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

HASGAL-1 (4D3A9N1d) MICRO WATERSHED

Irakallagada Hobli, Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

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

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PREFACE

In Karnataka, as in other Indian States, the livelihoods of rural people are intertwined with farming pursuits. Thechallenges in agriculture are seriously threatening the livelihood of a large number of farmers as they have been practicing farming in contextual factors beyond their control. Climatic factors are the most important ones and have become much more significant in recent times due to rapid climate changes induced by intensive anthropogenic activities affecting our ecosystem in multiple ways. Climate change has become the reality, it is happening and efforts to evolve and demonstrate climate resilient technologies have become essential. Due to the already over stressed scenario of agrarian sector, the climate change is resulting in manifold increase in the complexities, pushing the rural mass to face more and more unpredictable situations. The rising temperatures and unpredictable rainfall patterns are going to test seriously the informed decisions farmers have to make in order to survive in farming and sustain their livelihood.

It is generally recognized that impacts of climate change shall not be uniform across the globe. It is said that impact of climate change is more severe in South Asia. Based on the analysis of meteorological data, it is predicted that in India, there will be upward trend in mean temperature, downward trend in relative humidity, annual rainfall and number of wet days in a year. Also, in general, phenomena like erratic monsoon, spread of tropical diseases, rise in sea levels, changes in availability of fresh water, frequent floods, droughts, heat waves, storms and hurricanes are predicted. Each one of these adverse situations are already being experienced in various parts of India and also at the global level. Decline in agricultural productivity of small and marginal farmers becoming more vulnerable is already witnessed.

In Karnataka, more than 60 per cent of the population live in rural areas and depend on agriculture and allied activities for their livelihood. Though the state has achieved significant progress in increasing the yield of many crops, there is tremendous pressure on the land resources due to the growing and competing demands of various land uses. This is reflected in the alarming rate of land degradation observed. Already more than 50 per cent of the area is affected by various forms of degradation. If this trend continues, the sustainability of the fragile ecosystem will be badly affected. The adverse effects of change in the climatic factors are putting additional stress on the land resources and the farmers dependent on this.

The natural resources (land, water and vegetation) of the state need adequate and constant care and management, backed by site-specific technological interventions and investments particularly by the government. Detailed database pertaining to the nature of

the land resources, their constraints, inherent potentials and suitability for various land based rural enterprises, crops and other uses is a prerequisite for preparing location-specific action plans, which are in tune with the inherent capability of the resources. Any effort to evolve climate resilient technologies has to be based on the baseline scientific database. Then only one can expect effective implementation of climate resilient technologies, monitor the progress, make essential review of the strategy, and finally evaluate the effectiveness of the implemented programs. The information available at present on the land resources of the state are of general nature and useful only for general purpose planning. Since the need of the hour is to have site-specific information suitable for farm level planning and detailed characterization and delineation of the existing land resources of an area into similar management units is the only option.

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Hasgal-1 micro-watershed in Koppal Taluk, and District, Karnataka" for integrated development was taken up in collaboration with the State Agricutural Universities, IISC, KSRSAC, KSNDMC as Consortia partners. The project provides detailed land resource information at cadastral level (1:7920 scale) for all the plots and socio-economic status of farm households covering thirty per cent farmers randomely selected representing landed and landless class of farmers in the micro-watershed. The project report with the accompanying maps for the microwatershed will provide required detailed database for evolving effective land use plan, alternative land use options and conservation plans for the planners, administrators, agricutural extention personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur
Date: 21-09-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

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

The present study covers an area of 508 ha in Koppal taluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 71 per cent is covered by soil, 24 per cent by rock outcrops and 5 per cent by habitation and water body. The salient findings from the land resource inventory are summarized briefly below

- *The soils belong to 14 soil series and 34 soil phases (management units) and 7 land management units.*
- *The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 31 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area is suitable for agriculture.*
- *About 12 per cent of the soils are shallow (25-50 cm), 7 per cent of the soils are moderately shallow (50-75 cm), 22 per cent moderately deep (75- 100 cm) and 30 per cent is deep to very deep (100->150cm) soils.*
- *About 17 per cent sandy (loamy sand), 44 per cent loamy (sandy loam and sandy clay loam) and 10 per cent has clayey (sandy clay and clay) soils at the surface.*
- *About 29 per cent of the area has non-gravelly (<15%) soils, 34 per cent has gravelly soils (15-35 % gravel) and 8 per cent very gravelly (35-60 %) soils.*
- *With respect to available water capacity 31 per cent of the area has very low (<50mm/m), 22 per cent of the area has low (51-100 mm/m), 7 per cent medium (101-150 mm/m) and 11 per cent very high (>200 mm/m) in available water capacity.*

- *An area of about 2 per cent is nearly level (0-1%), 68 per cent is very gently sloping (1-3%) and <1 per cent is gently sloping (3-5%) lands.*
- *An area of about 17 per cent is slightly eroded (e1) and 54 per cent is moderately eroded (e2) lands.*
- *An area of about 6% is strongly acid (pH 5.0-5.5), 4% is moderately acid (pH 5.5-6.0), 12% is slightly acid (pH 6.0-6.5), 19% is neutral (pH 6.5-7.3), 11% is slightly alkaline (pH 7.3-7.8), 14% is moderately alkaline (pH 7.8-8.4) and 5% is strongly alkaline (pH 8.4-9.0) in reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dSm^{-1} indicating that the soils are non saline.*
- *Organic carbon is medium (0.5-0.75%) in 18 per cent and high (>0.75%) in 53 per cent area of the soils.*
- *Available phosphorus is medium (23-57 kg/ha) in the entire area of the microwatershed.*
- *Available potassium is low (<145 kg/ha) in 47 per cent, medium (145-337 kg/ha) in 17 per cent and high (>337 kg/ha) in 6 per cent area of the soils.*
- *Available sulphur is low (<10 ppm) in 22 per cent and medium (10-20 ppm) in 49 per cent area of the soils.*
- *Available boron is low (<0.5 ppm) in 70 per cent and medium (0.5-1.0) in 1 per cent area of the microwatershed.*
- *Available iron is deficient (<4.5 ppm) in 7 per cent and sufficient (>4.5 ppm) in 64 per cent area of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in 66 per cent and sufficient (>0.6 ppm) in 5 per cent area of the microwatershed.*
- *Available manganese and copper is sufficient in the entire area of the microwatershed.*
- *The land suitability for 31 major agricultural and horticultural crops grown in the microwatershed was assessed and the areas that are highly suitable (class S1) and moderately suitable (class S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price, and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

Crop	Suitability Area in ha (%)			Crop	Suitability Area in ha (%)	
	Highly suitable (S1)	Moderately suitable (S2)			Highly suitable (S1)	Moderately suitable (S2)
Sorghum	*34(7)*	*101(20)*		*Sapota*	*34(7)*	*77(15)*
Maize	*34(7)*	*101(20)*		*Pomegranate*	*34(7)*	*130(25)*
Bajra	*54(11)*	*145(28)*		*Musambi*	*34(7)*	*130(25)*
Groundnut	*54(11)*	*155(31)*		*Lime*	*34(7)*	*130(25)*
Sunflower	*34(7)*	*73(14)*		*Amla*	*54(11)*	*246(48)*
Redgram	*34(7)*	*73(14)*		*Cashew*	-	*112(22)*
Bengal gram	*54(11)*	*87(17)*		*Jackfruit*	*34(7)*	*77(15)*
Cotton	-	*135(27)*		*Jamun*	-	*164(32)*
Chilli	*34(7)*	*48(10)*		*Custard apple*	*54(11)*	*246(48)*
Tomato	*34(7)*	*48(10)*		*Tamarind*	-	*87(17)*
Brinjal	*20(4)*	*215(42)*		*Mulberry*	*34(7)*	*232(45)*
Onion	*20(4)*	*215(42)*		*Marigold*	*34(7)*	*101(20)*
Bhendi	*20(4)*	*215(42)*		*Chrysanthemum*	*34(7)*	*101(20)*
Drumstick	*34(7)*	*140(27)*		*Jasmine*	*34(7)*	*48(9)*
Mango	-	*34(7)*		*Crossandra*	*34(7)*	*48(9)*
Guava	*34(7)*	*77(15)*				

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the 7 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.*
- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation and drainage line treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. That would help in supplementing the farm income, provide fodder and fuel, and generate lot of biomass which in turn would help in maintaining the ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

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

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

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

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

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

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

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

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

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Hasgal-1 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig 2.1). It lies between $15^0$30' and $15^0$32' North latitudes and $76^0$16' and $76^0$18' East longitudes and covers an area of about 508 ha. It is about 25 km from Koppal town. It comprises and bounded by Ganganahala on the north, Hasagala and Hosura on the west and south and Arishinakeri on the south. It comprised by Hasagala on the central and Venkabagudi on the south. It surrounded by Chikkasoolikeri on the north and Methagalla village on the southern side of the microwatershed.

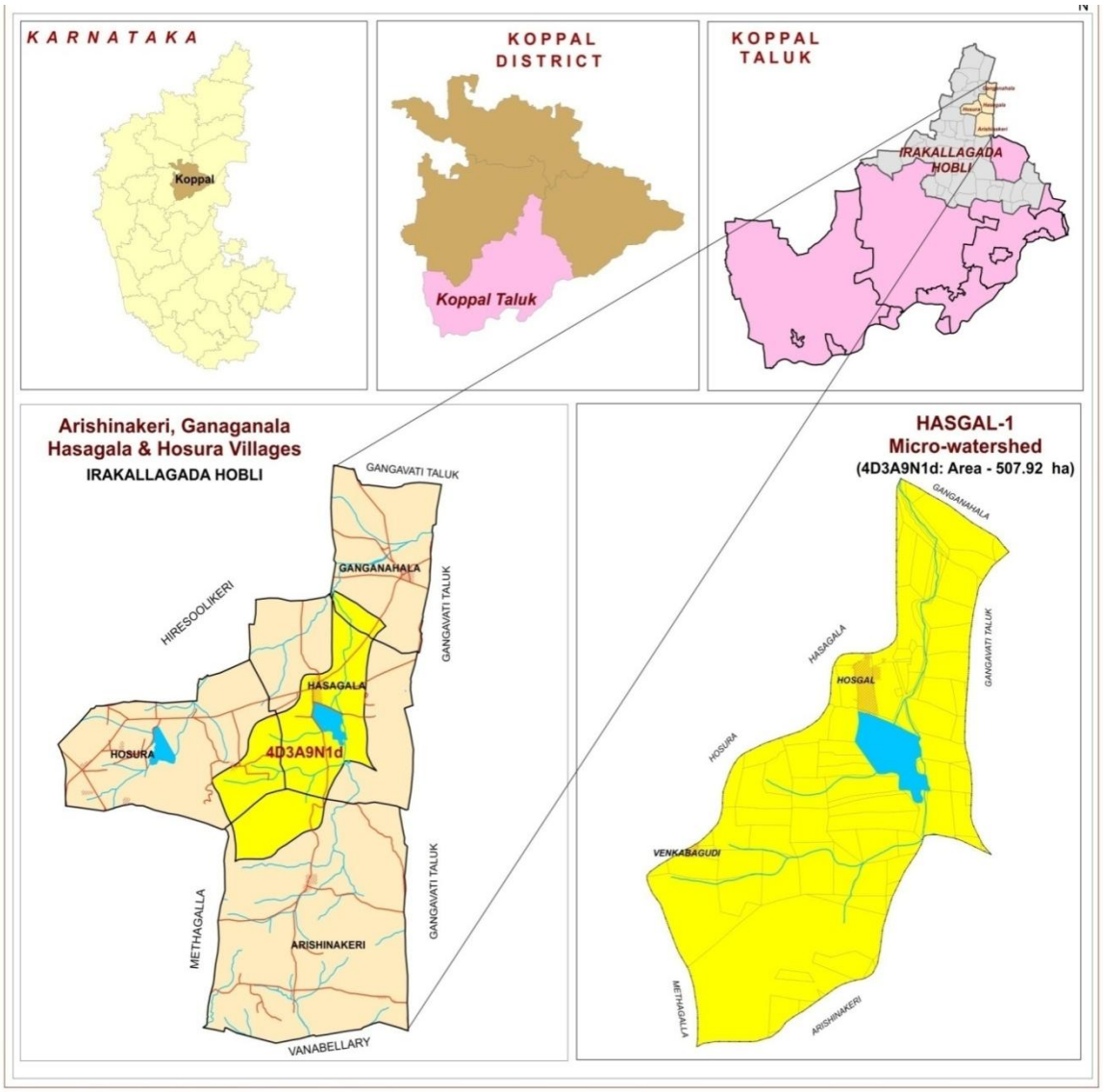

Fig.2.1 Location map of Hasgal-1Microwatershed

2.2 Geology

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

medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about 10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Bikkanahalli village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent paleo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2a Granite and granite gneiss rocks

Fig.2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss and Alluvial landscapes based on geology. The microwatershed area has been further divided into

mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 571 to 585 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought - prone with total annual rainfall of 662 mm (Table 2.1). Of this, a maximum of 424 mm precipitation is received during south–west monsoon period from June to September, north-east monsoon contributes about 161 mm and prevails from October to early December and the remaining 77 mm is received during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 45°C and in December and January, the temperatures will go down to 16°C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 145 mm and varies from a low of 101 mm in December to 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

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

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

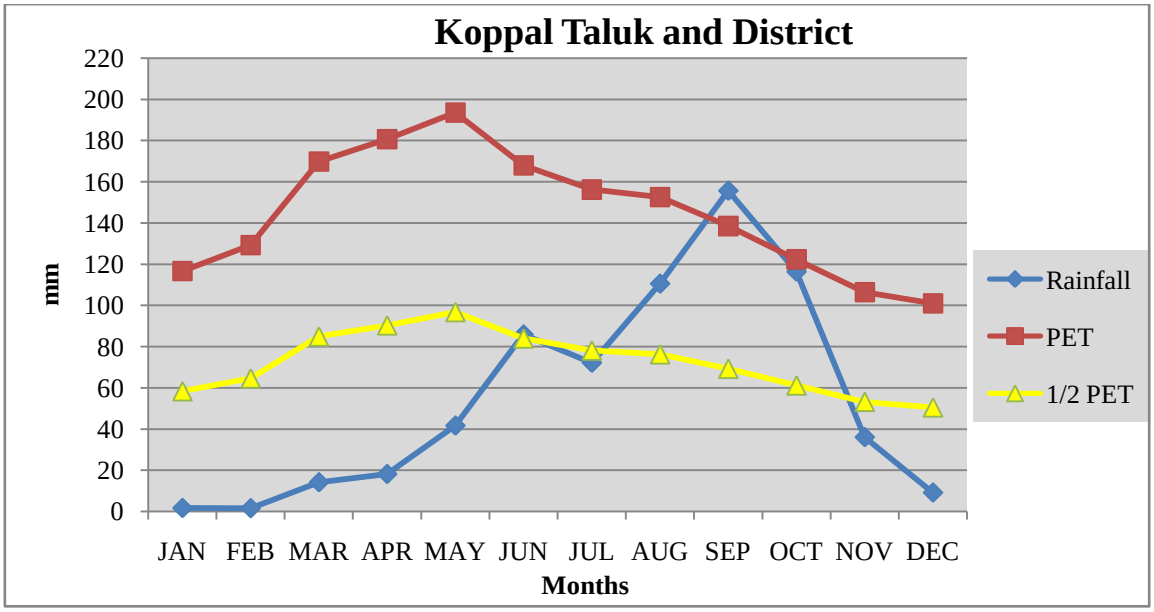

Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

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

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

Fig 2.4 Natural vegetation of Hasgal-1 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5). 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 Hasgal-1microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) and conservation structures is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and conservation structures in Hasgal-1 microwatershed is given in Fig 2.7.

Table 2.2 Land Utilization in Koppal District

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

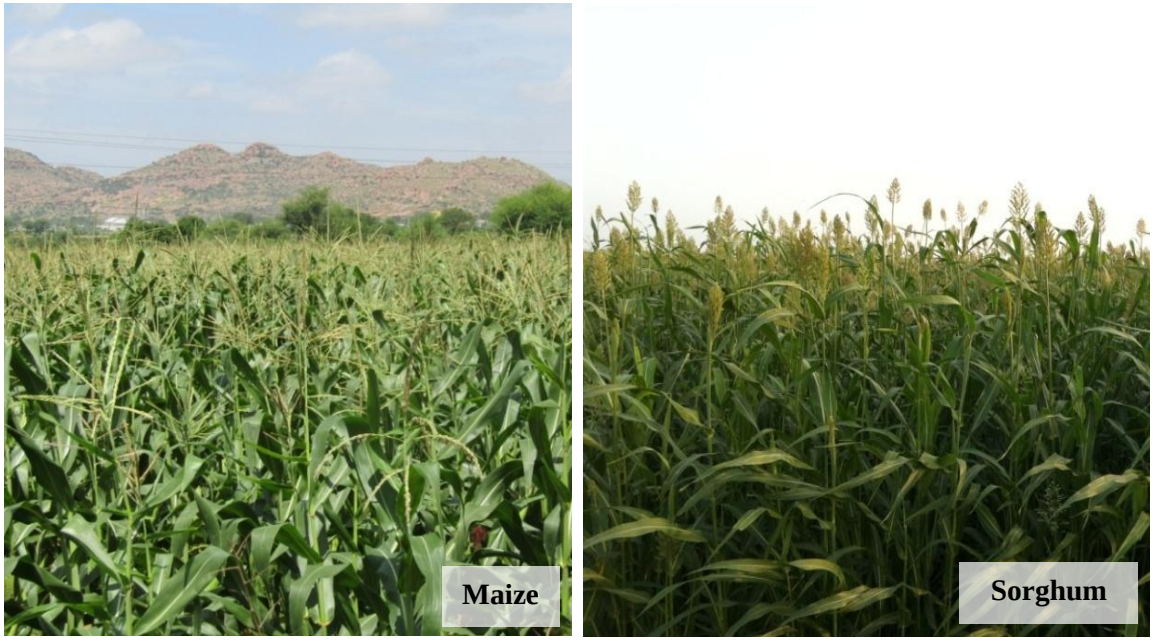

Fig.2.5 (a) Different crops and cropping systems in Hasgal-1 Microwatershed

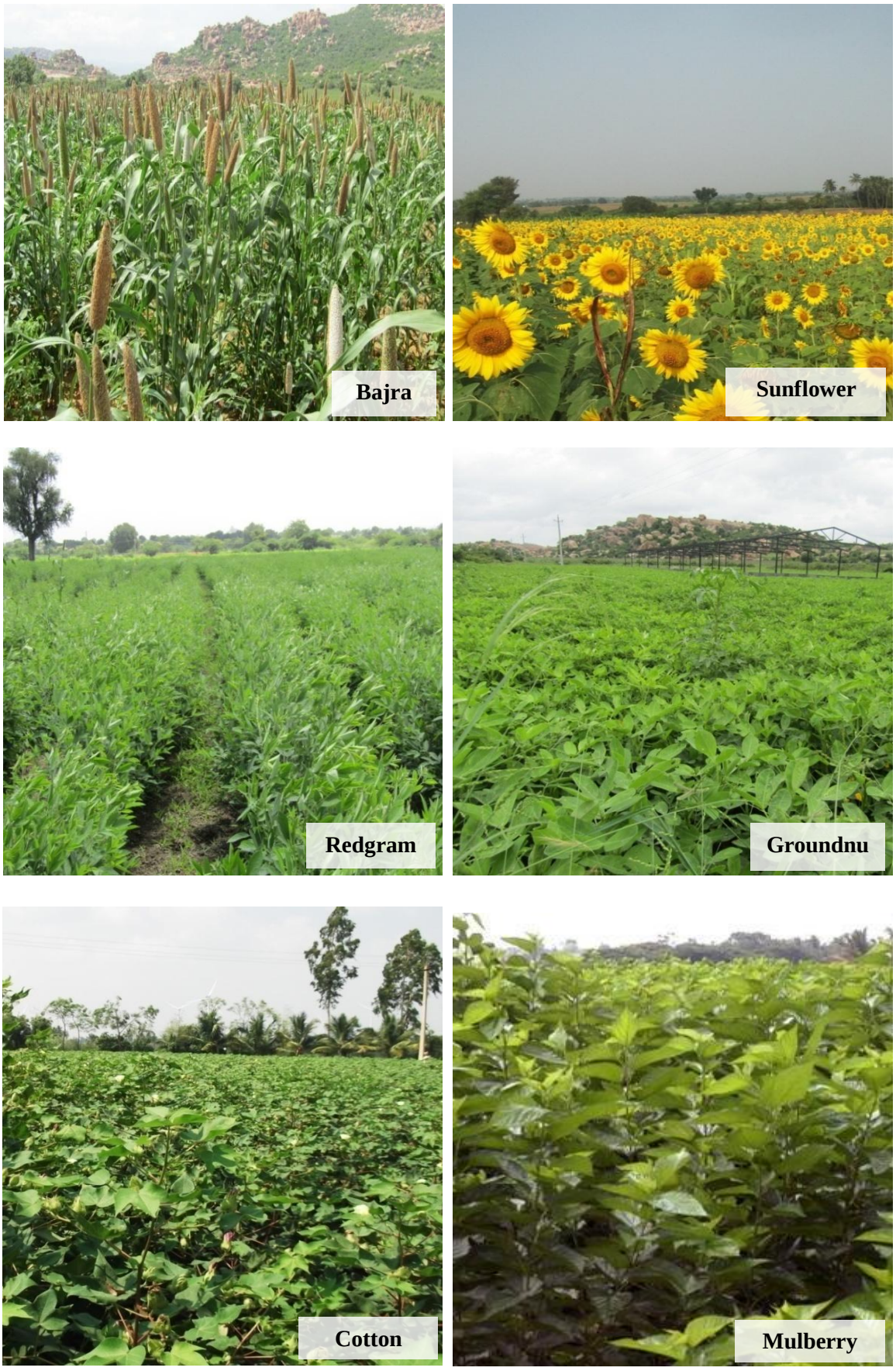

Fig.2.5 (b) Different crops and cropping systems in Hasgal-1 Microwatershed

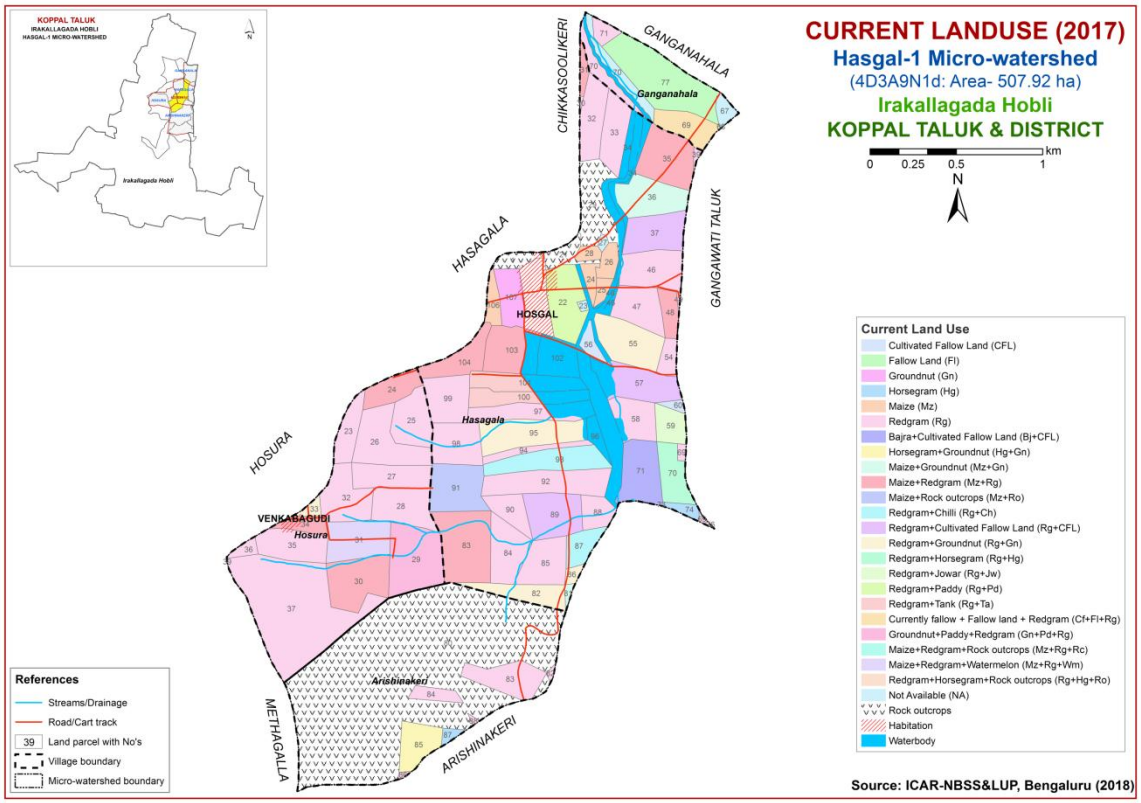

Fig.2.6 Current Land Use map of Hasgal-1 Microwatershed

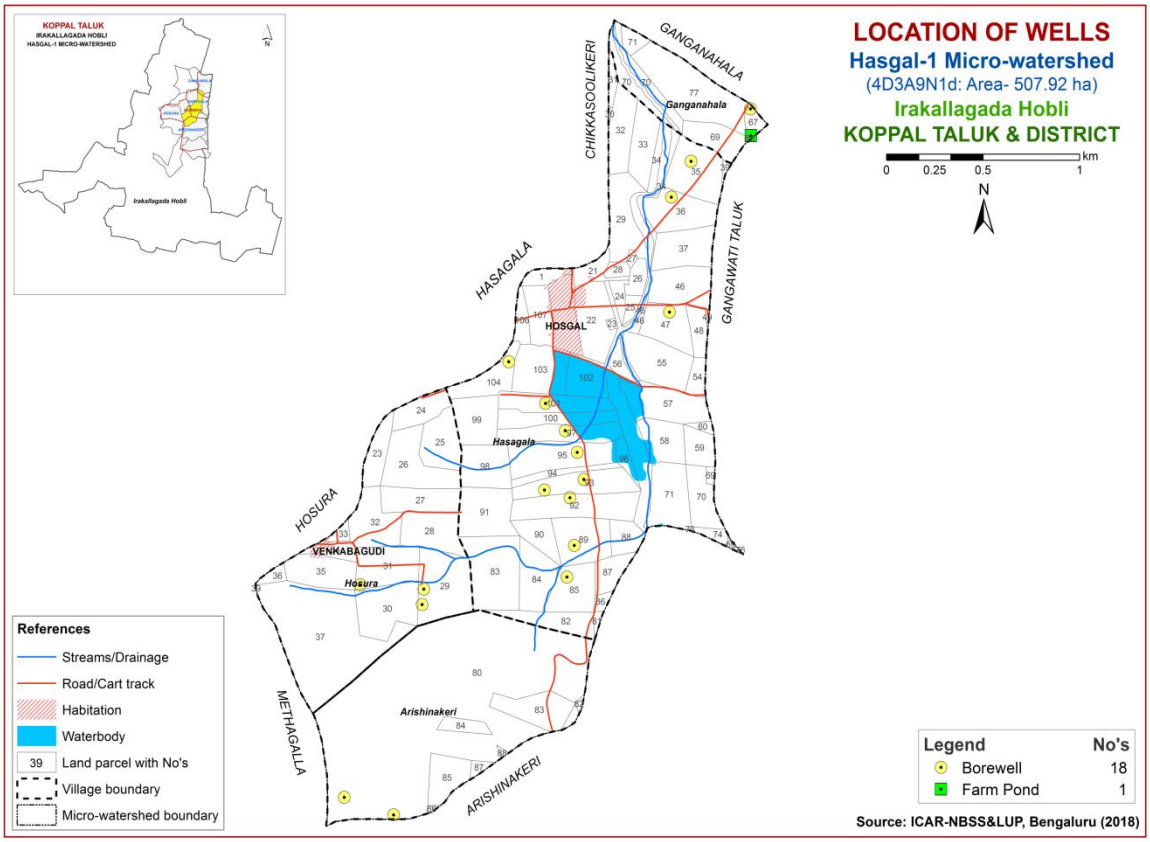

Fig.2.7 Location of wells and conservation structures map of Hasgal-1 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Hasgal-1 microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing their extent and geographic distribution on the microwatershed cadastral map. The detailed soil survey at 1:7920 scale was carried out in 508 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

