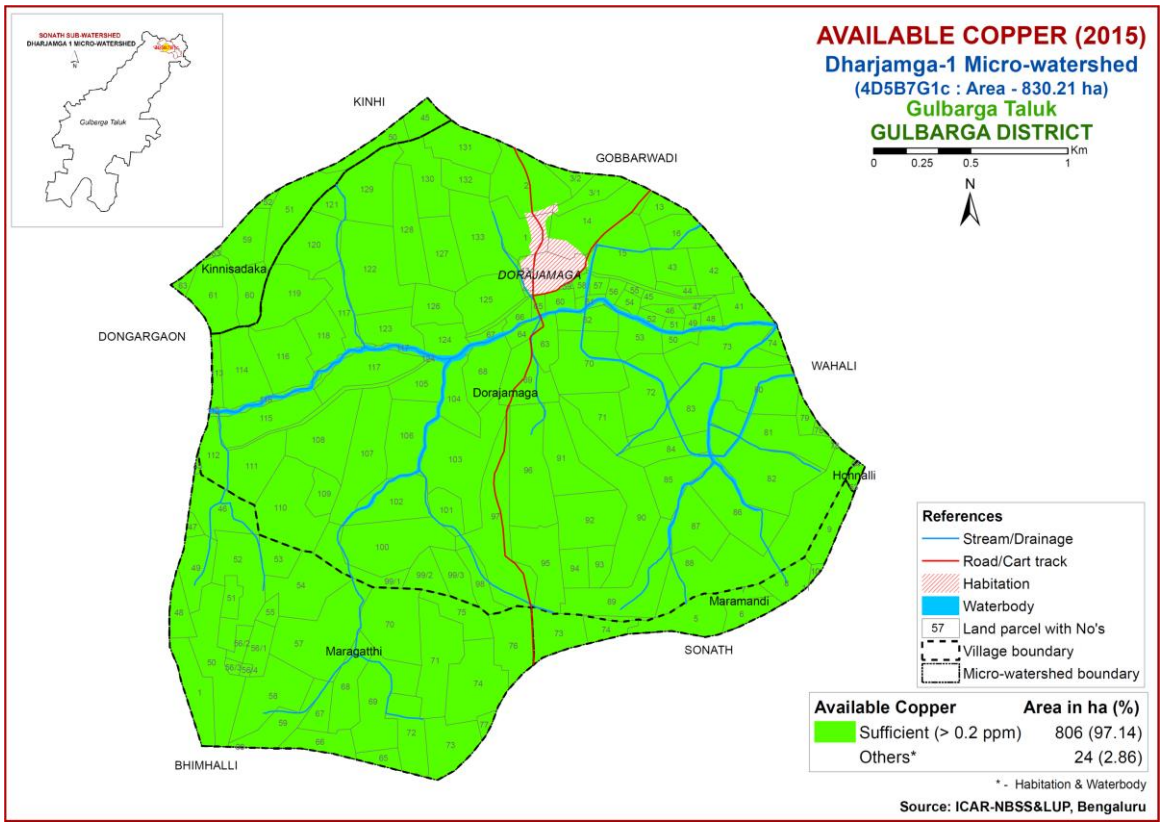


Fig.6.10 Soil available Copper map of Dharjamga-1 Microwatershed

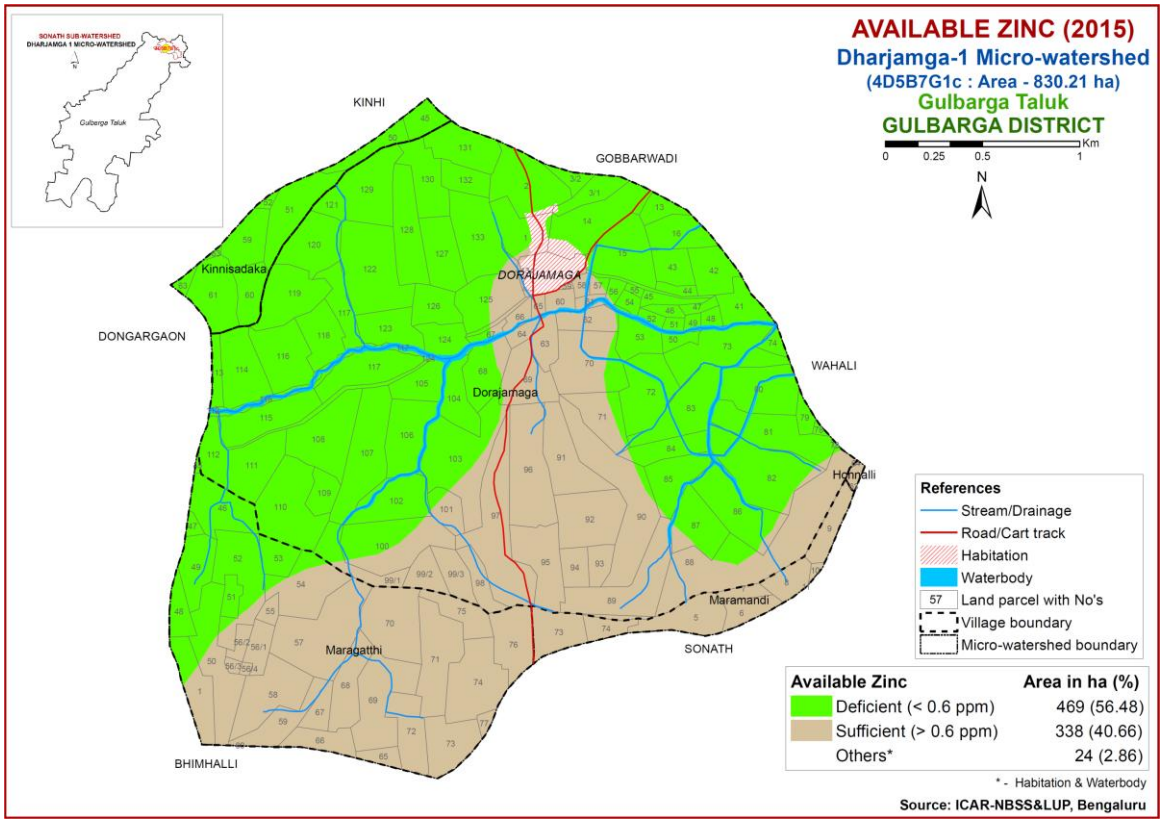


Fig.6.11 Soil available Zinc map of Dharjamga-1 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Dharjamga-1 microwatershed were assessed for their suitability for growing food, fibre, fodder 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 and S3 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable land with the limitations of soil depth and erosion is 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 19 major annual and perennial crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major crops grown in Karnataka in an area of 10.47 lakh ha in northern Karnataka in Bijapur, Kalaburgi, Raichur, Bidar, Belgaum, Dharwad and Bellary 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 is given in Figure. 7.1.

An area of about 94 ha (11%) in the microwatershed has soils that are highly suitable (Class S1) for growing sorghum crop. They have minor or no limitations for growing sorghum and are distributed mainly in the central, eastern, northwestern and northeastern part of the microwatershed.

Table 7.1 Soil-Site Characteristics of Dharjamga-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 (%)								
MGTiC2g2	740	150	WD	<25	sc	c	35-60	15-35	<50	3-5	Moderate	6.8	0.3	0.2	46	100
MGTiC3g3	740	150	WD	<25	sc	c	60-80	15-35	<50	3-5	Severe	6.8	0.3	0.2	46	100
MGTiD3g3	740	150	WD	<25	sc	c	60-80	15-35	<50	5-10	Severe	6.8	0.3	0.2	46	100
MGTmC3g2	740	150	WD	<25	c	c	35-60	15-35	<50	5-10	Severe	6.8	0.3	0.2	46	100
MAThD3g3	740	150	WD	<25	scl	c-sc	60-80	15-35	<50	5-10	Severe	6.8	0.3	0.2	46	100
MATmB1g1	740	150	WD	<25	c	c-sc	15-35	15-35	<50	1-3	Slight	6.8	0.3	0.2	46	100
NHAmB2	740	150	WD	25-50	c	c	-	<15	51-100	1-3	Moderate	7.2	0.1	0.3	40	100
NHAmB2g1	740	150	WD	25-50	c	c	15-35	<15	51-100	1-3	Moderate	7.2	0.1	0.3	40	100
NHAmB3g1	740	150	WD	25-50	c	c	15-35	<15	51-100	1-3	Severe	7.2	0.1	0.3	40	100
NHAmC3g1	740	150	WD	25-50	c	c	15-35	<15	51-100	3-5	Severe	7.2	0.1	0.3	40	100
BHImB1g1	740	150	WD	25-50	c	c	15-35	15-35	<50	1-3	Slight	7.2	0.1	0.3	40	100
DSImB2	740	150	WD	50-75	c	c	-	<15	101-150	1-3	Moderate	7.2	0.1	0.3	40	100
DSImB2g1	740	150	WD	50-75	c	c	15-35	<15	101-150	1-3	Moderate	7.0	0.1	0.2	28	100
GTTmB2	740	150	WD	50-75	c	c	-	15-35	51-100	1-3	Moderate	7.0	0.1	0.3	62	100
KMPmB2	740	150	WD	75-100	c	c	-	<15	101-150	1-3	Moderate					
KMPmB2g1	740	150	WD	75-100	c	c	15-35	<15	101-150	1-3	Moderate					
DIMiB2g1	740	150	WD	100-150	sc	c	15-35	<15	>200	1-3	Moderate					
DIMmC2g1	740	150	WD	100-150	c	c	15-35	<15	>200	3-5	Moderate					
DIMmD3g2	740	150	WD	100-150	c	c	35-60	<15	>200	5-10	Severe					
KNHmB2g1	740	150	WD	<25	c	c	15-35	35-60	<50	1-3	Moderate					
KNHmC3g1	740	150	WD	<25	c	c	15-35	35-60	<50	3-5	Severe					
KNHmD3g2	740	150	WD	<25	c	c	35-60	35-60	<50	5-10	Severe					

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

An area of about 267 ha (32%) is moderately suitable (Class S2) for growing sorghum and are distributed in the southern, central, southwestern, southeastern and northeastern part of the microwatershed. They have moderate limitations of erosion and rooting depth. Marginally suitable lands (Class S3) occupy maximum area of about 281 ha (34%) and are distributed in the central, western, and northwestern part of the microwatershed. They have severe limitations of rooting depth and erosion. An area of about 164 ha (20%) is not suitable (Class N) for growing sorghum and distributed in the central, eastern, northeastern and are northern part of the microwatershed. They have very severe limitations of gravelliness, topography, erosion and rooting depth.

Table 7.2 Crop suitability criteria for Sorghum

Crop requirement		**Rating**			
Soil –site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately Suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	class	Well to mod. 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

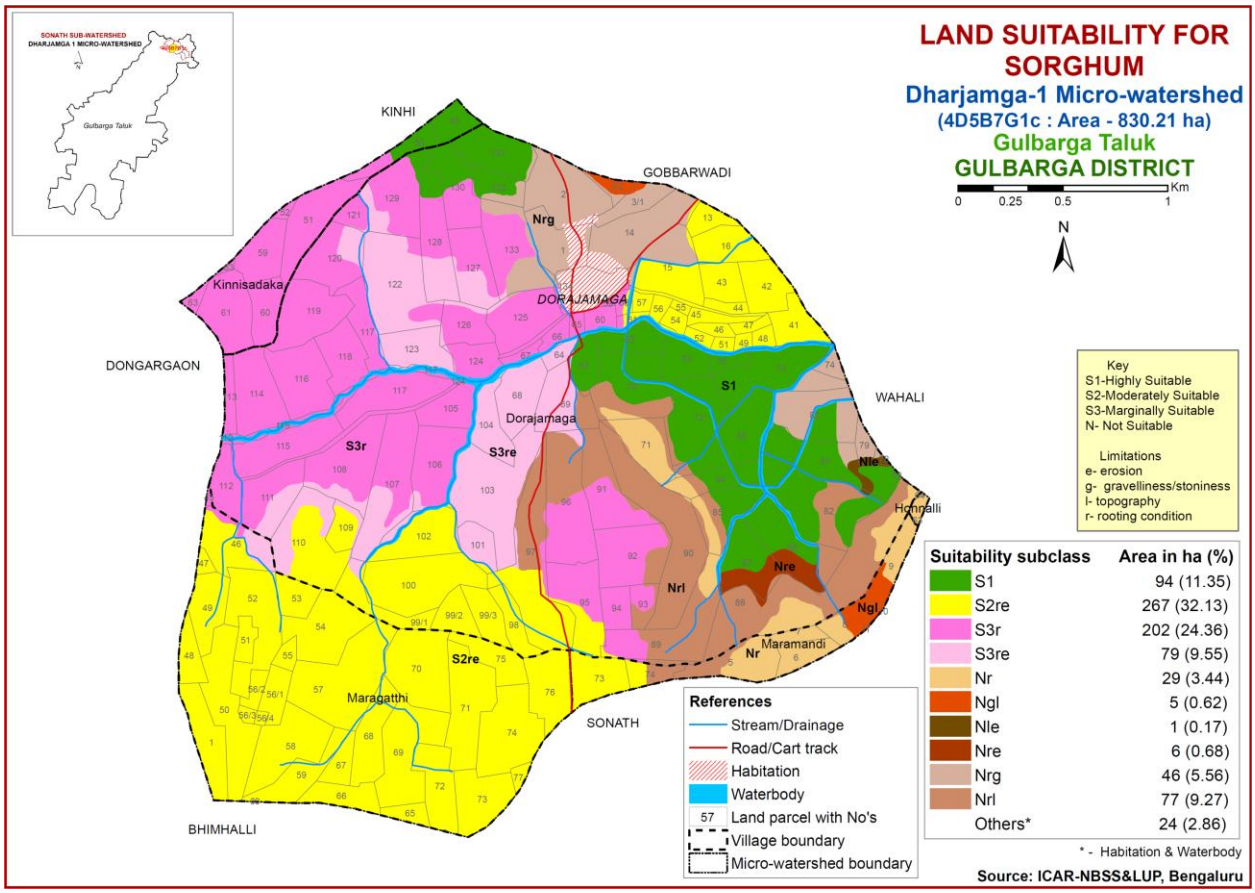


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

Maize is the most important food crop grown in an area of 13.37 lakh ha in all the district 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.

In Dharjamga-1 microwatershed, there are no lands that are highly (Class S1) and moderately (Class S2) suitable lands for growing maize. The marginally suitable (Class S3) lands cover a maximum area of about 642 ha (77%) and occur in all parts of the microwatershed. They have severe limitations of texture, erosion and rooting depth. About 164 ha (20%) area is not suitable (Class N) for growing maize and occurs in the eastern, central, northern and northwestern part of the microwatershed. They have very severe limitations of gravelliness, rooting depth, erosion, topography and texture.

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	

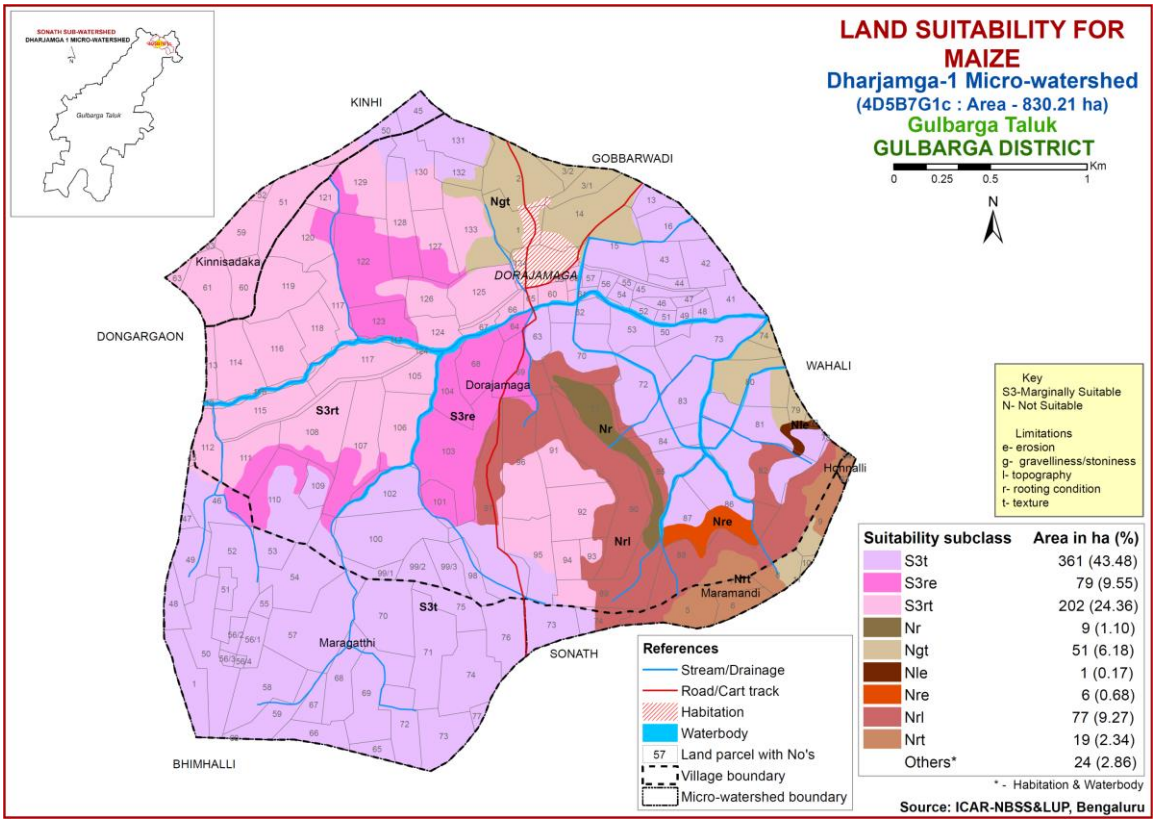


Fig. 7.2 Land Suitability map of Maize

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

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburgi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red gram (Table 7.4) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and land suitability map for growing red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.3.

In Dharjamga-1 microwatershed, there are no lands that are highly (Class S1) suitable for growing redgram. Major area of about 361 ha (43%) is moderately suitable (Class S2) for red gram and is distributed dominantly in all parts of the microwatershed. They have moderate limitations of texture, rooting depth and erosion. An area of about 281 ha (34%) is marginally suitable (Class S3) for growing red gram and are distributed in the central, western and northwestern part of the microwatershed. They have severe limitations of rooting depth, texture and erosion. An area of about 164 ha (20%) is not suitable (Class N) for growing red gram and distributed in the eastern, central, northeastern and northern part of the microwatershed. They have very severe limitations of gravelliness, rooting depth, erosion, topography and texture.

Table 7.4 Crop suitability criteria for Red gram

Crop requirement		**Rating**			
Soil–site characteristics	**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>210	180-210	150-180	<150
Soil drainage	class	Well drained	Mod. to 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
Surface soil texture	Class	l, scl, sil, cl, sl	sicl, sic, c(m)	ls	S, fragmental
Soil depth	Cm	>100	85-100	40-85	<40
Gravel content	% vol.	<20	20-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

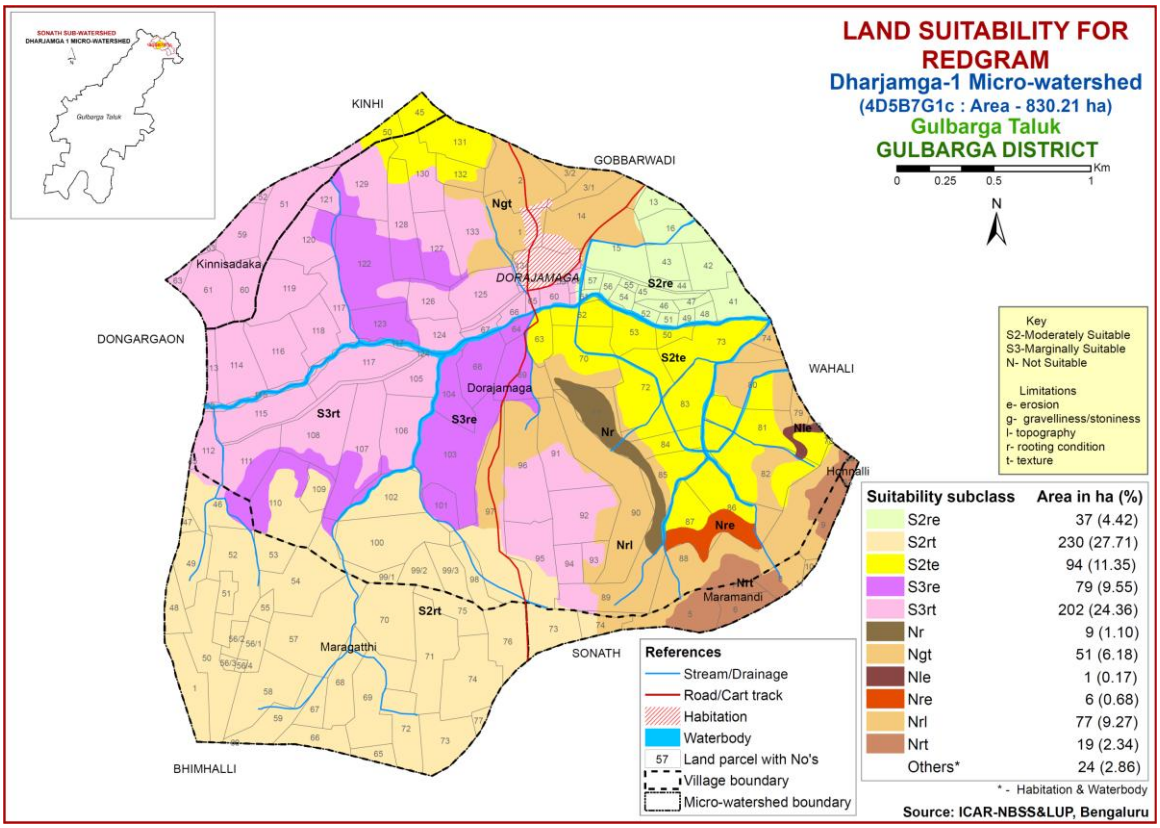


Fig. 7.3 Land Suitability map of Red gram

7.4 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is 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 7.5) 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 7.4.

Highly suitable (Class S1) lands are found to occur in a small area of 23 ha (3%) and are distributed in the northwestern and eastern part of the microwatershed. They have minor or no limitations for growing sunflower. An area of about 71 ha (9%) is moderately suitable (Class S2) for sunflower and is distributed in the northeastern and central part of the microwatershed. They have moderate limitation of erosion. Marginally suitable (Class S3) lands are found to occur in an area of about 267 ha (32%). The soils have limitation of rooting depth. They are dominantly distributed in the southern, southwestern, southeastern and northeastern part of the microwatershed. An area of about 445 ha (54%) is not suitable (Class N) for growing sunflower and occur in the western, northwestern, central and eastern part of the microwatershed. They have very severe limitations of gravelliness, topography, erosion and rooting depth.