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

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

G1	Hills/ Ridges/ Mounds
G11	Summits
G12	Side slopes
G121	Side slopes with dark grey tones
G2	Uplands
G21	Summits
G22	Gently sloping uplands
G221	Gently sloping uplands, yellowish green (eroded)
G222	Gently sloping uplands, yellowish white (severely eroded)
G23	Very gently sloping uplands
G231	Very gently sloping uplands, yellowish green
G232	Very gently sloping uplands, medium green and pink
G233	Very gently sloping uplands, pink and green (scrub land)
G234	Very gently sloping uplands, medium greenish grey
G235	Very gently sloping uplands, yellowish white (eroded)
G236	Very gently sloping uplands, dark green
G237	Very gently sloping uplands, medium pink (coconut garden)
G238	Very gently sloping uplands, pink and bluish white (eroded)
G3	Valleys/ lowlands
G31	Valleys, pink tones
G32	Valleys gray mixed with pink tones

DSe -Alluvial landscape

DSe 1 Summit

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

DSe 2 Very genetly sloping

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

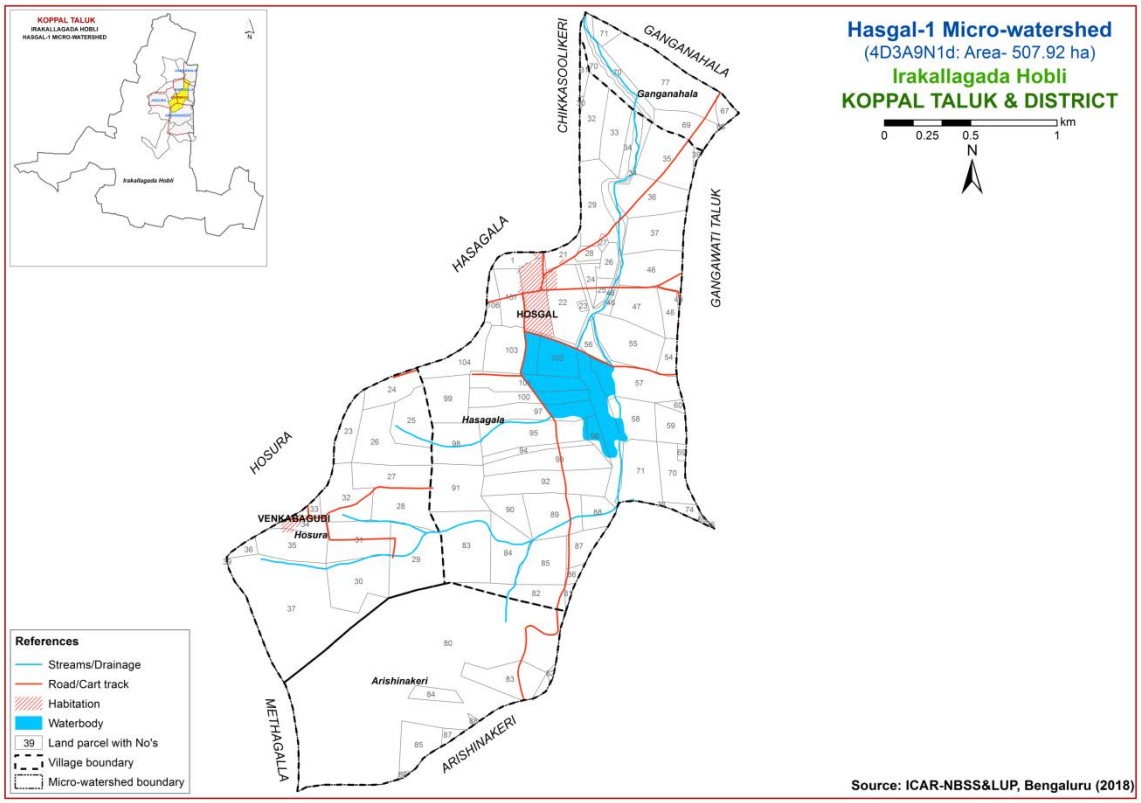

Fig 3.1 Scanned and Digitized Cadastral map of Hasgal-1 Microwatershed

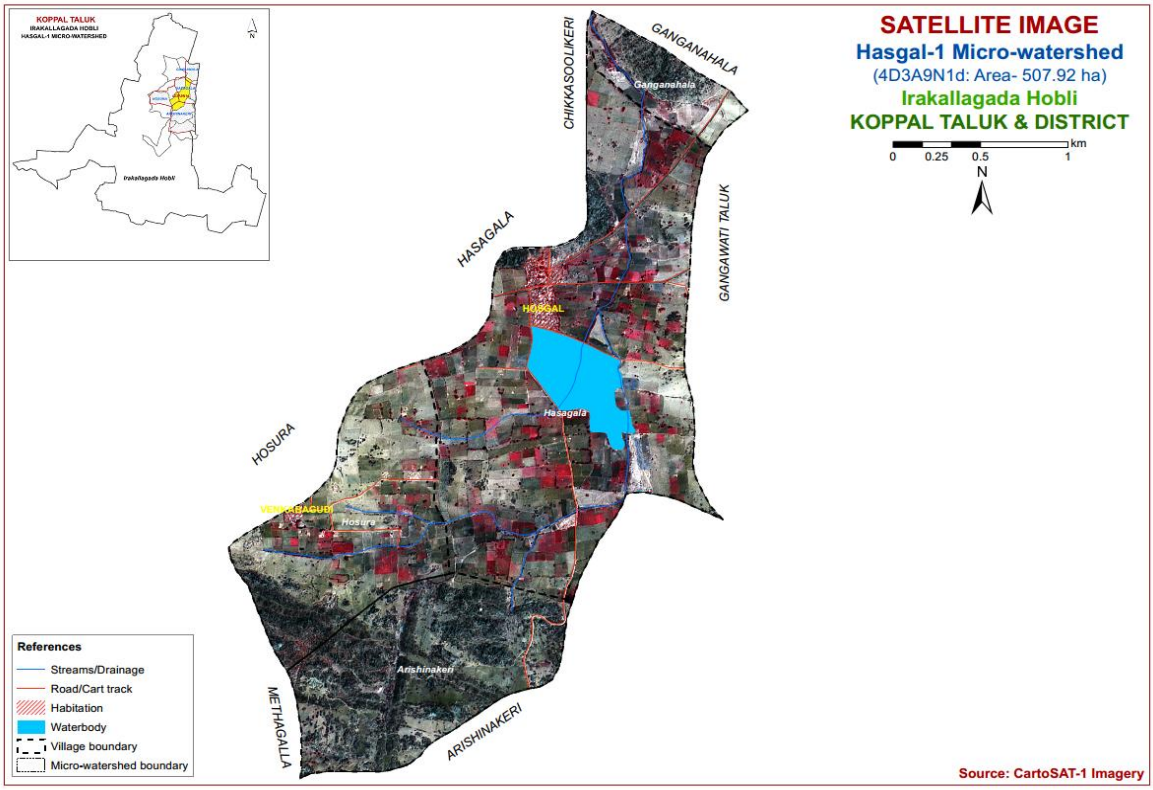

Fig.3.2 Satellite Image of Hasgal-1 Microwatershed

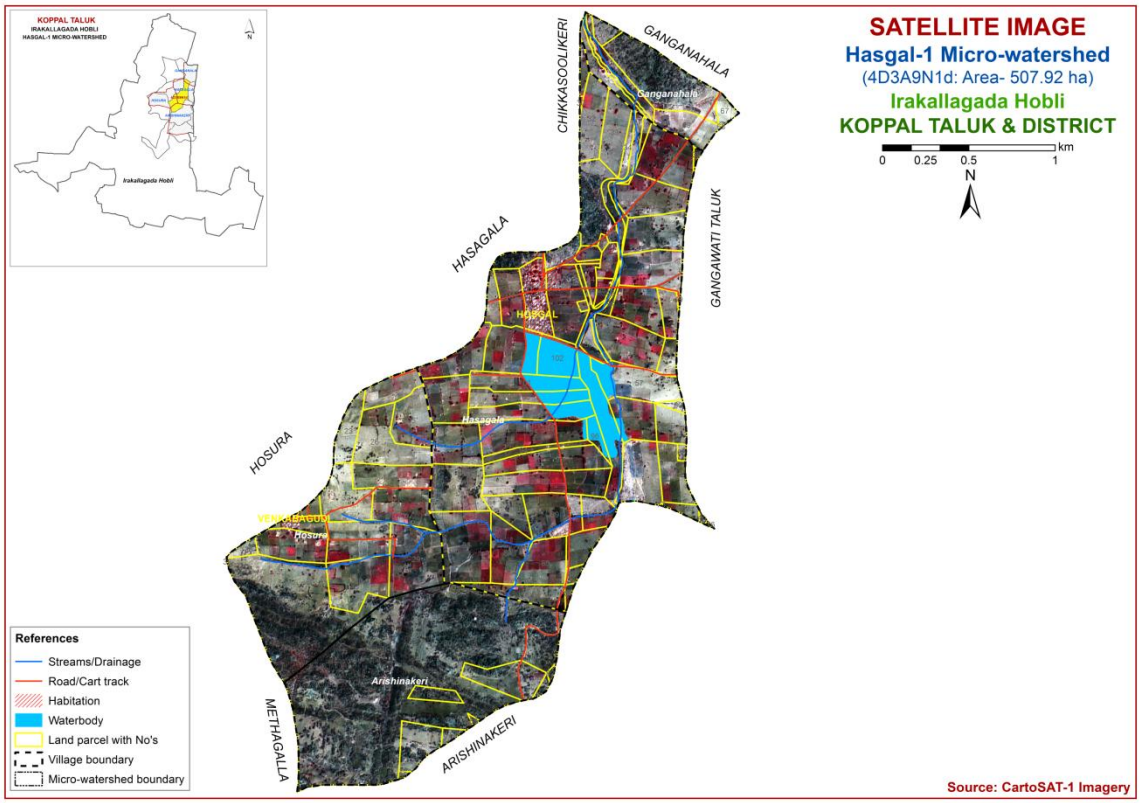

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Hasgal-1 Microwatershed

3.3 Field Investigation

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

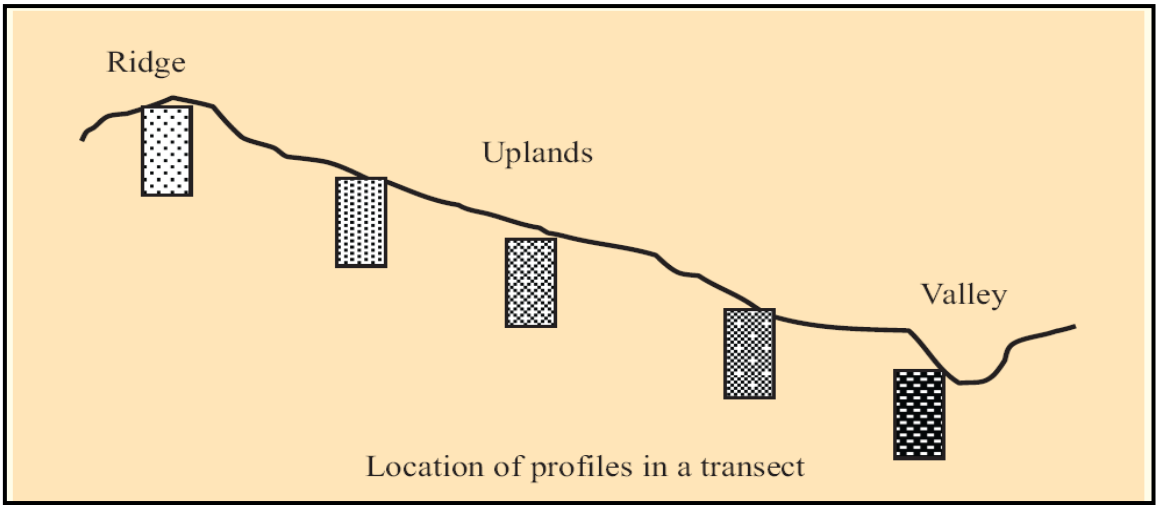

Fig: 3.4. Location of profiles in a transect

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

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, calcareousness, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 14 soil series were identified in Hasgal-1 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareo-usness**
1	Kaggalipura (KGP)	25-50	2.5YR2.5/4,3/4, 3/6	gsc	15-35	Ap-Bt-Cr	-
2	Harve (HRV)	25-50	2.5YR3/4,3/6 5YR3/3,4/4,3/4	gscl	>35	Ap-Bt-Cr	-
3	Kanchanahalli (KNH)	25-50	2.5YR3/4,3/6	sc	<15	Ap-Bt-Cr	-
4	Kutegoudanahundi (KGH)	50-75	7.5YR3/2,3/3,3/4	gscl	15-35	Ap-Bt-Cr	-
5	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3,5/4, 6/6 2.5YR3/4	gsc	>35	Ap-Bt-Cr	-
6	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4,3/6	gsc-gc	>35	Ap-Bt-Cr	-
7	Gollarahatti (GHT)	75-100	2.5YR3/4,3/6, 4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
8	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5 YR 3/4	gc	35-60	Ap-Bt-Cr	-
9	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
10	Mornal (MNL)	100-150	5YR 3/4, 2.5 YR 3/4, 4/6	gsc	15-35	Ap-Bt-Cr	-
11	Nagalapur (NGP)	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc	>35	Ap-Bt-Cr	-
12	Thimmasandra (TSD)	>150	10YR2/12/2,3/1, 3/2,4/1, 4/2,4/3	c	<15	Ap-Bw	-
13	Kavalakkeri (KLR)	>150	10 YR 2/1,3/1,3/2 7.5 YR 2.5/1,3/2	sc	<15	Ap-Bw	e-es
Soils of Alluvial landscape							
14	Bardur (BDR)	>150	10YR 2/1, 3/1, 3/2	c	<15	Ap-Bss	es

3.4 Soil Mapping

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

The soil map shows the geographic distribution of 34 mapping units representing 14 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 34 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one soil phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units

The 34 soil phases identified and mapped in the microwatershed were regrouped into 7 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMU's. For Hasgal-1 microwatershed, five soil and site characteristics, namely the soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The land use classes are expected to behave similarly for a given level of management.

3.5 Laboratory Characterization

Soil samples for each series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2018 from farmer's fields in Hasgal-1microwatershed (47 samples) for fertility status (major and micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Hasgal-1Microwatershed

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	KGP	Kaggalipura soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay soils occurring on nearly level to moderately sloping uplands under cultivation.		**22(4.32)**
14		KGPcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	16 (3.15)
17		KGPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	6(1.17)
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay loam soils occurring on nearly level to gently sloping uplands under		**30(5.9)**

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
		cultivation.		
22		HRVcC2g2R2	Sandy loam surface, slope 3-5%, moderate erosion, very gravelly (35-60%), fairly rocky (2-10%)	2(0.46)
25		HRVhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	10(1.98)
26		HRVhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	10(1.91)
465		HRVcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	8(1.55)
	KNH	Kanchanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown to dark red sandy clay soils occurring on nearly level to gently sloping uplands under cultivation.		**8(1.52)**
467		KNHiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	8(1.52)
	KGH	Kutegoudanahundi soils are moderately shallow (50-75 cm), well drained, have brown to dark brown, red gravelly sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation.		**27(5.23)**
62		KGHbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	9(1.69)
64		KGHcB1	Sandy loam surface, slope 1-3%, slight erosion	2(0.33)
65		KGHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	7(1.37)
66		KGHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	2(0.46)
68		KGHhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	7(1.38)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown, red gravelly sandy clay soils occurring on very gently to gently sloping uplands under cultivation.		**9(1.7)**
77		MKHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	4(0.7)
78		MKHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	4(0.85)
90		MKHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1(0.15)
	HDH	Hooradhahalli soils are moderately deep (75-100 cm), well drained, dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation.		**57(11.28)**
105		HDHbB2g1	Loamy sand surface, slope 1-3%, moderate	13(2.58)

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
			erosion, gravelly (15-35%)	
111		HDHcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	5(1.01)
112		HDHcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	11(2.24)
122		HDHhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	13(2.55)
123		HDHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	15(2.9)
	GHT	Gollarahatti soils are moderately deep (75-100 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay loam soils occurring on nearly level very gently sloping uplands under cultivation.		**20(3.94)**
137		GHTcB2	Sandy loam surface, slope 1-3%, moderate erosion	20(3.89)
141		GHThB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	0.27(0.05)
	BDG	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown, red gravelly clay soils occurring on nearly level to gently sloping uplands under cultivation.		**34(6.77)**
180		BDGcB1g1	Sandy loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	34(6.77)
	BPR	Balapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation.		**56(10.99)**
217		BPRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	36(7.11)
219		BPRbB2g2	Loamy sand surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	20(3.88)
	MNL	Mornal soils are deep (100-150 cm), well drained, have dark reddish brown to red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation.		**34(6.64)**
204		MNLcB2	Sandy loam surface, slope 1-3%, moderate erosion	34(6.64)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red, gravelly sandy clay soils occurring on nearly level to gently sloping uplands under cultivation.		**11(2.22)**
249		NGPbB1	Loamy sand surface, slope 1-3%, slight erosion	11(2.18)
258		NGPhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	0.21(0.04)
	TSD	Thimmasandra soils are very deep (>150 cm), moderately		**53(10.48)**

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
		well drained, have very dark brown to very dark grayish brown, black clay soils occurring on nearly level to very gently sloping lowlands under cultivation.		
443		TSDcB2	Sandy loam surface, slope 1-3%, moderate erosion	15(3.0)
445		TSDiB1	Sandy clay surface, slope 1-3%, slight erosion	4(0.83)
446		TSDmA1	Clay surface, slope 0-1%, slight erosion	11(2.13)
447		TSDmB2	Clay surface, slope 1-3%, moderate erosion	23(4.52)
	KLR	Kavalakkeri soils are very deep soils (>150 cm), moderately well drained, have black to dark reddish brown calcareous sandy clay soil occurring on nearly level to very gently sloping low lands under cultivation.		**0.11(0.02)**
473		KLRmA1	Clay surface, slope 0-1%, slight erosion	0.11(0.02)
Soils of Alluvial Landscape				
	BDR	Bidanagere soils are moderately deep (75-100 cm), well drained, have dark reddish brown, red calcareous clay soils occurring on nearly level to gently sloping uplands under cultivation.		**0.13(0.03)**
433		BDRmB2	Clay surface, slope 1-3%, moderate erosion	0.13(0.03)
999	Rock outcrops			119(23.5)
1000	Others	Habitation and Waterbody		28(5.47)

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

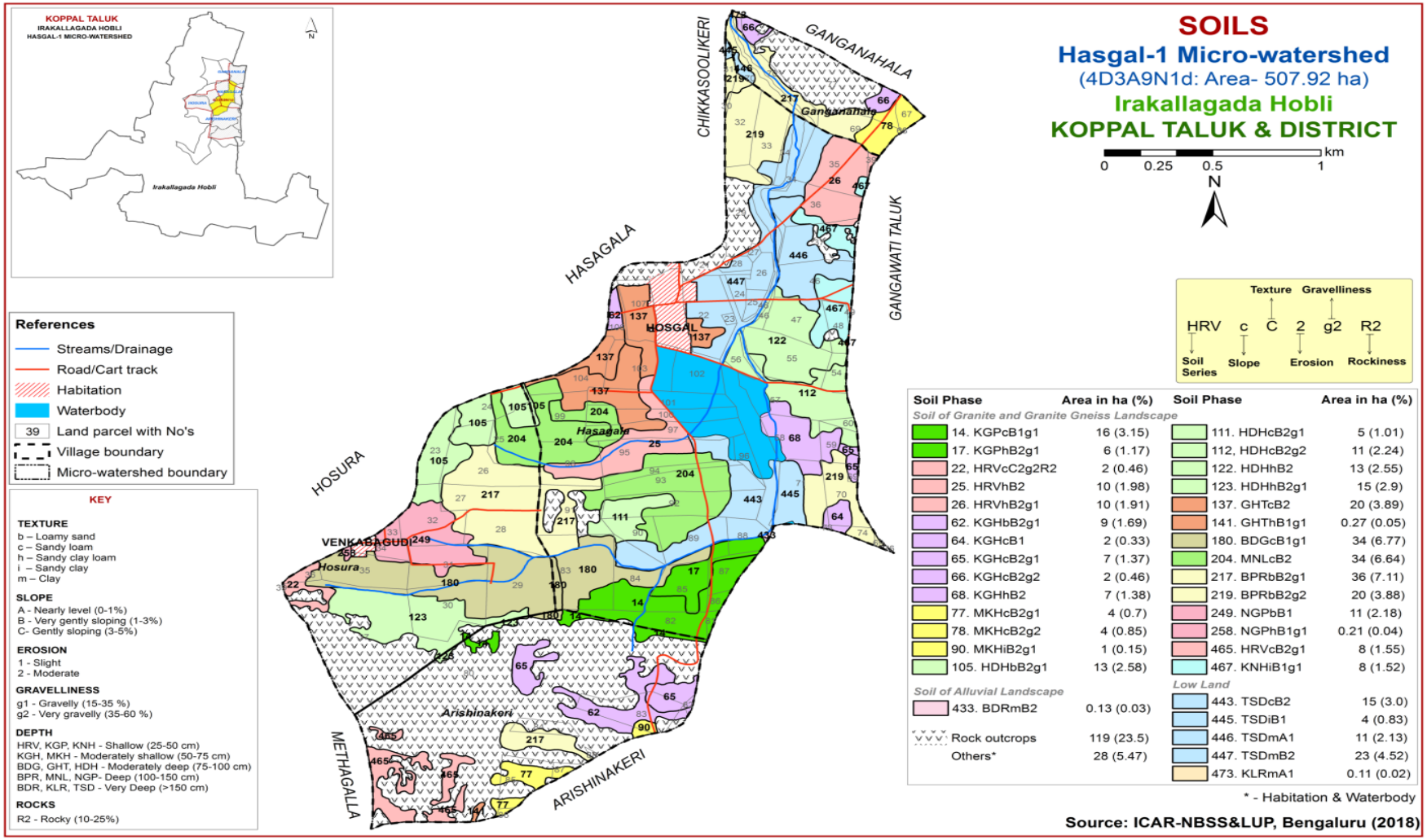

Fig 3.5 Soil Phase or Management Units of Hasgal-1Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Hasgal-1microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscape based on geology. In all, 14 soil series were identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 14 soil series identified followed by 34 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Hasgal-1microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite and Granite gneiss Landscape

In this landscape, 13 soil series were identified and mapped. Of these series, HDH series occupies maximum area of 57 ha (11%) followed by BPR 56 ha (11%), TSD 53 ha (10%), BDG 34 ha (7%), MNL 34 ha (7%), HRV 30 ha (6%), KGH 27 ha (5%), KGP 22 ha (4%), GHT 20 ha (4%), NGP 11 ha (2%), MKH 9 ha (2%), KNH 8 ha (2%) and KLR <1 ha (<1%).The brief description of the soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 30 to 50 cm. The thickness of A-horizon ranges from 10 to 17 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2.5 to 4 and chroma 2 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 25 per cent gravel. The thickness of B horizon ranges from 24 to 50 cm. Its colour is in 2.5 YR hue with value 2.5 and chroma 4. Its texture is sandy clay loam to sandy clay soils with gravel content of 15 to 35 per cent. The available water capacity is low (51-100 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Kaggalipura (KGP) Series

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

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

Landscape and soil profile characteristics of Harve (HRV) Series

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

The thickness of the solum ranges from 28 to 50 cm. The thickness of A horizon ranges from 12 to 18 cm. Its colour is in 5YR and 2.5 YR hue with value 3 and chroma 4 to 6. The texture varies from sandy clay loam to sandy clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 16 to 38 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Its texture is sandy clay with gravel content of < 15 per cent. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kanchanahalli (KNH) Series

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

The thickness of the solum ranges from 50 to 74 cm. The thickness of A horizon ranges from 12 to 22 cm. Its colour is in 7.5 YR and 10 YR hue with value and chroma 3 to 4. The texture varies from loamy sand to sandy loam with 15 to 30 per cent gravel. The thickness of B horizon ranges from 40 to 62 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. Its texture is sandy clay loam with gravel content of 15 to 35 per cent. The available water capacity is medium (101-150 mm/m). Five soil phases were identified and mapped.

Landscape and soil profile characteristics of Kutegoudanahundi (KGH) Series

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

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


Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

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

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 11 to 19 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon varies from 65 to 83 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (51-100 mm/m). Five soil phases were identified and mapped.

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

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

The thickness of the solum ranges from 78 to 98 cm. The thickness of A-horizon ranges from 12 to 18cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture varies from gravelly sandy clay loam with 15 to 35 per cent gravel. The thickness of B horizon ranges from 66 to 81cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay loam with 15 to 35 per cent gravel. The available water capacity is medium (101-150 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Gollarahatti (GHT) Series

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

The thickness of the solum ranges from 78 to 99 cm. The thickness of A-horizon ranges from 12 to 19 cm. Its colour is in 2.5 YR and 5 YR hue with value 2 to 3 and chroma 3 to 4. The texture varies from sandy clay loam to sandy clay with 10 to 20 per cent gravel. The thickness of B-horizon ranges from 68 to 85 cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 5 and chroma 3 to 4. Its texture is gravelly clay with gravel content of 35-60 per cent. The available water capacity is very low (<50 mm/m). Only one soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

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

The thickness of the solum ranges from 102 to 147 cm. The thickness of A horizon ranges from 12 to 17cm. Its colour is in 5 YR and 2.5 YR hue with value and chroma 3 to 4. The texture ranges from loamy sand to sandy clay with 15 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 4 to 6. Texture is sandy clay to clay with 35 to 50 per cent gravel. The available water capacity is low (51-100 mm/m). Two soil phases were identified and mapped.

Landscape Soil Profile Characteristics of Balapur (BPR) Series

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

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

Landscape and soil profile characteristics of Mornal (MNL) Series

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

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

Landscape and soil Profile Characteristics of Nagalapur (NGP) Series

4.1.12 Thimmasandra (TSD) Series: Thimmasandra soils are very deep (>150 cm), moderately well drained, have very dark brown to very dark grayish brown, clay soils. They have developed from alluvio-colluvium and occur on nearly level to very gently sloping lowlands under cultivation. The Thimmasandra series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 11 to 17 cm. Its colour is in 10 YR hue with value 3 and chroma 3. The texture is sandy clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is sandy clay to clay. The available water capacity is very high (>200 mm/m). Four soil phases were identified and mapped.