Table 7.5 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	

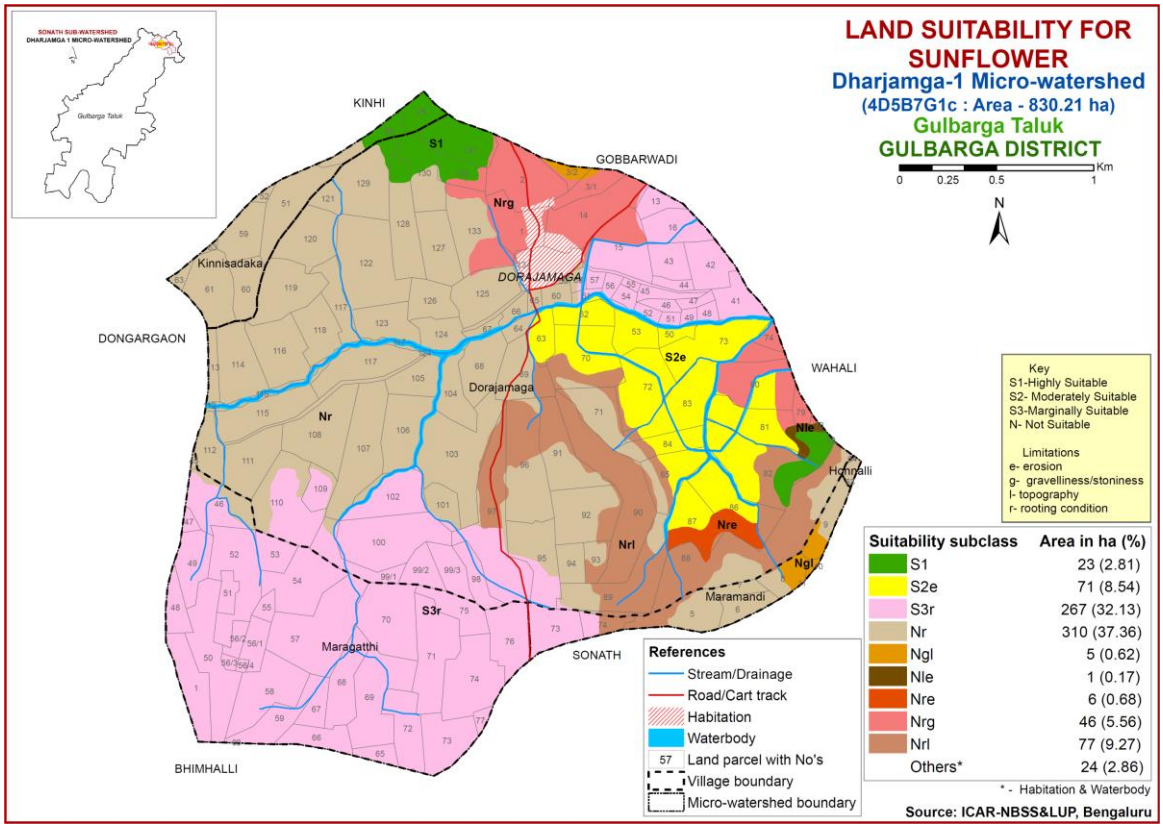


Fig. 7.4 Land Suitability map of Sunflower

7.5 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is the most important fibre crop grown in the State in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.6) 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 7.5.

A small area of about 23 ha (3%) in the microwatershed has soils that are highly suitable (Class S1) for growing cotton. They have minor or no limitations for growing cotton and are distributed in the northwestern and eastern part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in major area of about 338 ha (41%). The soils have moderate limitations of erosion and rooting depth. They are distributed in the southern, central, southeastern, southwestern and northeastern part of the microwatershed. The marginally suitable (Class S3) lands cover an area of about 281 ha (34%) and are distributed in the western and central part of the microwatershed. They have severe limitations of rooting depth and erosion. An area of about 164 ha (20%) is not suitable (Class N) for growing cotton and are distributed in the eastern, central northern and northeastern part of the microwatershed. They have very severe limitations of gravelliness, topography, erosion and rooting depth.

Table 7.6 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

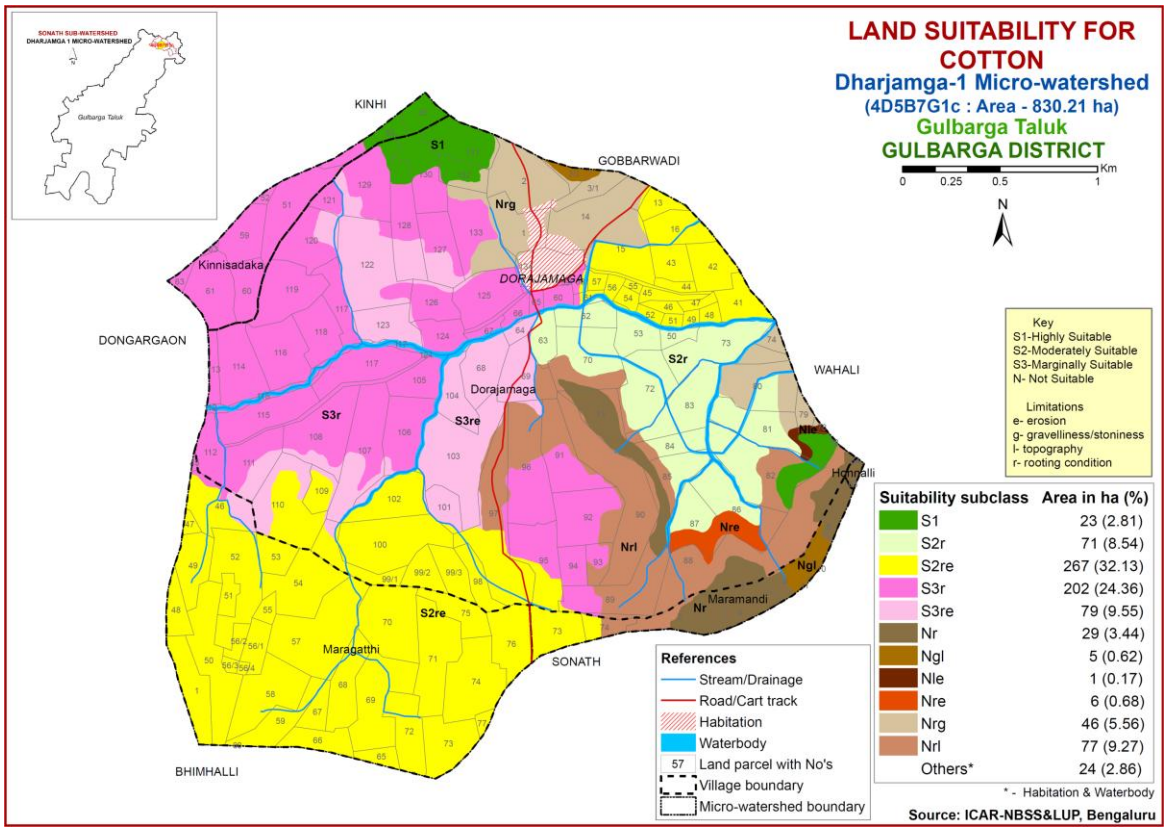


Fig. 7.5 Land Suitability map of Cotton

7.6 Land Suitability for Sugarcane (*Saccharum officinarum*)

Sugarcane is the most important commercial crop grown in 6.9 lakh ha area in Kalaburgi, Bijapur, Bagalkot, Bidar, Mysore, Chamarajanagar and Mandya districts under irrigated conditions. The crop requirements for growing sugarcane (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sugarcane was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

Highly (Class S1) and moderately suitable (Class S2) lands are not available for growing sugarcane in Dharjamga-1 microwatershed. The marginally suitable (Class S3) lands cover an area of about 361 ha (43%) and are distributed in the southern, southwestern, southeastern, northeastern, northwestern and central part of the microwatershed. They have severe limitations of texture. Major area of about 445 ha (54%) is not suitable (Class N) for growing sugarcane and occur in the western, central, eastern, northeastern and northwestern part of the microwatershed. They have very severe limitations of gravelliness, rooting depth, topography, erosion and texture.

Table 7.7 Crop suitability criteria for Sugarcane

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	>8
Soil drainage	class	Well drained	Mod./imperfectly drained	Poorly drained	V.poor/ excessively drained
Soil reaction	pH	7.0-8.0	6.0-6.9 8.1-9.0	4.0-5.9 9.1-9.5	<4.0/ >9.5
Surface soil texture	Class	l, cl, sil, sicl	C(m/k), sl	C+(ss)	
Soil depth	cm	>100	100-75	75-50	<50
stoniness	%	<15	15-35	35-50	>50
Salinity (EC)	dSm^{-1}	<2.0	2.0-4.0	4.0-9.0	>9
Sodicity (ESP)	%	<10	10-15	15-25	>25

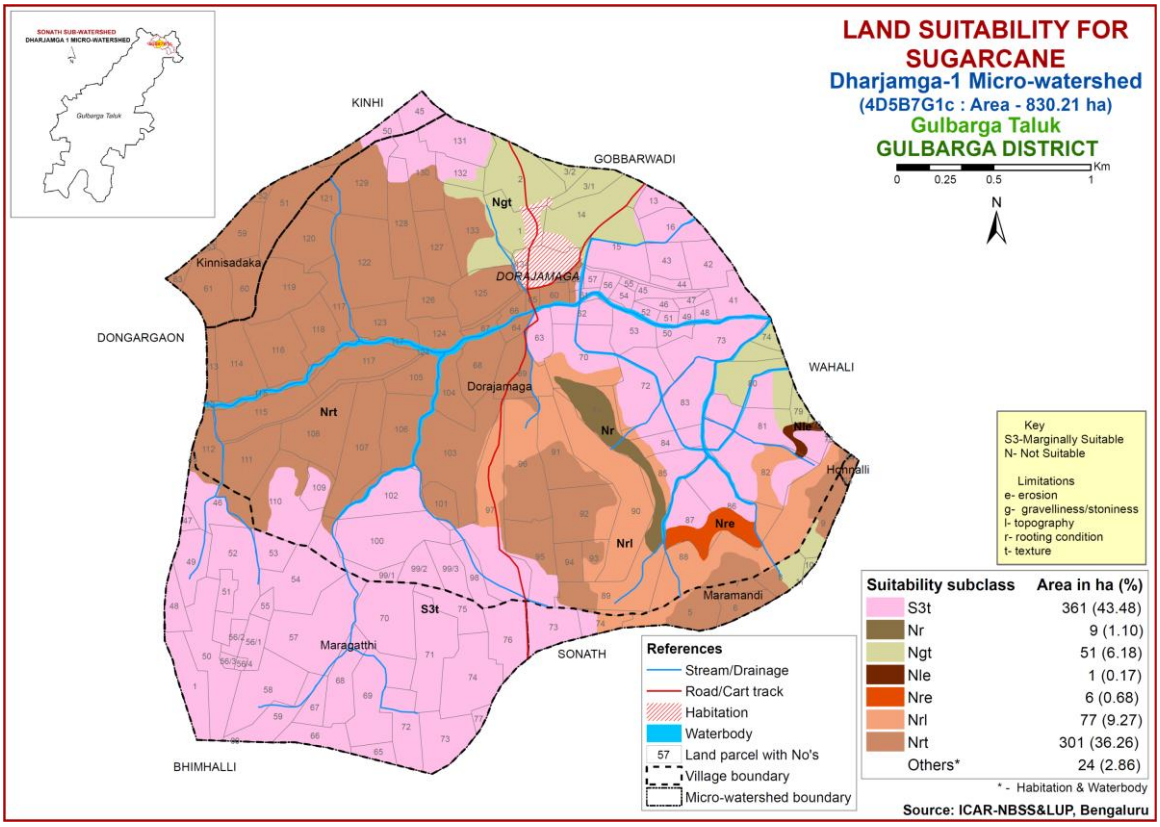


Fig. 7.6 Land Suitability map of Sugarcane

7.7 Land Suitability for Soybean (*Glycine max*)

Soybean is the most important pulse and oil seed crop grown in about 2.56 lakh ha area in Bijapur, Raichur, Kalaburgi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing soybean were matched with the soil-site characteristics and a

land suitability map for growing soybean was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

Highly suitable (Class S1) lands are found to occur in an area of 76 ha (9%). They have minor or no limitations for growing soybean and are distributed in the eastern and central part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in a major area of about 285 ha (34%). The soils have moderate limitations of erosion and rooting depth. They are dominantly distributed in the southern, southwestern, southeastern, northwestern and northeastern part of the microwatershed. The marginally suitable (Class S3) lands cover an area of about 281 ha (34%) and are distributed in the central, western and northwestern part of the microwatershed. They have severe limitations of rooting depth and erosion. An area of about 164 ha (20%) is not suitable (Class N) for growing soybean and occur in the eastern, central, northern and northeastern part of the microwatershed. They have very severe limitations of gravelliness, topography, erosion and rooting depth.

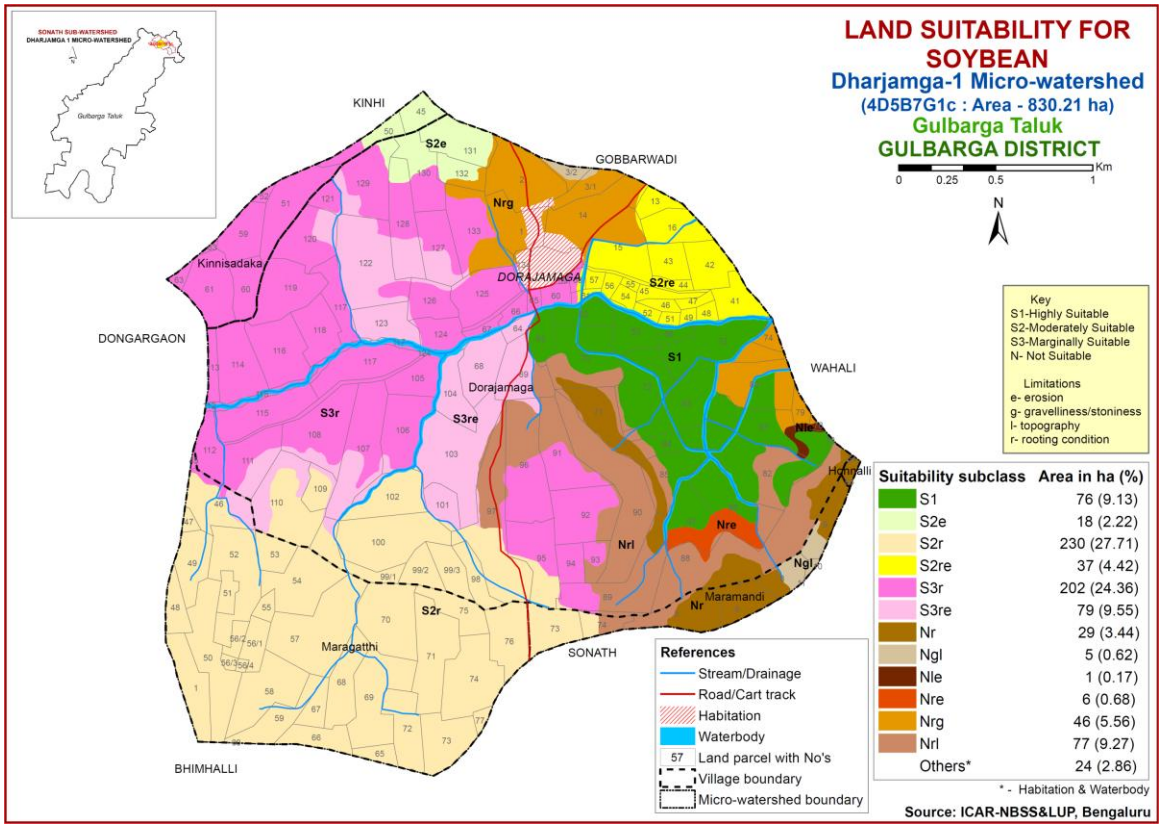


Fig. 7.7 Land Suitability map of Soybean

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

Bengal gram is the most important pulse crop grown in about 9.39 lakh ha area in Bijapur, Raichur, Kalaburgi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram were matched with the soil-site characteristics and

a land suitability map for growing Bengal gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

Highly suitable (Class S1) lands are found to occur in major area of 361 ha (43%). They have minor or no limitations for growing bengalgram and are distributed in the southern, southwestern, southeastern, central, northwestern and northeastern part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in an area of about 282 ha (34%). The soils have moderate limitations of rooting depth. They are dominantly distributed in the western, northwestern and central part of the microwatershed. The marginally suitable (Class S3) lands cover a small area of about 30 ha (4%) and are distributed in the eastern part of the microwatershed. They have severe limitations of gravelliness and rooting depth. An area of about 124 ha (15%) is not suitable (Class N) for growing bengalgram and occur in the eastern, central and northwestern part of the microwatershed. They have very severe limitations of gravelliness, topography, erosion and rooting depth.

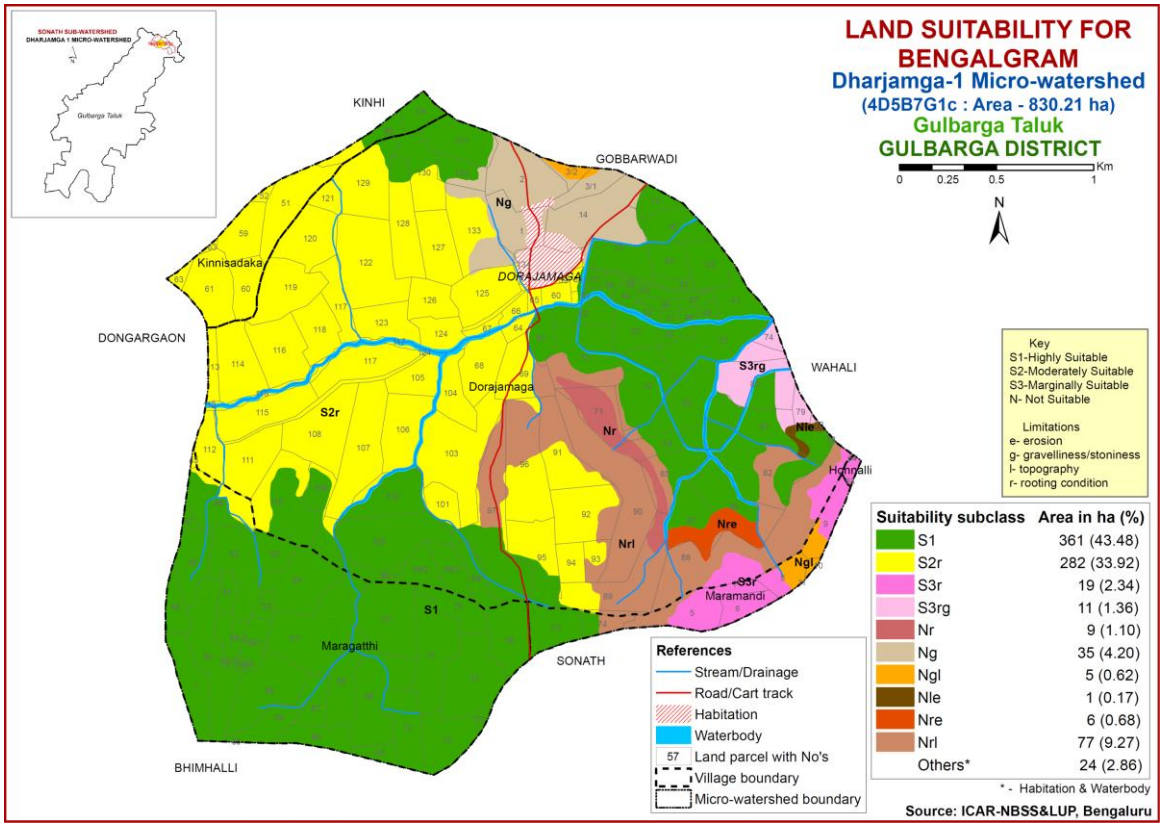


Fig. 7.8 Land Suitability map of Bengalgram

7.9 Land Suitability for Mango (*Mangifera indica*)

Mango is the most important fruit crop grown in about 1.73 lakh ha in all the districts of the State. The crop requirements for growing mango (Table 7.8) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.9.

No highly (Class S1) and moderately (Class S2) suitable lands are available for growing mango in the Dharjamga-1 microwatershed. The marginally suitable (Class S3) lands cover an area of about 94 ha (11%) and mainly occur in the northwestern, northeastern and eastern part of the microwatershed. They have severe limitations of texture. Major area of about 712 ha (86%) is not suitable (Class N) for growing mango and occur in all parts of the microwatershed. They have severe limitation of gravelliness, rooting depth, texture, erosion and topography.

Table 7.8 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	7.6-8.55.0-5.4	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	

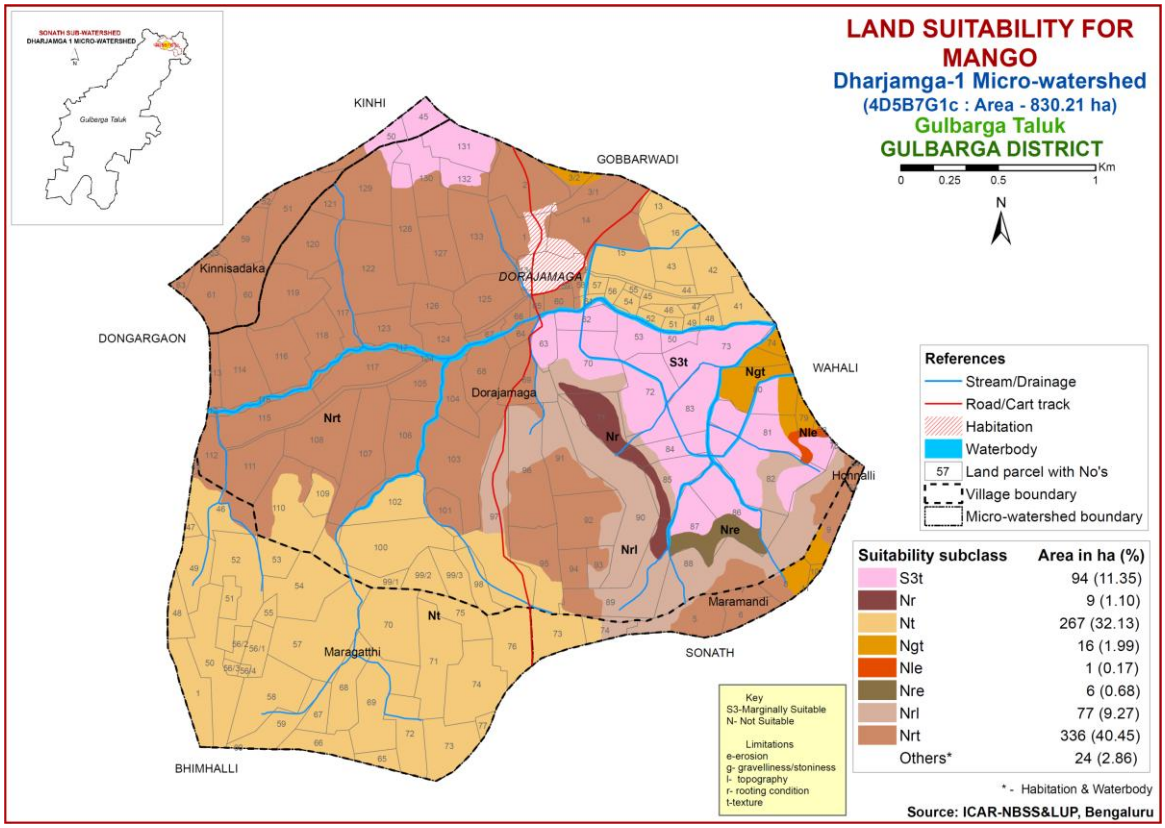


Fig. 7.9 Land Suitability map of Mango

7.10 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is the most important fruit crop grown in about 29373 ha in almost all the districts of the state. The crop requirements for growing sapota (Table 7.9) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.10.