Landscape and soil profile characteristics of Thimmasandra (TSD) Series

4.1.13 Kavalakkeri (KLR) Series: Kavalakkeri soils are very deep (>150 cm), moderately well drained, black to very dark brown, calcareous cracking sandy clay soils. They have developed from alluvio-colluvium and occur on nearly level to very gently sloping lowlands under cultivation. The Kavalakkeri series has been classified as a member of the fine, mixed, isohyperthermic (calc) family of Fluventic Haplustepts.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 18 to 29 cm. Its colour is in 7.5 and 10YR hue with value 3 to 4 and chroma 2 to 4. The texture is sandy clay. The thickness of B horizon ranges from 131-155 cm. Its colour is in 7.5YR and 10 YR hue with value 2 to 4 and chroma 1 to 4. Its texture is sandy clay to clay. The available water capacity is very high (>200mm/). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kavalakkeri (KLR) Series

4.2 Soils of Alluvial Landscape

In this landscape, only one soil series was identified and mapped. KVR series occupies an area of <1 ha (<1%).

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

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

Landscape and soil profile characteristics of Bardur (BDR) Series

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

Series Name: Harve (HRV), Pedon**:** R-10
Location: $15^0$25'11.63"N, $76^0$22'03.65"E Jabbaragudda village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Loamy-skeletal, mixed, isohyperthermic (Paralithic) Rhodustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	65.64	9.07	25.28	29.04	12.99	9.00	3.48	11.15	50	scl	12.87	4.81
15-29	Bt1	56.13	7.75	36.12	27.81	11.43	7.21	1.44	8.24	60	sc	15.69	6.24
29-47	Bt2	63.42	6.53	30.05	32.38	13.93	7.48	5.74	3.89	60	scl	15.41	9.29

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-15	6.05	-	-	0.21	0.93	-	8.89	1.96	0.50	0.08	11.43	11.24	0.44	100.00	0.73
15-29	5.99	-	-	0.15	0.29	-	9.72	2.75	0.51	0.09	13.07	12.71	0.35	100.00	0.74
29-47	6.07	-	-	0.11	0.38	-	9.35	2.47	0.49	0.06	12.36	12.71	0.42	97.29	0.44

Contd…

Series Name: Kutegoudanahundi (KGH), **Pedon:** R1
Location: Lambani tanda village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine-loamy, mixed, isohyperthermic Typic Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	79.84	7.93	12.23	30.70	15.50	14.08	12.26	7.29	20	sl	10.46	4.79
12-35	Bt1	64.49	9.69	25.82	33.88	10.92	8.06	7.45	4.18	25	scl	16.40	9.12
35-58	Bt2	62.27	9.51	28.22	35.38	8.90	7.06	3.27	7.67	30	scl	19.13	11.05
58-72	Bc	62.77	7.40	29.83	32.76	11.50	7.63	6.82	4.07	40	scl	19.86	10.16

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.66	-	-	0.089	0.83	-	6.39	1.56	0.21	0.08	8.23	8.22	0.67	100	0.93
12-35	7.39	-	-	0.061	0.73	-	-	-	0.25	0.07	-	14.95	0.58	100	0.49
35-58	7.56	-	-	0.064	0.69	-	-	-	0.27	0.08	-	16.34	0.58	100	0.52
58-72	7.92	-	-	0.146	0.47	-	-	-	0.36	0.12	-	17.72	0.59	100	0.69

Contd…

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

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

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

Contd…

Soil Series: Hooradhahalli (HDH), **Pedon:** RM-69
Location: $13^0$24'31"N, $76^0$33'41"E, (4D3D8G2d), Hesarahalli village, Chikkanayakanahalli taluk, Tumukura district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	72.56	15.17	12.27	4.57	8.33	17.38	23.88	18.39	35	sl	-	-
18-33	Bt1	56.29	10.75	32.96	7.88	10.24	13.41	14.43	10.34	55	scl	-	-
33-58	Bt2	46.66	10.79	42.55	10.79	9.87	8.43	9.04	8.53	55	sc	-	-
58-90	Bt3	43.09	13.63	43.27	9.90	8.25	7.32	8.76	8.87	45	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	6.54	-	-	0.07	0.60	0.00	2.68	1.38	0.44	0.42	4.91	5.84	0.48	84.07	7.11
18-33	5.90	-	-	0.07	0.52	0.00	3.99	1.27	0.09	0.37	5.71	8.61	0.26	66.32	4.29
33-58	6.16	-	-	0.07	0.44	0.00	4.92	1.67	0.08	0.55	7.22	10.00	0.24	72.23	5.50
58-90	6.39	-	-	0.06	0.40	0.00	4.30	2.02	0.08	0.46	6.87	9.21	0.21	74.61	5.05

Contd…

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

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-26	5.70	-	-	0.06	0.20	0.00	1.50	0.60	0.09	0.13	2.32	3.17	0.29	73.00	4.10
26-63	6.26	-	-	0.04	0.24	0.00	7.35	1.55	0.09	0.17	9.15	9.89	0.32	93.00	1.72
63-84	6.50	-	-	0.05	0.20	0.47	-	-	0.09	0.21	0.30	10.18	0.32	100.00	2.06

Contd…

Series: Bidanagere (BDG), **Pedon**: RM-3
Location: $13^0$22'11"N, $76^0$38'03"E, (4D3D8G1a), Tharabenahalli village, Chikkanayakanahalli Taluk, Tumakuru District.
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Clayey-skeletal, mixed, isohyperthermic Rhodic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	81.19	11.25	7.56	12.54	15.07	17.90	21.94	13.75	50	ls	-	-
20-35	Bt1	57.45	11.45	31.10	12.76	11.02	10.92	12.45	10.31	50	scl	-	-
35-92	Bt2	44.63	7.85	47.52	12.40	9.61	8.37	7.75	6.51	60	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-20	6.24	-	-	0.06	0.60	0.00	1.61	0.26	0.10	0.01	1.98	3.76	0.50	52.56	0.35
20-35	5.99	-	-	0.02	0.40	0.00	4.25	0.46	0.08	0.28	5.07	8.02	0.26	63.18	3.46
35-92	6.70	-	-	0.03	0.20	0.00	5.45	0.31	0.10	0.22	6.09	9.90	0.21	61.48	2.24

Contd…

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

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

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

Contd…

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

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-17	7.89	-	-	0.137	0.33	0.00	4.92	3.35	0.35	0.45	9.07	9.01	0.67	100	5.04
17-31	8.19	-	-	0.31	0.45	0.00	7.24	5.16	0.16	0.15	12.70	13.57	0.35	94	1.12
31-56	8.2	-	-	0.414	0.53	0.00	6.49	5.32	0.11	0.13	12.05	18.55	0.41	65	0.71
56-104	8.64	-	-	0.422	0.37	0.00	6.21	4.64	0.16	0.14	11.15	15.16	0.42	74	0.95
104-126	8.71	-	-	0.436	0.2	0.00	7.06	6.31	0.09	0.33	13.79	14.52	0.44	95	2.31

Contd…

Series Name: Nagalapur (NGP), **Pedon :** R-10
Location: $15^0$26'38.0"N, $76^0$10'27.0" E Budashettynala village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey- skeletal, mixed, isohyperthermic Typic Paleustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-16	Ap	78.43	6.36	15.21	25.23	18.82	14.04	13.22	7.12	30	sl	9.32	5.56
16-38	Bt1	46.97	8.53	44.51	14.33	12.34	7.43	6.80	6.07	30	sc	18.70	13.79
38-58	Bt2	51.92	7.48	40.60	20.98	10.07	7.37	7.48	6.02	40	sc	17.93	13.75
58-81	Bt3	54.05	7.18	38.77	27.07	10.58	5.91	5.81	4.67	50	sc	17.92	11.87
81-104	Bt4	59.03	8.93	32.04	21.88	13.11	8.88	8.05	7.12	50	scl	16.63	10.55
104-126	BC	62.35	9.26	28.40	21.19	14.51	9.88	8.13	8.64	60	scl	15.03	10.06

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-16	6.77	-	-	0.09	0.82	-	3.52	2.14	0.18	0.03	5.87	7.10	0.47	82.70	0.46
16-38	6.89	-	-	0.06	0.57	-	9.35	3.85	0.10	0.21	13.50	14.70	0.33	91.87	1.40
38-58	6.80	-	-	0.06	0.52	-	8.76	3.42	0.10	0.26	12.55	14.20	0.35	88.35	1.85
58-81	6.84	-	-	0.06	0.32	-	7.67	2.77	0.10	0.58	11.12	12.90	0.33	86.18	4.48
81-104	6.86	-	-	0.05	0.20	-	6.97	2.07	0.09	0.95	10.07	11.90	0.37	84.59	7.95
104-126	6.70	-	-	0.07	0.10	-	5.53	1.77	0.07	0.73	8.09	9.40	0.33	86.09	7.77

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Soil Series: Thimmasandra (TSD), **Pedon:** R-14
Location: 11°55'64.2"N, 76°51'82.9" E, (4B3A5K3b), Somanapura village, Chamarajanagara taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification**: Fine, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-19	Ap	12.27	25.92	61.81	0.98	0.98	1.52	3.91	4.89	-	c	-	-
19-33	A2	32.98	26.29	40.72	2.75	4.44	4.97	8.35	12.47	-	c	-	-
33-58	Bw1	10.21	27.99	61.81	0.98	1.30	1.19	2.17	4.56	-	c	-	-
58-83	Bw2	9.83	27.40	62.77	1.09	0.98	0.98	1.86	4.91	-	c	-	-
83-95	Bw3	6.17	26.07	67.76	0.99	0.77	0.55	0.99	2.86	-	c	-	-
95-116	Bw4	7.52	28.87	63.61	0.77	1.00	1.11	1.88	2.77	-	c	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-19	8.46	-	-	0.175	1.01	4.45	-	-	1.91	0.18		36.61	0.59	100	0.19
19-33	8.65	-	-	0.16	0.81	6.41	-	-	0.77	0.39		23.98	0.59	100	0.64
33-58	8.94	-	-	0.26	0.56	6.90	-	-	0.82	2.24		33.59	0.54	100	2.67
58-83	9.13	-	-	0.335	0.4	8.01	-	-	0.30	1.01		36.72	0.58	100	1.10
83-95	9.05	-	-	0.412	0.36	4.58	-	-	0.76	4.17		38.88	0.57	100	4.30
95-116	8.96	-	-	0.4	0.28	4.21	-	-	0.96	4.02		43.63	0.69	100	3.68

Series Name: Kavalakeri (KLR), **Pedon :** R-5
Location: $15^0$27'55.2"N, $76^0$15'48.0" E Kenchanadoni village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, mixed, isohyperthermic (calc) Fluventic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-21	Ap	41.67	28.70	29.62	6.62	10.58	5.70	8.00	10.76	-	cl	22.02	15.06
21-40	Bw1	32.23	29.16	38.61	3.76	4.03	3.04	8.24	13.16	-	cl	26.28	19.49
40-70	Bw2	37.41	26.13	36.46	7.52	6.25	4.62	8.61	10.42	-	cl	26.65	18.87
70-106	Bw3	46.43	18.15	35.42	13.93	14.29	5.98	5.98	6.25	-	sc	22.83	17.66
106-137	Bw4	55.64	12.91	31.45	10.59	8.16	12.67	11.46	12.76	-	scl	24.04	12.85
137-162	Bw5	47.16	16.68	36.16	2.88	4.80	5.68	17.12	16.68	-	sc	30.46	16.24

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-21	7.11	-	-	0.33	0.82	8.84	-	-	0.10	0.67	-	19.50	0.66	100.00	3.42
21-40	7.50	-	-	0.32	0.40	6.63	-	-	0.15	0.99	-	23.20	0.60	100.00	4.26
40-70	7.68	-	-	0.33	0.34	8.19	-	-	0.09	1.18	-	21.90	0.60	100.00	5.38
70-106	7.82	-	-	0.23	0.42	6.50	-	-	0.07	1.36	-	21.80	0.62	100.00	6.23
106-137	7.86	-	-	0.23	0.32	3.57	-	-	0.08	0.95	-	17.30	0.55	100.00	5.47
137-162	7.75	-	-	0.31	0.38	3.90	-	-	0.09	1.01	-	22.10	0.61	100.00	4.55

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Series Name: Bardur (BDR), **Pedon:** R-4
Location: $15^0$14'31.7"N, $76^0$01'19.1"E, Moranali village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very fine, smectitic, isohyperthermic (calcareous) Typic Haplusterts.

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-25	8.73	-	22.78	0.203	0.24	5.76	-	-	0.65	4.43	-	40.56	0.73	-	4.37
25-53	9.17	-	18.56	0.295	0.45	4.92	-	-	0.32	10.47	-	74.70	1.19	-	5.61
53-90	9.27	-	18.60	0.388	0.66	6.00	-	-	0.24	10.49	-	76.20	1.16	-	5.51
90-126	9.22	-	20.02	0.608	0.57	5.88	-	-	0.21	15.93	-	77.20	1.16	-	8.25
126-152	9.21	-	20.79	0.936	0.33	6.60	-	-	0.37	20.88	-	80.90	1.20	-	10.32
152-210	9.03	-	23.21	1.47	0.33	8.16	-	-	0.24	15.34	-	73.10	1.12	-	8.39

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

The most important soil and site characteristics that affect the land use and conservation needs of an area are land capability, land irrigability, soil depth, soil texture, coarse fragments, available water capacity, soil slope, soil erosion, soil reaction etc. These are interpreted from the data base generated through land resource inventory and several thematic maps are generated. These would help in identifying the areas suitable for growing crops and, soil and water conservation measures and structures needed thus helping to maintain good soil health for sustained crop production. The various thematic maps generated are described below.

5.1 Land Capability Classification

Land capability classification is an interpretative grouping of soil map units (soil phases) mainly based on inherent soil characteristics, external land features and environmental factors that limit the use of land for agriculture, pasture, forestry, or other uses on a sustained basis (IARI, 1971). The land and soil characteristics used to group the land resources in an area into various land capability classes, subclasses and units are

Soil characteristics: Soil depth, soil texture, coarse fragments, soil reaction, available water capacity, calcareousness, salinity/alkali *etc*.

Land characteristics: Slope, erosion, drainage, rock outcrops.

Climate: Total rainfall and its distribution, and length of crop growing period.

The Land Capability Classification system is divided into land capability classes, subclasses and units based on the level of information available. Eight land capability classes are recognized. They are

Class I: They are very good lands that have no limitations or very few limitations that restrict their use.

Class II: They are good lands that have minor limitations and require moderate conservation practices.

Class III: They are moderately good lands that have severe limitations that reduce the choice of crops or that require special conservation practices.

Class IV: They are fairly good lands that have very severe limitations that reduce the choice of crops or that require very careful management.

Class V: Soils in these lands are not likely to erode, but have other limitations like wetness that are impractical to remove and as such not suitable for agriculture, but suitable for pasture or forestry with minor limitations.

Class VI: The lands have severe limitations that make them generally unsuitable for cultivation, but suitable for pasture or forestry with moderate limitations.

Class VII: The lands have very severe limitations that make them unsuitable for cultivation, but suitable for pasture or forestry with major limitations.

Class VIII: Soil and other miscellaneous areas (rock lands) that have very severe limitations that nearly preclude their use for any crop production, but suitable for wildlife, recreation and installation of wind mills.

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

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

The 34 soil map units identified in the Hasgal-1 microwatershed are grouped under 2 land capability classes and 7 land capability subclasses (Fig. 5.1).

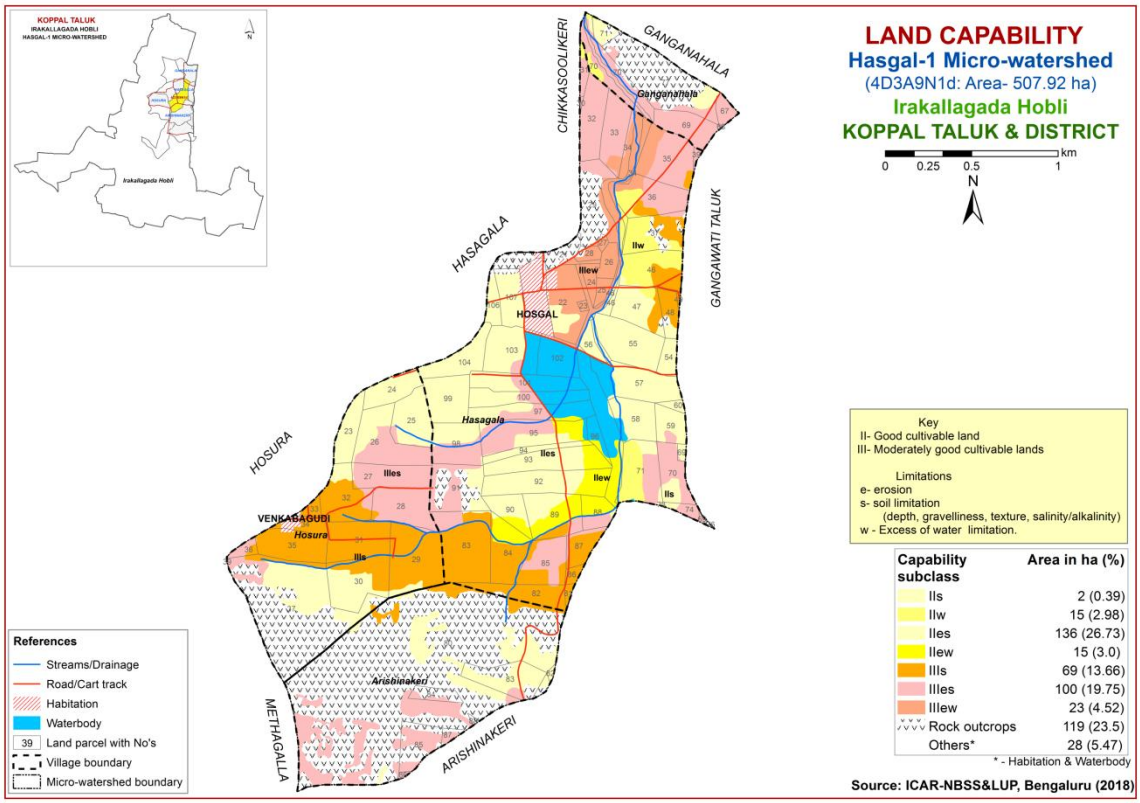


Fig. 5.1 Land Capability classification map of Hasgal-1 Microwatershed

Entire cultivated area in the microwatershed is suitable for agriculture. Good lands (Class II) cover an area of about 168 ha (33%) and are distributed in the northern, eastern, western, central and southern part of the microwatershed with minor problems of soil, erosion and drainage. Moderately good (Class III) lands covers a maximum area of about 192 ha (38%) and are distributed in all part of the microwatershed with major problems of soil, drainage and erosion. An area of about 119 ha (24%) covered by rock outcrops and 28 ha (5%) is covered by others (habitation and water body).

5.2 Soil Depth

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

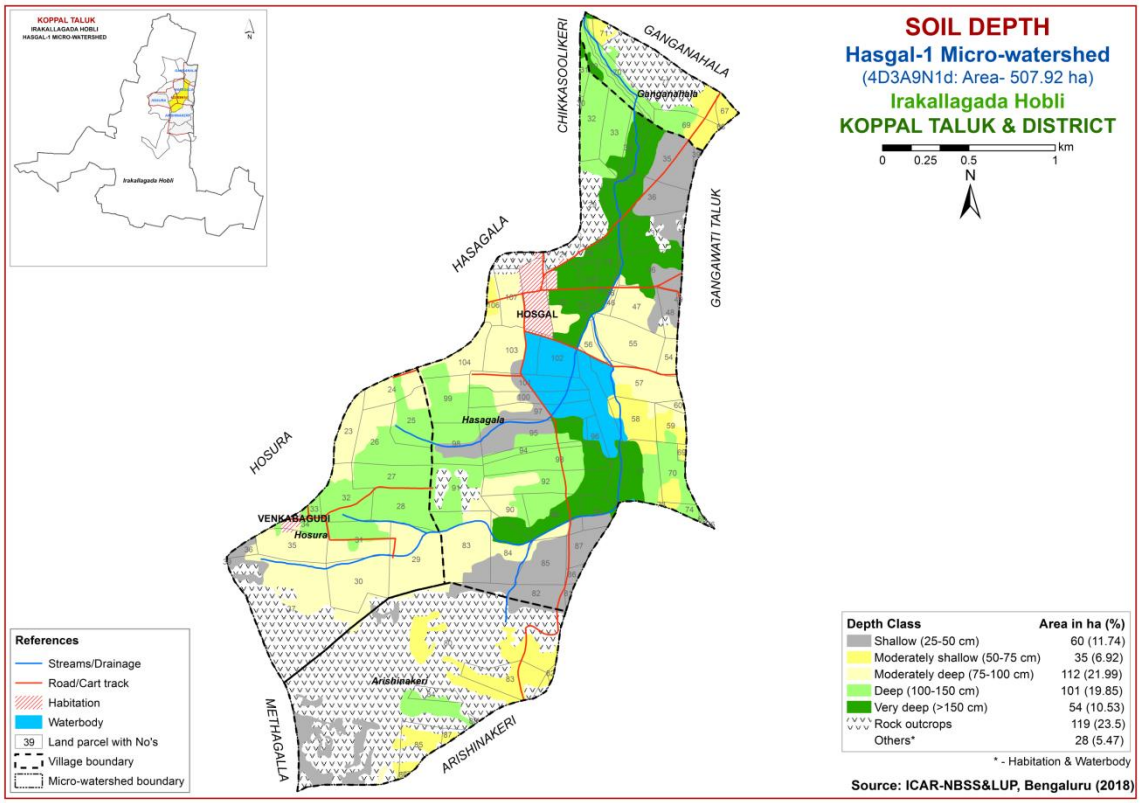


Fig. 5.2 Soil Depth map of Hasgal-1Microwatershed

Shallow (25-50 cm) soils cover an area of about 60 ha (12%) and are distributed in the northern, central, southeastern and southern part of the microwatershed. Moderately

shallow (50-75 cm) soils cover an area of about 35 ha (7%) and distributed in the northern, western and southern part of the microwatershed. An area of about 112 ha (22%) is moderately deep soils (75-100 cm) and are distributed in the eastern, western, central and southern part of the microwatershed. Deep to very deep (100- >150 cm) soils occupy a maximum area of about 155 ha (30%) and are distributed in all parts of the microwatershed.

The most productive lands cover about 155 ha (30%) where all climatically adopted long duration crops can be grown. Problem soils cover about 60 ha (12%) where only short duration crops can be grown.

5.3 Surface Soil Texture

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

An area of about 89 ha (17%) is sandy at the surface and are distributed in the northern, western, eastern and southern part of the microwatershed. Maximum area of about 226 ha (44%) is loamy at the surface and are distributed in all part of the microwatershed. An area of about 47 ha (10%) is clayey at the surface and are distributed in the northern and eastern part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (10%) have high potential for soil-water retention and availability and nutrient retention and availability, but have more problems of drainage, infiltration, workability and other physical problems. The other productive lands are loamy (44%) soils which also have high potential for soil- water retention and nutrient availability but have no drainage or other physical problems. Problem soils cover 17 per cent areas that have problems of moisture and nutrient availability.

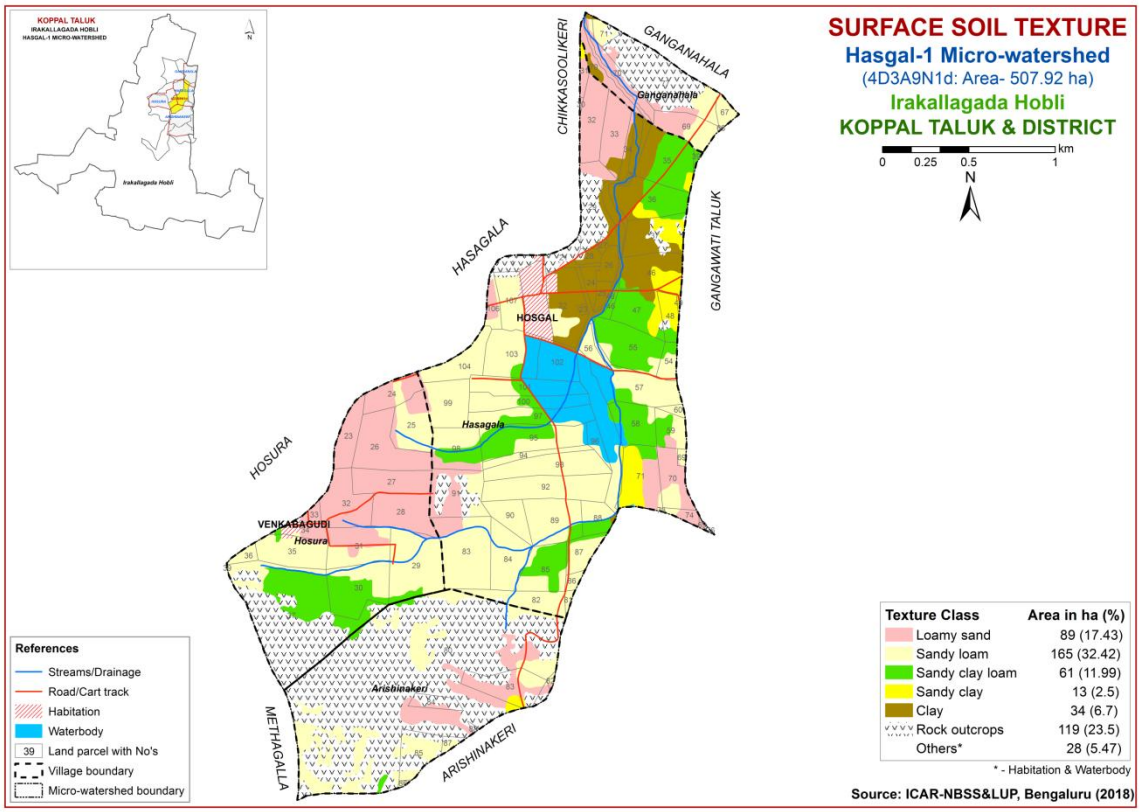


Fig. 5.3 Surface Soil Texture map of Hasgal-1Microwatershed

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover an area of about 150 ha (29%) and distributed in the northern, central, eastern, western and southern part of the microwatershed. Maximum area of about 171 ha (34%) is covered by gravelly (15-35% gravel) soils and are distributed in all parts of the microwatershed. Very gravelly (35-60%) soils cover an area of about 40 ha (8%) and are distributed in the northern, eastern and southern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 29 per cent that are non gravelly (<15%) soils. These are most productive soils and have potential for growing both annual and perennial crops. The problem soils that are very gravelly (35-60%) cover an area of about 8 per cent where only short duration crops can be grown.

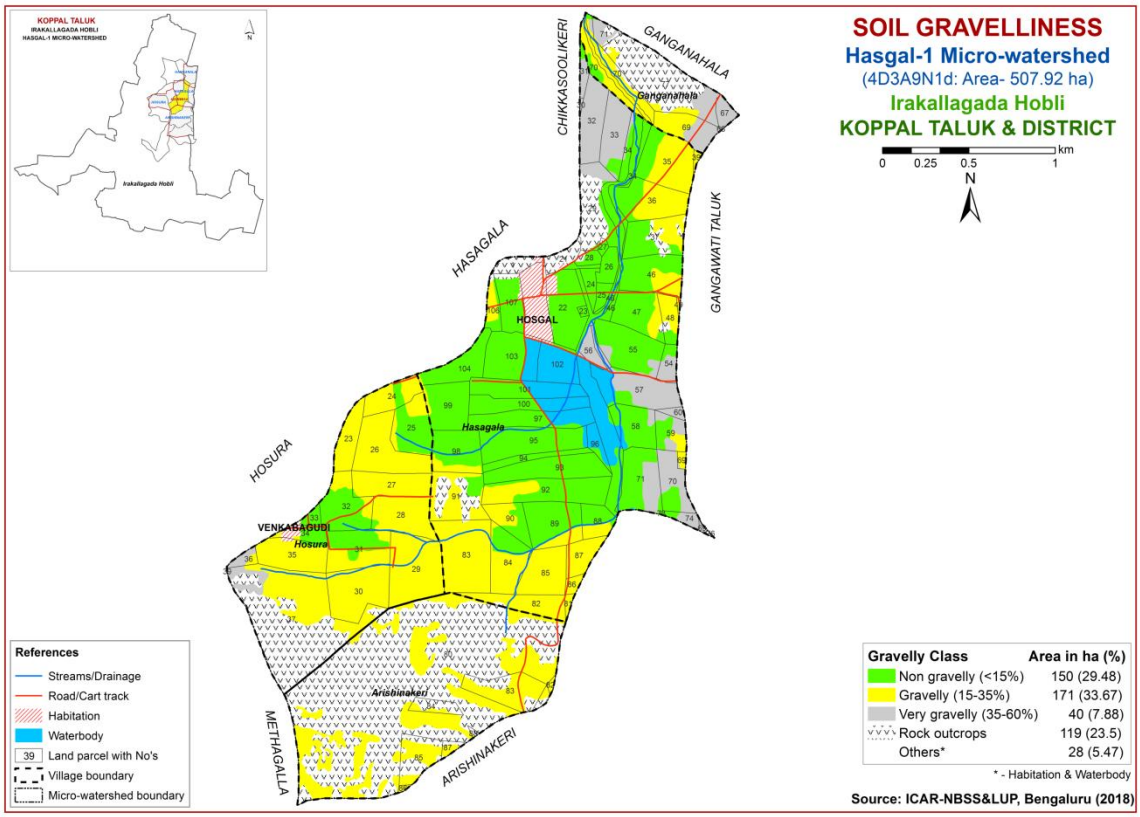


Fig. 5.4 Soil Gravelliness map of Hasgal-1Microwatershed

5.5 Available Water Capacity

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

Maximum area of about 160 ha (31%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in all part of the microwatershed. An area of about 114 ha (22%) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the northern, eastern, western and southern part of the microwatershed. An area of about 34 ha (7%) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the western and central part of the microwatershed. An area of about 54 ha (11%) is very high (>200 mm/m) in available water capacity and are distributed in the northern and eastern part of the microwatershed.

An area of about 274 ha (53%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can

be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 54 ha (11%) has soils that have high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

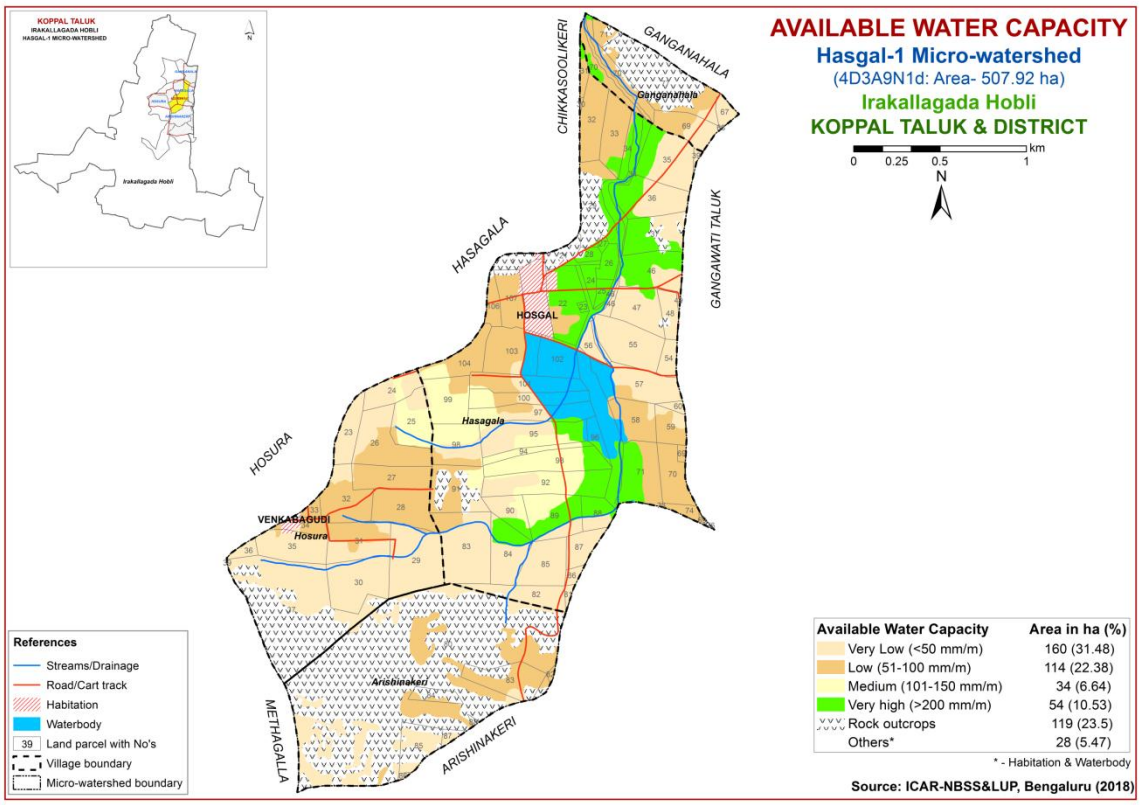


Fig. 5.5 Soil Available Water Capacity map of Hasgal-1Microwatershed

5.6 Soil Slope

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

An area of about 11 ha (2%) has nearly level (0-1%) lands and distributed in the northern part of the microwatershed. Maximum area of about 348 ha (68%) in the microwatershed falls under very gently sloping (1-3%) lands and are distributed in all parts of the microwatershed. An area of about 2 ha (<1%) is gently sloping (3-5%) lands and are distributed in the southern part of the microwatershed. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

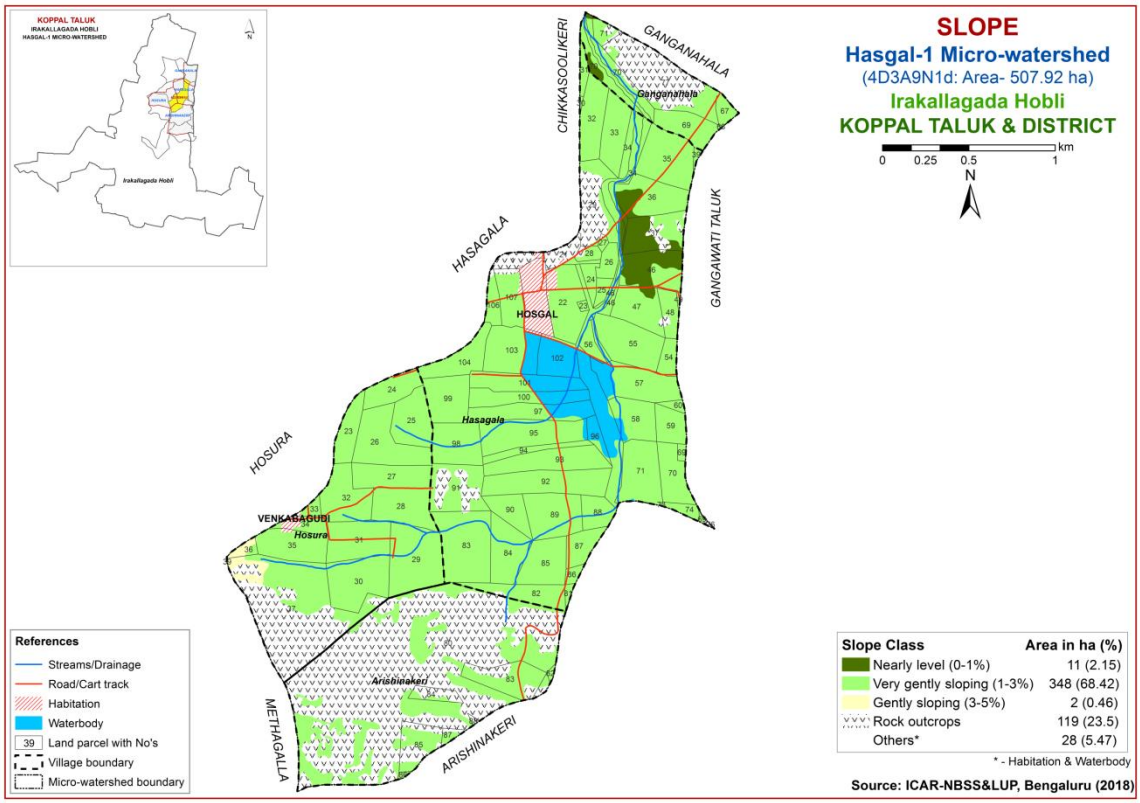


Fig. 5.6 Soil Slope map of Hasgal-1Microwatershed

5.7 Soil Erosion

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

Slightly eroded (e1 class) lands cover an area of about 86 ha (17%) and are distributed in the northern, eastern and southern part of the microwatershed. Maximum area of about 274 ha (54%) is moderately eroded (e2 class) and distributed in all part of the microwatershed. Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

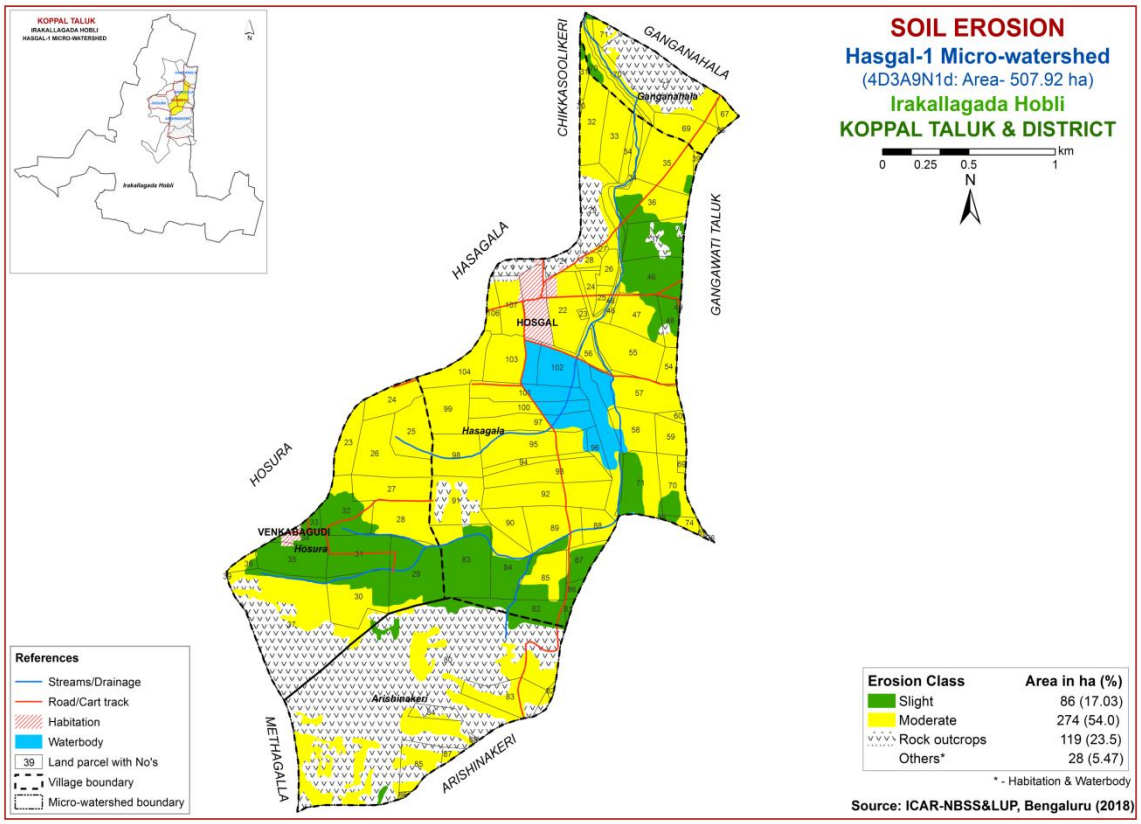


Fig. 5.7 Soil Erosion map of Hasgal-1 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterized by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 320 m grid interval) all over the microwatershed through land resource inventory in the year 2017 were analyzed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil analysis of the Hasgal-1microwatershed for soil reaction (pH) showed that an area of about 29 ha (6%) is strongly acid (pH 5.0-5.5) and are distributed in the southern part of the microwatershed. An area of about 21 ha (4%) is moderately acid (pH 5.5-6.0) and are distributed in the southern part of the microwatershed. An area of about 63 ha (12%) is slightly acid (pH 6.0-6.5) and are distributed in the northern, eastern and southern part of the microwatershed. Maximum area of about 94 ha (19%) is neutral (pH 6.5-7.3) and are distributed in all part of the microwatershed. An area of about 57 ha (11%) is slightly alkaline (pH 7.3-7.8) and are distributed in the northern, central, western and eastern part of the microwatershed. An area of about 71 ha (14%) is moderately alkaline (pH 7.8-8.4) and are distributed in the northern, central, western and eastern part of the microwatershed. An area of about 26 ha (5%) is strongly alkaline (pH 8.4-9.0) and are distributed in the northern, central and eastern part of the microwatershed. Thus, major soils in the microwatershed are alkaline (154 ha) in reaction (Fig.6.1).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

An area of about 90 ha (18%) is medium (0.5-0.75%) in organic carbon content and distributed in the northern and southern part of the microwatershed. Maximum area of about 271 ha (53%) is high (>0.75%) in organic carbon and distributed in all part of the microwatershed (Fig.6.3).

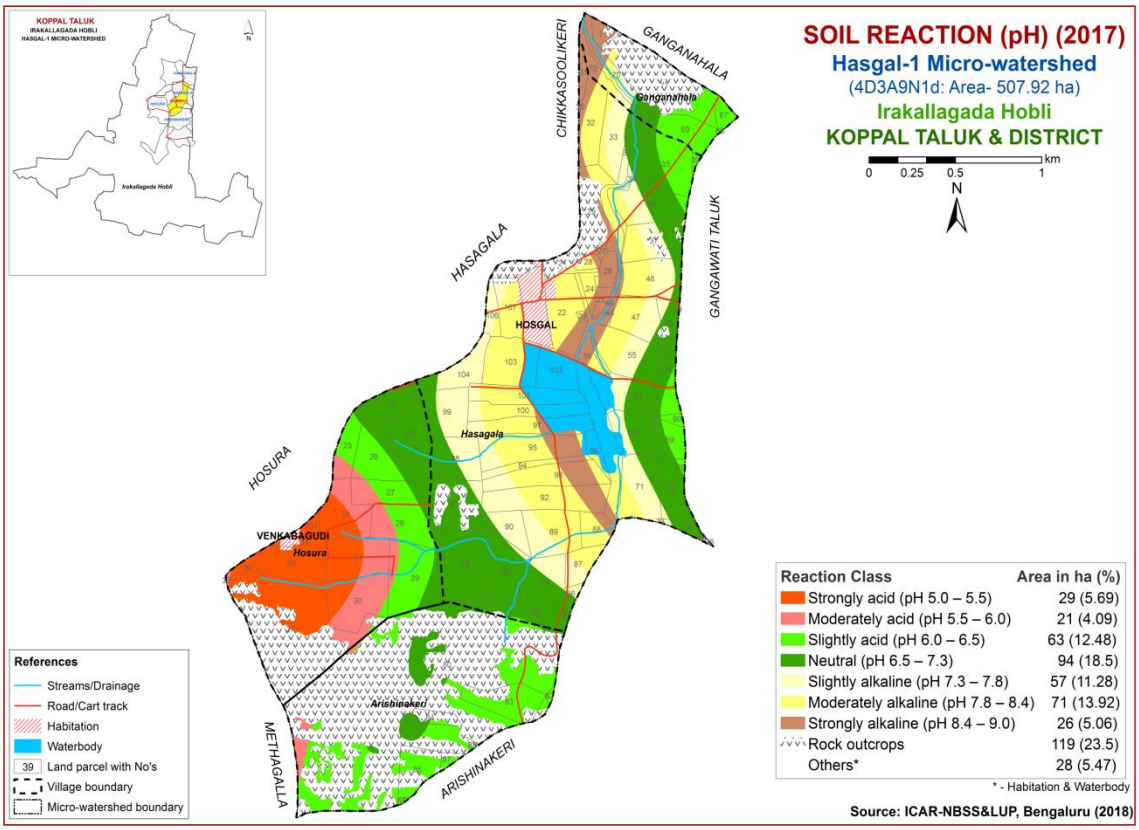


Fig.6.1 Soil Reaction (pH) map of Hasgal-1Microwatershed

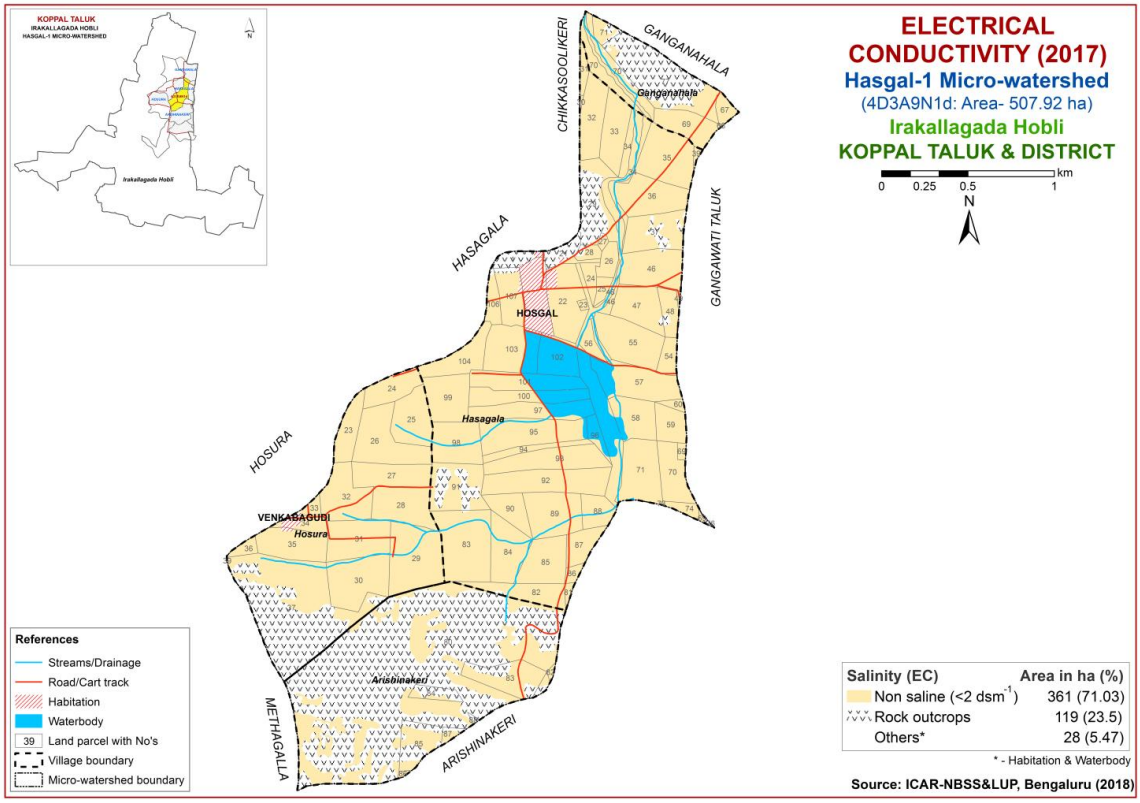


Fig.6.2 Electrical Conductivity (EC) map of Hasgal-1Microwatershed

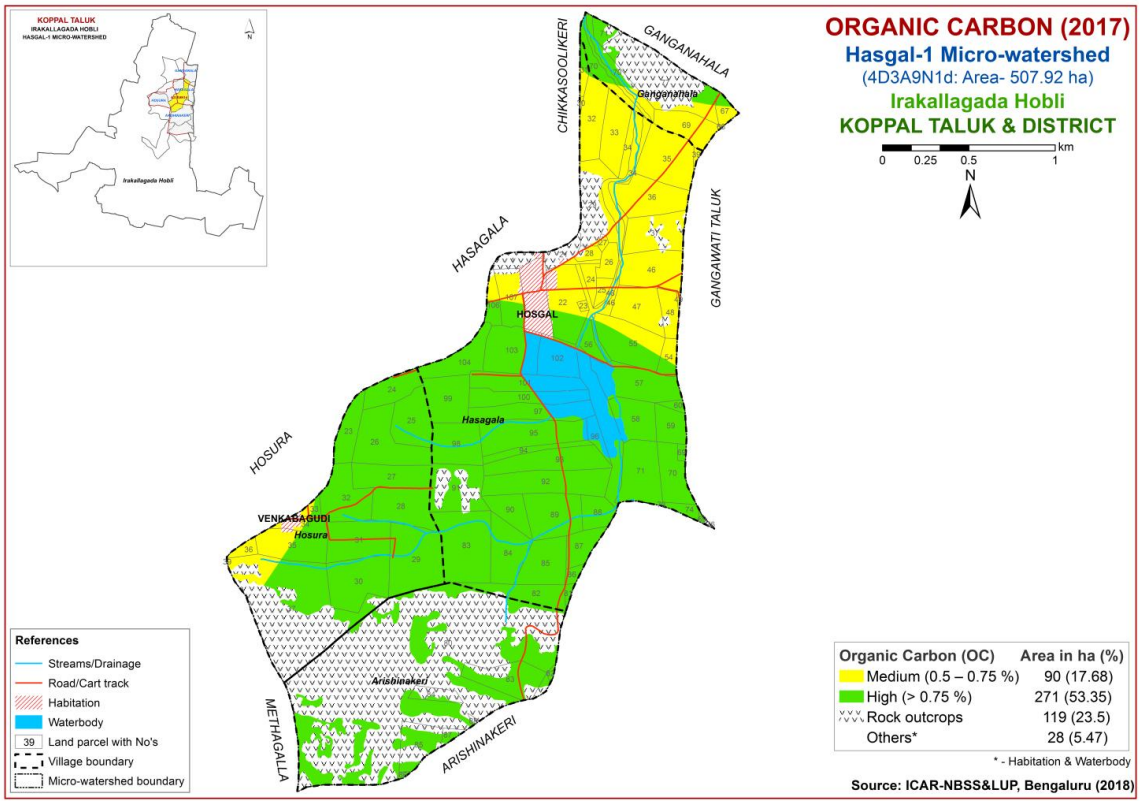


Fig.6.3 Soil Organic Carbon map of Hasgal-1Microwatershed

6.4 Available Phosphorus

Available phosphorus content is medium (23-57 kg/ha) in entire part of the microwatershed. Apply additional 25% phosphorous in areas where it is low and medium in available phosphorous (Fig 6.4).

6.5 Available Potassium

Available potassium content is low (<145 kg/ha) in a maximum area of about 241 ha (47%) and are distributed in all part of the microwatershed. Medium (145-337 kg/ha) in an area of about 88 ha (17%) and are distributed in the northern, western and southern part of the microwatershed. An area of about 31 ha (6%) is high (>337 kg/ha) in available potassium and are distributed in the western part of the microwatershed (Fig. 6.5). Apply additional 25% potassium in areas where it is low and medium in available potassium.