In Dharjamga-1 microwatershed, there are no lands that are highly (Class S1) and moderately (Class S2) suitable for growing sapota. The marginally suitable (Class S3) lands cover an area of about 361 ha (43%) and mainly occur in the southern, southwestern, southeastern, central, northwestern, northeastern and eastern part of the microwatershed. They have severe limitations of rooting depth and texture. Major area of about 445 ha (54%) is not suitable (Class N) for growing sapota and occur in the western, northwestern, central, eastern and northern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography, erosion and texture.

Table 7.9 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 availabiliy	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

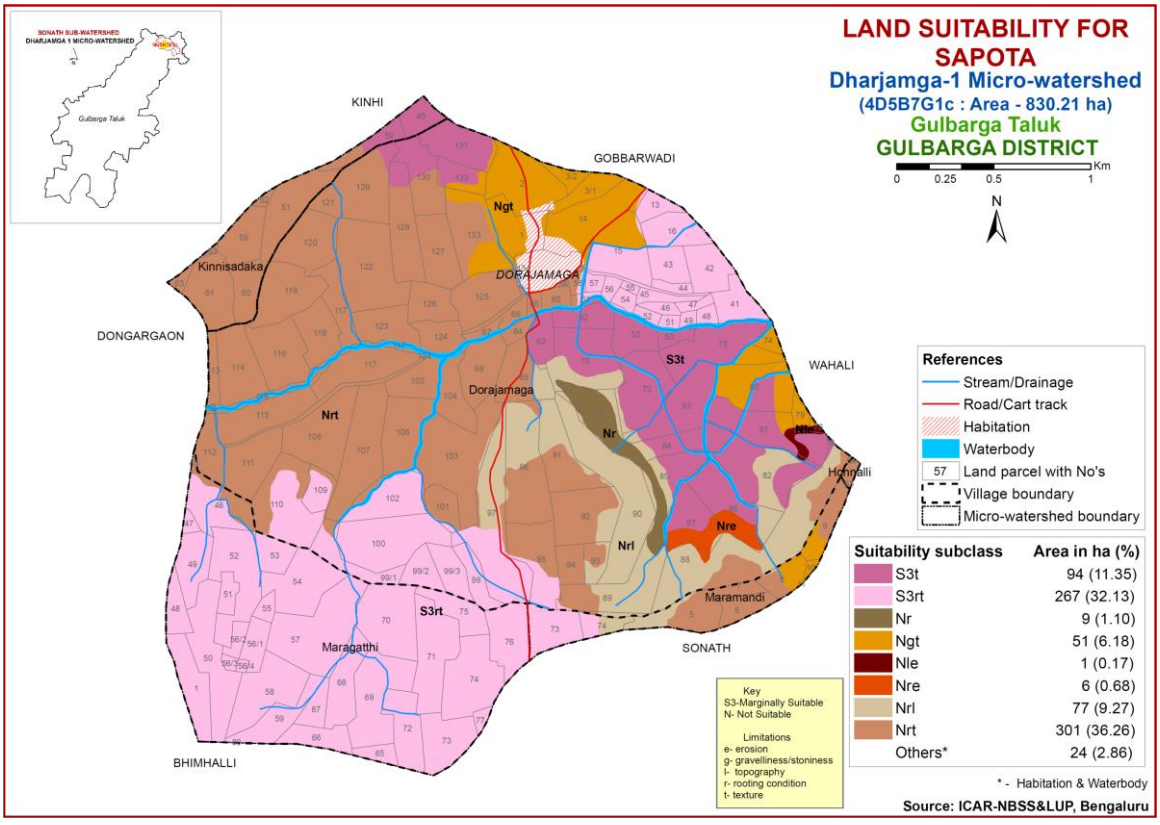


Fig. 7.10 Land Suitability map of Sapota

7.11 Land Suitability for Guava (*Psidium guajava*)

Guava is the most important fruit crop grown in about 6558 ha in the State in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga, Bangalore, Kolar, Chikaballapur and Chamarajnagar districts. The crop requirements for growing guava (Table 7.10) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

In Dharjamga-1 microwatershed, there are no highly (Class S1) and moderately (Class S2) suitable lands available for growing guava. Marginally suitable (Class S2) lands are found to occur in an area of about 361 ha (43%). The soils have moderate limitations of texture and rooting depth. They are dominantly distributed in the southern, southwestern, southeastern, northeastern, northwestern and central part of the microwatershed. Major area of about 469 ha (57%) is not suitable (Class N) for growing guava and occur in the western, northwestern, central, northeastern and eastern part of the microwatershed. They have severe limitations of gravelliness, topography, erosion, texture and rooting depth.

Table 7.10 Crop suitability criteria for Guava

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

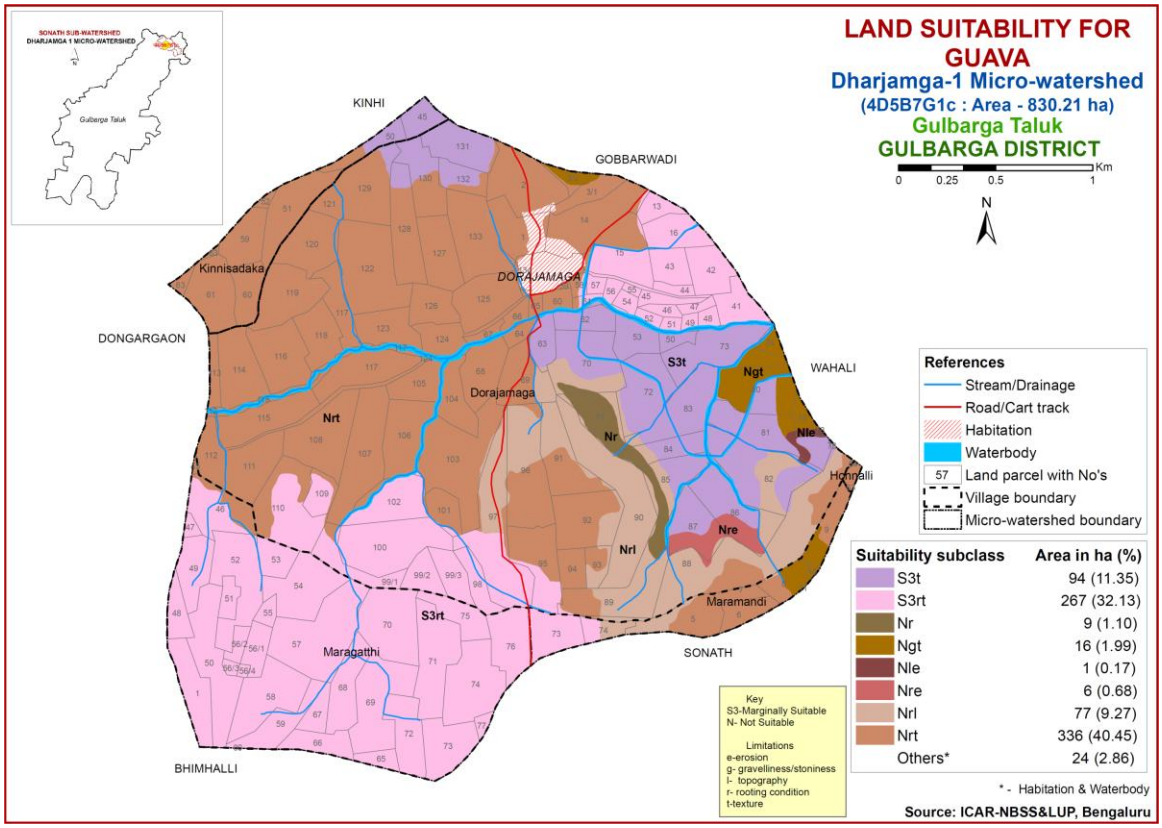


Fig 7.11 Land Suitability map of Guava

7.12 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is the most important fruit crop grown in 5368 ha in almost all the districts of the state. The crop requirements for growing jackfruit were matched with the soil-site characteristics and a land suitability map for growing jackfruit was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

No highly (Class S1) and moderately (Class S2) suitable lands are available for growing jackfruit in the microwatershed. The marginally suitable (Class S3) lands cover an area of about 361 ha (43%) and mainly occur in the southern, southwestern, southeastern, central, northwestern, northeastern and eastern part of the microwatershed. They have severe limitations of rooting depth and texture. Major area of about 445 ha (54%) is not suitable (Class N) for growing jackfruit and occur in the western, northwestern, central, eastern and northern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography, erosion and texture.

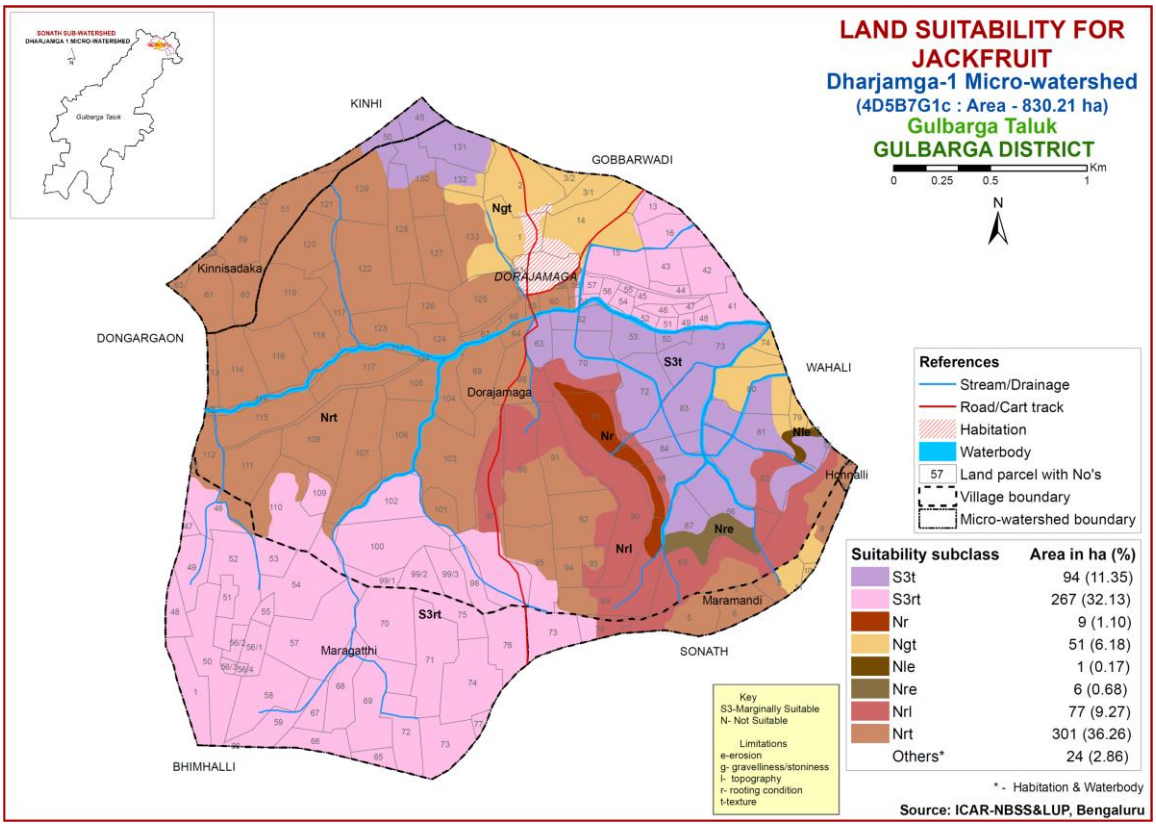


Fig 7.12 Land Suitability map of Jackfruit

7.13 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is the most important fruit crop grown in almost all the districts of the state. The crop requirements for growing jamun were matched with the soil-site characteristics and a land suitability map for growing jamun was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

No highly (Class S1) suitable lands are available for growing jamun in the microwatershed. The moderately suitable (Class S2) lands found to occur in a small area of about 23 ha (3%). The soils have moderate limitation of texture. They are dominantly distributed in the northwestern and eastern part of the microwatershed. The marginally suitable (Class S3) lands cover an area of 338 ha (41%) and mainly occur in the southern, southeastern, southwestern, central and northeastern part of the microwatershed. They have severe limitations of rooting depth and texture. Major area of about 445 ha (54%) is not suitable (Class N) for growing jamun and occur in the western, northwestern, central, eastern and northern part of the microwatershed. They have severe limitations of rooting depth, gravelliness, topography, erosion and texture.

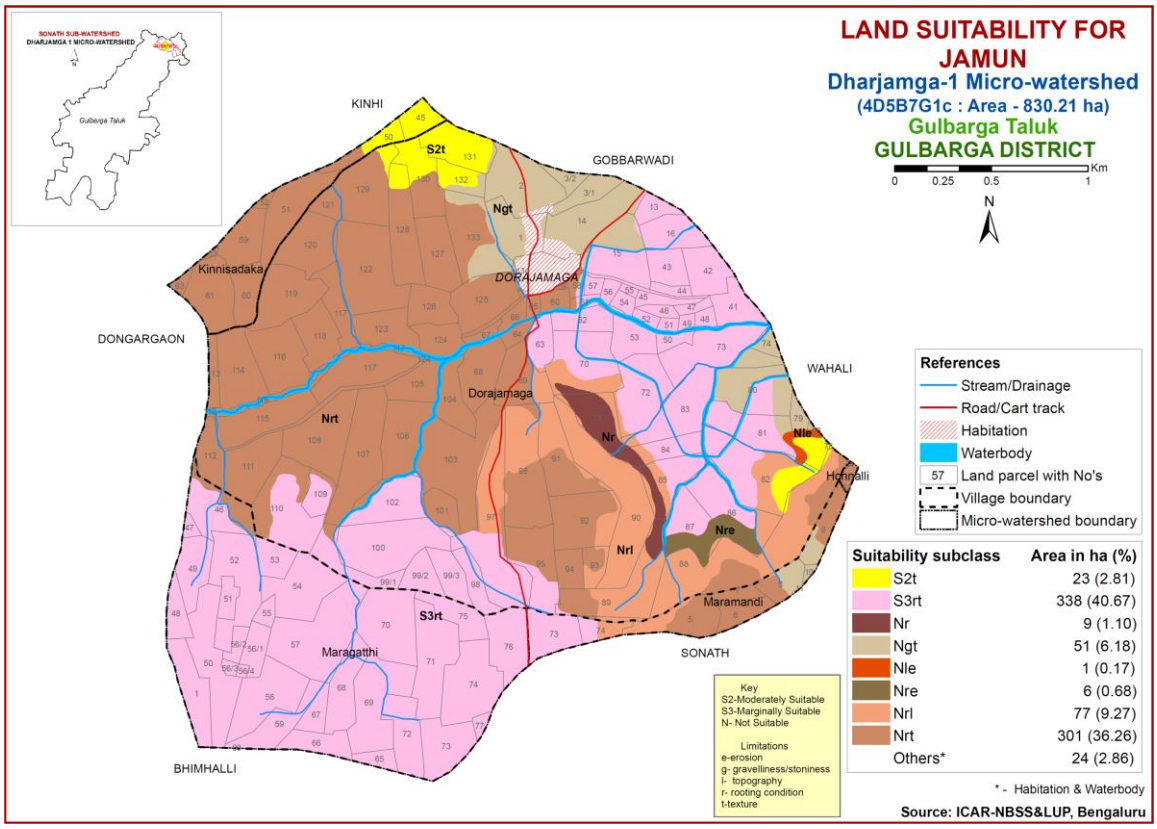


Fig 7.13 Land Suitability map of Jamun

7.14 Land Suitability for Musambi (*Citrus limetta*)

Musambi is the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements for growing musambi were matched with the soil-site characteristics and a land suitability map for growing musambi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.14.

Highly suitable (Class S1) lands are found to occur in a small area of about 23 ha (3%) and are distributed in the northwestern and eastern part of the microwatershed. They have minor or no limitations for growing musambi. The moderately suitable (Class S2) lands cover an area of about 71 ha (9%). The soils have moderate limitation of rooting depth. They are dominantly distributed in the northeastern and central part of the microwatershed. The marginally suitable (Class S3) lands cover an area of 267 ha (32%) and mainly occur in the southern, southeastern, southwestern and northeastern part of the microwatershed. They have severe limitations of rooting depth. Major area of about 445 ha (54%) is not suitable (Class N) for growing musambi and occur in the western, northwestern, central, eastern and northern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography and erosion.

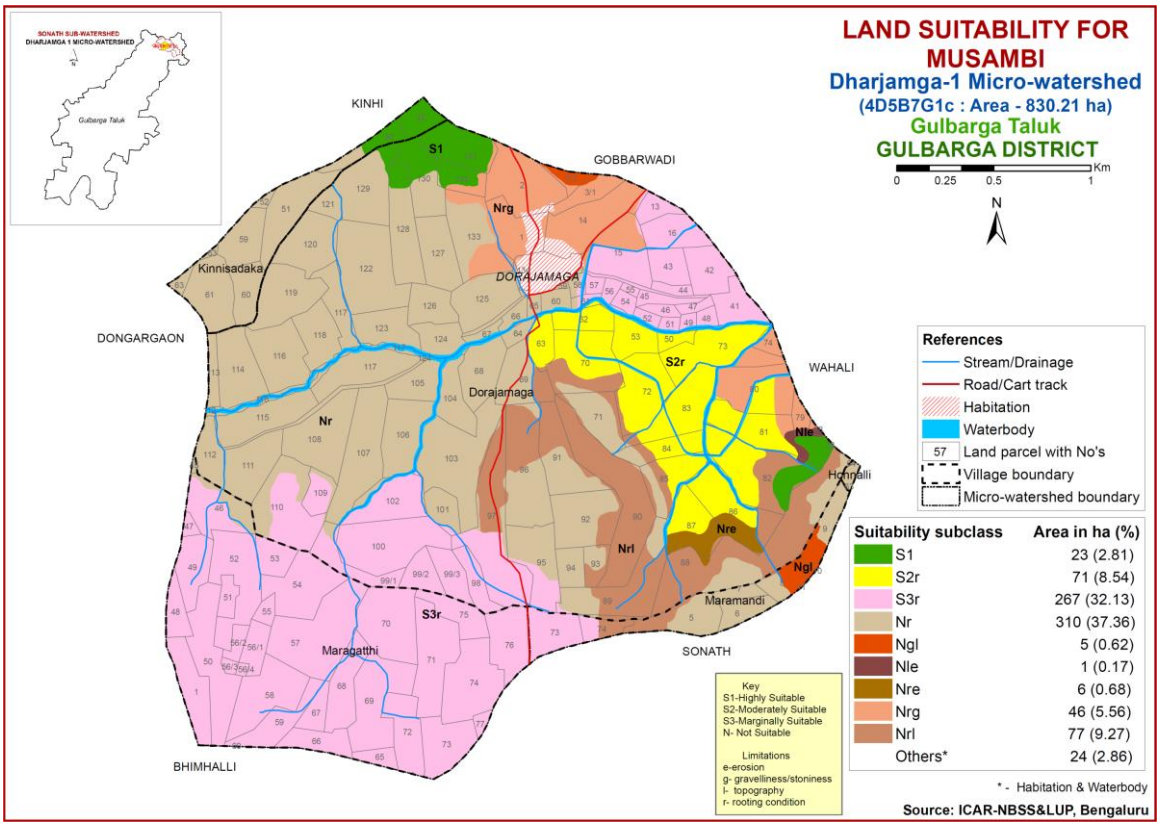


Fig 7.14 Land Suitability map of Musambi

7.15 Land Suitability for Lime (*Citrus sp*)

Lime is the most important fruit crop grown in 11752 ha in almost all the districts of the state. The crop requirements for growing lime (Table 7.11) 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 is given in Figure 7.15.

Highly suitable (Class S1) lands are found to occur in a small area of about 23 ha (3%) and are distributed in the northwestern and eastern part of the microwatershed. They have minor or no limitations for growing lime. The moderately suitable (Class S2) lands cover an area of about 71 ha (9%). The soils have moderate limitation of rooting depth. They are dominantly distributed in the northeastern and central part of the microwatershed. The marginally suitable (Class S3) lands cover an area of 267 ha (32%) and mainly occur in the southern, southeastern, southwestern and northeastern part of the microwatershed. They have severe limitations of rooting depth. Major area of about 445 ha (54%) is not suitable (Class N) for growing lime and occur in the western, northwestern, central, eastern and northern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography and erosion.