6.6 Available Sulphur

Available sulphur content is low (<10 ppm) in an area of about 111 ha (22%) and are distributed in the northern, eastern and western part of the microwatershed. Maximum area of about 249 ha (49%) is medium (10-20 ppm) in available sulphur and are distributed in all part of the microwatershed. The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content in Hasgal-1 microwatershed is low (< 0.5ppm) in a maximum area of about 354 ha (70%) and distributed in all parts of the microwatershed. An area of about 7 ha (1%) is medium (0.5-1.0 ppm) and distributed in the northern part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in an area of about 37 ha (7%) and are distributed in the western and southwestern part of the microwatershed. Sufficient (>4.5 ppm) in a maximum area of about 323 ha (64%) and are distributed in all parts of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

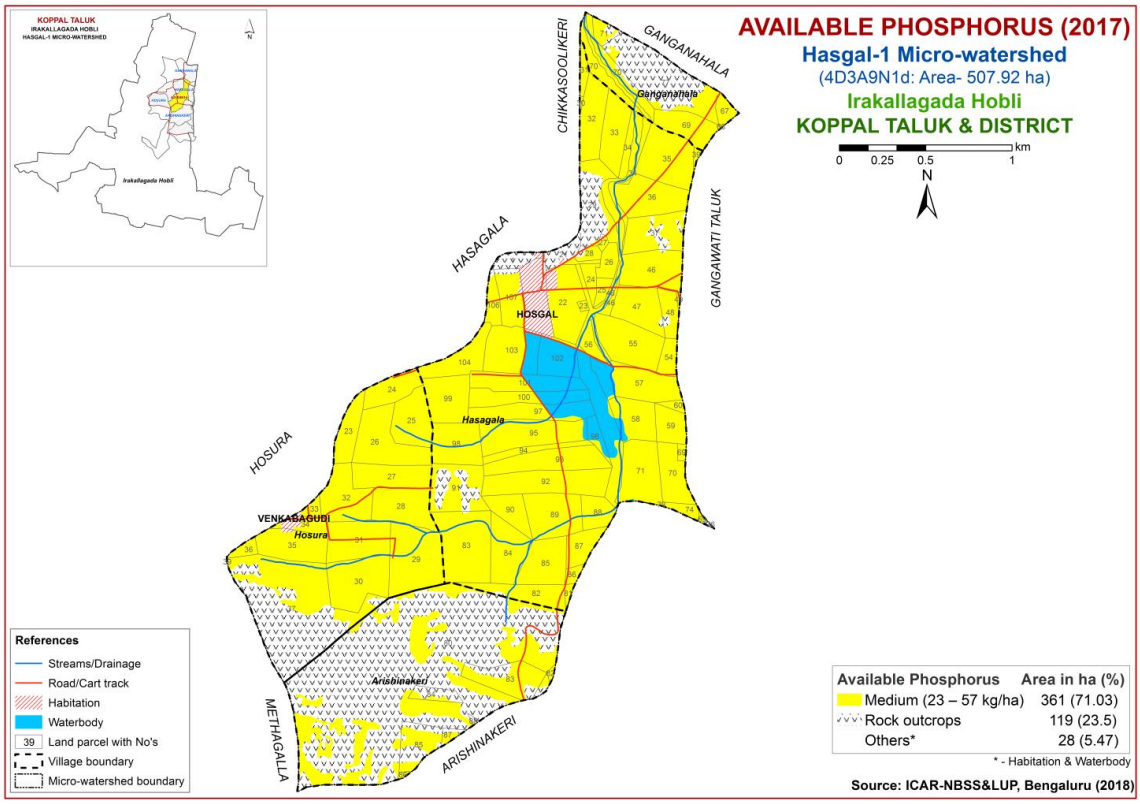


Fig.6.4 Soil Available Phosphorus map of Hasgal-1Microwatershed

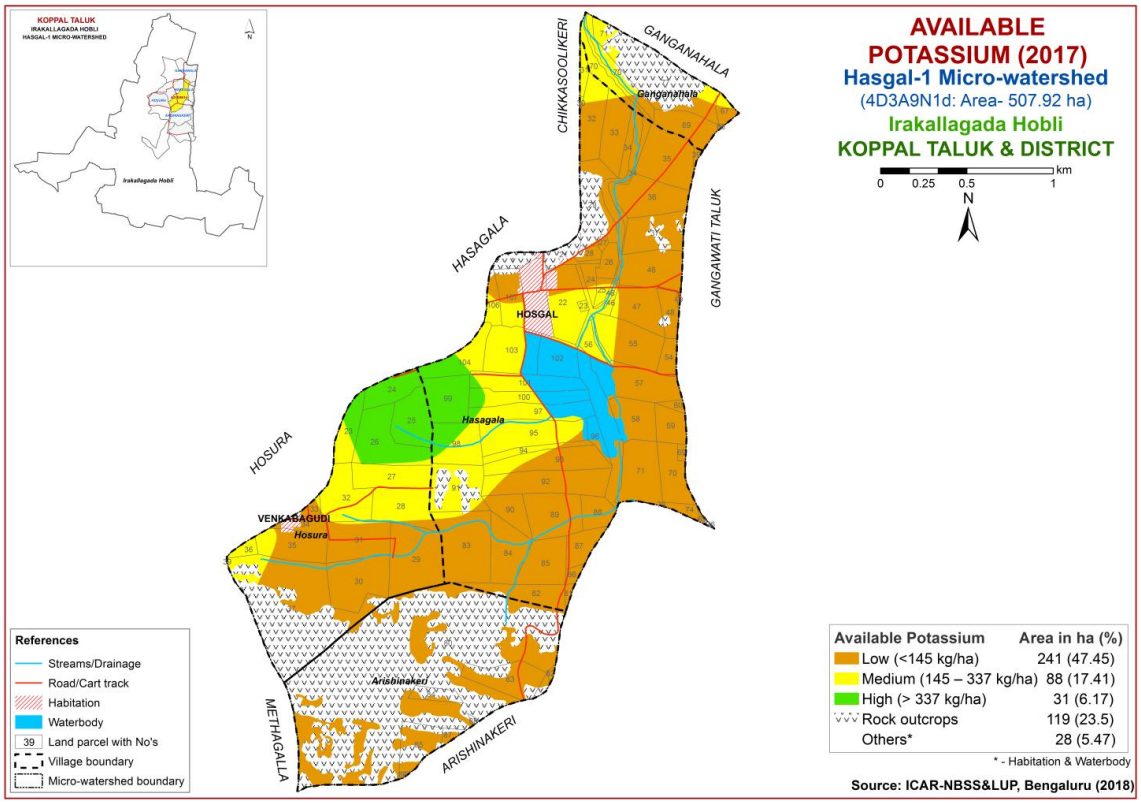


Fig.6.5 Soil Available Potassium map of Hasgal-1Microwatershed

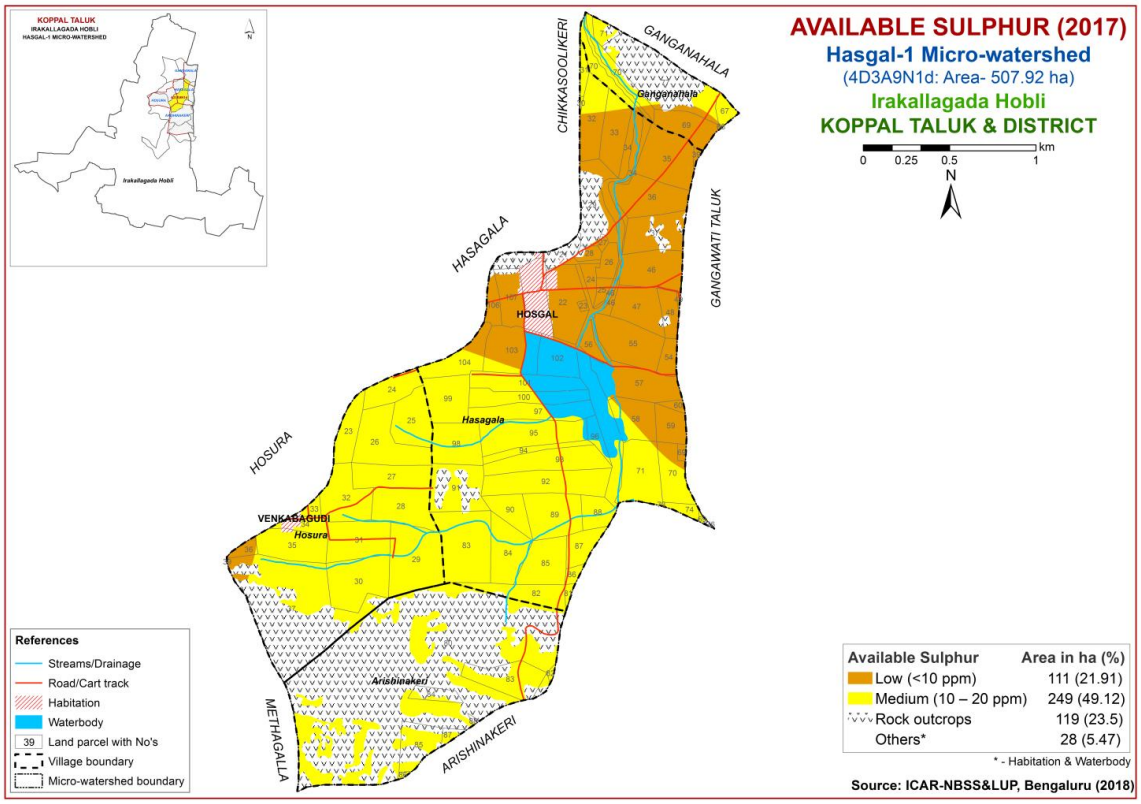


Fig.6.6 Soil Available Sulphur map of Hasgal-1Microwatershed

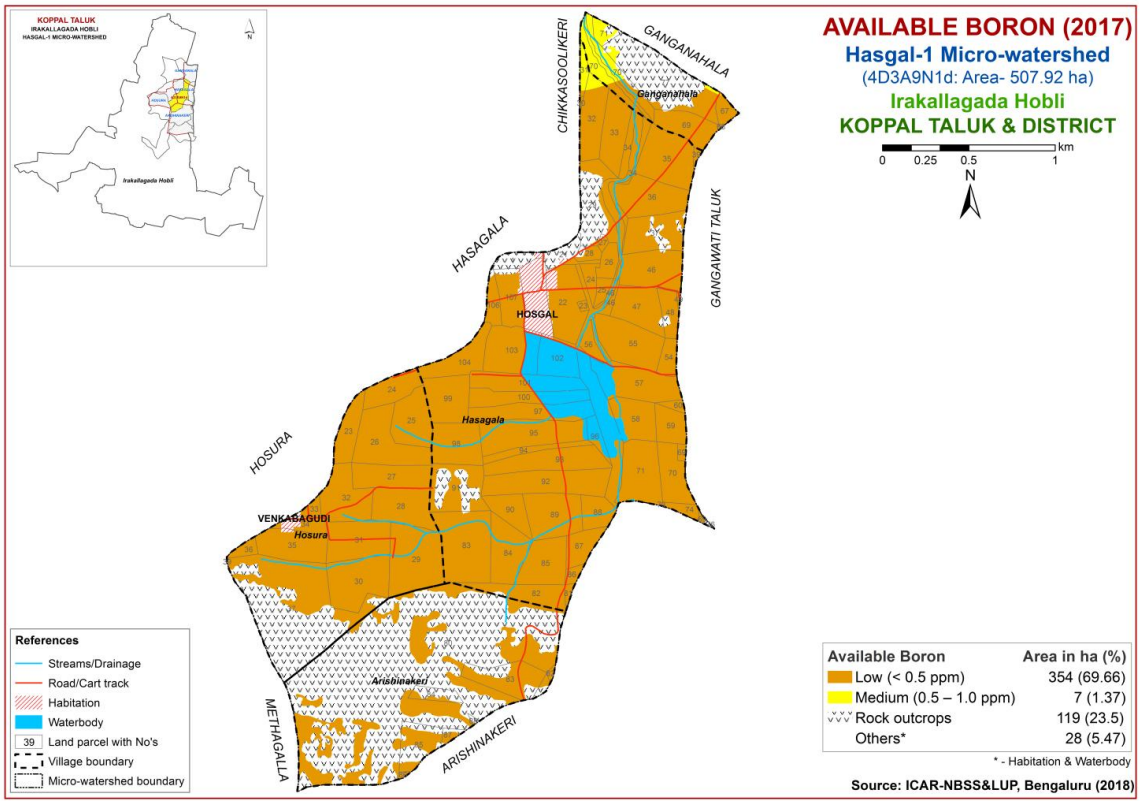


Fig.6.7 Soil Available Boron map of Hasgal-1Microwatershed

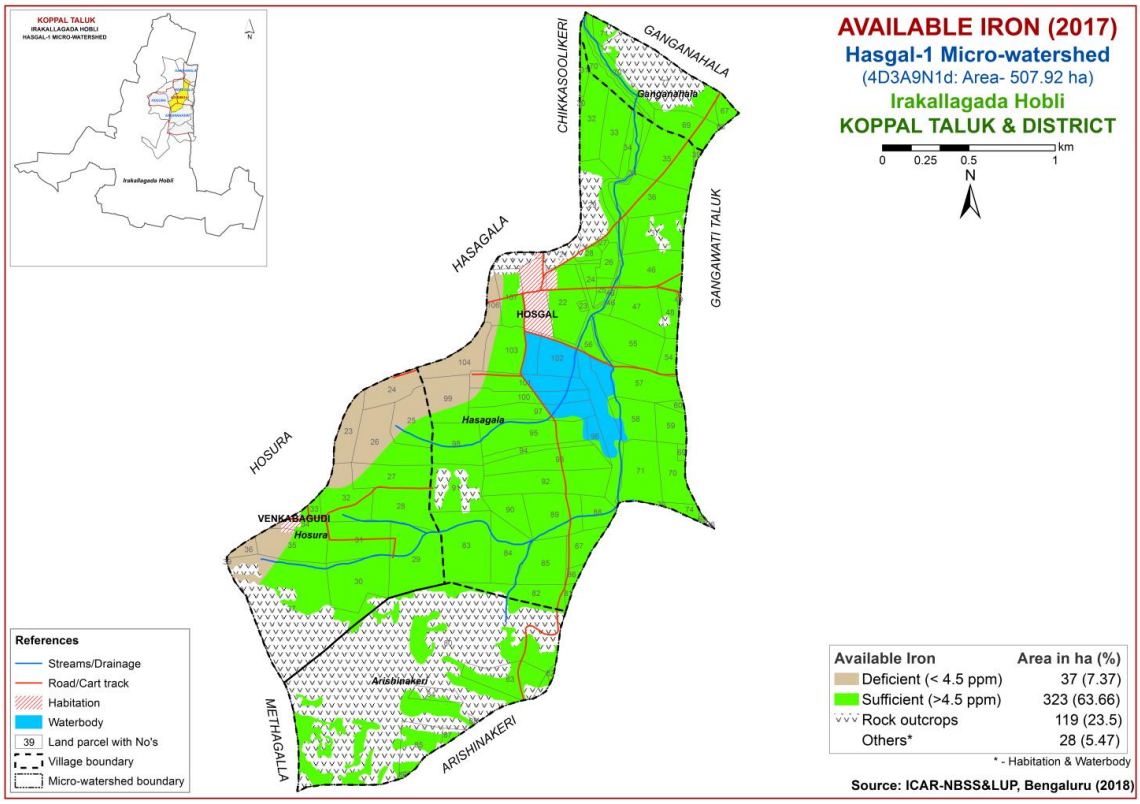


Fig.6.8 Soil Available Iron map of Hasgal-1Microwatershed

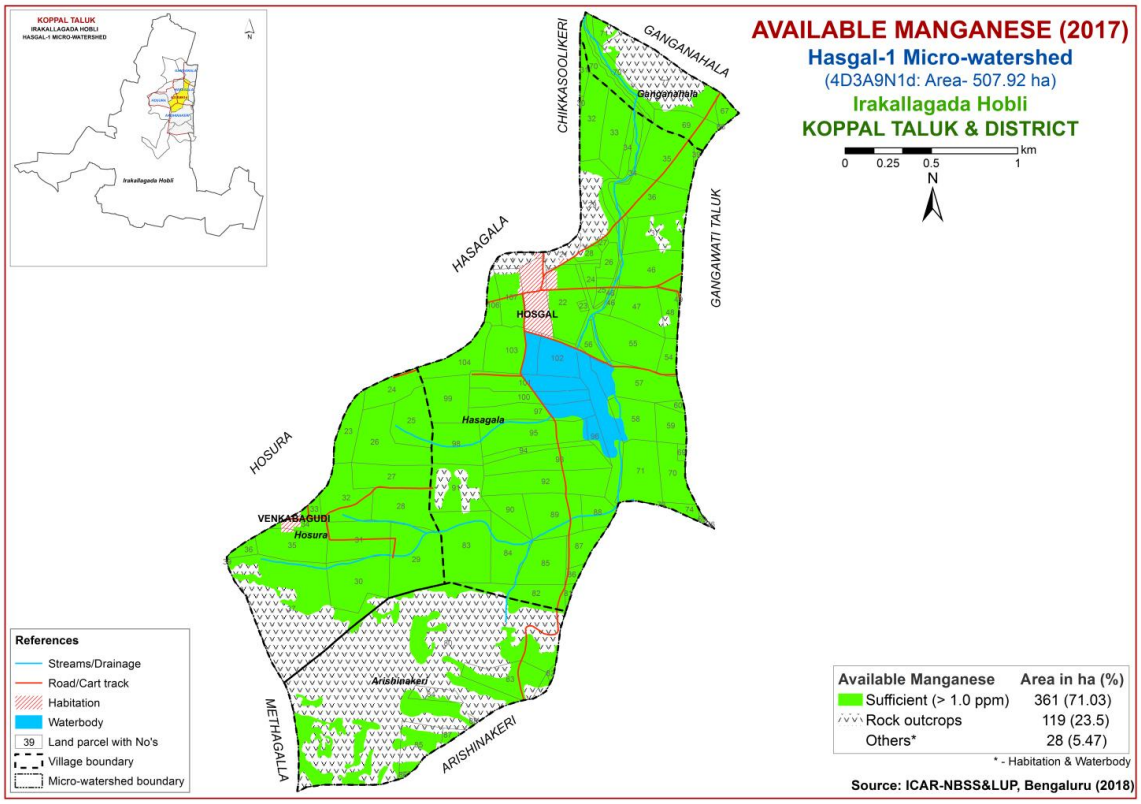


Fig.6.9 Soil Available Manganese map of Hasgal-1Microwatershed

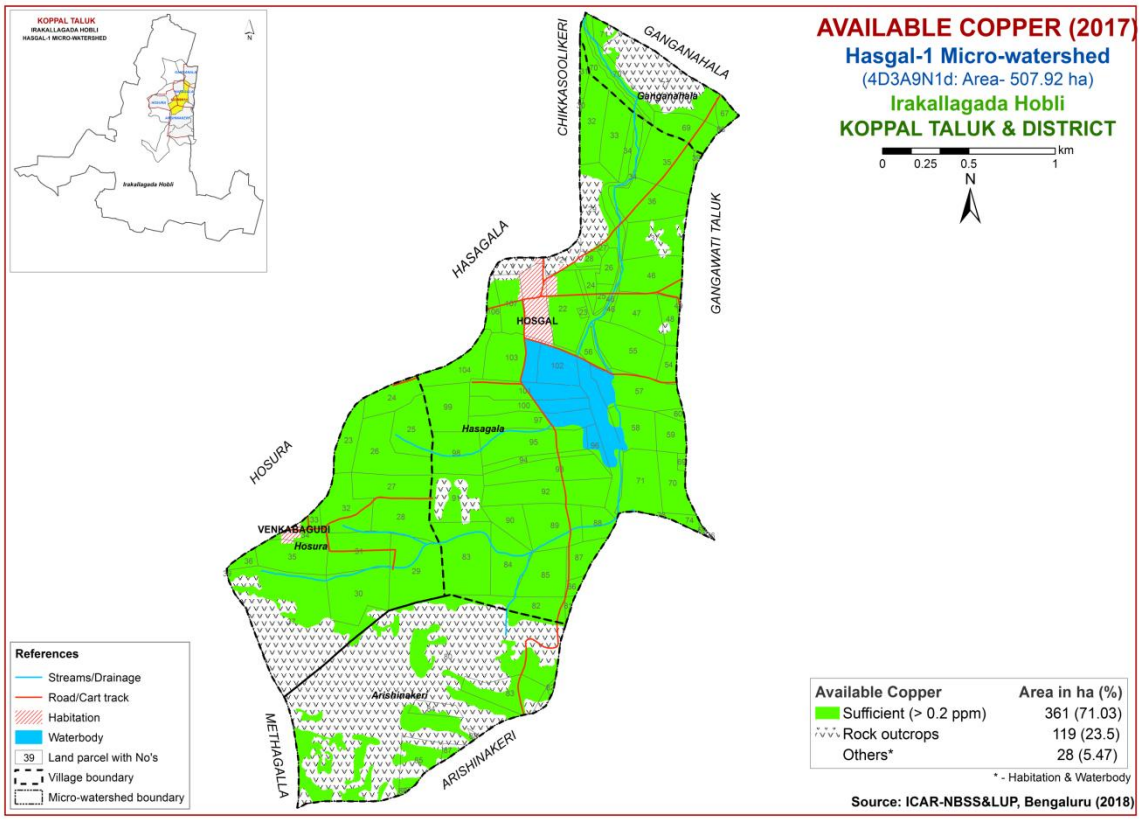


Fig.6.10 Soil Available Copper map of Hasgal-1Microwatershed

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in a maximum area of about 335 ha (66%) and are distributed in all parts of the microwatershed (Fig 6.11). An area of about 26 ha (5%) is sufficient (>0.6 ppm) and are distributed in the northern part of the microwatershed.

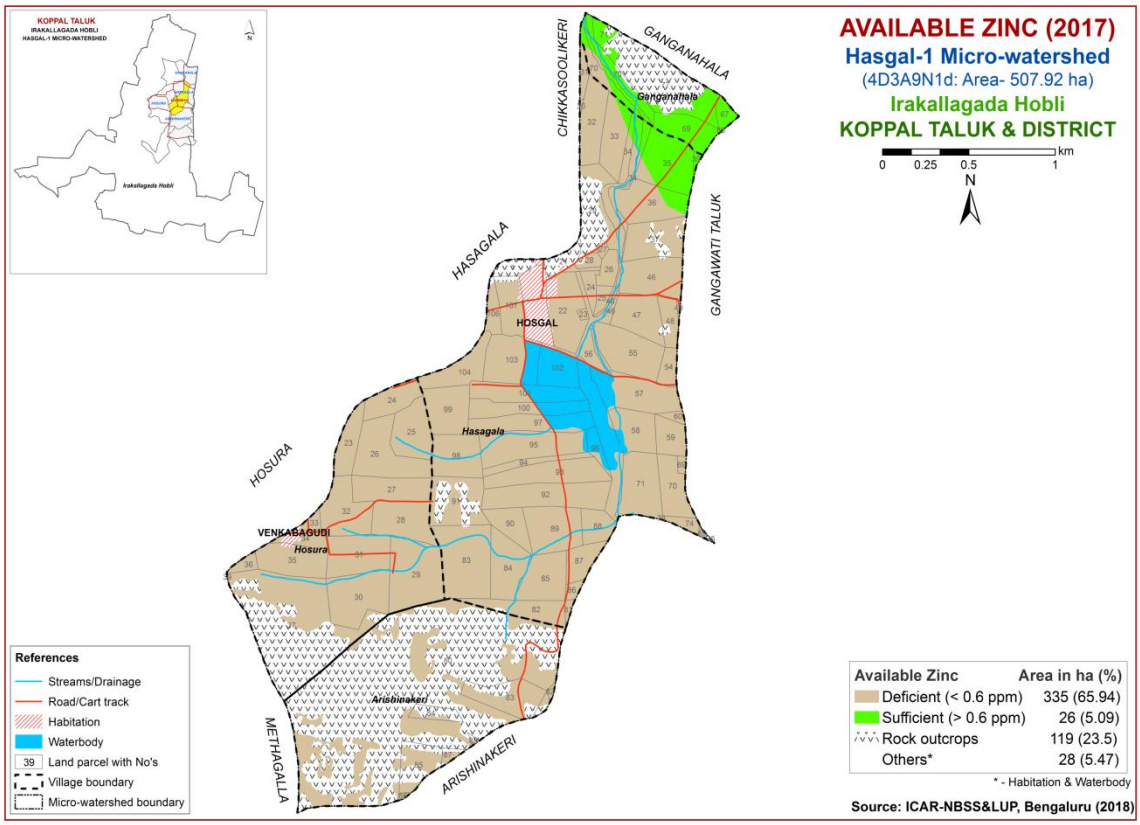


Fig.6.11 Soil Available Zinc map of Hasgal-1Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Hasgal-1microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The soil and land characteristics were matched with the crop requirements to arrive at the crop suitability. The soil and land characteristics table (Table 7.1) were matched with the crop requirements (Tables 7.2-7.32) to arrive at the crop suitability and the criteria tables are given at the end of the chapter. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1- Highly Suitable, Class S2- Moderately Suitable and Class S3- Marginally Suitable. Order N has two Classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 and N1 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 's' for sodium 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 31 major agricultural and horticultural crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Highly suitable (Class S1) lands occupy an area of about 34 ha (7%) for growing sorghum and occur in the western and central part of the microwatershed. An area of about 101 ha (20%) is moderately suitable (Class S2) for growing sorghum and distributed in the northern, western, southern and eastern part of the microwatershed with minor limitations of drainage, rooting depth and gravelliness. Maximum area of about 226 ha (44%) is marginally suitable (Class S3) for growing sorghum and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

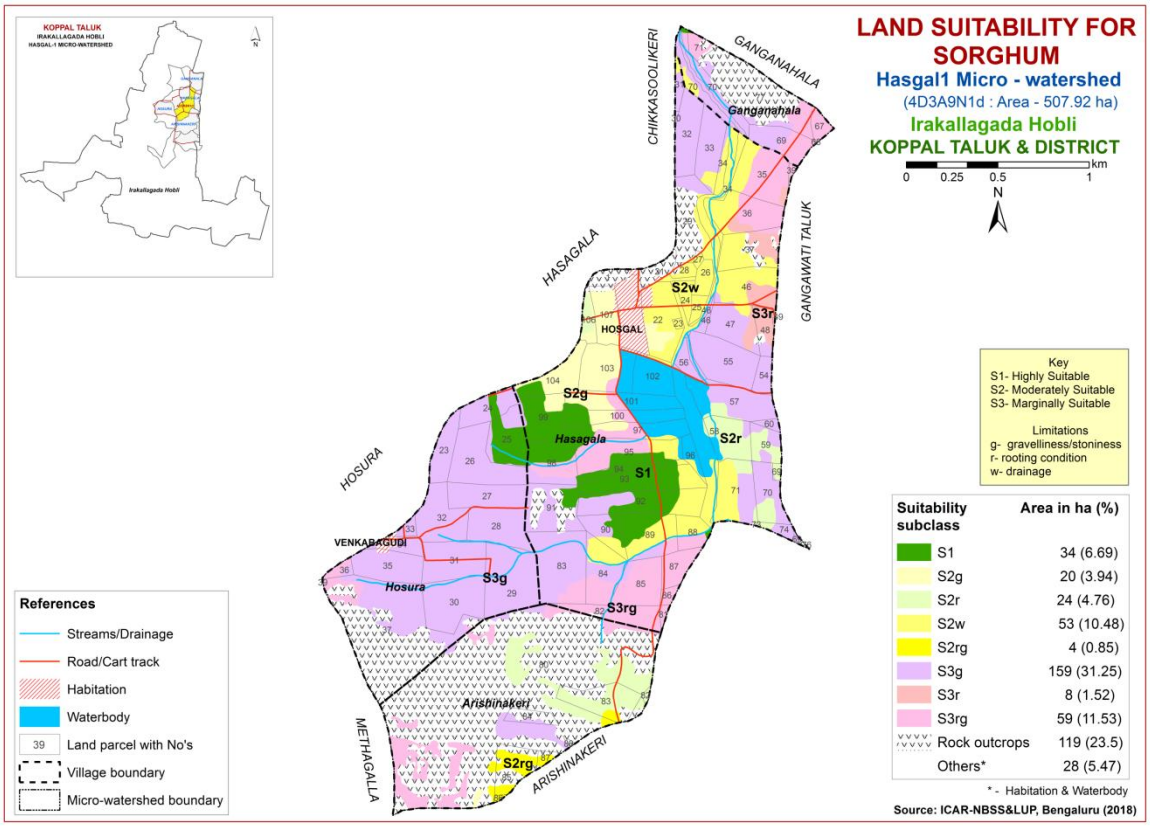


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Highly suitable (Class S1) lands occupy an area of about 34 ha (7%) for growing maize and occur in the western and central part of the microwatershed. An area of about 101 ha (20%) is moderately suitable (Class S2) for growing maize and distributed in the northern, western, southern and eastern part of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Maximum area of about 226 ha

(44%) is marginally suitable (Class S3) for growing maize and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

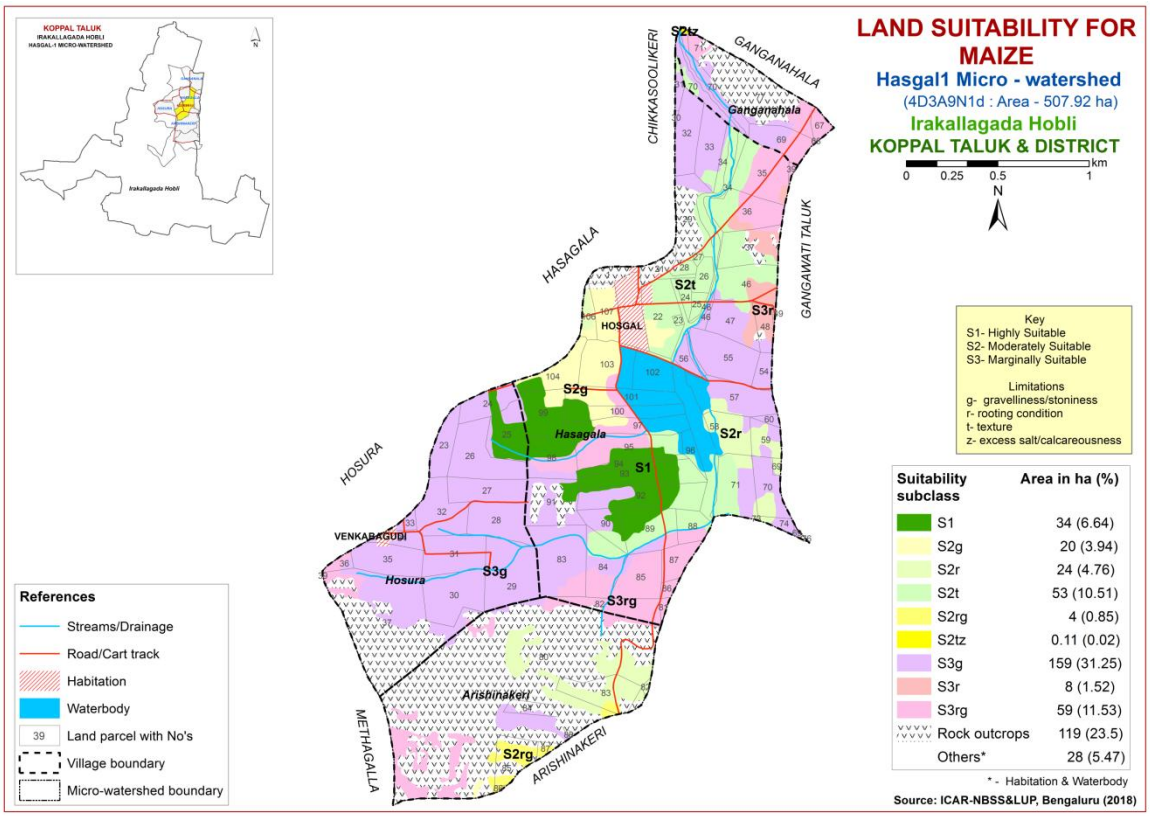


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the major food crop grown in an area of 2.34 lakh ha in Karnataka in the northern districts. The crop requirements (Table 7.4) for growing bajra were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

Highly suitable (Class S1) lands occupy an area of about 54 ha (11%) for growing Bajra and occur in the western and central part of the microwatershed. An area of about 145 ha (28%) is moderately suitable (Class S2) for growing Bajra and distributed in the northern, western, southern and eastern part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and gravelliness. Maximum area of about 161 ha (32%) is marginally suitable (Class S3) for growing Bajra and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, texture and rooting depth.

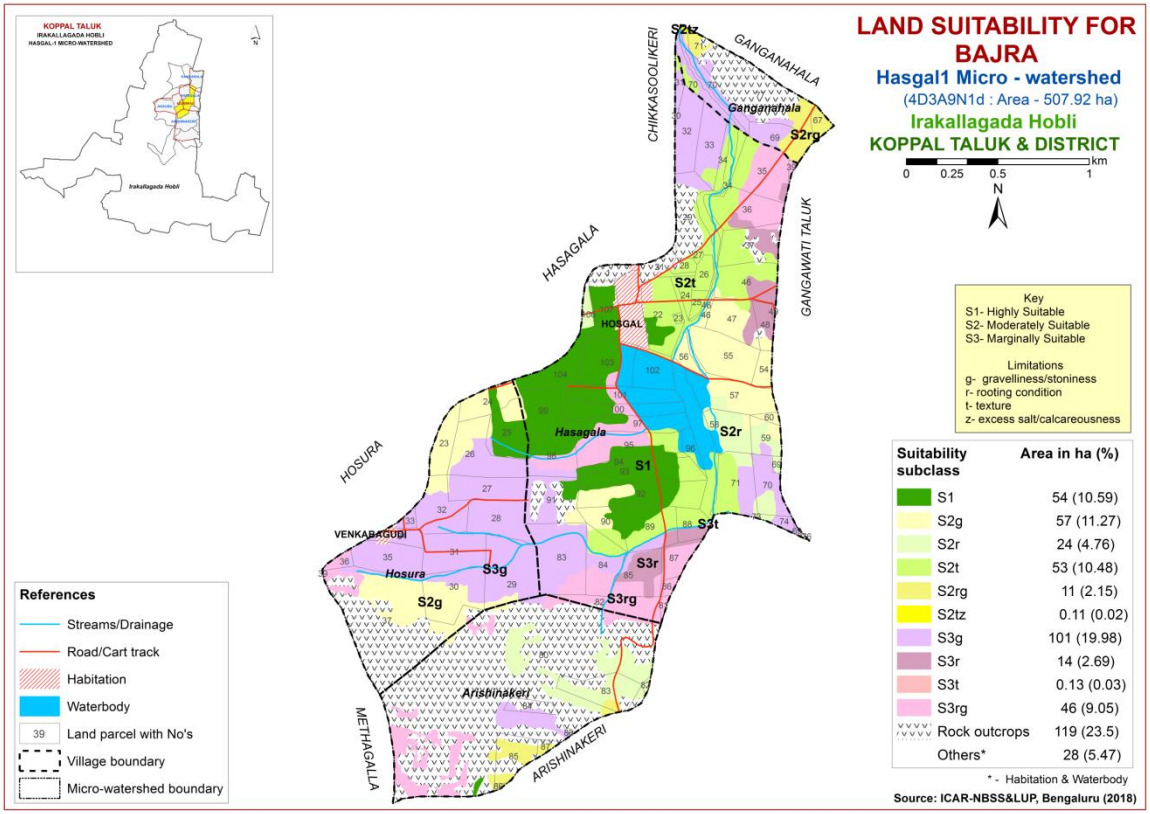


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

Highly suitable (Class S1) lands occupy an area of about 54 ha (11%) for growing Groundnut and occur in the western and central part of the microwatershed. Maximum area of about 155 ha (31%) is moderately suitable (Class S2) for growing Groundnut and distributed in all parts of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 151 ha (29%) and occur in the northern, western, eastern and southern part of the microwatershed with major limitations of gravelliness, texture, drainage and rooting depth.

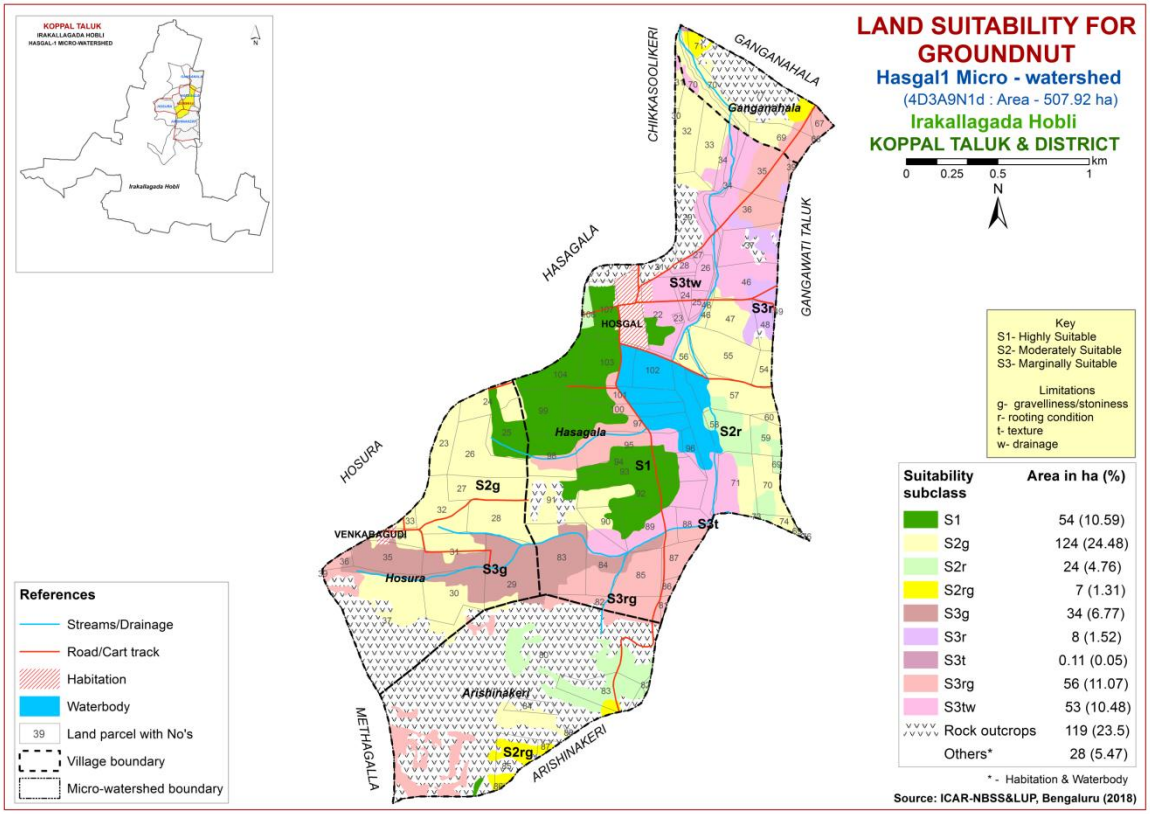


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

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

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Sunflower and distributed in the western and central part of the microwatershed. An area of about 73 ha (14%) is moderately suitable (Class S2) and distributed in the northern, eastern and western part of the microwatershed with minor limitations of rooting depth, gravelliness and drainage. Marginally suitable (Class S3) lands cover a maximum area of about 215 ha (43%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 38 ha (8%) is currently not suitable (Class N1) for growing Sunflower and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

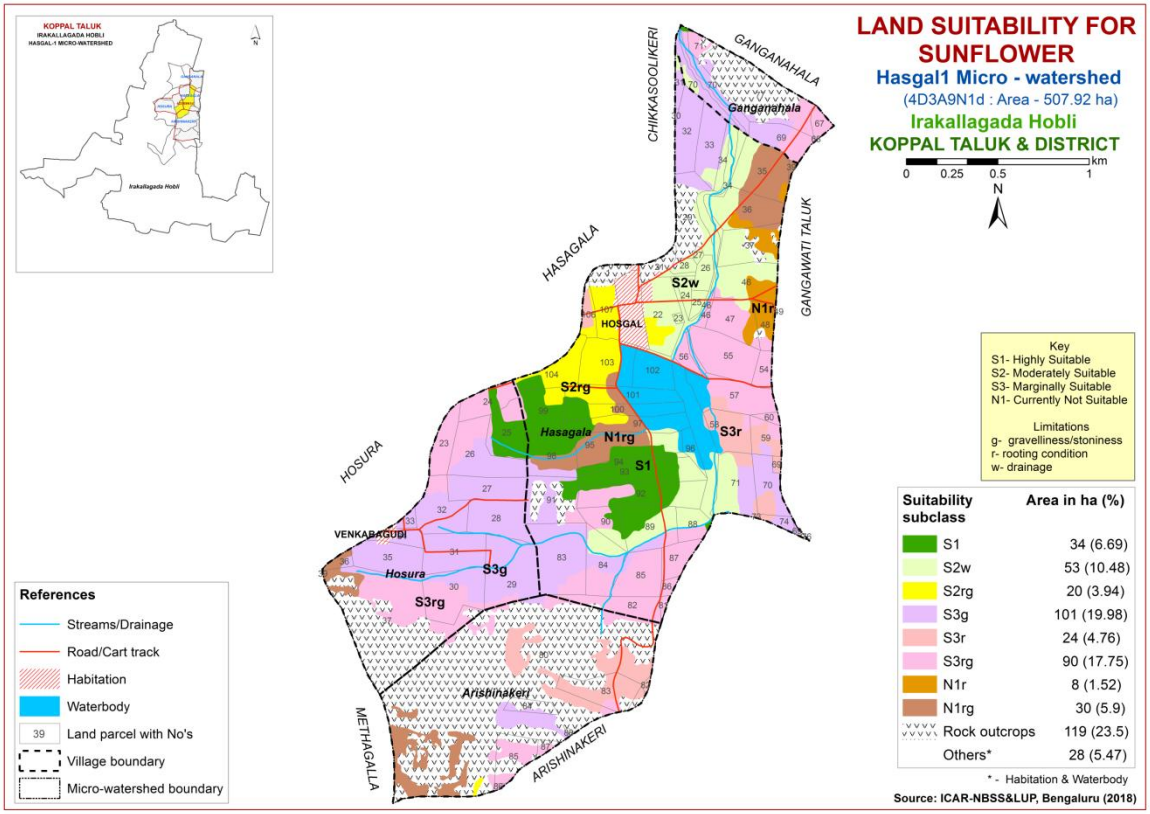


Fig. 7.5 Land Suitability map of Sunflower

7.6 Land Suitability for Redgram (*Cajanus cajan*)

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Redgram and distributed in the western and central part of the microwatershed. An area of about 73 ha (14%) is moderately suitable (Class S2) and distributed in the northern, eastern and central part of the microwatershed with minor limitations of texture, rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands cover a maximum area of about 194 ha (38%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Redgram and are distributed in the northern, central, eastern and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

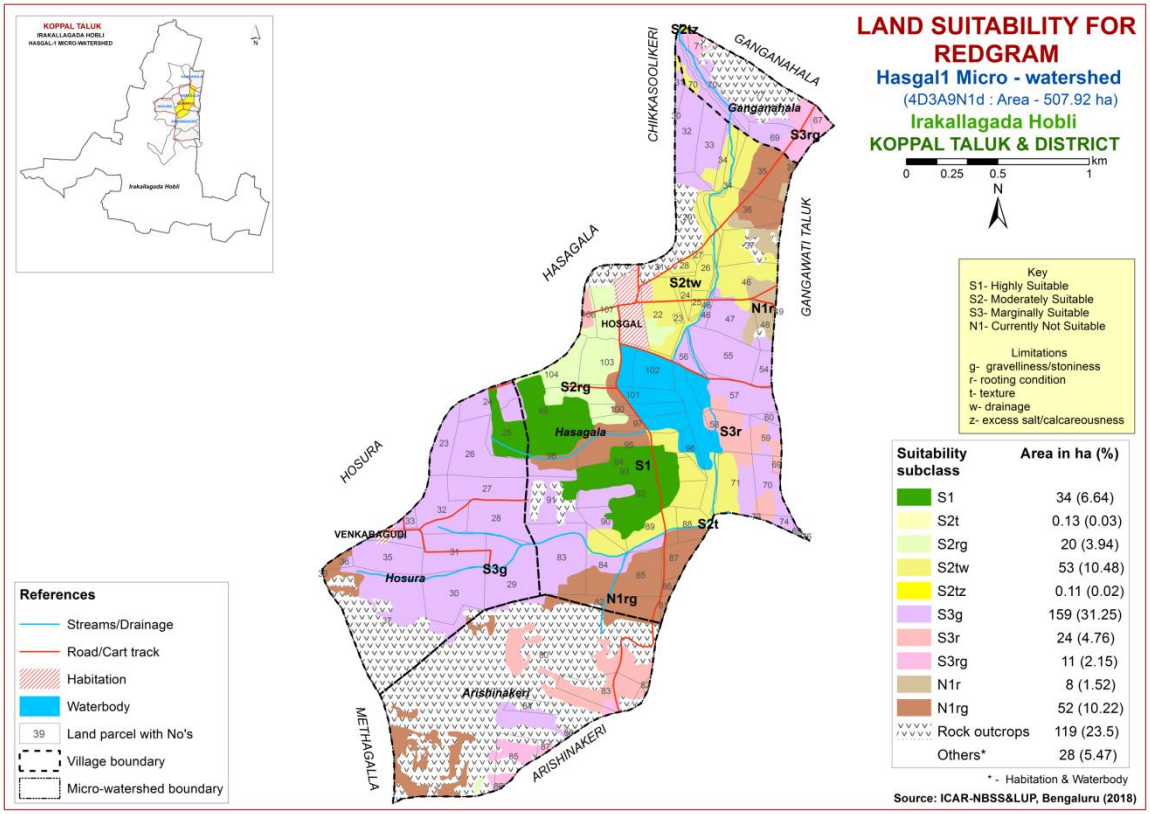


Fig. 7.6 Land Suitability map of Redgram

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

Bengal gram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bell ary districts. The crop requirements for growing Bengal gram (Table 7.8) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengal gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.7.

An area of about 54 ha (11%) is highly suitable (Class S1) for growing Bengal gram and are distributed in the northern, central and eastern part of the microwatershed. An area of about 87 ha (17%) is moderately suitable (Class S2) and are distributed in the northern, western, central, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands occupy a maximum area of about 221 ha (43%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture and gravelliness.

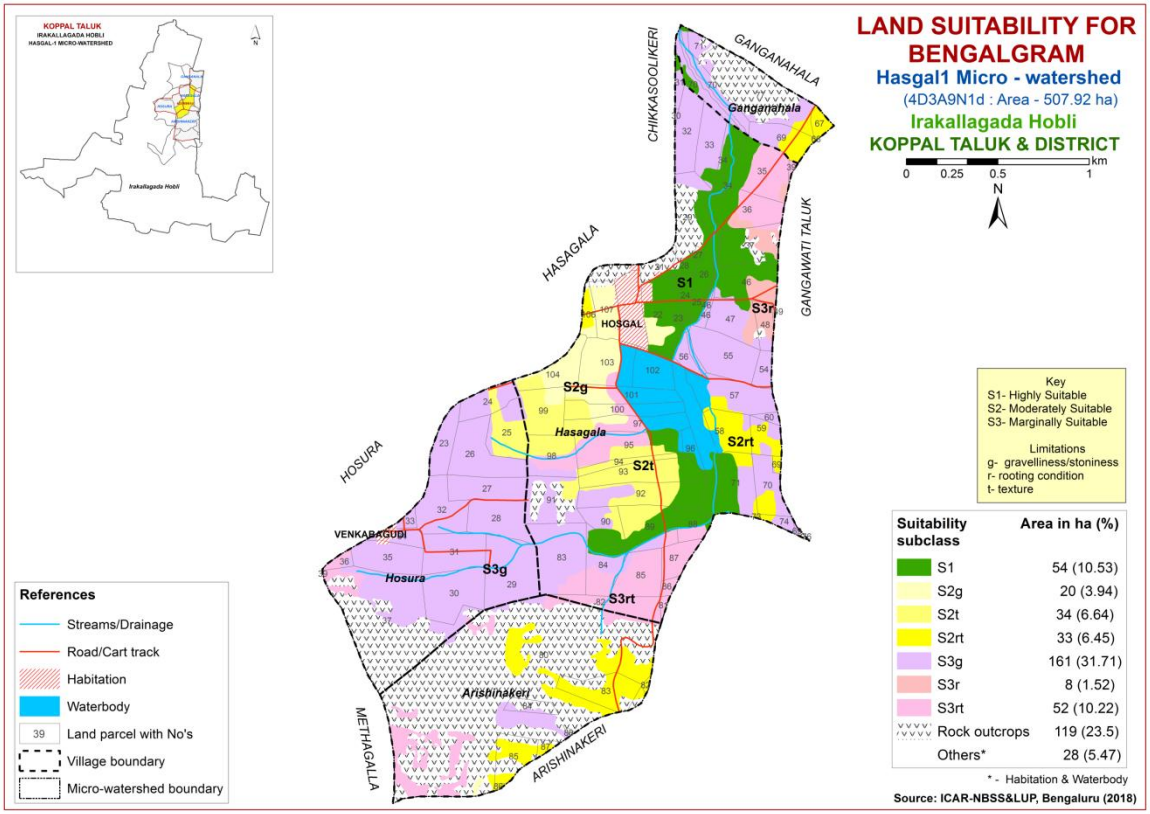


Fig. 7.7 Land Suitability map of Bengal gram

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

No highly suitable (Class S1) lands for growing cotton in the microwatershed. An area of about 135 ha (27%) is moderately suitable (Class S2) and are distributed in the northern, western, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and drainage. Marginally suitable (Class S3) lands occupy a maximum area of about 225 ha (44%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture and gravelliness.

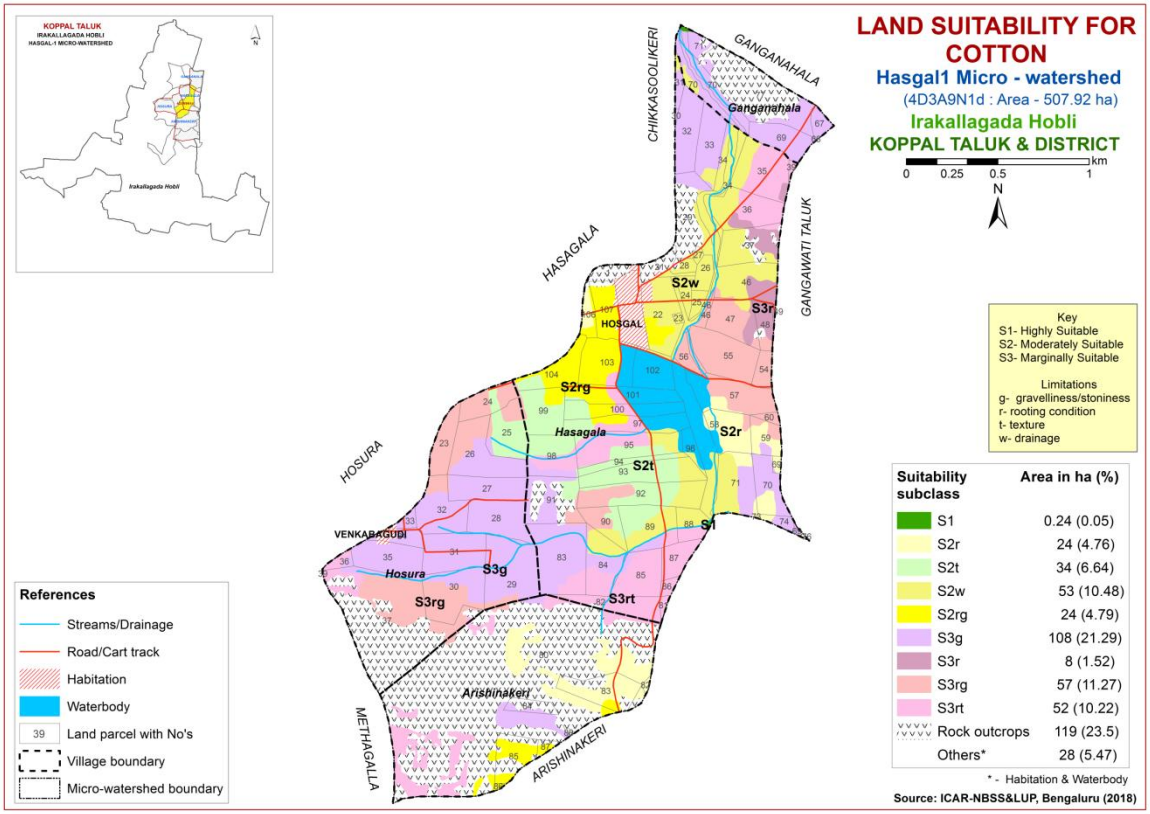


Fig. 7.8 Land Suitability map of Cotton

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

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

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Chilli and are distributed in the western and central part of the microwatershed. An area of about 48 ha (10%) is moderately suitable (Class S2) and are distributed in the eastern, western and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands occupy a maximum area of about 278 ha (54%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture, drainage and gravelliness.

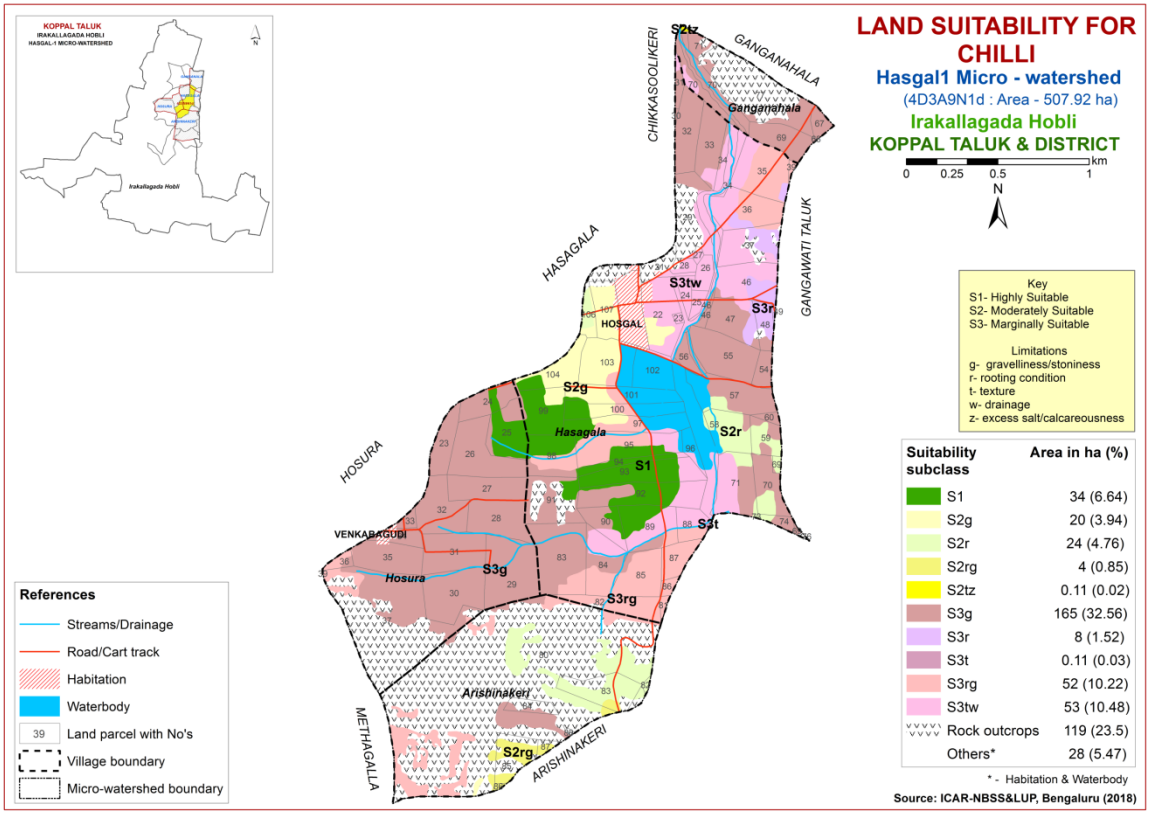


Fig. 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

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

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Tomato and are distributed in the western and central part of the microwatershed. An area of about 48 ha (10%) is moderately suitable (Class S2) and are distributed in the eastern, western and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 278 ha (54%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture, drainage and gravelliness.