Table 7.11 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	Temp 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 condition	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	

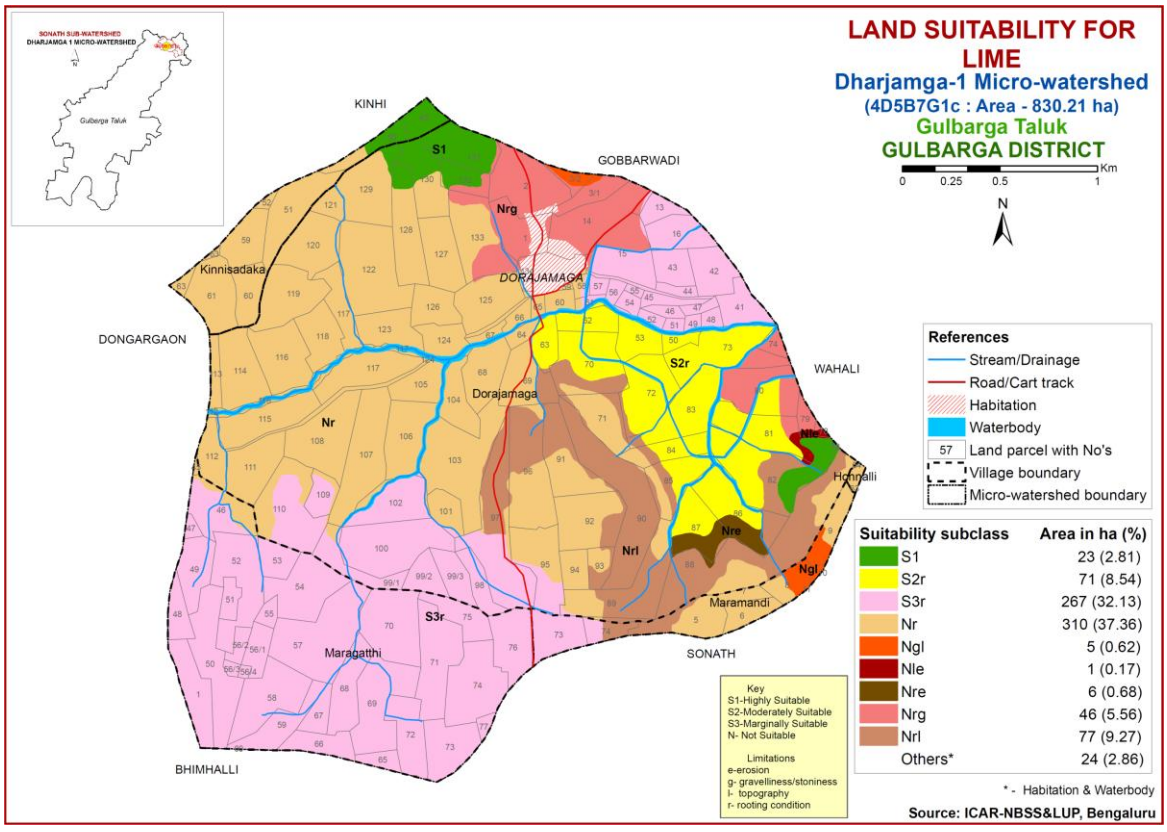


Fig 7.15 Land Suitability map of Lime

7.16 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is the most important plantation crop grown in an area of about 70552 ha in almost all the districts. The crop requirements for growing Cashew were matched with the soil-site characteristics and a land suitability map for growing Cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

Entire area is not suitable (Class N) for growing cashew in the microwatershed.

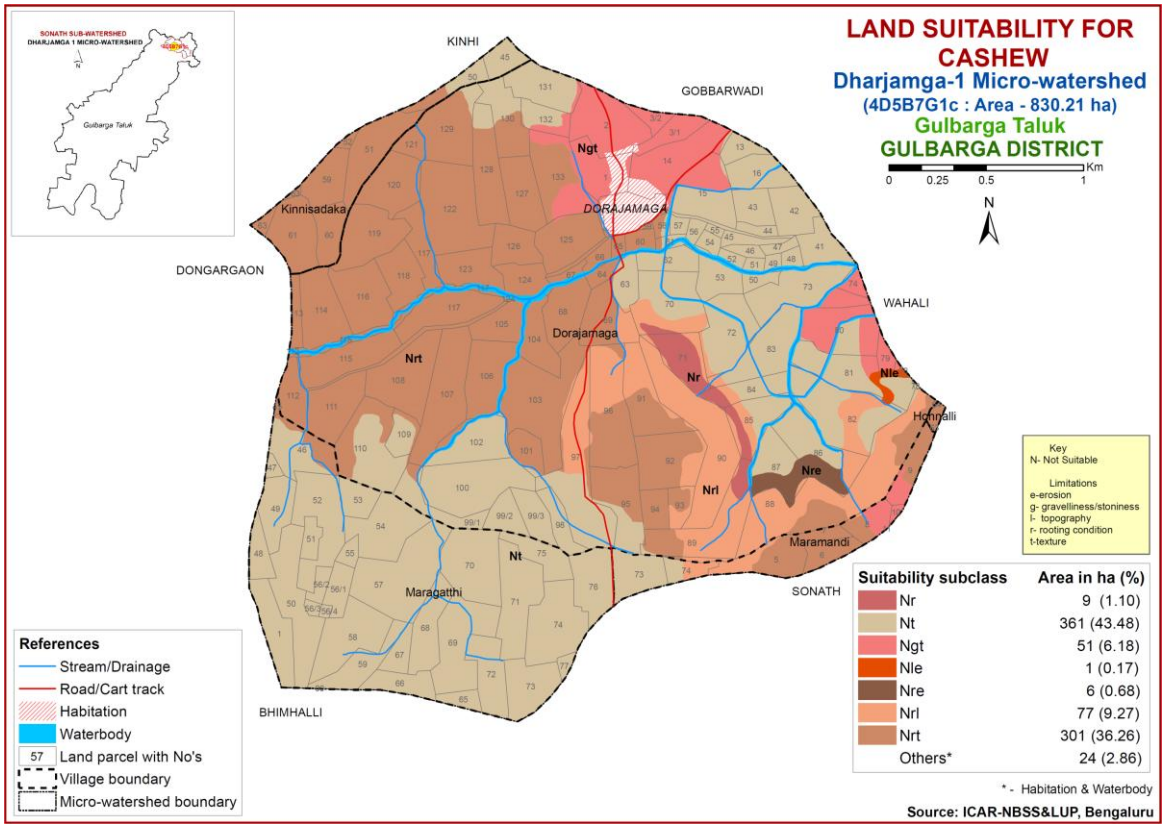


Fig 7.16 Land Suitability map of Cashew

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

Custard apple is the most important fruit crop grown in 1426 ha in almost all the districts of the state. The crop requirements for growing custard apple were matched with the soil-site characteristics 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 is given in Figure 7.17.

Highly suitable (Class S1) lands are found to cover an area of 94 ha (11%) and are distributed in the northwestern, northeastern and central part of the microwatershed. They have minor or no limitations for growing custard apple. Moderately suitable (Class S2) lands are found to occur in an area of about 267 ha (32%). The soils have moderate limitations of erosion and rooting depth. They are dominantly distributed in the southern, southeastern, southwestern and northeastern part of the microwatershed. The marginally

suitable (Class S3) lands cover a major area of about 282 ha (34%) and mainly occur in the western, northwestern and central part of the microwatershed. They have severe limitations of rooting depth, erosion and topography. An area of about 163 ha (20%) is not suitable (Class N) for growing custard apple and occur in the eastern, central, northern and northeastern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography and erosion.

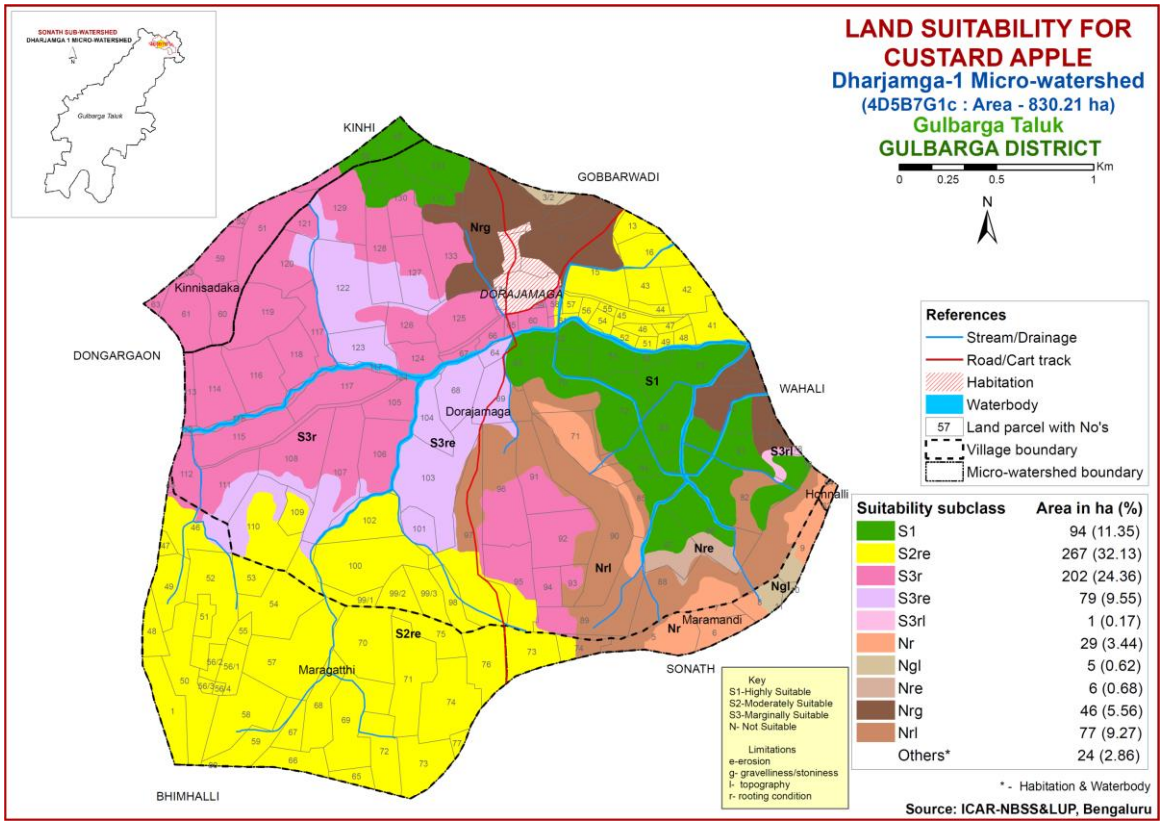


Fig 7.17 Land Suitability map of Custard Apple

7.18 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is the most important medicinal plant grown in 151 ha in almost all the districts of the state. The crop requirements for growing amla were matched with the soil-site characteristics and a land suitability map for growing amla was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.18.

Highly suitable (Class S1) lands are found to cover an area of 94 ha (11%) and are distributed in the northwestern, northeastern and central part of the microwatershed. They have minor or no limitations for growing amla. Moderately suitable (Class S2) lands are found to occur in an area of about 267 ha (32%). The soils have moderate limitations of erosion and rooting depth. They are dominantly distributed in the southern, southeastern, southwestern and northeastern part of the microwatershed. The marginally suitable (Class S3) lands cover a major area of about 282 ha (34%) and mainly occur in the western, northwestern and central part of the microwatershed. They have severe limitations of

rooting depth, erosion and topography. An area of about 163 ha (20%) is not suitable (Class N) for growing amla and occur in the eastern, central, northern and northeastern part of the microwatershed. They have very severe limitations of rooting depth, gravelliness, topography and erosion.

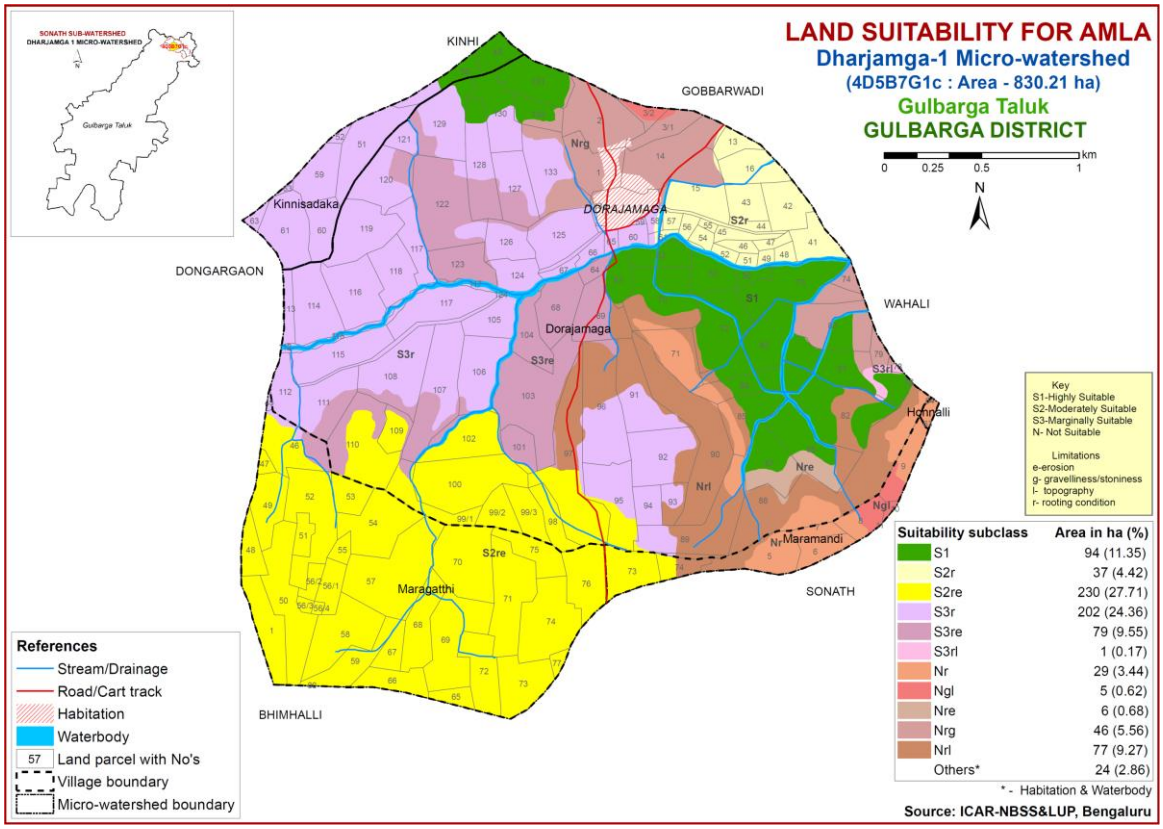


Fig 7.18 Land Suitability map of Amla

7.19 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is the most important spice crop raised in 14897 ha in all the districts of the state. The crop requirements for growing tamarind were matched with the soil-site characteristics and a land suitability map for growing tamarind was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.19.

No highly (Class S1) suitable lands are available for growing tamarind in the Dharjamga-1 microwatershed. Moderately suitable (Class S2) lands are found to occur in an area of about 23 ha (3%). The soils have moderate limitations of texture and rooting depth. They are distributed in the northwestern and eastern part of the microwatershed. The marginally suitable (Class S3) lands cover about 71 ha (9%) area and mainly occur in the northeastern, central and eastern part of the microwatershed. The soils have severe limitation of texture and rooting depth. Major area of about 712 ha (86%) is not suitable (Class N) for growing tamarind and occur in all parts of the microwatershed. The soils have very severe limitation of texture, gravelliness, erosion, topography and rooting depth.

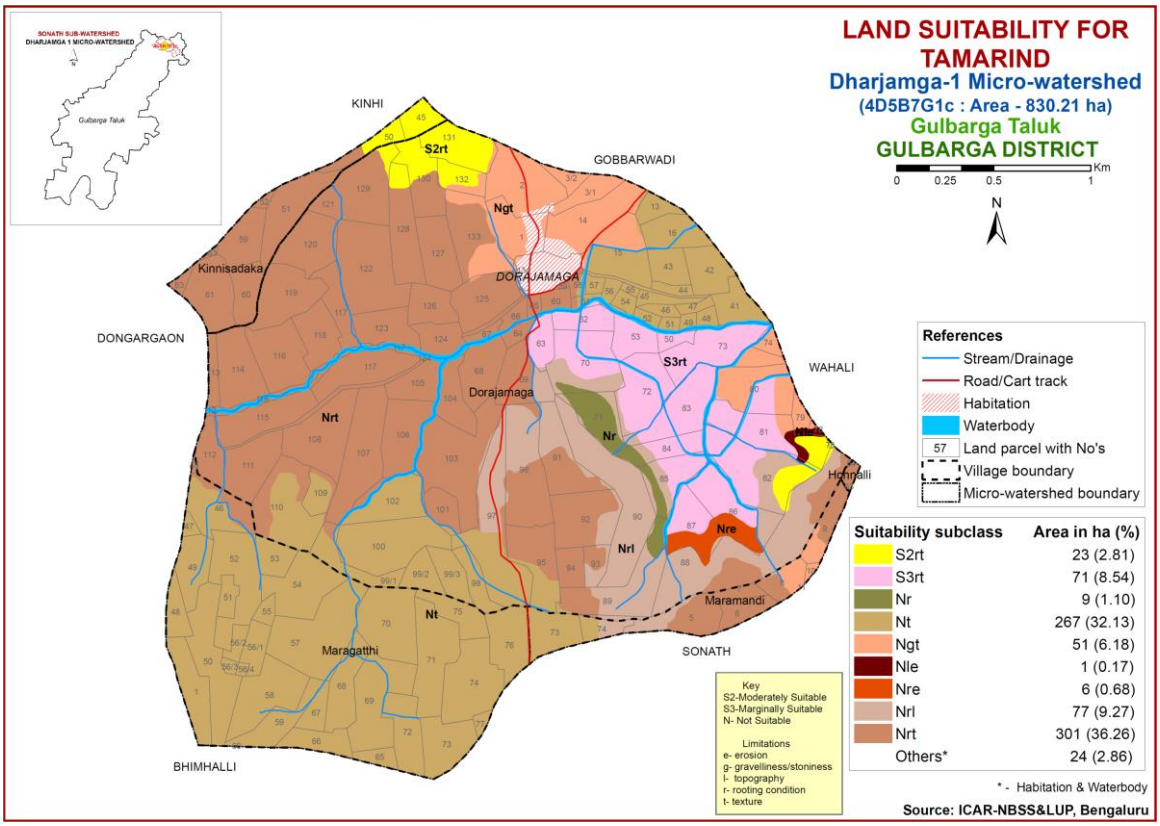


Fig 7.19 Land Suitability map of Tamarind

7.20 Land Use Classes (LUCs)

The 22 soil map units identified in Dharjamga-1 microwatershed have been regrouped into 5 Land Use Classes (LUC's) for the purpose of preparing a Proposed Crop Plan. Land Use Classes 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 Use Classes map (Fig.7.20) has been generated. These Land Use Classes are expected to behave similarly for a given level of management.

The map units that have been grouped into 5 land use classes along with brief description of soil and site characteristics are given below.

LUCs	Soil map units	Soil and site characteristics
1	MGTiC3g3, MGTiD3g3 MGTmC3g2, MGTiD3g3 KNHmB2g1, KNHmC3g1 22KNHmD3g2,19DIMmD3g2	Very shallow, clayey soils with slopes of 3-10%, gravelly to extremely gravelly (15-80%) and moderate to severe erosion.
2	MGTiC2g2, MATmB1g1 NHAmB3g1, NHAmC3g1	Very shallow to shallow, clayey soils with slopes of 1-5%, gravelly to very gravelly (15-60%) and slight to severe erosion.
3	NHAmB2, NHAmB2g1 BHImB1g1	Shallow, clay soils with slopes of 1-3%, gravelly (15-35%) and slight to moderate erosion
4	DSImB2 ,DSImB2g1 GTTmB2,KMPmB2 KMPmB2g1	Moderately shallow, clay soils with slopes of 1-3%, gravelly (15-35%) and moderate erosion
5	DIMiB2g1, DIMmC2g1	Deep, clayey soils with slopes of 1-5% gravelly (15-35%) and moderate erosion

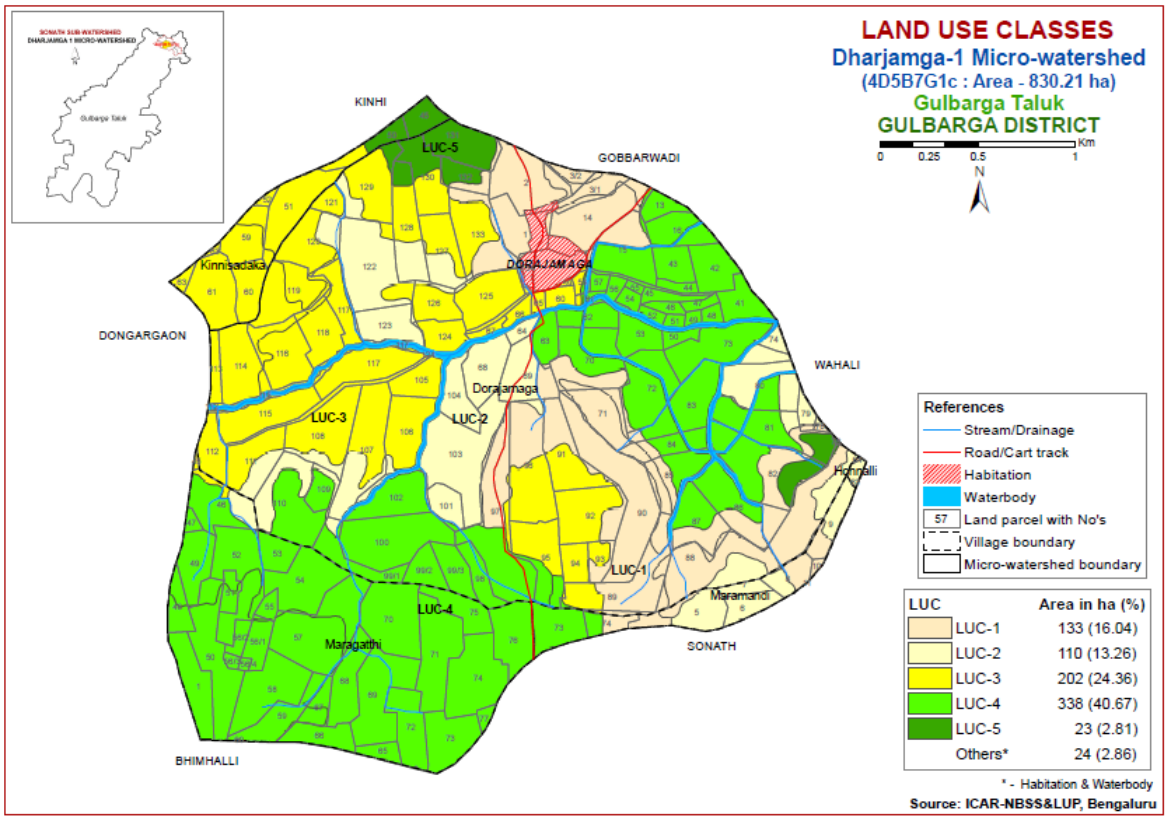


Fig. 7.20 Land Use Classes map of Dharjamga-1 Microwatershed

7.21 Proposed Crop Plan for Dharjamga-1 Microwatershed

After assessing the land suitability for the 19 crops, a proposed crop plan has been prepared for the 5 identified LUCs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the nineteen crops. The resultant proposed crop plan is presented below in Table 7.12