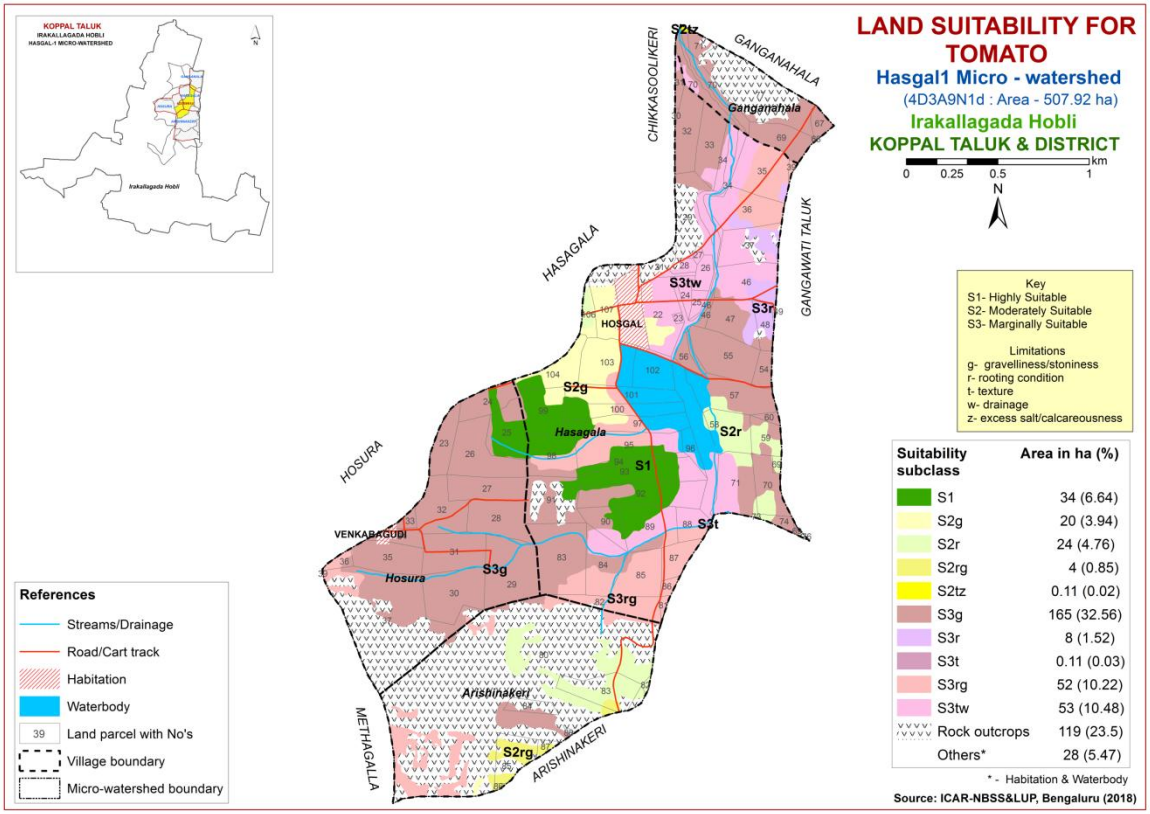


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Brinjal (*Solanum melongena*)

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

An area of about 20 ha (4%) is highly suitable (Class S1) lands for growing Brinjal and distributed in the western part of the microwatershed. Maximum area of about 215 ha (42%) is moderately suitable (Class S2) for growing Brinjal and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 126 ha (25%) and occur in the northern, eastern, central and southern part of the microwatershed with major limitations of gravelliness and rooting depth.

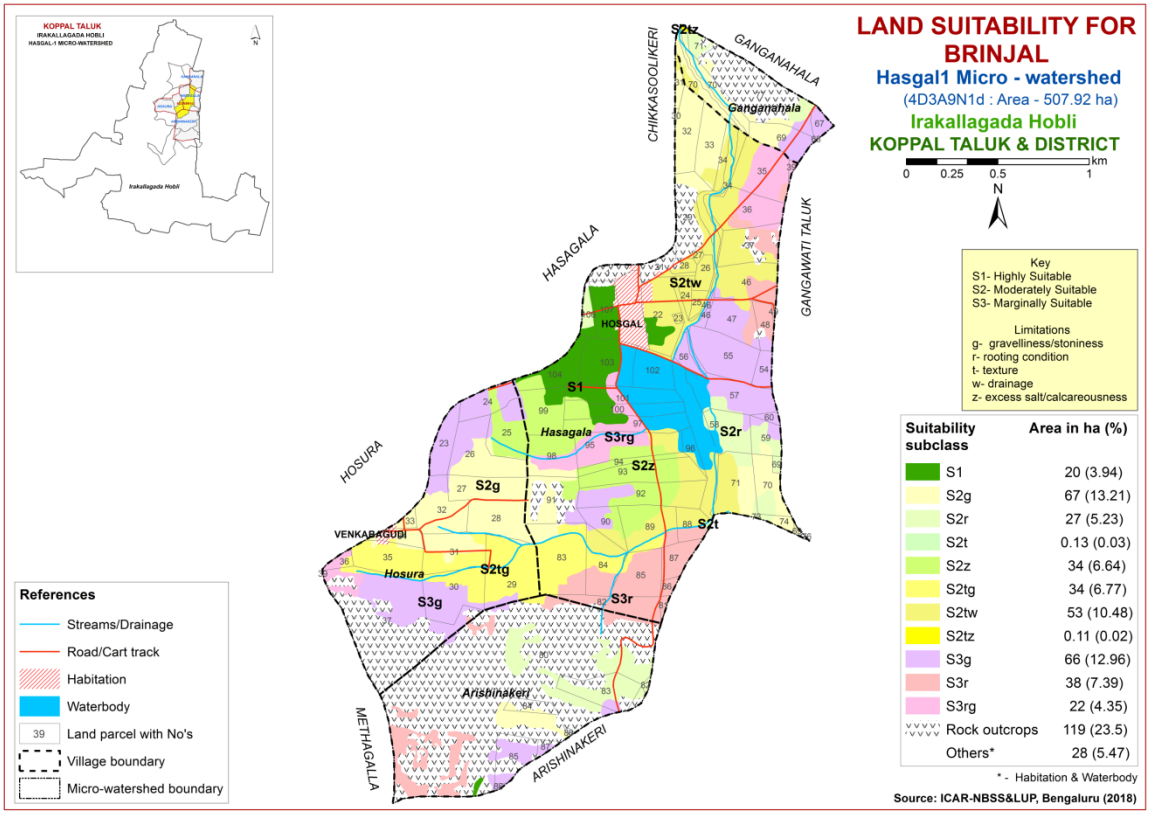


Fig 7.11 Land Suitability map of Brinjal

7.12 Land Suitability for Onion (*Allium cepa L.*,)

Onion is one of the most important vegetable crop grown in the state. The crop requirements for growing onion (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing onion was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

An area of about 20 ha (4%) is highly suitable (Class S1) lands for growing Onion and distributed in the western part of the microwatershed. Maximum area of about 215 ha (42%) is moderately suitable (Class S2) for growing Onion and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 126 ha (25%) and occur in the northern, eastern, central and southern part of the microwatershed with major limitations of gravelliness, texture, calcareousness and rooting depth.

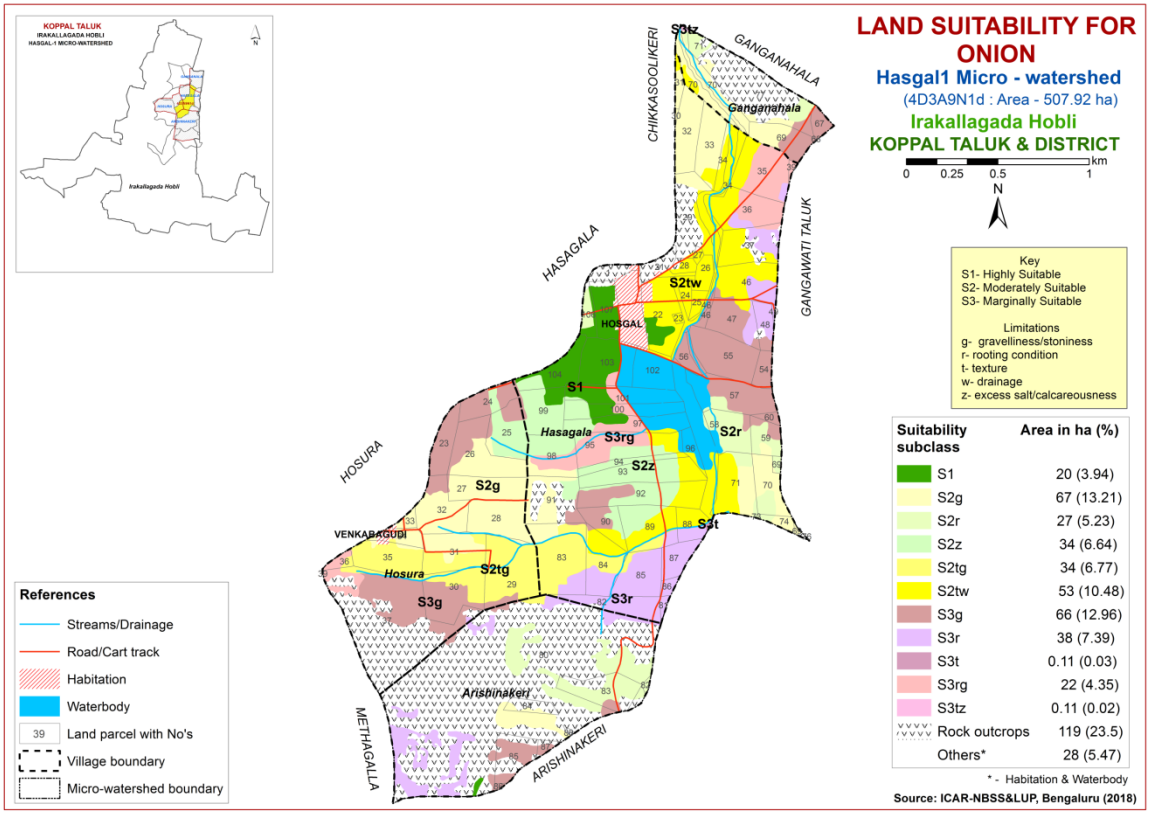


Fig 7.12 Land Suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

Bhendi is one of the most important vegetable crop grown in the state. The crop requirements for growing bhendi (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing bhendi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

An area of about 20 ha (4%) is highly suitable (Class S1) lands for growing Bhendi and distributed in the western part of the microwatershed. Maximum area of about 215 ha (42%) is moderately suitable (Class S2) for growing Bhendi and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 126 ha (25%) and occur in the northern, eastern, central and southern part of the microwatershed with major limitations of gravelliness and rooting depth.

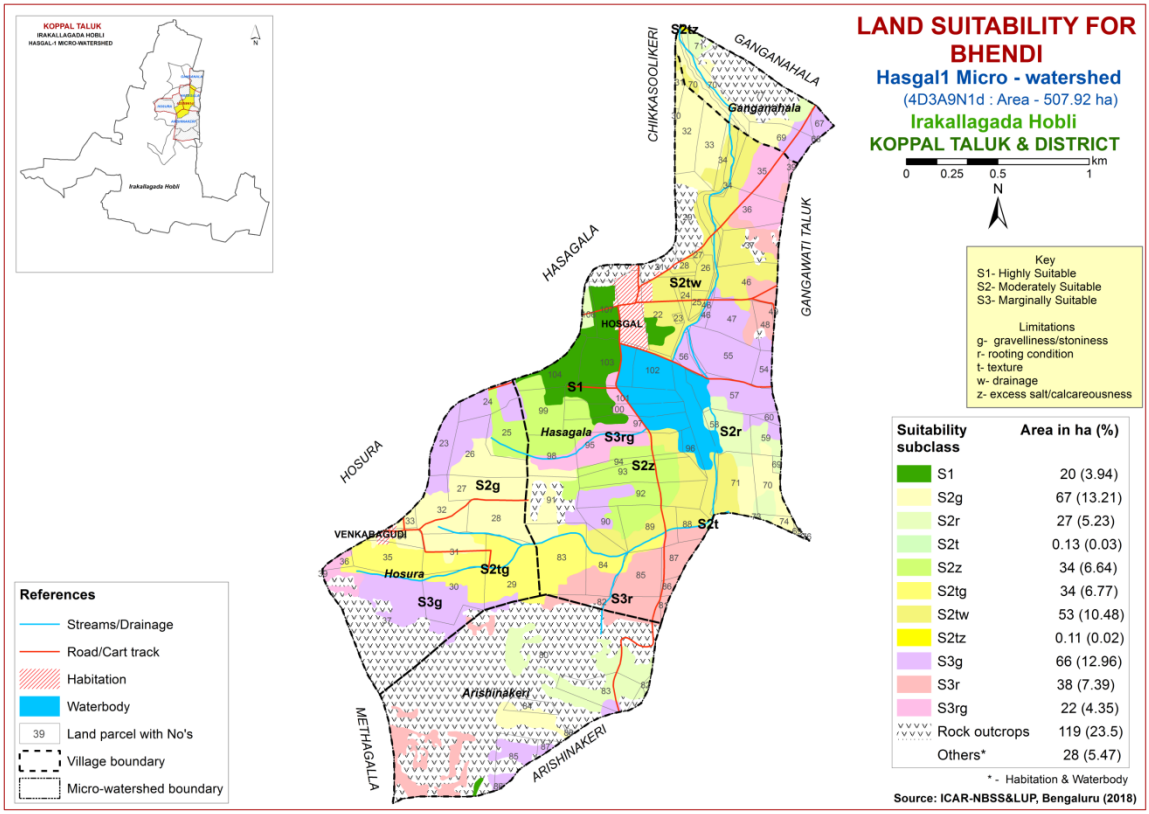


Fig 7.13 Land Suitability map of Bhendi

7.14 Land Suitability for Drumstick (*Moringa oleifera)*

Drumstick is one of the most important vegetable crop grown in 2403 ha area in the state. The crop requirements for growing drumstick (Table 7.15) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Drumstick and distributed in the western and central part of the microwatershed. Maximum area of about 140 ha (27%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, calcareousness, gravelliness and drainage. Marginally suitable (Class S3) lands cover an area of about 127 ha (25%) and distributed in the northern, eastern, western and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Drumstick and are distributed in the northern, central, eastern and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

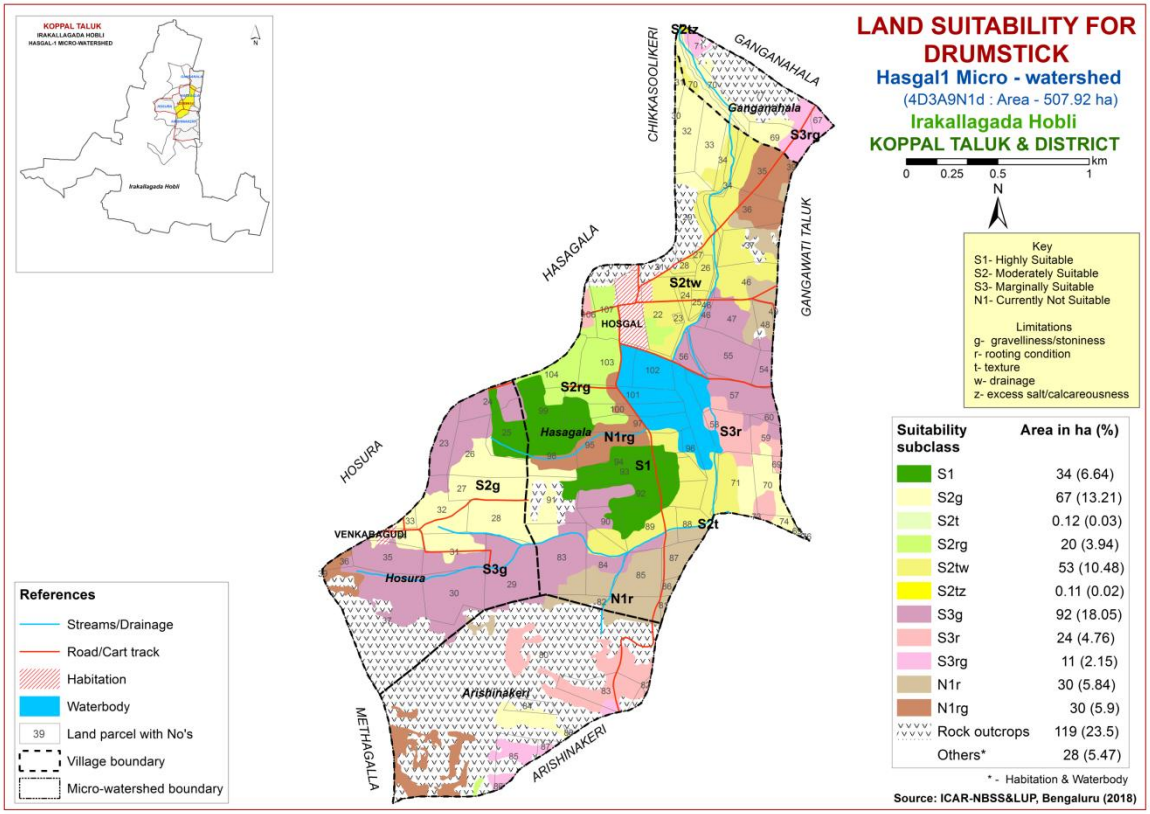


Fig. 7.14 Land Suitability map of Drumstick

7.15 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.16) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.15.

No highly suitable (Class S1) lands for growing Mango in the microwatershed. An area of about 34 ha (7%) is moderately suitable (Class S2) and distributed in the western and central part of the microwatershed with minor limitation of rooting depth. Marginally suitable (Class S3) lands cover a maximum area of about 231 ha (45%) and distributed in all part of the microwatershed. They have moderate limitations of gravelliness, texture, drainage, calcareousness and rooting depth. An area of about 94 ha (19%) is currently not suitable (Class N1) for growing Mango and are distributed in the northern, eastern and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

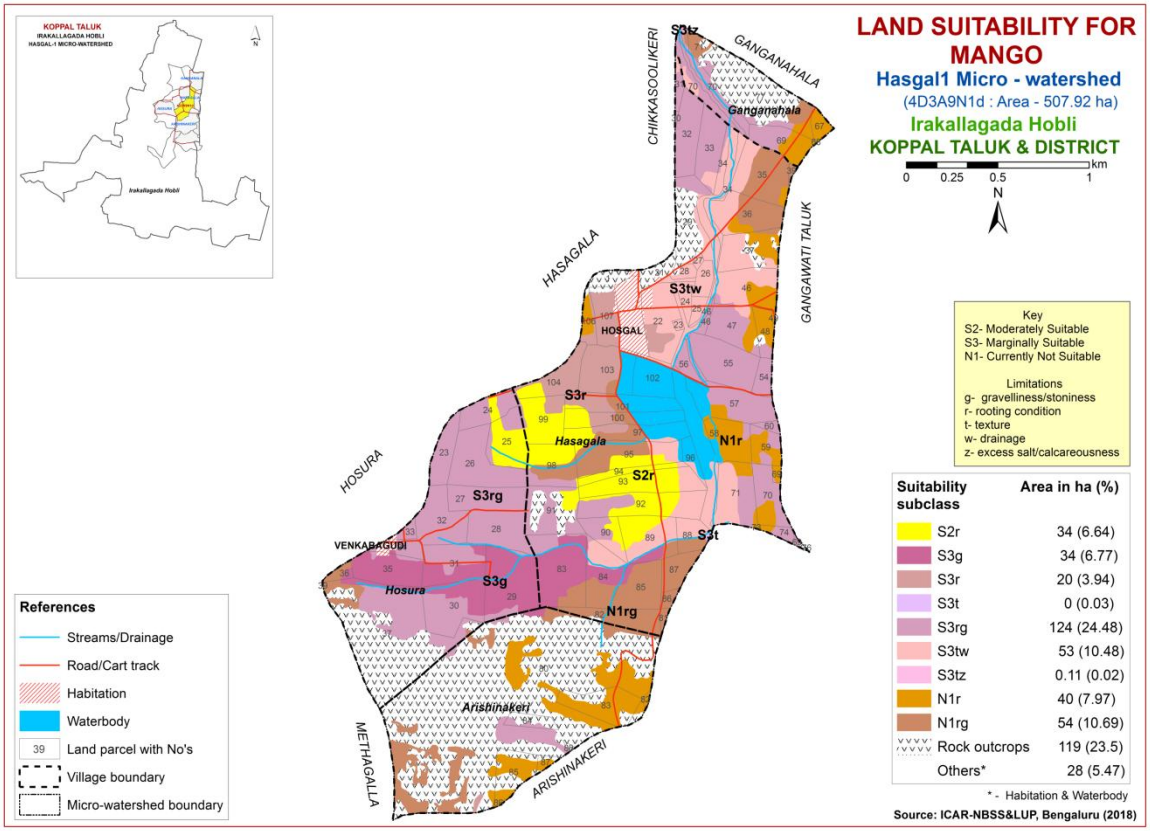


Fig. 7.15 Land Suitability map of Mango

7.16 Land Suitability for Guava (*Psidium guajava*)

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

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Guava and distributed in the western and central part of the microwatershed. An area of about 77 ha (15%) is moderately suitable (Class S2) and distributed in the eastern, western and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 189 ha (37%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, texture, drainage, calcareousness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Guava and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

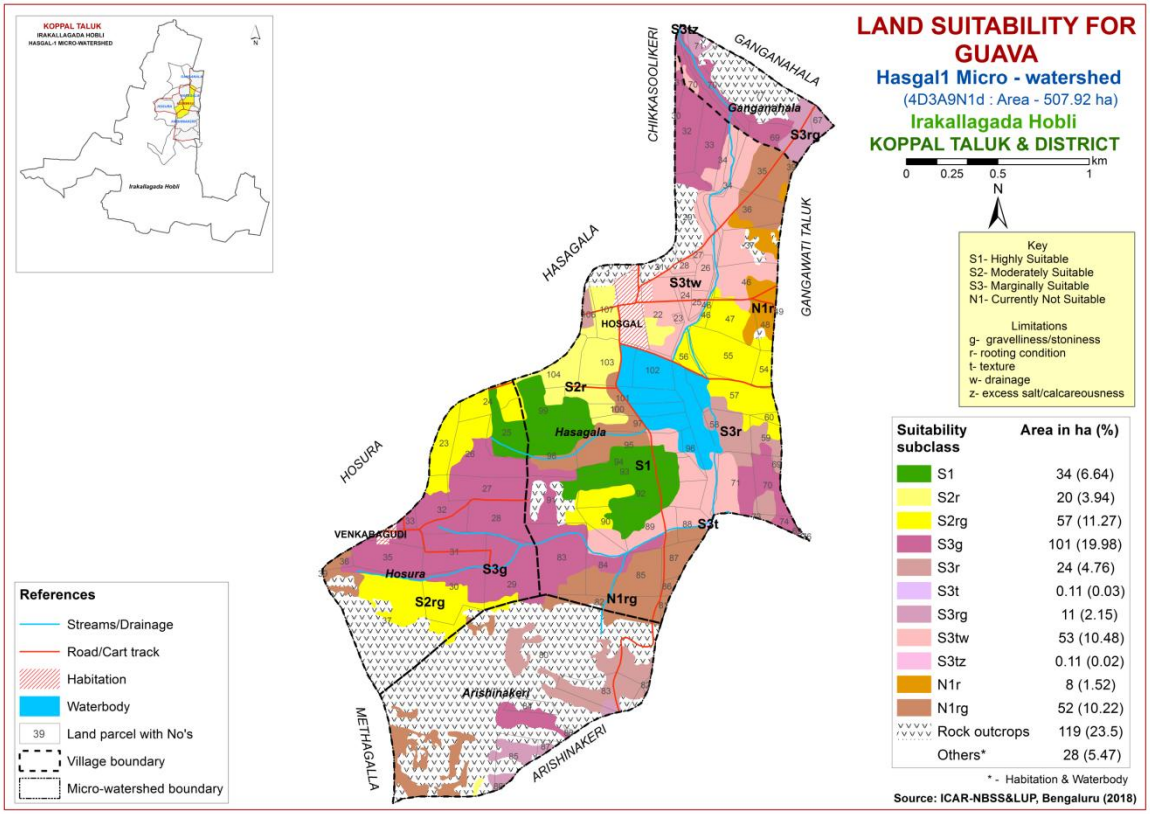


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of about 29373 ha in almost all the districts of the state. The crop requirements (Table 7.18) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.17.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Sapota and distributed in the western and central part of the microwatershed. An area of about 77 ha (15%) is moderately suitable (Class S2) and distributed in the eastern, western and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 189 ha (37%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, texture, drainage, calcareousness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Sapota and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

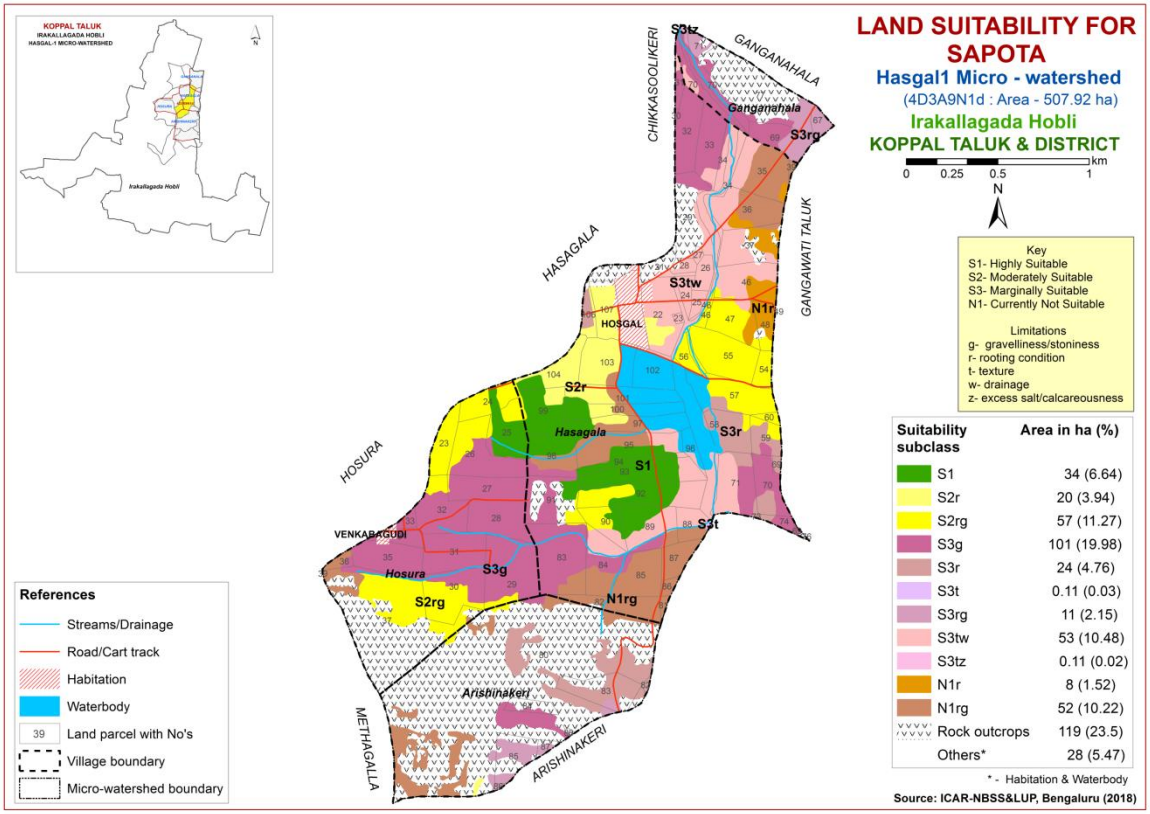


Fig. 7.17 Land Suitability map of Sapota

7.18 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the commercially grown fruit crop in about 18488 ha in Karnataka mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.19) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Pomegranate and distributed in the western and central part of the microwatershed. An area of about 130 ha (25%) is moderately suitable (Class S2) and distributed in the northern, eastern, western and southern part of the microwatershed with minor limitations of texture, rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands cover a maximum area of about 136 ha (27%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Pomegranate and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