Table 7.12 Proposed Crop Plan for Dharjamga-1 Microwatershed

	Mapping unit	Survey No	Field crops	Forestry Crop/Grasses	Horticulture crops (Rainfed Condition)	Horticulture crops with suitable intervention	Suitable Intervention
LUC-1	2MGTiC3g3 3MGTiD3g3 4MGTmC3g2 5MGTiD3g3 20KNHmB2g1 21KNHmC3g1 22KNHmD3g2 19DIMmD3g2	Dorajamaga: 1,2,3/1,3/2,14,71,78, 88,89,90 Maramandi: 8,10,11,74	-	Neem, Glyricydia , Silviculture, Agave, Simaroba	-	-	Crescent bunds
LUC-2	1MGTiC2g2 6MATmB1g1 9NHAmB3g1 10NHAmC3g1	Dorajamaga: 64,68,69,74,79,80,101,103,104, 122,123 Honnalli: 63,64 Maramandi: 5,6,7,9	Horse gram, Green gram, chick pea	Neem, Glyricydia , Silviculture, Agave, Simaroba	-	-	Crescent bunds
LUC-3	7NHAmB2 8NHAmB2g1 11BHImB1g1	Dorajamaga: 58,59,60,65,66,67,91,92,93, 94,95,96,105, 106,107,108,111,112, 113,114,115,116,117,118,119,120, 121,124, 125,126,127,128,129,130, 133, XX Kinnisadaka: 51,52,59,60,61,63 Maragatthi: 45	Bajra, Linseed, Green gram, Black gram, Chick pea	Subabhul, Neem, Teak	Custard apple, Charoli, Ber, Amla Vegetables: Ladies finger, Brinjal, Cowpea, Flower Crops: Marigold, Chrysanthemum	Custard apple, Charoli, Ber, Amla Vegetables: Onion, Tomato, Brinjal, Chillies, Bhendi Flower Crops: Marigold, Chrysanthemum	Drip irrigation, suitable soil and water conservations like cultivation on raised beds with mulches and drip

LUC-4	12 DSImB2 13 DSImB2g1 14 GTTmB2 15KMPmB2 16KMPmB2g1	Dorajamaga: 13,15,16,41,42,43,44,45,46,47, 48,49,50, 51,52,53,54,55,56,57,62,63,70, 72,73,81, 82,83,84,85,86,87,97,98,99/1, 99/2,99/3, 100,102,109,110 Maragatthi: 1,46,47,48,49,50,51,52, 53,54,55,56/1,56/2,56/3, 56/4,57,58,59,60,65,66, 67,68,69,70,71,72,73,74, 75,76,77 Maramandi: 73	Sorghum, Cotton, Red Gram, Black gram, Green gram, Soybean, Sesame, Sunflower, Safflower Rabi: Sorghum, Chickpea	Subabhul, Neem, Teak	Custard apple, Charoli, Ber, Amla Vegetables: Ladies finger, Brinjal, Cowpea, Flower Crops: Marigold, Chrysanthemum	Custard apple, Charoli, Ber, Amla, Papaya, Banana, Lime, Citrus Vegetables: Onion, Tomato, Brinjal, Chillies, Bhendi Flower Crops: Marigold, Chrysanthemum	Drip irrigation, suitable soil and water conservations like cultivation on raised beds with mulches and drip Graded bunds, Strengthening of field bunds
LUC-5	17DIMiB2g1 18DIMmC2g1	Dorajamaga: 131,132 Kinnisadaka: 45,50	Sorghum, Cotton, Red Gram Black gram, Green gram, Soybean, Sesame, Sunflower, Safflower, Rabi: Sorghum, Chickpea	-	Vegetables: Ladies finger, Brinjal, Cowpea, coriander Field crops: Sorghum, Cotton, Red Gram, Sunflower,Safflower, Perennial component: Guava, Tamarind, Sapota, Lime, Mosambi Flower Crops: Marigold, Chrysanthemum	Banana, Papaya, Lime. Mosambi, Guava, Tamrind Vegetables: Onion, Tomato, Brinjal, Chillies, Bhendi Flower Crops: Marigold, Chrysanthemum	Drip irrigation, suitable soil and water conservations like cultivation on raised beds with mulches and drip Graded bunds, Strengthening of field bunds

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Dharjamga-1 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of NHA (250 ha), DSI (230 ha), KNH (92 ha), KMP (71 ha), MGT (48 ha), GTT (37 ha), BHI (31 ha), DIM (25 ha) and MAT (23 ha).
- As per land capability classification, nearly 87 per cent area comes under arable land category (Class II, III and IV) and 13 per cent area belongs to nonarable land (Class VI and VIII) category. The major limitations identified in the arable lands were soil and erosion.

- On the basis of soil reaction, about 296 ha (36%) area is moderately alkaline (pH 7.8-8.4) followed by slightly alkaline (pH 7.3-7.8) soils in 244 ha (29%). An area of about 267 ha (32%) is neutral (pH 6.5-7.3) in reaction. Thus, about 65 per cent of the soils in the microwatershed are alkaline in reaction.

Soil Health Management

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

Alkaline soils

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. Out of total area of 830 ha in the microwatershed, major area of 755 ha is suffering from either moderate or severe erosion. These areas need immediate soil and water conservation and other land husbandry practices for restoring soil health.

Dissemination of information and communicate 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 Plans) and Interventions needed

Net planning in IWMP is focusing on preparation of

1. Soil and Water Conservation Plan 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 (Saturation Plans) are briefly presented below.

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.

- **Surface soil texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, raddish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka may 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 Dharjamga-1 microwatershed.

- **Organic Carbon:** In about 54 ha (6%) area, the OC content is medium (0.5-0.75%) and in about 753 ha (91%) area, it is high (>0.75%). The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.

- **Promoting green manuring:** Growing of green manuring crops cost 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 54 ha area where OC is low to medium. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.

- **Available Phosphorus**: In 69 ha (3%) area, the available phosphorus is low and an area of about 738 ha (89%) it is medium in available phosphorus in the microwatershed. Hence for all the crops, 25% additional P-needs to be applied.

- **Available Potassium:** Available potassium is medium in 637 ha (77%) area of the microwatershed, low in 5 ha (<1%) area of the microwatershed. Hence, in all these plots, when available potassium is medium or low, for all crops an additional 25 % potassium may be applied. It is high in 164 ha (20%) area of the microwatershed.

- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is low in 352 ha (42%) area of the microwatershed and medium in 424 ha (51%).These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertitilizer (13% sulphur) for 2-3 years for the deficiency to be corrected. About 30 ha (4%) area has soils that are high in available sulphur.

- **Available iron:** It is deficient in 36 ha (4%) area of the microwatershed and it is sufficient in 770 ha (93%) area in the microwatershed.

- **Available Zinc:** It is deficient in 469 ha (56%) area of the microwatershed. It is sufficient in 338 ha (41%) area in the microwatershed. Application of zinc sulphate @25kg/ha is to be applied, in those area where available zinc is deficient.

Soil alkalinity: The microwatershed has 540 ha area with soils that alkaline in reaction. 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.

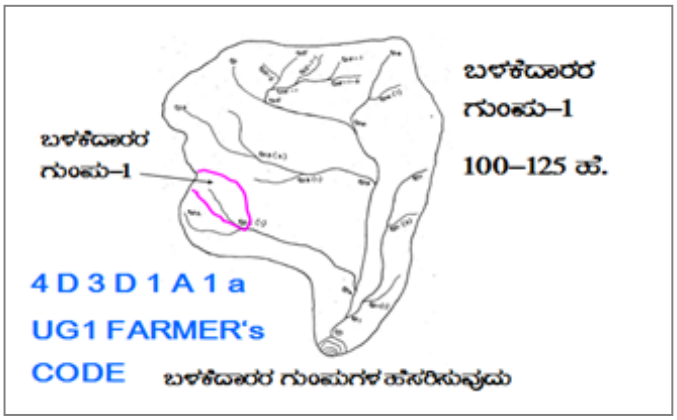
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and 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 Dharjamga-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 has to be collected.

Steps for Survey and Preparation of Treatment Plan

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

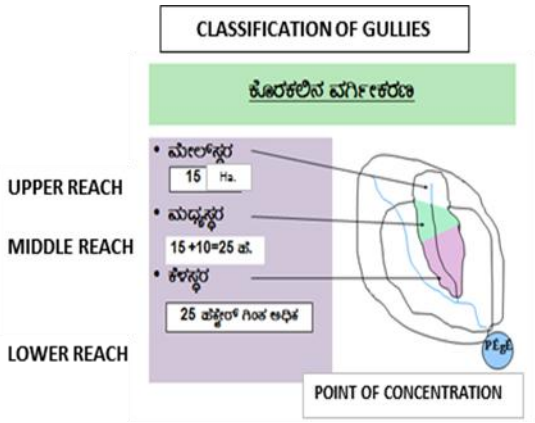
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

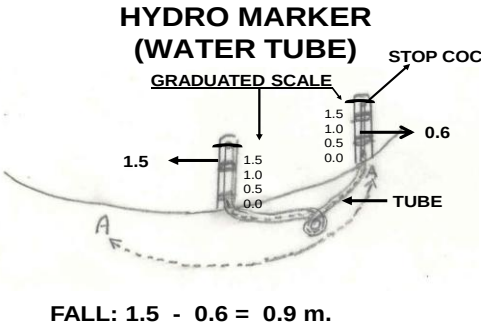
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

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

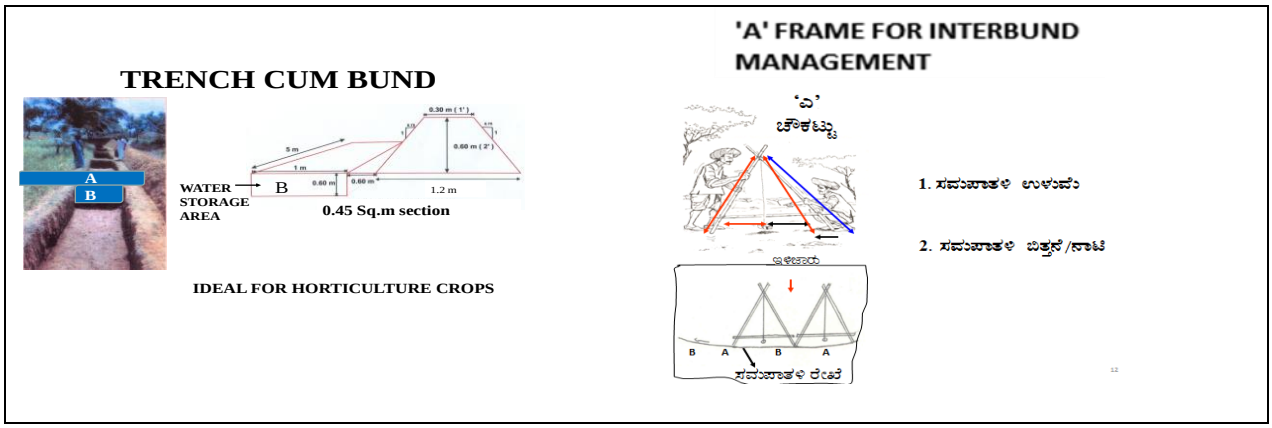
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soil	
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 soil	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black soil	
0.6	3.1	0.7	1.78:1	1.29	Medium black soil	
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. Water Ways

- Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.
- Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.
- 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 are formed in the field.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 444 ha (53%) requires crescent bunds, 267 ha (32%) area requires trench cum bunding and an area of about 96 ha (12%) needs graded bunding / strengthening of field bunds.

The conservation plan prepared may be presented to all the stakeholders including farmers and after including their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

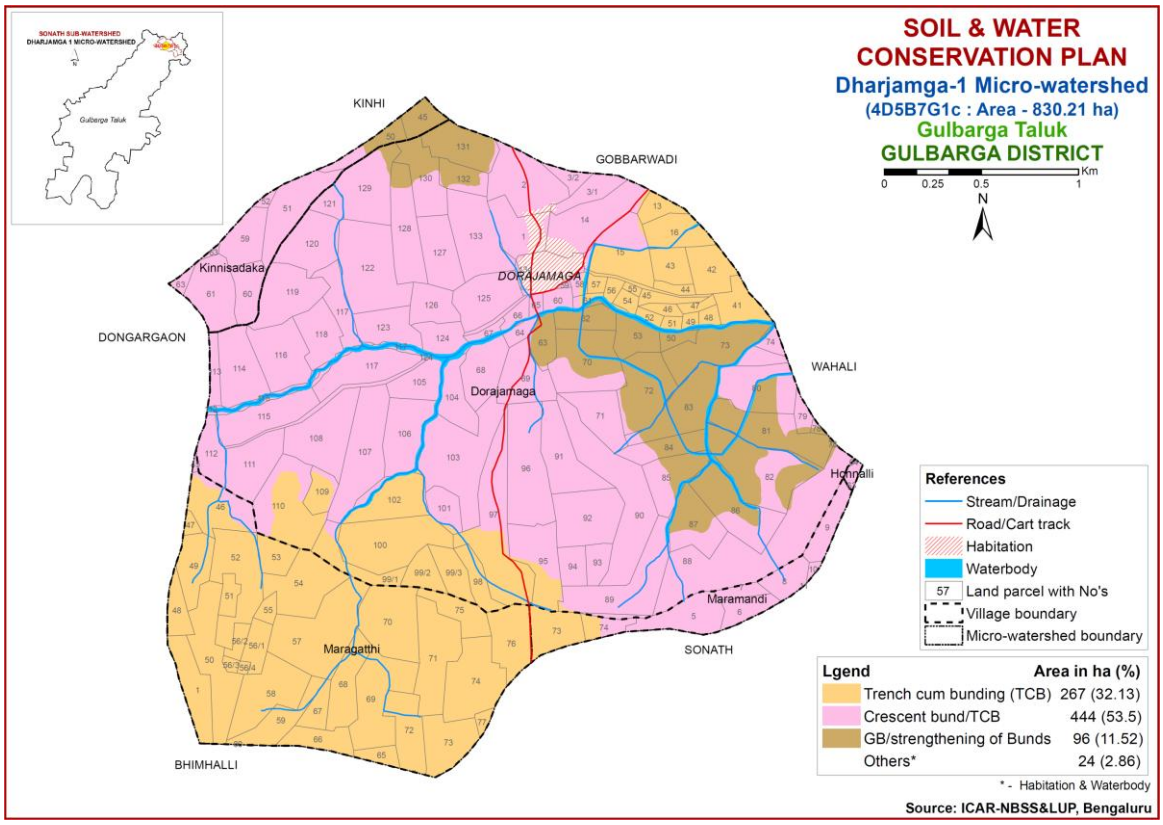


Fig. 9.1 Soil and Water Conservation Plan map of Dharjamga-1 Microwatershed

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

It is recommended to open 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

Dharjamga-1 Microwatershed

Soil Phase Information

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	1	6.11	MGTmC3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Redgram+Jowar +Scrub land (Rg+Jw+SL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	2	9.76	MGTmC3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Redgram+Grass Land (Rg+GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	3/1_ GRASS _FIELD	3.24	MGTiC3g3	LMU-1	Very shallow (<25 cm)	Sandy clay	Extremely gravelly (60-80%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Grass Land (GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	3/2_ GRASS _FIELD	1.54	MGTiD3g3	LMU-1	Very shallow (<25 cm)	Sandy clay	Extremely gravelly (60-80%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Grass Land (GL)	Not Available	VIse	Crescent bund/TCB
Dorajamaga	13	2.16	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	14	9.94	MGTmC3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Scrub Land+Grass Land (SL+GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	15	8.62	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	16	4.97	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	41	4.21	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	42	4.96	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	43	3.48	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	44	1.07	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	45	1.54	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	46	1.05	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	47	0.95	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	48	1.06	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	49	0.77	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	50	1.47	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	51	0.75	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Open weill	IVse	TCB
Dorajamaga	52	0.95	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	53	4.44	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	54	1.1	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	TCB
Dorajamaga	55	0.41	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	TCB
Dorajamaga	56	1.01	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Dorajamaga	57	0.83	GTTmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Open weill	IVse	TCB
Dorajamaga	58	0.94	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow (CF)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	59	0.18	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	Crescent bund/TCB
Dorajamaga	60	1.8	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow (CF)	Bore well	IVse	Crescent bund/TCB
Dorajamaga	61	0.99	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	Open weill	Others	Others
Dorajamaga	62	3.44	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	63	3.14	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	64	1.33	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	65	0.85	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow (CF)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	66	1.44	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub Land (Rg+SL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	67	1.13	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	68	6.24	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Scrub Land (Rg+SL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	69	6.71	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	NA	Open weill	IVse	Crescent bund/TCB
Dorajamaga	70	10.75	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	71	5.91	KNHmB2g1	LMU-1	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	72	8.99	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	73	10.49	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Onion+Cotton (Rg+On+Ct)	Open weill	IIIse	GB/strengthening of Bunds
Dorajamaga	74	1.31	MGTiC2g2	LMU-2	Very shallow (<25 cm)	Sandy clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	78	0.44	DIMmD3g2	LMU-1	Deep (100-150 cm)	Clay	Very gravelly (35-60%)	Very high (>200 mm/m)	Moderately sloping (5-10%)	Severe	Redgram (Rg)	Not Available	IVse	GB/strengthening of Bunds
Dorajamaga	79	1.42	MGTiC2g2	LMU-2	Very shallow (<25 cm)	Sandy clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	80	9	MGTiC2g2	LMU-2	Very shallow (<25 cm)	Sandy clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	81	9.68	KMPmB2	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Wheat+Sugarcane+Grass land (Rg+Wh+Sc+GL)	Bore well,Open weill	IIIse	GB/strengthening of Bunds
Dorajamaga	82	13.47	KMPmB2	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub land+Grass land (Rg+SL+GL)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	83	8.86	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	84	4.42	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	85	6.18	KMPmB2g1	LMU-4	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Open weill	IIIse	GB/strengthening of Bunds
Dorajamaga	86	9.87	KMPmB2	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Scrub land+Grass land (Rg+SL+GL)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	87	6.87	KMPmB2	LMU-4	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IIIse	GB/strengthening of Bunds
Dorajamaga	88_ GRASS FIELD	23.98	KNHmD3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Grass Land (GL)	Not Available	VIse	Crescent bund/TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	89	11.53	KNHmD3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Redgram+Scrub land+Grass land (Rg+SL+GL)	Bore well	VIse	Crescent bund/TCB
Dorajamaga	90	15.76	KNHmD3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Redgram+Grass Land (Rg+GL)	Not Available	VIse	Crescent bund/TCB
Dorajamaga	91	8.2	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	92	9.24	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	93	2.38	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Grass Land (Rg+GL)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	94	2.79	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	95	8.24	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Jowar (Rg+Jw)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	96	12.49	BHImB1g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IVs	Crescent bund/TCB
Dorajamaga	97	15.56	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub Land+Grass Land (SL+GL)	Not Available	IVse	TCB
Dorajamaga	98	3.22	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Dorajamaga	99/1_GRASS_FIELD	4.64	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Dorajamaga	99/2_GRASS_FIELD	3.22	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Dorajamaga	99/3_GRASS_FIELD	3.64	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Dorajamaga	100	12.09	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Dorajamaga	101	3.18	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Wheat (Rg+Wh)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	102	7.46	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Safflower (Rg+Sf)	Not Available	IVse	TCB
Dorajamaga	103	14.84	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Scrub Land (Rg+SL)	Bore well	IVse	Crescent bund/TCB
Dorajamaga	104	4.92	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Wheat+Jowar (Rg+Wh+Jw)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	105	4.47	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	106	8.04	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Open weill	IVse	Crescent bund/TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	107	11.7	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	108	10.3	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Safflower (Rg+Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	109	2.88	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Dorajamaga	110	11.72	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Dorajamaga	111	7.3	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bengalgram+Jowar+Safflower (Rg+Bg+Jw+Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	112	3.97	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	113	1.95	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	Crescent bund/TCB
Dorajamaga	114	7.84	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Sugarcane (Rg+Sc)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	115	8.54	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bengalgram+Wheat (Rg+Bg+Wh)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	116	8.2	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	117	12.66	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bengalgram+Wheat+Jower (Rg+Bg+Wh+Jw)	Bore well	IVse	Crescent bund/TCB
Dorajamaga	118	5.54	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	119	8.24	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	120	7.46	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Safflower (Rg+Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	121	1.92	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Safflower (Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	122	13.3	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Safflower (Rg+Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	123	5.33	NHAmB3g1	LMU-2	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+Wheat+Sugarcane (Rg+Wh+Sc)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	124	3.91	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar+Sugarcane (Rg+Jw+Sc)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	125	7.32	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Sugarcane (Rg+Sc)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	126	4.37	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar+Sugarcane (Rg+Jw+Sc)	Bore well	IVse	Crescent bund/TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Dorajamaga	127	6.55	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	128	8.1	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Bore well	IVse	Crescent bund/TCB
Dorajamaga	129	9.07	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Bengalgram+Jowar+Safflower (Rg+Bg+Jw+Sf)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	130	6.42	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	131	6.6	DIMiB2g1	LMU-5	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIse	GB/strengthening of Bunds
Dorajamaga	132	3.36	DIMiB2g1	LMU-5	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIse	GB/strengthening of Bunds
Dorajamaga	133	10.01	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	Crescent bund/TCB
Dorajamaga	134	1.1	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Honnalli	63	0.78	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	NA	Not Available	IVs	Crescent bund/TCB
Honnalli	64_GRASS_FIELD	0.05	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Grass Land (GL)	Not Available	IVs	Crescent bund/TCB
Kinnisadaka	45	2.88	DIMiB2g1	LMU-5	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIse	GB/strengthening of Bunds
Kinnisadaka	50	3.11	DIMiB2g1	LMU-5	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IIse	GB/strengthening of Bunds
Kinnisadaka	51	7.82	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar+Safflower (Rg+Jw+Sf)	Not Available	IVse	Crescent bund/TCB
Kinnisadaka	52	0.52	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	Crescent bund/TCB
Kinnisadaka	59	5.09	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar+Safflower (Rg+Jw+Sf)	Not Available	IVse	Crescent bund/TCB
Kinnisadaka	60	4.26	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Soybean (Rg+Sb)	Not Available	IVse	Crescent bund/TCB
Kinnisadaka	61	7.52	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	Crescent bund/TCB
Kinnisadaka	63	1.07	NHAmB2g1	LMU-3	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	Crescent bund/TCB
Maragatthi	1	6.39	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Maragatthi	45	0.21	NHAmB2	LMU-3	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	Crescent bund/TCB
Maragatthi	46	7.31	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Maragatthi	47	0.76	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	TCB
Maragatthi	48	2.91	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Maragatthi	49	5.23	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Maragatthi	50	10.67	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Safflower+GRass land (Rg+Sf+GL)	Not Available	IVse	TCB
Maragatthi	51	1.8	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	52	9.93	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar +Grass land (Rg+Jw+GL)	Not Available	IVse	TCB
Maragatthi	53	3.15	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Maragatthi	54	8.88	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Maragatthi	55	1.23	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Grass Land (GL)	Not Available	IVse	TCB
Maragatthi	56/1	2.9	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	56/2	1.42	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	56/3	0.55	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	56/4	0.35	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	57	14.61	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Safflower (Rg+Sf)	Not Available	IVse	TCB
Maragatthi	58	9.3	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Maragatthi	59	5.14	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Open weill	IVse	TCB
Maragatthi	60	0.01	DSImB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	NA	Not Available	IVse	TCB
Maragatthi	65	1.74	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Safflower (Sf)	Not Available	IVse	TCB
Maragatthi	66	3.86	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	67	2.36	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	68	6.21	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Maragatthi	69	10.7	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	70	10.14	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	71	9.86	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	72	6.14	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	73	6.59	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	74	10.13	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	75	4.3	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	76	6.78	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maragatthi	77	0.78	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVse	TCB
Maramandi	5	6.39	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Grass Land (Rg+GL)	Not Available	IVs	Crescent bund/TCB
Maramandi	6	3.08	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Bengalgram+Grass Land (Rg+Bg+GL)	Not Available	IVs	Crescent bund/TCB

VILLAGE	Survey No.	Area (ha)	Soils phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	AWC	Slope	Soil Erosion	CLU code	WELLS	LCC	Conservation Plan
Maramandi	7	1.52	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Grass Land (GL)	Not Available	IVs	Crescent bund/TCB
Maramandi	8	3.34	MAThD3g3	LMU-1	Very shallow (<25 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Redgram+Grass Land (Rg+GL)	Not Available	VIse	Crescent bund/TCB
Maramandi	9	3.92	MATmB1g1	LMU-2	Very shallow (<25 cm)	Clay	Gravelly (15-35%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IVs	Crescent bund/TCB
Maramandi	10	0.42	MAThD3g3	LMU-1	Very shallow (<25 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	NA	Not Available	VIse	Crescent bund/TCB
Maramandi	11	0.01	MAThD3g3	LMU-1	Very shallow (<25 cm)	Sandy clay loam	Extremely gravelly (60-80%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	NA	Not Available	VIse	Crescent bund/TCB
Maramandi	73	5.49	DSImB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Grass Land (Rg+GL)	Not Available	IVse	TCB
Maramandi	74	2.38	KNHmD3g2	LMU-1	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very low (<50 mm/m)	Moderately sloping (5-10%)	Severe	Redgram+Grass Land (Rg+GL)	Not Available	VIse	Crescent bund/TCB

Appendix II

Dharjamga-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
Dorajamaga	1	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	2	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	3/1_GRASS_FIELD	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	3/2_GRASS_FIELD	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)
Dorajamaga	13	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	14	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	16	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	42	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	43	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	44	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	46	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	47	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	48	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	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
Dorajamaga	49	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	50	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	51	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	52	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	53	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	54	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	55	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	56	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	57	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	58	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	59	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	60	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	61	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	62	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	63	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	64	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

VILLAGE	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dorajamaga	65	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	66	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	67	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	68	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	69	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	70	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	71	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	72	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	73	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	74	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	78	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	79	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	80	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	81	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	82	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	83	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	84	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	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
Dorajamaga	85	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	86	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	87	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	88_GRASS_FIELD	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	89	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	90	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	91	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	92	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	93	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	94	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	95	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	96	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	97	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	98	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	99/1_GRASS_FIELD	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	99/2_GRASS_FIELD	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	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
Dorajamaga	99/3_GRASS_FIELD	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	100	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	101	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Dorajamaga	102	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	103	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	104	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	105	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	106	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	107	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	108	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	109	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	110	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	111	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	112	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	113	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	114	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

VILLAGE	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Dorajamaga	115	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	116	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	117	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	118	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	119	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	120	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	121	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	122	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	123	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	124	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	125	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	126	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	127	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Dorajamaga	128	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Dorajamaga	129	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	130	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	131	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)	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
Dorajamaga	132	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Dorajamaga	133	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Dorajamaga	134	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Honnalli	63	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 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)	Sufficient (> 0.6 ppm)
Honnalli	64_GRASS_FIELD	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)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kinnisadaka	45	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	50	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)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	51	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	52	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	59	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	60	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	61	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kinnisadaka	63	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	1	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	46	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	47	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	48	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	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
Maragatthi	49	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	50	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	51	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Maragatthi	52	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Maragatthi	53	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Maragatthi	54	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	55	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	56/1	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	56/2	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	56/3	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	56/4	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	57	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	58	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	59	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	60	Slightly alkaline (pH 7.3 – 7.8)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	65	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

VILLAGE	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Maragatthi	66	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	67	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	68	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	69	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	70	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	71	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	72	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	73	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	74	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	75	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	76	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maragatthi	77	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maramandi	5	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maramandi	6	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 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)	Sufficient (> 0.6 ppm)
Maramandi	7	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Maramandi	8	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

VILLAGE	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Maramandi	9	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)	Sufficient (> 0.6 ppm)
Maramandi	10	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)	Sufficient (> 0.6 ppm)
Maramandi	11	Neutral (pH 6.5 – 7.3)	Non saline(<2 dsm)	High (> 0.75 %)	Low(< 23 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)
Maramandi	73	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)	Sufficient (> 0.6 ppm)
Maramandi	74	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)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Dharjamga-1 Microwatershed

Soil Suitability Information

VILLAGE	Survey No.	Sorghum	Maize	Sunflower	Cotton	Mango	Sapota	Guava	Jackfruit	Jamun	Musambi	Lime	Cashew	Custardapple	Amla	Tamarind	Red gram	Bengal gram	Sugarcane	Soyabean
Dorajamaga	1	Nrg	Ngt	Nrg	Nrg	Nrt	Ngt	Nrt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ng	Ngt	Nrg
Dorajamaga	2	Nrg	Ngt	Nrg	Nrg	Nrt	Ngt	Nrt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ng	Ngt	Nrg
Dorajamaga	3/1_GRASS_FIELD	Nrg	Ngt	Nrg	Nrg	Nrt	Ngt	Nrt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ng	Ngt	Nrg
Dorajamaga	3/2_GRASS_FIELD	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngt	Ngt	Ngt	Ngl	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngl	Ngt	Ngl
Dorajamaga	13	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	14	Nrg	Ngt	Nrg	Nrg	Nrt	Ngt	Nrt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ng	Ngt	Nrg
Dorajamaga	15	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	16	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	41	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	42	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	43	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	44	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	45	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	46	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	47	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	48	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	49	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	50	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	51	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	52	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	53	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	54	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	55	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	56	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	57	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2r	Nt	S2re	S1	S3t	S2re
Dorajamaga	58	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	59	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	60	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	61	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Dorajamaga	62	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	63	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	64	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	65	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	66	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	67	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	68	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	69	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	70	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1

VILLAGE	Survey No.	Sorghum	Maize	Sunflower	Cotton	Mango	Sapota	Guava	Jackfruit	Jamun	Musambi	Lime	Cashew	Custardapple	Amla	Tamarind	Redgram	Bengal gram	Sugarcane	Soyabean
Dorajamaga	71	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr	Nr
Dorajamaga	72	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	73	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	74	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ngt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	S3rg	Ngt	Nrg
Dorajamaga	78	Nle	Nle	Nle	Nle	Nle	Nle	Nle	Nle	Nle	Nle	Nle	Nle	S3rl	S3rl	Nle	Nle	Nle	Nle	Nle
Dorajamaga	79	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ngt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	S3rg	Ngt	Nrg
Dorajamaga	80	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	Ngt	Ngt	Ngt	Nrg	Nrg	Ngt	Nrg	Nrg	Ngt	Ngt	S3rg	Ngt	Nrg
Dorajamaga	81	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	82	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	83	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	84	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	85	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	86	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	87	S1	S3t	S2e	S2r	S3t	S3t	S3t	S3t	S3rt	S2r	S2r	Nt	S1	S1	S3rt	S2te	S1	S3t	S1
Dorajamaga	88_GRASS_FIELD	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl
Dorajamaga	89	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl
Dorajamaga	90	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl
Dorajamaga	91	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	92	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	93	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	94	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	95	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	96	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	97	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	98	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	99/1_GRASS_FIELD	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	99/2_GRASS_FIELD	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	99/3_GRASS_FIELD	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	100	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	101	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	102	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	103	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	104	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	105	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	106	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	107	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	108	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	109	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Dorajamaga	110	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r

VILLAGE	Survey No.	Sorghum	Maize	Sunflower	Cotton	Mango	Sapota	Guava	Jackfruit	Jamun	Musambi	Lime	Cashew	Custardapple	Amla	Tamarind	Redgram	Bengalgram	Sugarcane	Soyabean
Dorajamaga	111	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	112	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	113	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	114	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	115	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	116	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	117	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	118	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	119	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	120	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	121	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	122	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	123	S3re	S3re	Nr	S3re	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3re	S3re	Nrt	S3re	S2r	Nrt	S3re
Dorajamaga	124	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	125	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	126	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	127	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	128	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	129	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	130	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	131	S1	S3t	S1	S1	S3t	S3t	S3t	S3t	S2t	S1	S1	Nt	S1	S1	S2rt	S2te	S1	S3t	S2e
Dorajamaga	132	S1	S3t	S1	S1	S3t	S3t	S3t	S3t	S2t	S1	S1	Nt	S1	S1	S2rt	S2te	S1	S3t	S2e
Dorajamaga	133	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Dorajamaga	134	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Honnalli	63	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Honnalli	64_GRASS_FIELD	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Kinnisadaka	45	S1	S3t	S1	S1	S3t	S3t	S3t	S3t	S2t	S1	S1	Nt	S1	S1	S2rt	S2te	S1	S3t	S2e
Kinnisadaka	50	S1	S3t	S1	S1	S3t	S3t	S3t	S3t	S2t	S1	S1	Nt	S1	S1	S2rt	S2te	S1	S3t	S2e
Kinnisadaka	51	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Kinnisadaka	52	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Kinnisadaka	59	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Kinnisadaka	60	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Kinnisadaka	61	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Kinnisadaka	63	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Maragatthi	1	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	45	S3r	S3rt	Nr	S3r	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	S3r	S3r	Nrt	S3rt	S2r	Nrt	S3r
Maragatthi	46	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	47	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	48	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	49	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	50	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	51	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	52	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	53	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r

VILLAGE	Survey No.	Sorghum	Maize	Sunflower	Cotton	Mango	Sapota	Guava	Jackfruit	Jamun	Musambi	Lime	Cashew	Custardapple	Amla	Tamarind	Redgram	Bengal gram	Sugarcane	Soyabean
Maragatthi	54	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	55	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	56/1	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	56/2	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	56/3	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	56/4	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	57	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	58	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	59	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	60	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	65	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	66	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	67	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	68	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	69	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	70	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	71	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	72	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	73	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	74	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	75	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	76	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maragatthi	77	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maramandi	5	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Maramandi	6	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Maramandi	7	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Maramandi	8	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngt	Ngt	Ngt	Ngl	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngl	Ngt	Ngl
Maramandi	9	Nr	Nrt	Nr	Nr	Nrt	Nrt	Nrt	Nrt	Nrt	Nr	Nr	Nrt	Nr	Nr	Nrt	Nrt	S3r	Nrt	Nr
Maramandi	10	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngt	Ngt	Ngt	Ngl	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngl	Ngt	Ngl
Maramandi	11	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngt	Ngt	Ngt	Ngl	Ngl	Ngt	Ngl	Ngl	Ngt	Ngt	Ngl	Ngt	Ngl
Maramandi	73	S2re	S3t	S3r	S2re	Nt	S3rt	S3rt	S3rt	S3rt	S3r	S3r	Nt	S2re	S2re	Nt	S2rt	S1	S3t	S2r
Maramandi	74	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl	Nrl

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

EXECUTIVE SUMMARY

Baseline socioeconomic characterisation is prerequisite to prepare action plan for program implementation and to assess the project performance before making any changes in the watershed development program. The baseline provides appropriate policy direction for enhancing productivity and sustainability in agriculture.

Methodology: *Dharjamga-1 Microwatershed (Sonath sub-watershed, Gulbarga taluk, Gulbarga district) is located in between $17^0$37' – $17^0$39' North latitudes and $77^0$3' – $77^0$5' East longitudes, covering an area of about 830 ha, bounded by Kinhi, Dongaragaon, Bhimnalli, Sonath, Wahadi and Gobbarwadi villages with length of growing period (LGP) 120-150 days. We used soil resource map as basis for sampling farm households to test the hypothesis that soil quality influence crop selection, and conservation investment of farm households. The level of technology adoption and productivity gaps and livelihood patterns were analyses. The cost of soil degradation and ecosystem services were quantified.*

Results: *The socio-economic outputs for Dharjamga-1 micro-watershed (Sonath sub-watershed, Gulbarga taluk, Gulbarga district) are presented here.*

Social Indicators;

- *Male and female ratio is 63.2 to 36.8 per cent to the total sample population.*
- *Younger age 18 to 50 years group of population is around 57.9 per cent to the total population.*
- *Literacy population is around 42.1 per cent.*
- *Social groups belong to other backward caste (OBC) is around 50.0 per cent.*
- *Fire wood is the source of energy for a cooking among 90 per cent.*
- *About 80.0 per cent of households have a yashaswini health card.*
- *Dependence on ration cards for food grains through public distribution system is around 50 per cent.*
- *Swachha bharath program providing closed toilet facilities around 10 per cent of sample households.*
- *Women participation in decisions making of agriculture productivity of among the all sample households was found.*

Economic Indicators;

- *The average land holding is 0.83 ha indicates that majority of farm households are belong to marginal and small farmers. The total cultivated area by dry land condition among the sample households.*

- *Agriculture is the main occupation among 53.1 per cent and agriculture is the main and agriculture labour is subsidiary occupation for 40.6 per cent of sample households.*
- *The average value of domestic assets is around Rs. 24500 per household. Mobile and television are popular media mass communication.*
- *The average livestock value is around Rs. 43600 per household; about 50 per cent of household are having livestock.*
- *The average per capita food consumption is around 776.4 grams (1727 kilo calories) against national institute of nutrition (NIN) recommendation at 827 gram. Around 100 per cent of sample households are consuming less than the NIN recommendation.*
- *The annual average income is around Rs. 41320 per household. About 80 per cent of farm households are below poverty line.*
- *The per capita average monthly expenditure is around Rs. 2294.*

Environmental Indicators-Ecosystem Services;

- *The value of ecosystem service helps to support investment to decision on soil and water conservation and in promoting sustainable land use.*
- *The onsite cost of different soil nutrients lost due to soil erosion is around Rs. 2718 per ha/year. The total cost of annual soil nutrients is around Rs. 2190754 per year for the total area of 830.21 ha.*
- *The average value of ecosystem service for food grain production is around Rs 22897/ha/year of red gram.*
- *The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The per hectare value of water used and value of water was in red gram (Rs.61122).*

Economic Land Evaluation;

- *The major cropping pattern is red gram (100 %).*
- *In Dharjamga-1 Micro-watershed, major soil of Basaltic landforms of Margutti series is having very shallow soil depth cover around 5.7 % of area. On this soil farmers are presently growing red gram, soil of Matki series is having very shallow soil depth cover around 2.8 % of area. On this soil farmers are presently growing red gram, soil of Novinihal series is having shallow soil depth cover around 30.1% of area. On this soil farmers are presently growing red gram, soil of Bhimanahalli series is having shallow soil depth cover around 3.8 % of area. On this soil farmers are presently growing red gram, soil of gutti series is having moderately shallow soil depth cover around 4.4% of area. On this soil farmers are presently growing red gram, soil of Kamalapur series is*

having moderately deep soil depth cover around 8.5 % of area. On this soil farmers are presently growing red gram.

- *The total cost of cultivation and benefit cost ratio (BCR) in study area for red gram ranges between Rs.29890/ha in NHA soil (with BCR of 1.57) and Rs.14968/ha in MGT soil (with BCR of 2.74).*
- *The land management practices reported by the farmers are crop rotation, tillage practices, fertilizer application and use of farm yard manure (FYM). Due to higher wages farmer are following labour saving strategies is not prating soil and water conservation measures. Less ownership of livestock limiting application of FYM.*
- *It was observed soil quality influences on the type and intensity of land use. More fertilizer applications in deeper soil to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*
- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in red gram (3.6 to 22.4%).*

Chapter 2

INTRODUCTION

Watershed Development program aim to restore degraded watersheds in rainfed regions to increase their capacity to capture and store rain water, reduce soil erosion, and improved soil nutrients and carbon contents so they can produce greater agricultural yields and other benefits. As majority of rural poor live in these regions and dependent on natural resources for their livelihood and sustenance, improvements in agricultural yields improve human welfare and simultaneously improve national food security.

Sujala–III watershed development project conceptualised and implemented by the Watershed Development Department of Government of Karnataka with tripartite cost-sharing arrangements. The World Bank through International Development Association provided major portion of plan outlay as a loan to Government of India and in turn loan to Government of Karnataka.

The objectives of Sujala-III is to demonstrate more effective watershed management through greater integration of programs related to rain fed agriculture, innovative and science based approaches and strengthened institutions and capacities. The project is implemented in 11 districts of Bidar, Vijayapura, Gulbarga, Yadgir, Koppal, Gadag, Raichur, Davanagere, Tumkur, Chikkamangalur and Chamarajanagar which have been identified by the Watershed Development Department based on rainfall and socio-economic conditions. The project will be implemented over six years and linked with the centrally financed integrated watershed management programme.

Economic evaluations can better guide in watershed planning and implementation, as well as raise awareness of benefits of ecosystem restoration for food security and poverty alleviation program. The present study aims to characterize socio-economic status of farm households, assess the land and water use status, evaluate the economic viability of land use, prioritize farming constraints and suggest the measures for soil and water conservation for sustainable agriculture.

Objectives of the study

1. To characterize socio-economic status of farm households
2. To evaluate the economic viability of land use and land related constraints
3. To estimate the ecosystem service provided by the watershed and
4. To suggest alternatives for sustainable agriculture production.

Chapter 3

METHODOLOGY

Study area

Dharjamga-1 Microwatershed is located in North-eastern Dry Zone of Karnataka (Figure 1). The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane. It's represented Agro Ecological Sub Region (AESR) 6.2 having LGP 120-150 days.

Dharjamga-1 Microwatershed (Sonath sub-watershed, Gulbarga taluk, Gulbarga district) is located in between $17^0$37' – $17^0$39' North latitudes and $77^0$3' – $77^0$5' East longitudes, covering an area of about 830 ha, bounded by Kinhi, Dongaragaon, Bhimnalli, Sonath, Wahadi and Gobbarwadi villages.

Sampling Procedure:

In this study we have followed soil variability as criterion for sampling the farm households. In each micro-watershed the survey numbers and associated soil series are listed. Minimum three farm households for each soil series were taken and summed up to arrive at total sample for analysis.

Sources of data and analysis:

For evaluating the specific objectives of the study, primary data was collected from the sample respondents by personal interview method with the help of pre-tested questionnaire. The data on socio-economic characteristics of respondents such as family size and composition, land holdings, asset position, occupational pattern and education level was collected. The present cropping pattern and the level of input use and yields collected during survry. The data collected from the representative farm households were analysed using Automated Land Potential Evalution System (Figure 2).

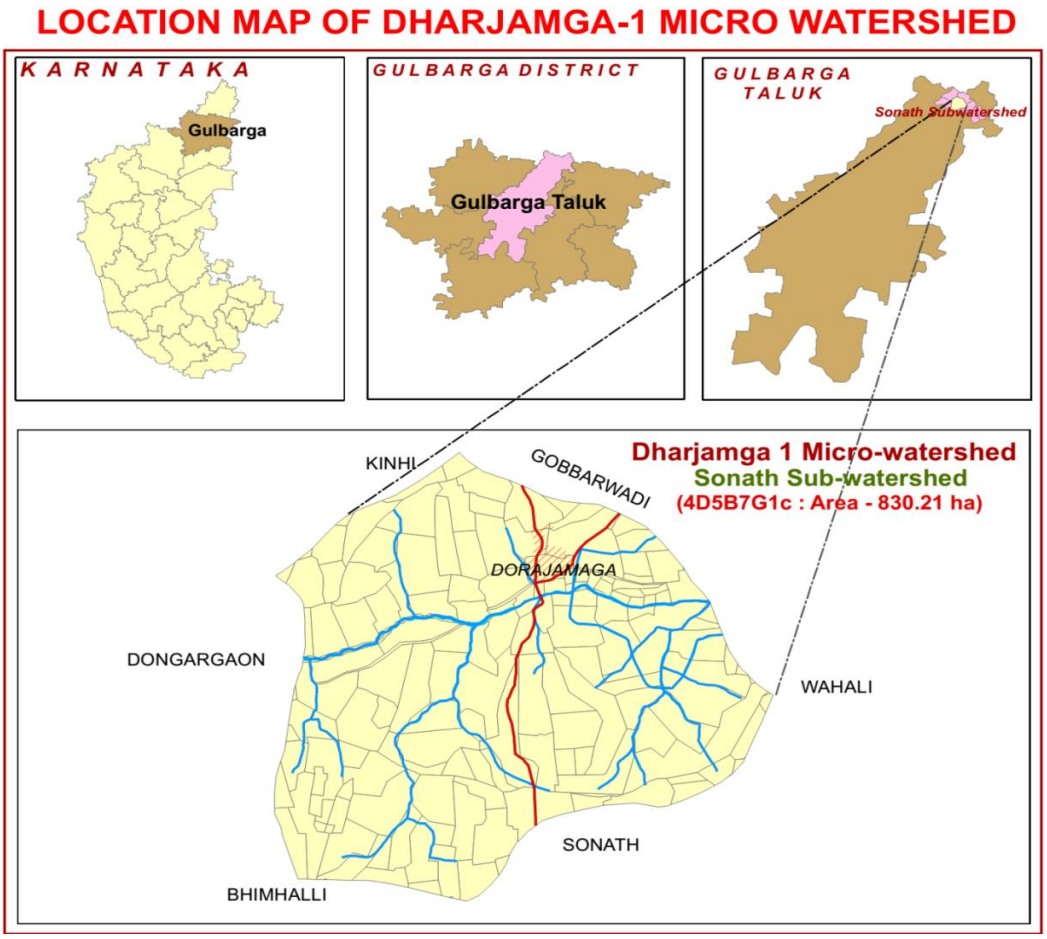


Figure 1: Location of study area

Steps followed in socio-economic assessment

1. •After the completion of soil profile study link the cadastral number to the soil profile in the micro watershed.
2. • Download the names of the farmers who are owning the land for each cadastral number in the Karnataka BHOOMI Website.
3. • Compiling the names of the farmers representing for all the soil profiles studied in the micro watershed for socio-economic Survey.
4. • Conducting the socioeconomic survey of selected farm households in the micro watershed .
5. • Farm households database created using the Automated Land Potential Evaluation System (ALPES) for analysis of socio economic status for each micro watershed .
6. • Synthesis of tables and preparation of report for each micro watershed .

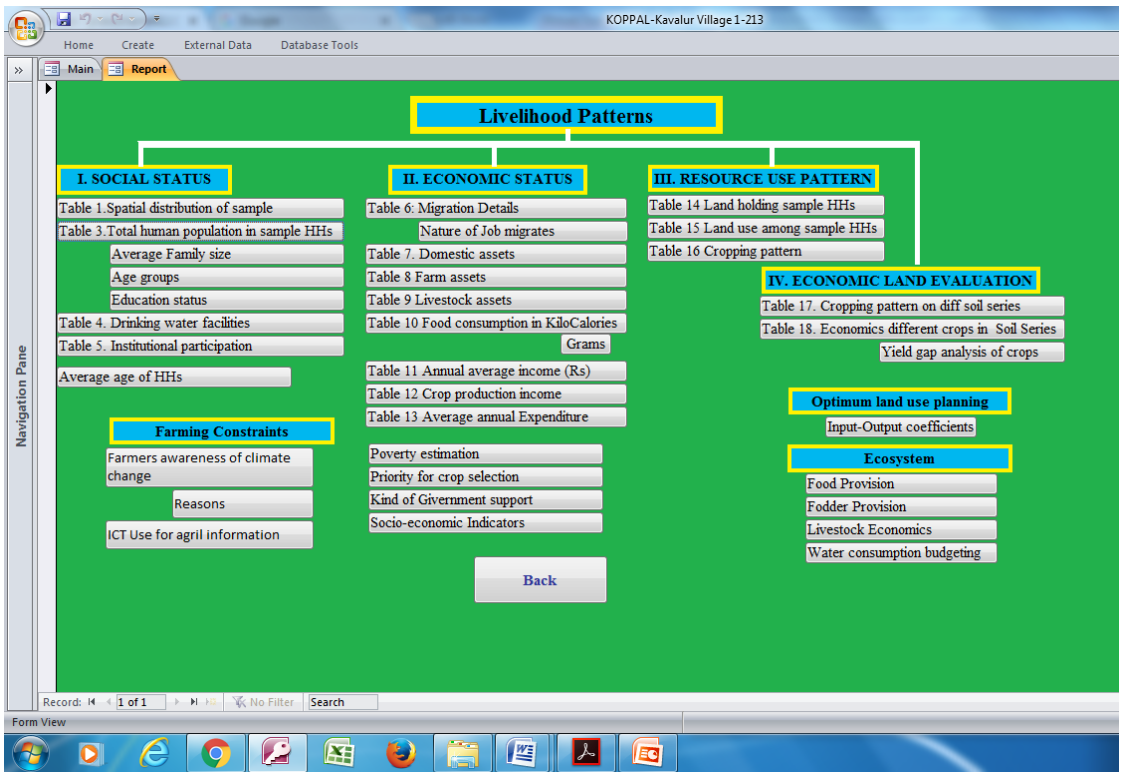


Figure 2: ALPES FRAMEWORK

The sample farmers were post classified in to marginal and small (0.0 to <=2 ha), medium and semi medium (>2 to <=10 ha) and large (>10 ha). The steps involved in estimation of soil potential involve estimation of total cost of cultivation, the yield/gross returns and net income per hectare. The cost of inputs such seed, manure and fertilizer, plant protection chemicals, payment towards human and bullock labour and interest on working capita are included under operational costs. In the case of perennial crops, the cost of establishment was estimated by using actual physical requirements and prevailing market prices. Estimation cost included maintenance cost up to bearing period. The value of main product and by product from the crop enterprise at the market rates were the gross returns of the crop. Net returns were worked out by deducting establishment and maintained cost from gross returns.

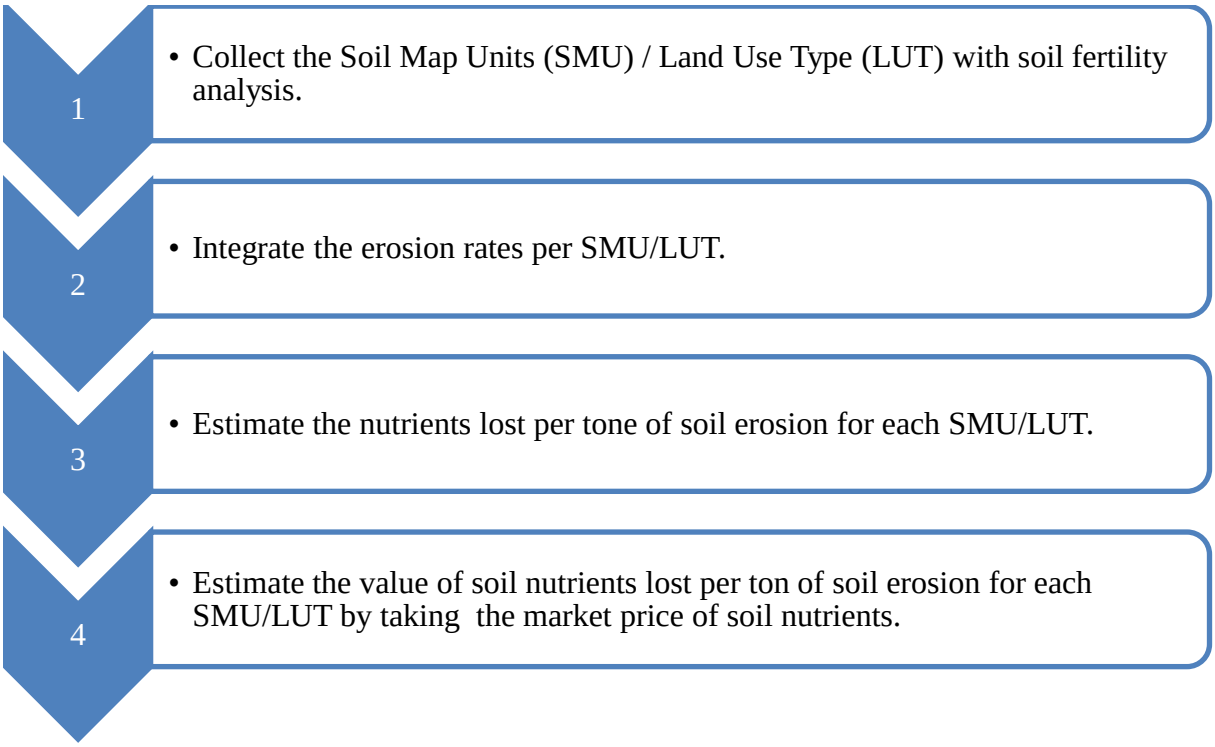
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total cost.

Economic suitability classes: once each land use –land area combination has been assigned an economic value by the land evaluation, the question arises as to its 'suitability', that is, the degree to which it satisfies the land user. The FAO framework defines two suitability orders: 'S'(suitable if benefit cost ratio (BCR)>1) and 'N'(not suitable if (BCR<1), which are dived into five economic suitability classes:'S1'(highly suitable if BCR>3), 'S2'(suitable if BCR>2 and <3),'S3'(Marginally suitable if BCR >1 and <2), 'N1'(Not suitable for economic reasons but physically suitable) and 'N2'(not suitable for physical reasons). The limit between 'S3' and 'N1'must be at least at the point of financial feasibility (i.e. net returns, NPV, or IRR>0 and BCR>1). The other limits depend on social factors such as farm size, family size, alternative employment or investment possibilities and wealth expectations; these need to be specified for the Soil series.

Economic Valuation of Soil ecosystem services:

The replacement cost approach was followed for estimating the onsite cost of soil erosion, Market price method was followed for estimating the value of food and fodder production. Value transfer menthods was followed for estimating the value of water demand by different crops in the Microwatershed.

Steps followed in Replacement cost methods for estimation of onsite cost of soil erosion



Chapter 4

RESULTS AND DISCUSSIONS

The demographic information shows that the household population dynamics encompasses the socioeconomic status of the farmer. For a rural family, the household size should be optimal to earn a comfortable livelihood through farm and non-farm wage earning. The total number of population in watershed area was 38, out of which 63.2 per cent were males and 36.8 per cent females. Average family size of the households is 5.3. Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of 30 to 50 years (36.8 %) followed by more than 50 years (23.7 %) 18 to30 years (21.1 %) and 0 to 18 years (18.4 %). Hence, in the study area in general, the respondents were of young and middle age, indicating thereby that the households had almost settled with whatever livelihood options they were practicing and sample respondents were young by age who could venture into various options of livelihood sources. Data on literacy indicated that 57.9 per cent of respondents were illiterate and 42.1 per cent literate (Table 1).

Table 1: Human population among sample households in Dharjamga-1 Microwatershed

Particulars	**Units**	**Value**
Total human population in sample HHs	Number	38
Male	% to total Population	63.2
Female	% to total Population	36.8
Average family size	Number	3.8
Age group		
0 to 18 years	% to total Population	18.4
18 to 30 years	% to total Population	21.1
30 to 50 years	% to total Population	36.8
>50 years	% to total Population	23.7
Average age	Age in years	36.9
Education Status		
Illiterates	% to total Population	57.9
Literates	% to total Population	42.1
Primary School (<5 class)	% to total Population	2.6
Middle School (6- 8 class)	% to total Population	10.5
High School (9- 10 class)	% to total Population	10.5
Others	% to total Population	18.4

The ethnic groups among the sample farm households found to be 50.0 per cent to other backward caste (OBC) followed by general castes 30.0 per cent and schedule caste

(SC) of 20 per cent (Table 2 and Figure 3). About 90.0 per cent of sample households is using fire wood as source of fuel for cooking. All the sample farmers are having electricity connection. About 50.0 per cent of farm households are having ration cards for taking food grains from public distribution system. Only 10.0 per cent of farm households are having toilet facilities.

Table 2: Basic needs of sample households in Dharjamga-1 Microwatershed

Particulars	**Units**	**Value**
Social groups		
SC	% of Households	20.0
OBC	% of Households	50.0
General	% of Households	30.0
Types of fuel use for cooking		
Fire wood	% of Households	90.0
Gas	% of Households	10.0
Energy supply for home		
Electricity	% of Households	100.0
Number of households having Health card		
Yes	% of Households	80.0
No	% of Households	20.0
MGNREGA Card		
Yes	% of Households	0.0
No	% of Households	100.0
Ration Card		
Yes	% of Households	50.0
No	% of Households	50.0
Households with toilet		
Yes	% of Households	10.0
No	% of Households	90.0
Drinking water facilities		
Tube Well	% of Households	100.00

The data collected on the source of drinking water in the study area is presented in Table 2. All the sample respondents are having tube well source for water supply for domestic purpose.

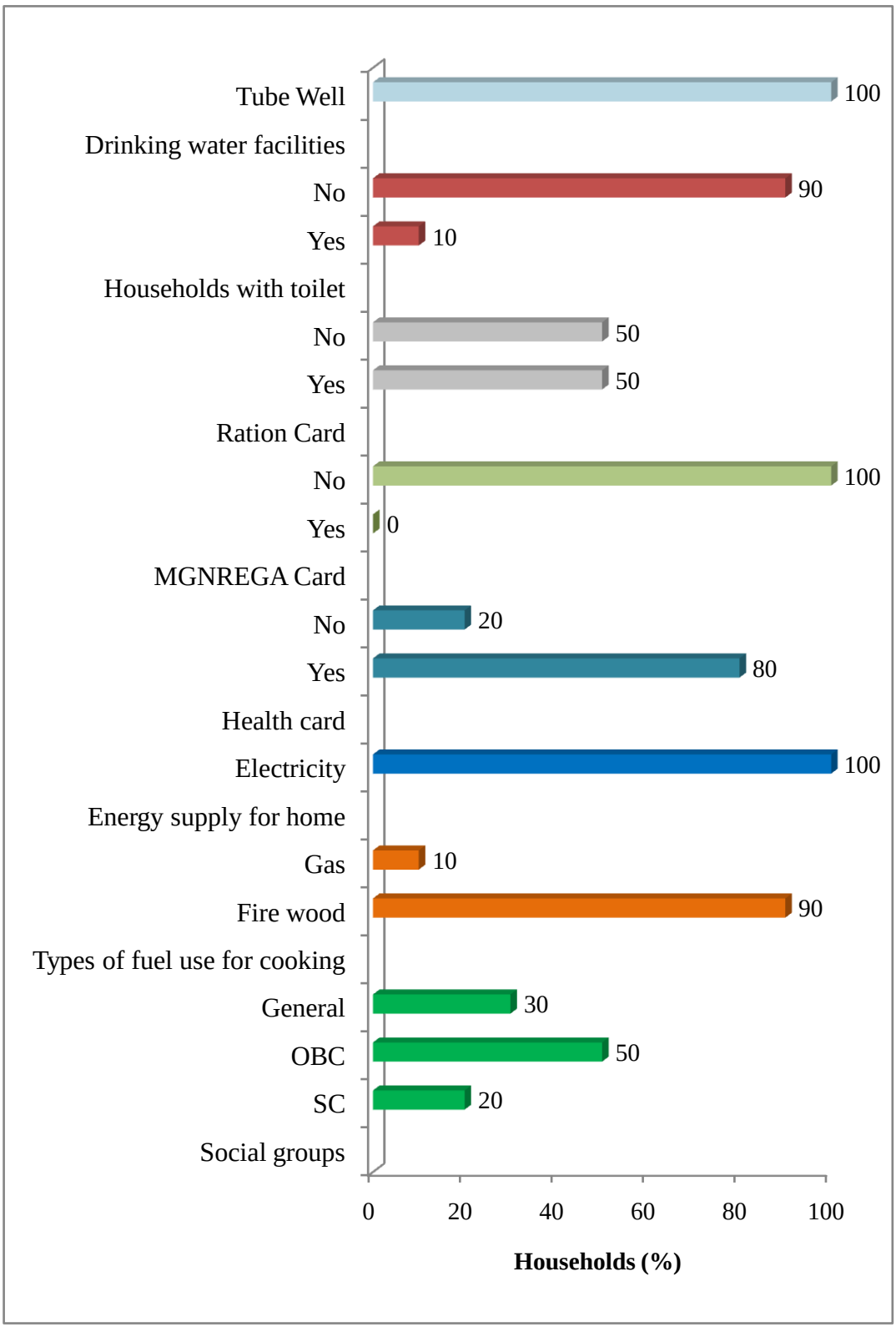


Figure 3: Basic needs of sample households in Dharjamga-1 Microwatershed

The occupational pattern (Table 3) among sample households shows that agriculture is the main occupation around 60.5 per cent of farmers followed by subsidiary

occupations like agricultural labour (34.2 %) and private service (2.6 %). Private services as a main occupation were 2.6 per cent of sample households.

Table 3: Occupational pattern in sample population in Dharjamga-1 Microwatershed

Occupation		**% to total**
Main	**Subsidiary**	
Agriculture	Agriculture	60.5
	Agriculture Labour	34.3
	Private service	2.6
Private service		2.6
Grand Total		100
Family labour availability		**Man days/month**
Male		28.0
Female		20.0
Total		48.0

The important assets especially with reference to domestic assets were analyzed and are given in Table 4 and Figure 4. The important domestic assets possessed by all categories of farmers are mobile phones (100 %) followed by television (90 %) and motorcycle (20 %). The average value of domestic assets is around Rs 24500 per household.

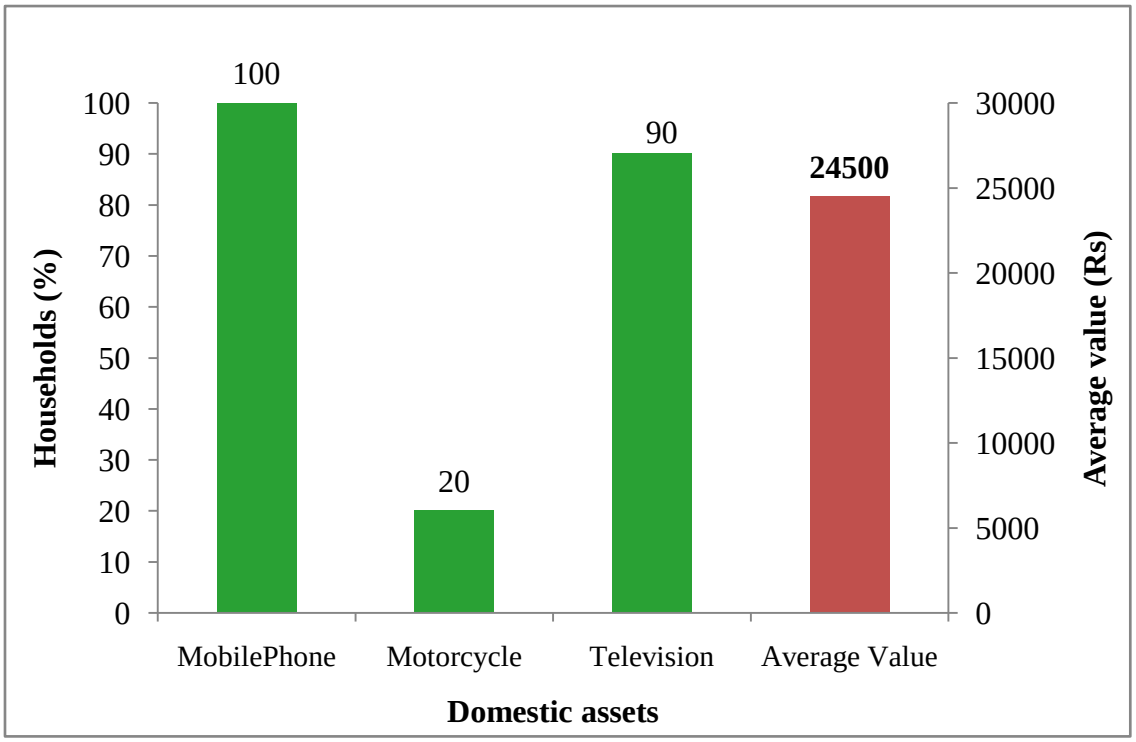


Figure 4: Domestic assets among the sample households in Dharjamga-1 Microwatershed

Table 4: Domestic assets among the sample households in Dharjamga-1 Microwatershed

Particulars	% of households	Average value in Rs
Mobile Phone	100.0	5500
Motorcycle	20.0	60000
Television	90.0	8000
Average Value	24500	

Livestock is an integral component of the conventional farming systems (Table 5 and Figure 5). The livestock population is bullocks were around 20 per cent followed by local dry cow (20.0%), cross breed milching cow (20.0 %), milching buffalos (20 %) and goats (20.0 %). The average value of livestock was Rs 43600 per household.

Table 5: Livestock assets among sample households in Dharjamga-1 Microwatershed

Particulars	% of livestock population	Average value in Rs
Local Dry Cow	20.0	10000
Crossbreed Milching Cow	20.0	40000
Milching Buffalos	20.0	18000
Bullocks	20.0	100000
Goats	20.0	50000
Average value	43600	

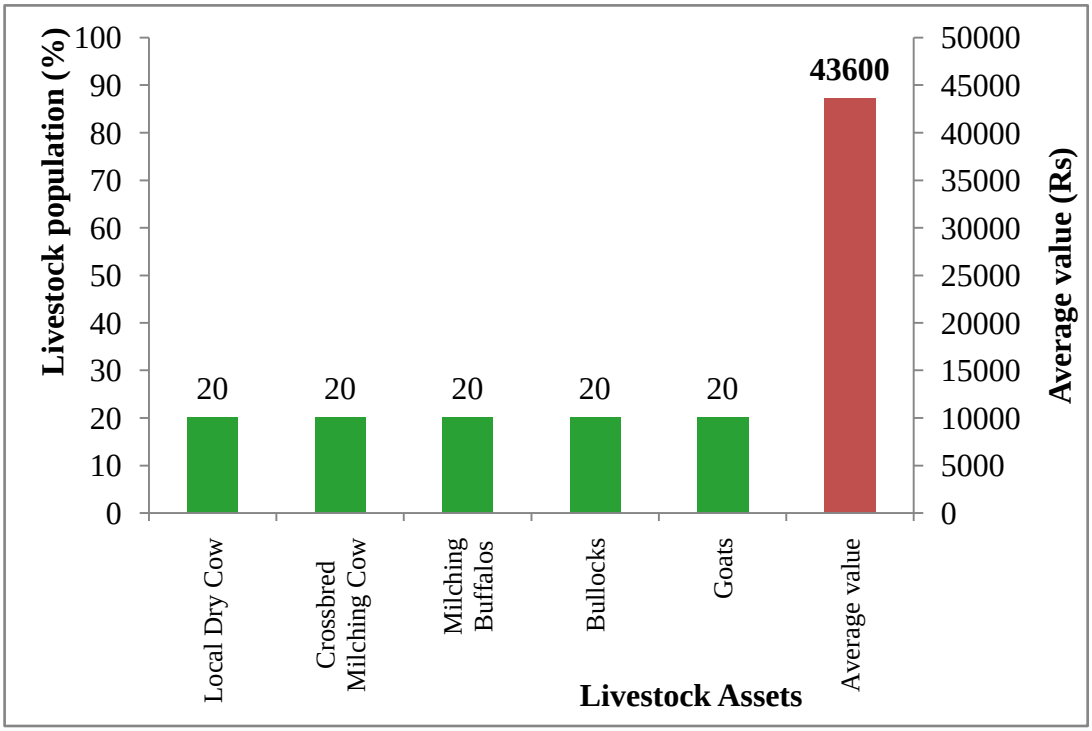


Figure 5: Livestock assets among sample households in Dharjamga-1 Microwatershed

Average milk produced in sample households is 975 litters/ annum. Among the farm households, About 15 Numbers of livestock population in sample households (Table 6).

Table 6: Milk produced of sample households in Dharjamga-1 Microwatershed

Particulars	
Name of the Livestock	**Ltr./Lactation/animal**
Crossbred Milching Cow	910
Milching Buffalos	1040
Average milk produced	975
Livestock having households (%)	50.0
Livestock population (Numbers)	15

A woman participation in decision making is in this Microwatershed is presented in Table 7. About 100 per cent women earning for her family requirement and 100 per cent of women taking decision in her family and agriculture related activities.

Table 7: Women empowerment of sample households in Dharjamga-1 Microwatershed

% to Grand Total

Particulars	**Yes**	**No**
Women participation in local organization activities	0.0	100
Women elected as panchayat member	0.0	100
Women earning for her family requirement	100	0.0
Women taking decision in her family and agriculture related activities	100	0.0

Table 8: Per capita daily consumption of food among the sample households in Dharjamga-1 Microwatershed

Particulars	**NIN recommendation (gram/ per day/ person)**	**Present level of consumption (gram/ per day/ person)**	**Kilo Calories /day/person**
Cereals	396	315.4	1072.3
Pulses	43	38.3	131.3
Milk	200	141.1	91.7
Vegetables	143	131.2	31.5
Cooking Oil	31	41.6	236.9
Egg	0.5	86.4	129.6
Meat	14.2	22.5	33.8
Total	**827.7**	**776.4**	**1727.0**
Threshold of NIN recommendation		827 gram*	2250 Kcal*
% Below NIN		80.0	100.0
% Above NIN		20.0	0.0

Note: * day/person

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the Table 8 and Figure 6. More quantity of cereals is consumed by sample farmers which accounted for 1072.3 kcal per person. The other important food items consumed was pulses 131.3 kcal followed by cooking oil 236.9 kcal, milk 91.7 kcal, vegetables 31.5 kcal, egg 129.6 kcal and meat 33.8 kcal. In the sampled households, farmers were consuming less (1727 kcal) than NIN- recommended food requirement (2250 kcal).

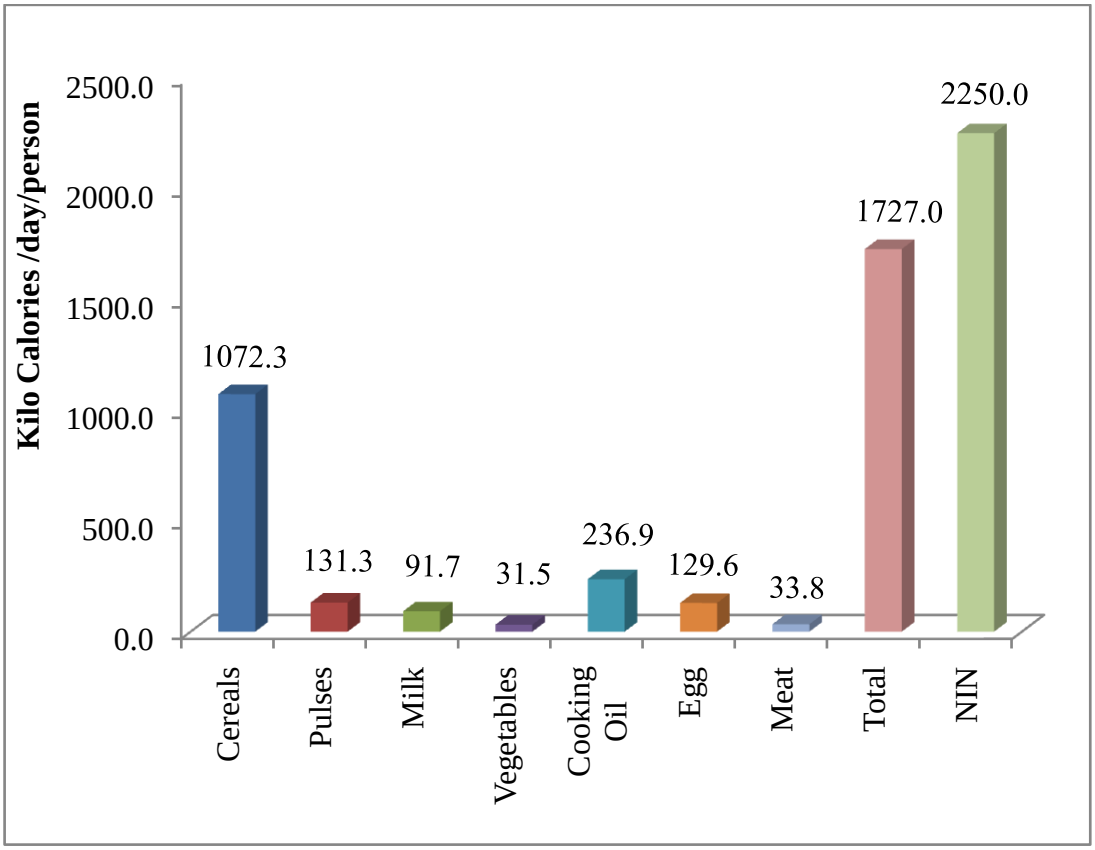


Figure 6: Per capita daily consumption of food among the sample households in Dharjamga-1 Microwatershed

Annual income of the sample HHs: The annual household income is around Rs 41320. Major source of income to the farmers in the study area is from crop production (Rs 20670) followed by livestock (Rs. 20650). The monthly per capita income is Rs.906, which is less than the threshold monthly income of Rs 975 for considering above poverty line. Due to the fact that erratic rainfall and shortage of water, farmers are diverting from crop production activities to enable the household for a comfortable livelihood. The incomes from the other aforesaid sources are very meagre (Table 9).

Table 9: Annual average income of HHs from various sources in Dharjamga-1 Microwatershed

Particulars	Income *
Nonfarm income (Rs)	0 (0)
Livestock income (Rs)	20650 (20)
Crop Production (Rs)	20670 (100)
Total Annual Income (Rs)	***41320***
Average monthly per capita income (Rs)	906
Threshold for Poverty level (Rs 975 per month/person)	
% of households below poverty line	80.0
% of households above poverty line	20.0

* Figure in the parenthesis indicates % of Households

The total annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 35820) followed by education, clothing, social function and health. Now a day's education is most important among all of us. In today's competitive world, education is a necessity for man after food, clothing, and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs 2294 and about 80 per cent of farm households are below poverty line and 20 per of farm households are above poverty line (Table 10 and Figure 7).

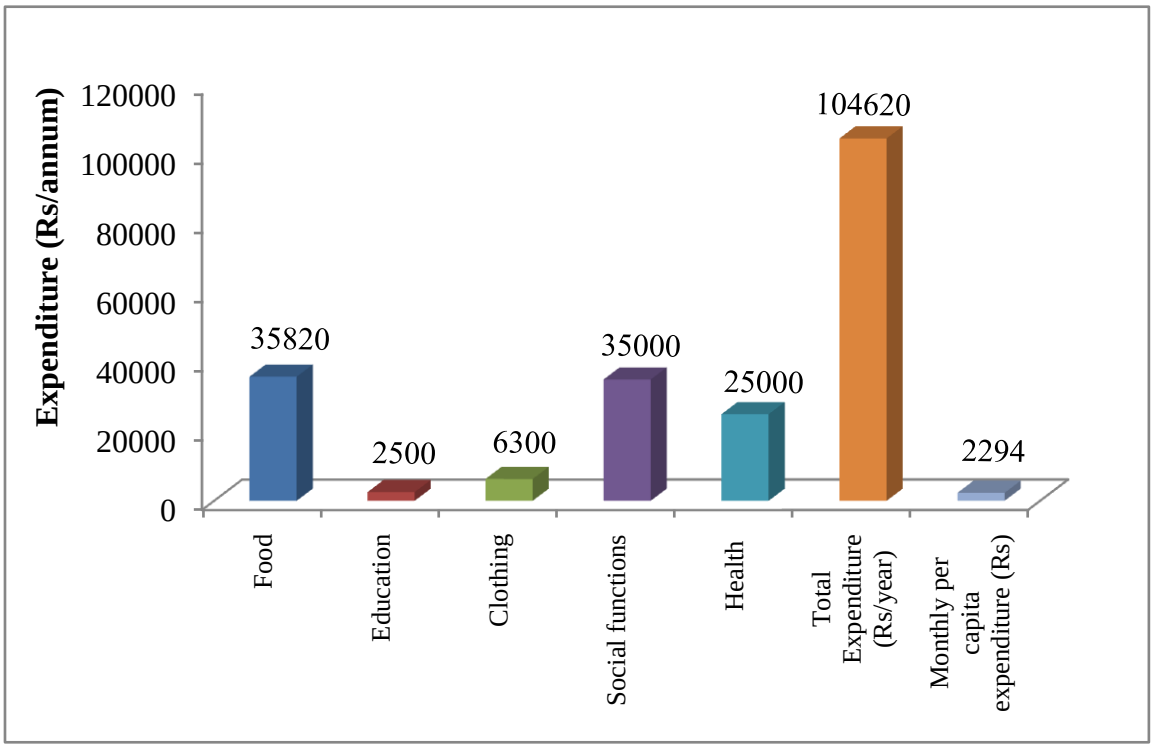


Figure 7: Average annual expenditure of sample HHs in Dharjamga-1 Microwatershed

Table 10: Average annual expenditure of sample HHs in Dharjamga-1 Microwatershed

Particulars	Value in Rupees	Per cent
Food	35820	34.2
Education	2500	2.4
Clothing	6300	6.0
Social functions	35000	33.5
Health	25000	23.9
Total Expenditure (Rs/year)	104620	100.0
Monthly per capita expenditure (Rs)	2294	

Land use: The total sample house hold land holding in the Dharjamga-1 Microwatershed is 8.3 ha (Table 11). Of which 8.3 ha is rain fed land.

Table 11: Land use among samples households in Dharjamga-1 Microwatershed

Particulars	Per cent	Area in ha
Irrigated land	0.0	0.0
Rain fed Land	100.0	8.3
Fallow Land	0.0	0.0
Total land holding	100.0	8.3
Average land holding	0.83	

In the Microwatershed, the prevalent present land uses under perennial plants are neem trees (94.1 %) and tamarind (5.9%) (Table 12).

Table 12: Number of trees/plants covered in sample farm households in Dharjamga-1 Microwatershed

Particulars	Number of Plants/trees	Per cent
Neem trees	16	94.1
Tamarind	1	5.9
Grand Total	17	100.0

The land use decisions are usually based on experience of farmers, tradition, expected profit, personal preferences, resources and social requirements. The present dominant crops grown in dry lands in the study area were by red gram (100 %) which was taken during Kharif (Table 13).

Table 13: Present cropping pattern and cropping intensity in Dharjamga-1 Microwatershed % to Grand Total

Crops	Kharif	Grand Total
Red gram	100.0	100.00
Grand Total	100.0	100.0

Economic land evaluation

The main purpose of economic land evaluation in the watershed is to identify the existing production constraints and propose the potential/alternate options for agro-technology transfer and for bridging the adoption and yield gap.

In Dharjamga-1 Microwatershed, 9 soil series are identified and mapped (Table 14). The distribution of major soil series are Novinihala covering an area around 250.1 ha (30.1 %) followed by Dinsi 230.0 ha (27.7 %), Kinhi 91.8 ha (11.0 %), Kamalapaur 70.9 ha (8.5 %), Margutti 47.5 ha (5.7 %), Gutti 36.6 ha (4.4 %), Bhimanahalli 31.5 ha (3.8 %), Dimal 24.7 ha (3.0 %) and Matki 23.2 ha (2.8 %).

Table 14: Distribution of soil series in Dharjamga-1 Microwatershed

Sl. No	Soil series	Description	Area in ha (%)
1	MGT	Marguti soils are very shallow (<25cm), well drained. They have very dark grayish brown to dark brown, clayey soils and occur on very gently sloping to moderately sloping uplands	47.5 (5.7)
2	MAT	Matki soils are very shallow (<25cm), well drained. They have dark reddish brown to dark reddish gray, clayey soils and occur on very gently sloping to moderately sloping uplands	23.2 (2.8)
3	NHA	Novinihala soils are shallow (25-50 cm), well drained. They have very dark grayish brown to dark brown clayey soils and occur on very gently sloping to moderately sloping uplands	250.1 (30.1)
4	BHI	Bhimanahalli soils area shallow (25-50 cm), well drained. They have very dark gray to brown clay soils and occur on very gently sloping to gently sloping uplands.	31.5 (3.8)
5	DSI	Dinsi soils are moderately shallow (50-75 cm), moderately well drained. They have very dark gray to brown clayey soils and occur on nearly level to very gently sloping uplands	230.0 (27.7)
6	GTT	Gutti soils are moderately shallow (50-75 cm), moderately well drained. They have very dark grayish brown to brown, clayey soils and occur on very gently sloping to gently sloping uplands	36.7 (4.4)
7	KMP	Kamalapur soils are moderately deep (75-100 cm), moderately well drained. They have very dark gray to very dark grayish brown clayey soils and occur on nearly level to very gently sloping uplands	70.9 (8.54)
8	DIM	Dimal soils are deep (100-150 cm), moderately well drained. They have very dark grayish brown to very dark gray clayey soils and occur on very gently sloping to moderately sloping uplands	24.7 (3.0)
9	KNH	Kinhi soils are very shallow (<25 cm), well drained to somewhat excessive drained. They have dark reddish brown to yellowish red gravelly clay soils and occur on very gently to gently sloping uplands	91.8 (11.0)

Present cropping pattern on different soil series are given in Table 15. Crops grown on margutti, Matki, Novinihal, Bhimanahalli, Gutti and Kamalapur soils are red gram.

Table 15: Cropping pattern on major soil series in Dharjamga-1 Microwatershed

(Area in per cent)

Soil Series	Soil Depth	Crops	Dry	Grand Total
			Kharif	
MGT	Very shallow (<25 cm)	Red gram	100	100
MAT	Very shallow (<25 cm)	Red gram	100	100
NHA	Shallow (25-50 cm)	Red gram	100	100
BHI	Shallow (25-50 cm)	Red gram	100	100
GTT	Moderately shallow (50-75 cm)	Red gram	100	100
KMP	Moderately deep (75-100 cm)	Red gram	100	100

Land is used for agricultural use for growing cereals, pulse, oilseeds and commercial crops. The soil/ land potential are measures in terms of physical yield and net income. The alternative land use options for each micro-watershed are given below (Table 16).

Table 16: Alternative land use options for different size group of farmers (Benefit Cast Ratio) in Dharjamga-1 Microwatershed.

Soil Series	Small Farmers
MGT	Red gram (2.74)
MAT	Red gram (2.03)
NHA	Red gram (1.57)
BHI	Red gram (2.21)
GTT	Red gram (1.75)
KMP	Red gram (1.77)

The productivity of different crops grown in Dharjamga-1 Microwatershed under potential yield of the crops is given in Table 17.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Table 17. The total cost of cultivation in study area for red gram ranges between Rs. 29890/ha in NHA soil (with BCR of 1.57) and Rs. 14968/ha in MGT soil (with BCR of 2.74).

The data on FYM, Nitrogen, Phosphorus and Potash application by the farmers to different crops and recommended FYM for different crops is given in Table 17. There is a huge gap between FYM application by farmers and recommended FYM in all the crops

across the soils. There is a larger yield gap in crops grown across different soil series. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of crops. It is a fact that, recommended practices are major contributing factors to yield. Inadequate knowledge about recommended practices leads to their improper adoption. Strengthening of extension services by concerned agency is required to increase adoption of recommended cultivation practices and ultimately reducing the gap. By adopting soil-test fertiliser recommendation, there is scope to increase yield and income to Rs 7730 in red gram cultivation.

Table 17: Economic land evaluation and bridging yield gap for different crops in Dharjamga-1 Microwatershed

Particulars	**MGT (<25 cm)**	**MAT (<25 cm)**	**BHI (25-50cm)**	**NHA (25-50 cm)**	**GTT (50-75 cm)**	**KMP (75-100 cm)**
	Redgram	**Redgram**	**Redgram**	**Redgram**	**Redgram**	**Redgram**
Total cost (Rs/ha)	14968	24381	28433	29890	28440	24358
Gross Return (Rs/ha)	40972	49400	55575	47048	49575	43981
Net returns (Rs/ha)	26003	25019	27142	17158	21135	19623
BCR	2.74	2.03	2.21	1.57	1.75	1.77
Farmers Practices (FP)						
FYM (t/ha)	1.8	2.5	3.8	2.0	3.7	2.5
Nitrogen (kg/ha)	37.9	22.5	22.5	17.9	42.0	19.3
Phosphorus (kg/ha)	27.3	57.5	57.5	45.6	49.8	49.2
Potash (kg/ha)	0.0	0.0	0.0	0.0	0.0	0.0
Grain (Qtl/ha)	11.8	12.5	12.5	11.9	11.8	9.6
Price of Yield (Rs/Qtl)	3500	4000	4500	4000	4250	4733
Soil test based fertilizer Recommendation (STBR)						
FYM (t/ha)	7.4	7.4	7.4	7.4	7.4	7.4
Nitrogen (kg/ha)	24.7	18.5	18.5	18.5	18.5	18.5
Phosphorus (kg/ha)	49.4	49.4	49.4	49.4	49.4	49.4
Potash (kg/ha)	24.7	30.9	24.7	18.5	24.7	22.6
Grain (Qtl/ha)	12.4	12.4	12.4	12.4	12.4	12.4
% of Adoption/yield gap (STBR-FP) / (STBR)						
FYM (%)	76.0	66.3	49.4	73.2	49.5	66.1
Nitrogen (%)	-53.5	-21.5	-21.5	3.6	-126.5	-4.0
Phosphorus (%)	44.8	-16.4	-16.4	7.6	-0.9	0.4
Potash (%)	100.0	100.0	100.0	100.0	100.0	100.0
Grain (%)	4.1	-1.2	-1.2	3.6	4.4	22.4
Value of yield and Fertilizer (Rs)						
Additional Cost (Rs/ha)	6943	5123	3750	5970	3864	5347
Additional Benefits(Rs/ha)	1756	-600	-675	1781	2288	13078
Net change Income(Rs/ha)	-5187	-5723	-4425	-4189	-1577	7730

Economic valuation of Ecosystem Services (ES) was aimed at combining use and non-use values to determine Total Economic Value (TEV) of ES. Ecosystem Services (ES) were valued based on their annual flow or utilization in common monetary units, Rs/year. The valuation of ES was based on market price in 2017 or market cost approaches whichever is applicable, and in other cases on value or benefit transfer from previous valuation studies.

The onsite cost of different soil nutrients lost due to soil erosion is given in Table 18 and Figure 8. The average value of soil nutrient loss is around Rs 2718 per ha/year. The total cost of annual soil nutrients is around Rs 2190754 per year for the total area of 830.21 ha.

Table 18: Estimation of onsite cost of soil erosion in Dharjamga-1 Microwatershed

Particulars	Quantity(kg)		Value (Rs)	
	Per ha	Total	Per ha	Total
Organic matter	387.92	312665	2443.91	1969789
Phosphorous	0.30	244	13.34	10749
Potash	2.51	2025	50.24	40497
Iron	0.21	169	10.04	8089
Manganese	0.53	428	146.09	117752
Cupper	0.08	64	44.47	35845
Zinc	0.01	10	0.47	382
Sulpher	0.23	182	9.05	7296
Boron	0.01	9	0.44	354
Total	391.81	315796	2718.06	2190754

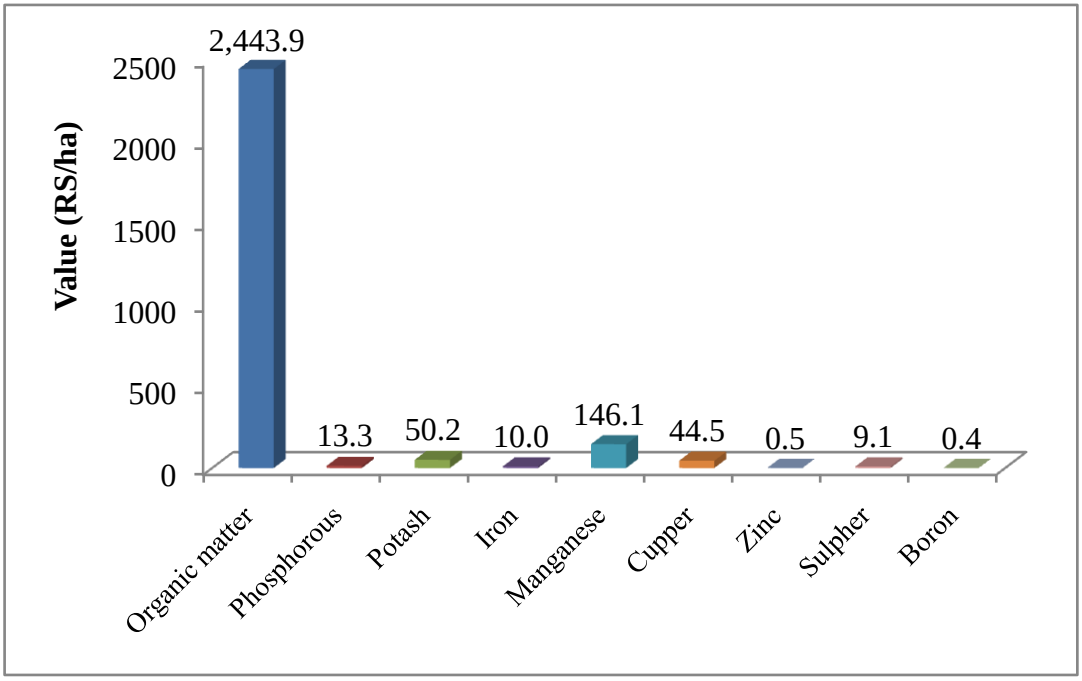


Figure 8: Estimation of onsite cost of soil erosion in Dharjamga-1 Microwatershed

The average value of ecosystem service for food grain production is around Rs 22897/ ha/year in red gram (Table 19).

Table 19: Ecosystem services of food grain production in Dharjamga-1 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Returns (Rs/ha)
Pulses	Redgram	8.3	11	4320	48502	25606	22897

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The per hectare value of water used and value of water was (Table 20) in red gram (Rs 61122).

Table 20: Ecosystem services of water supply in Dharjamga-1 Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Redgram	11.2	6112	61122	544

The main farming constraints in Dharjamga-1 Microwatershed to be found are less rainfall, lack of good quality seeds, lack of storage, damage of crops by wild animals and non availability of plant protection chemicals. Majority of farmers depend up on bank and money lender of the sources of loan for purpose of crop production. Farmers to sell the agriculture produce through village market and the farmers getting the agriculture related information on newspaper and television. Farmers reported that they are not getting timely support/extension services from the concerned development department (Table 21).

Table 21: Farming constraints related land resources of sample households in Dharjamga-1 Microwatershed

Sl.No	Particulars	Per cent
1	Less Rainfall	80.0
2	Lack of transportation	40.0
3	Lack of storage	30.0
4	Damage of crops by Wild Animals	60.0
5	Non availability of Plant Protection Chemicals	100.0
6	**Source of loan**	
	Bank	90.0
	Money Leander	10.0
7	**Market for selling**	
	Village market	100.0
8	**Sources of Agri-Technology information**	
	Newspaper	40.0
	Television	60.0

The findings of the study would be very much useful to the planners and policy makers of the study area to identify the irrationality in the existing production pattern and to suggest appropriate production plans for efficient utilization of their scarce resources resulting in increased net farm incomes and employment. The study also throws light on future potentialities of increasing net farm income and employment under different situations viz., with existing and recommended technology.