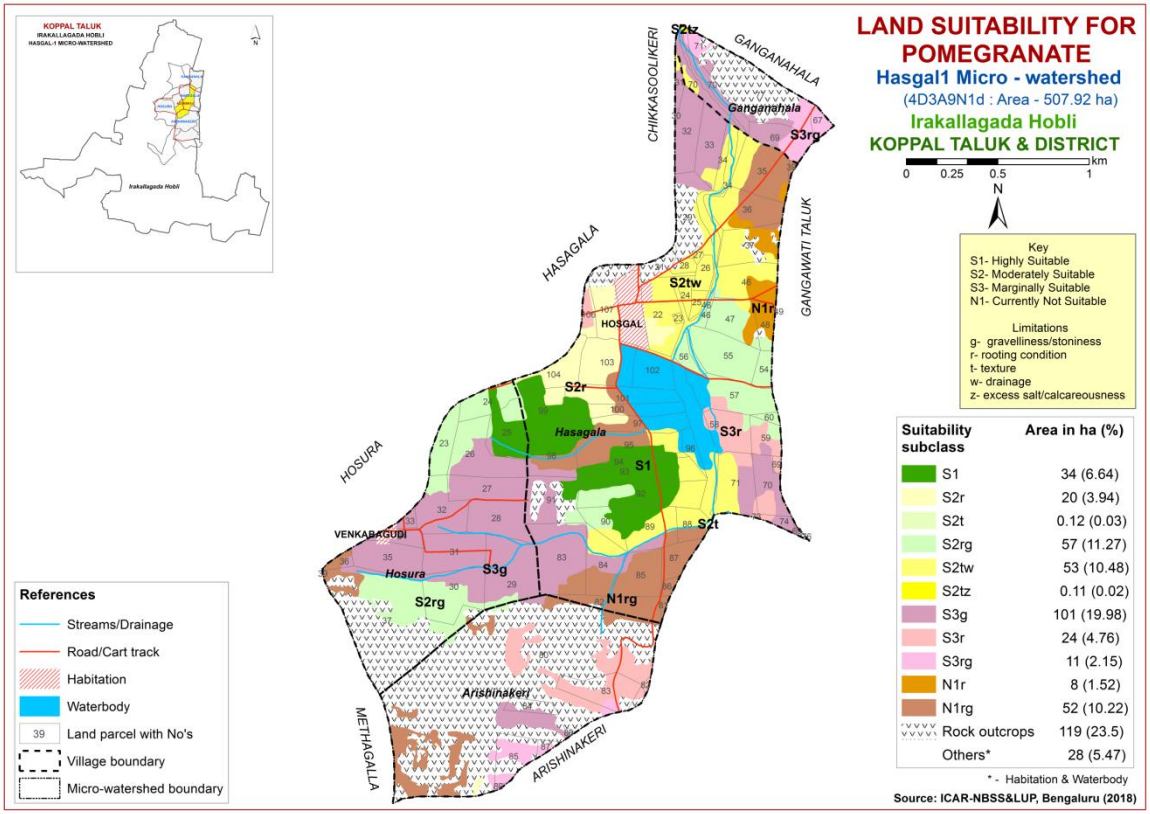


Fig. 7.18 Land Suitability map of Pomegranate

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the state. The crop requirements (Table 7.20) for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Musambi was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Musambi and distributed in the western and central part of the microwatershed. An area of about 130 ha (25%) is moderately suitable (Class S2) and distributed in the northern, eastern, western and southern part of the microwatershed with minor limitations of rooting depth, drainage and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 136 ha (27%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Musambi and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

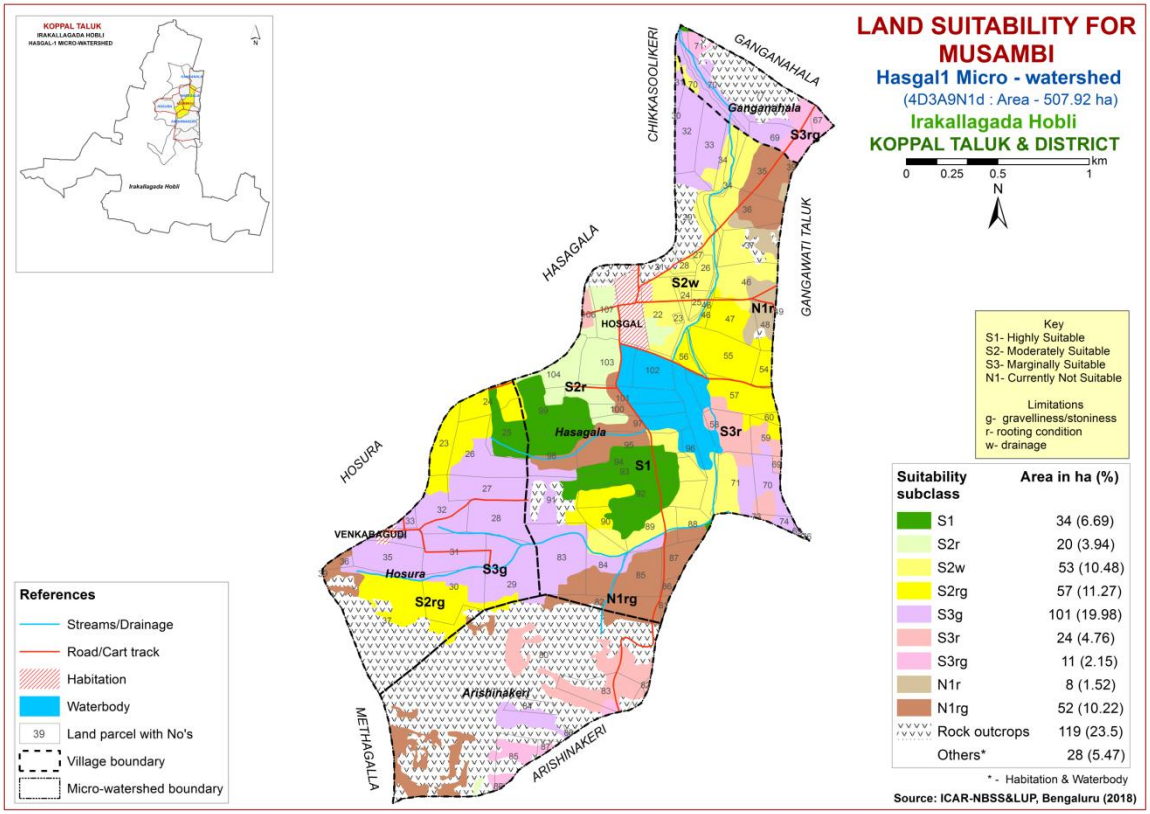


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Lime and distributed in the western and central part of the microwatershed. An area of about 130 ha (25%) is moderately suitable (Class S2) and distributed in the northern, eastern, western and southern part of the microwatershed with minor limitations of rooting depth, drainage and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 136 ha (27%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Lime and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

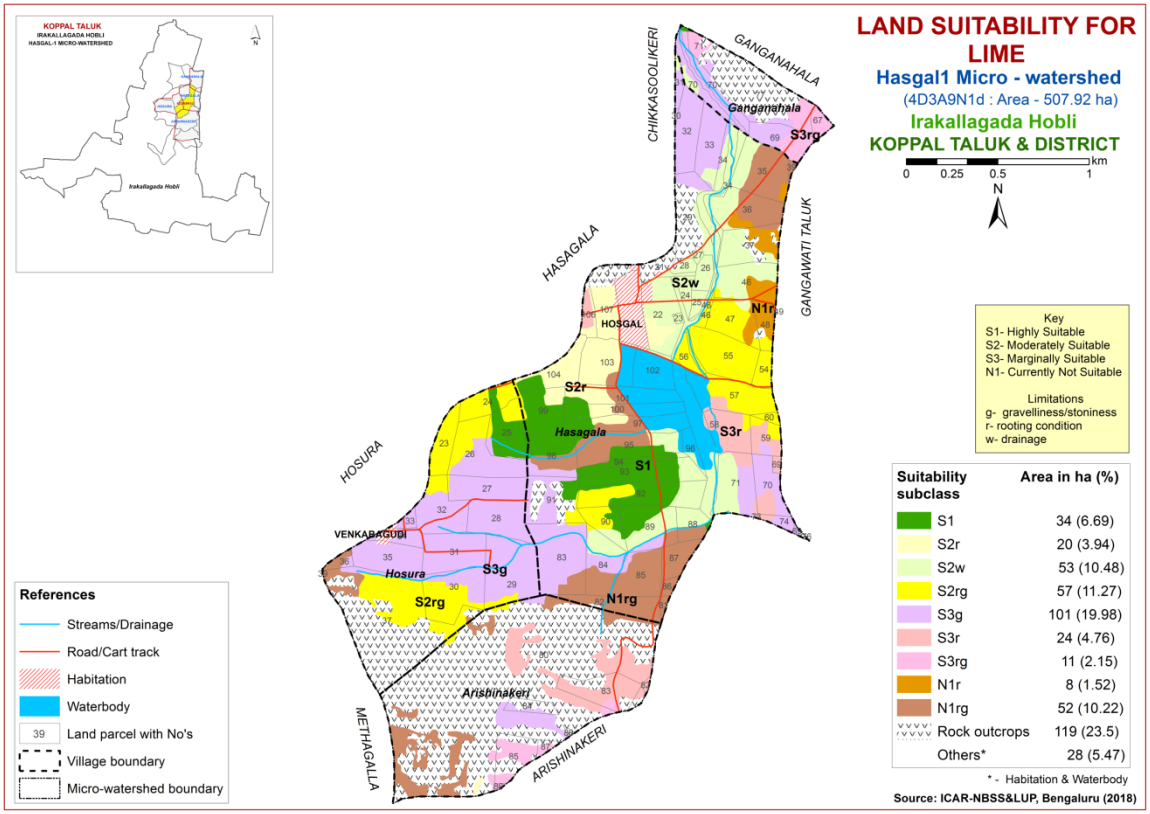


Fig. 7.20 Land Suitability map of Lime

7.21 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important fruit and medicinal crop grown in an area of 151 ha and distributed in almost all the districts of the state. The crop requirements (Table 7.22) for growing amla were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.21.

An area of about 54 ha (11%) is highly suitable (Class S1) for growing Amla and are distributed in the western and central part of the microwatershed. Maximum area of about 246 ha (48%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, rooting depth, texture and drainage. Marginally suitable (Class S3) lands occupy an area of about 60 ha (12%) and are distributed in the northern, central and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

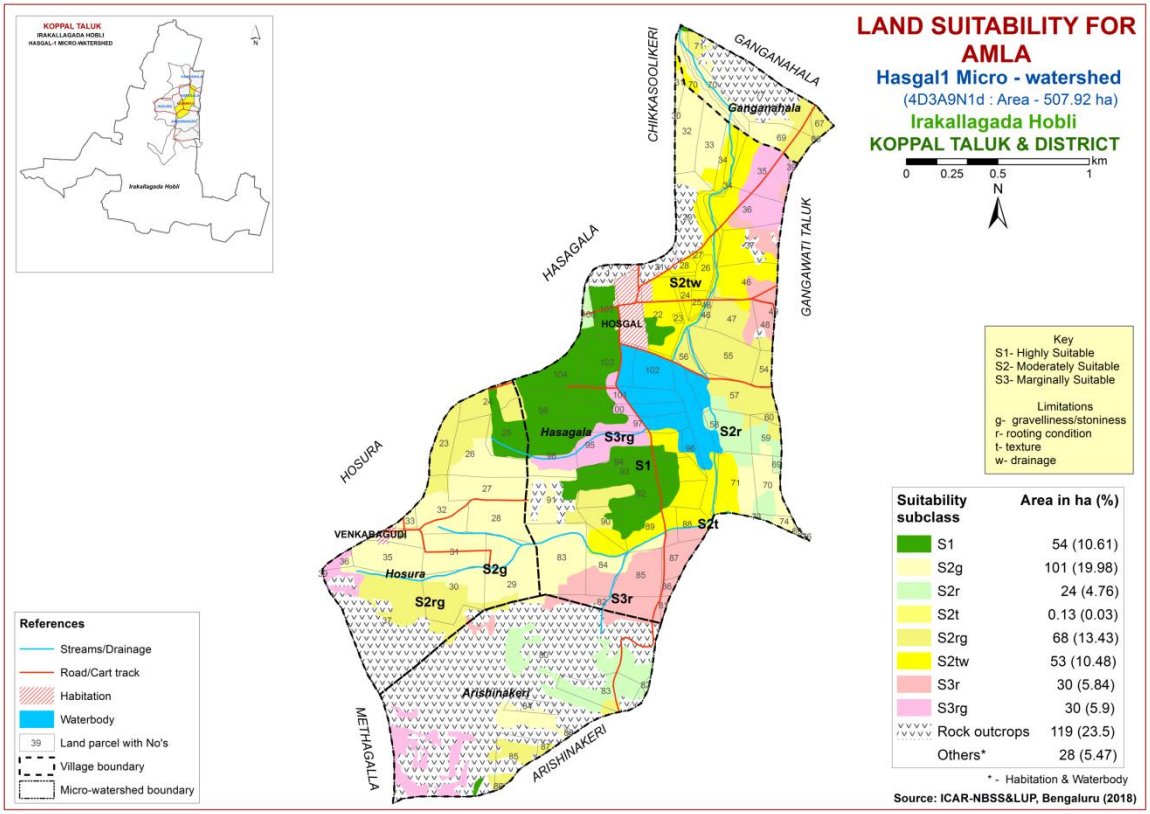


Fig. 7.21 Land Suitability map of Amla

7.22 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.23) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

No highly suitable (Class S1) lands for growing Cashew in the microwatershed. An area of about 112 ha (22%) is moderately suitable (Class S2) and distributed in the western, eastern and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 102 ha (20%) and distributed in the northern, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. Maximum area of about 147 ha (29%) is currently not suitable (Class N1) for growing Cashew and are distributed in all parts of the microwatershed with severe limitations of rooting depth, texture, drainage, calcareousness and gravelliness.

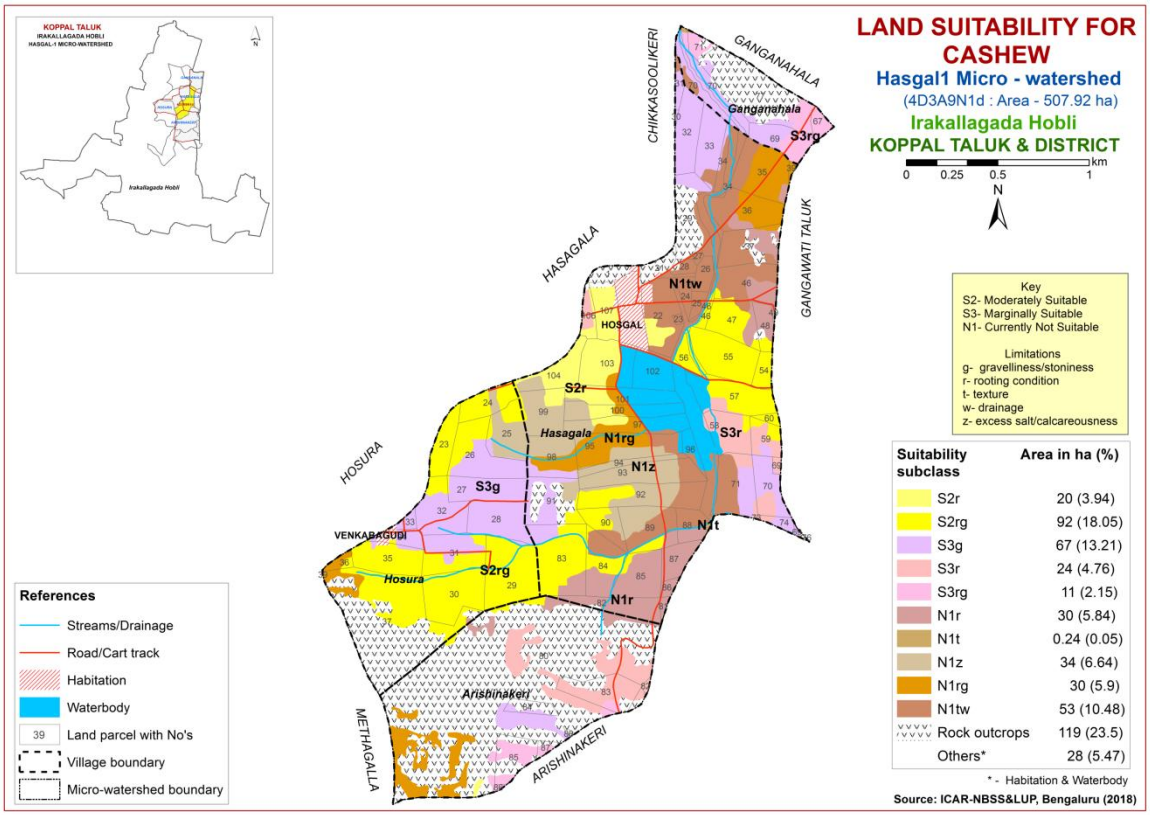


Fig. 7.22 Land Suitability map of Cashew

7.23 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in all the districts of the state. The crop requirements (Table.7.24) for growing jackfruit were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in figure 7.23.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Jackfruit and distributed in the western and central part of the microwatershed. An area of about 77 ha (15%) is moderately suitable (Class S2) and distributed in the eastern, western and southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 189 ha (37%) and distributed in all parts of the microwatershed. They have moderate limitations of gravelliness, texture, drainage, calcareousness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Jackfruit and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

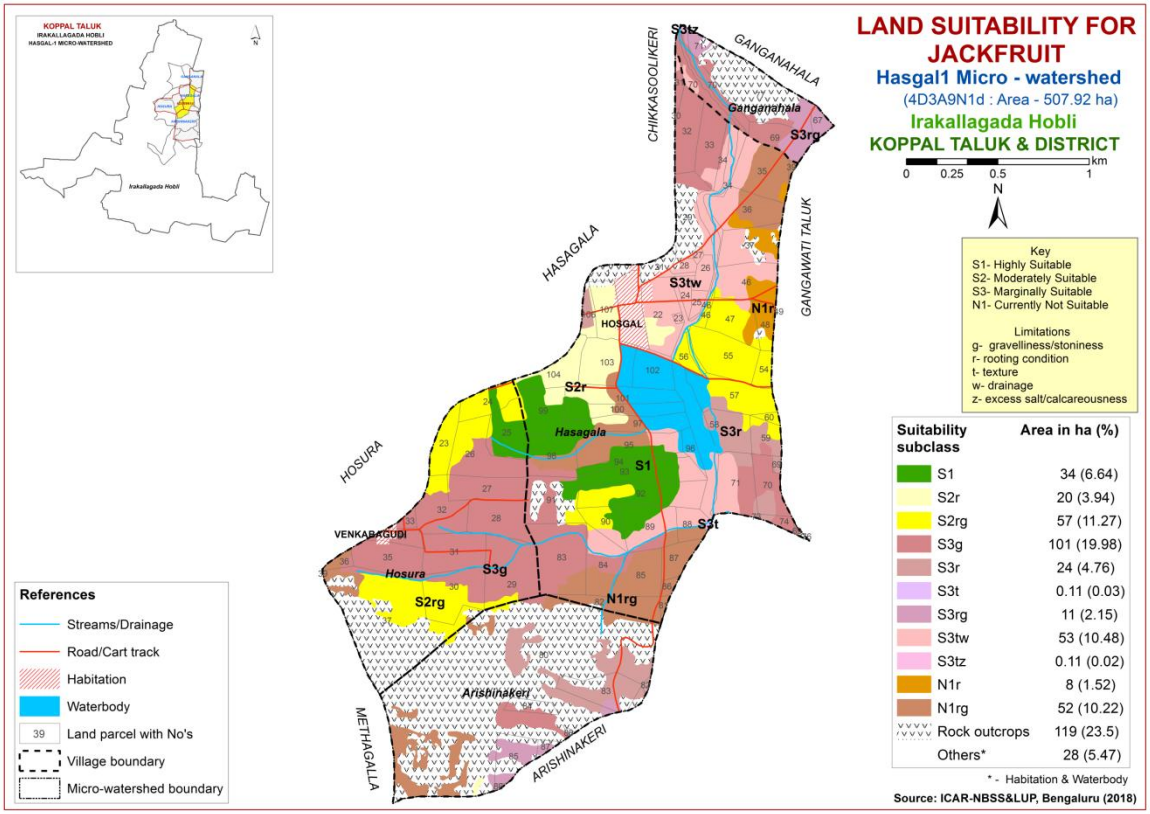


Fig. 7.23 Land Suitability map of Jackfruit

7.24 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the state. The crop requirements (Table 7.25) for growing Jamun were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Jamun was generated .The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.24.

No highly suitable (Class S1) lands for growing Jamun in the microwatershed. Maximum area of about 164 ha (32%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of rooting depth, texture, drainage, calcareousness and gravelliness. Marginally suitable (Class S3) lands cover an area of about 136 ha (27%) and distributed in the northern, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Jamun and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

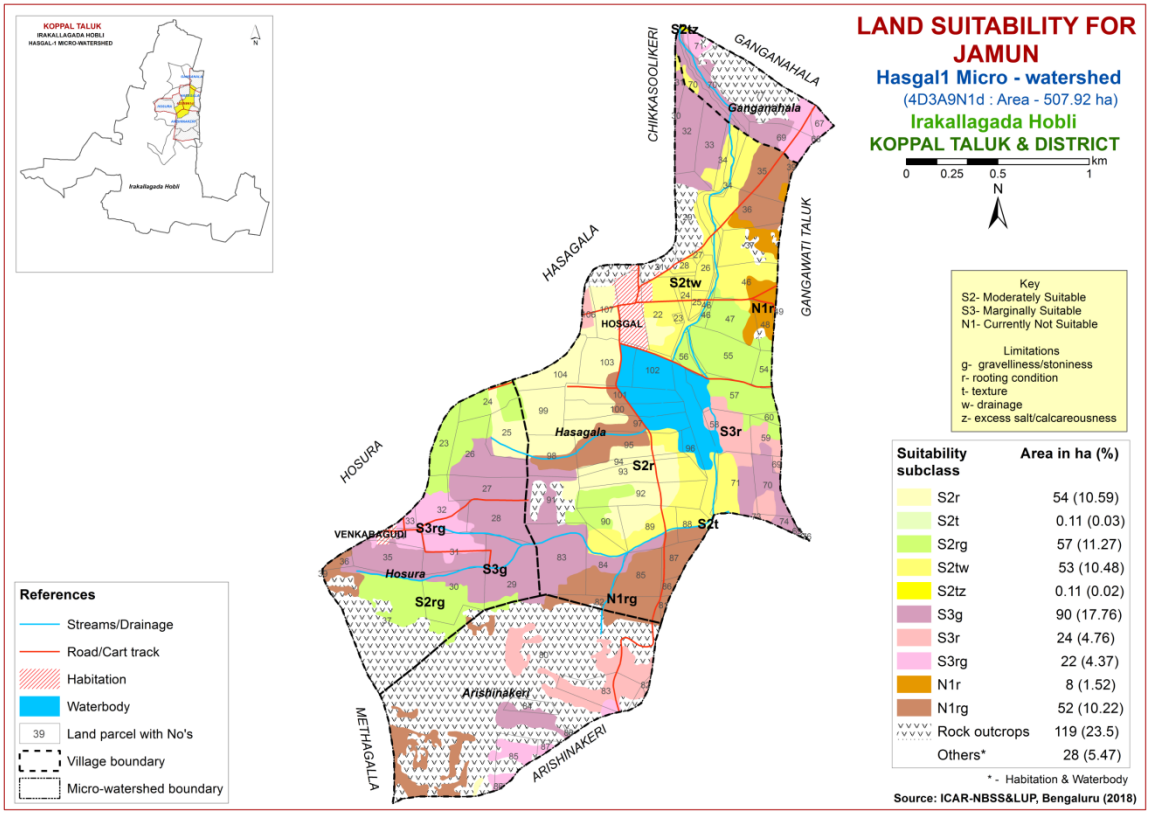


Fig. 7.24 Land Suitability map of Jamun

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements (Table 7.26) for growing custard apple were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated .The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.25.

An area of about 54 ha (11%) is highly suitable (Class S1) for growing Custard Apple and are distributed in the western and central part of the microwatershed. Maximum area of about 246 ha (48%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, rooting depth and drainage. Marginally suitable (Class S3) lands occupy an area of about 60 ha (12%) and are distributed in the northern, central and southern part of the microwatershed with moderate limitations of rooting depth and gravelliness.

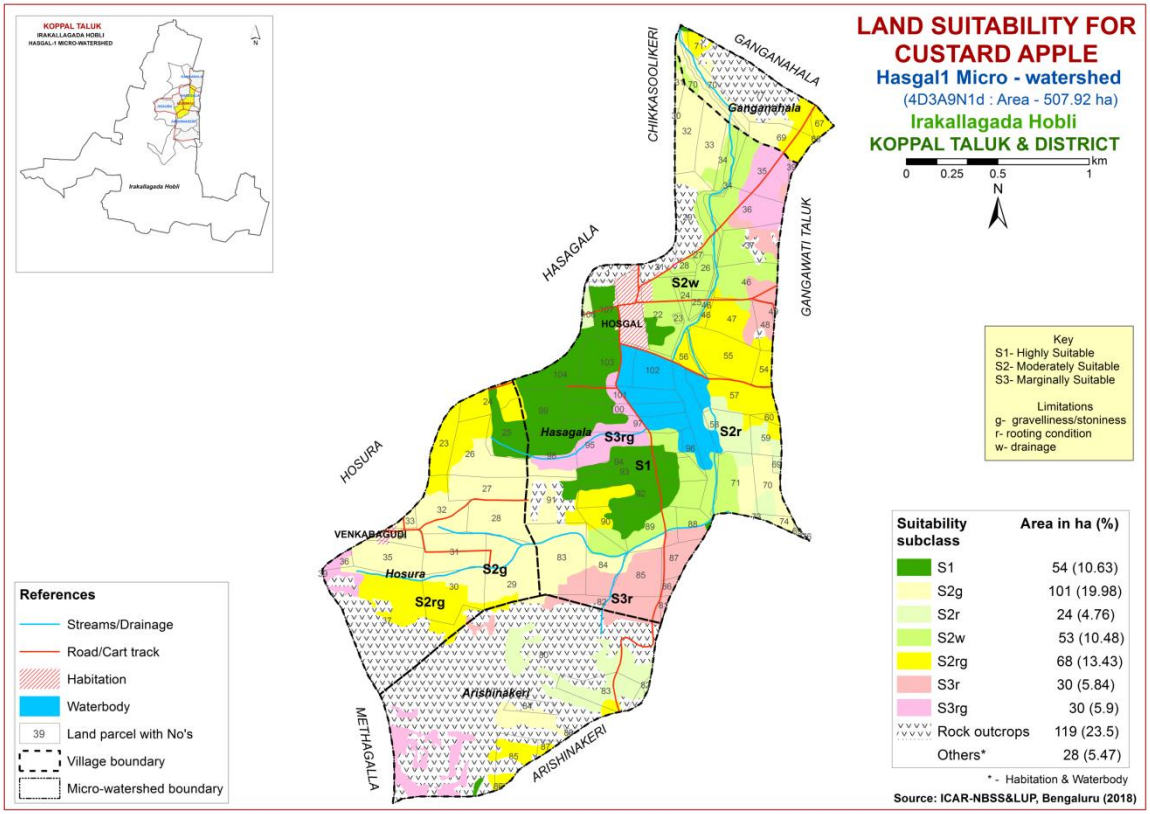


Fig. 7.25 Land Suitability map of Custard Apple

7.26 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop grown in 14897 ha in all the districts of the state. The crop requirements (Table 7.27) for growing tamarind were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.26.

No highly suitable (Class S1) lands for growing Tamarind in the microwatershed. An area of about 87 ha (17%) is moderately suitable (Class S2) and distributed in the northern, western and central part of the microwatershed with minor limitations of rooting depth, texture, drainage and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of about 179 ha (35%) and distributed in all part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. An area of about 94 ha (19%) is currently not suitable (Class N1) for growing Tamarind and are distributed in the northern, eastern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

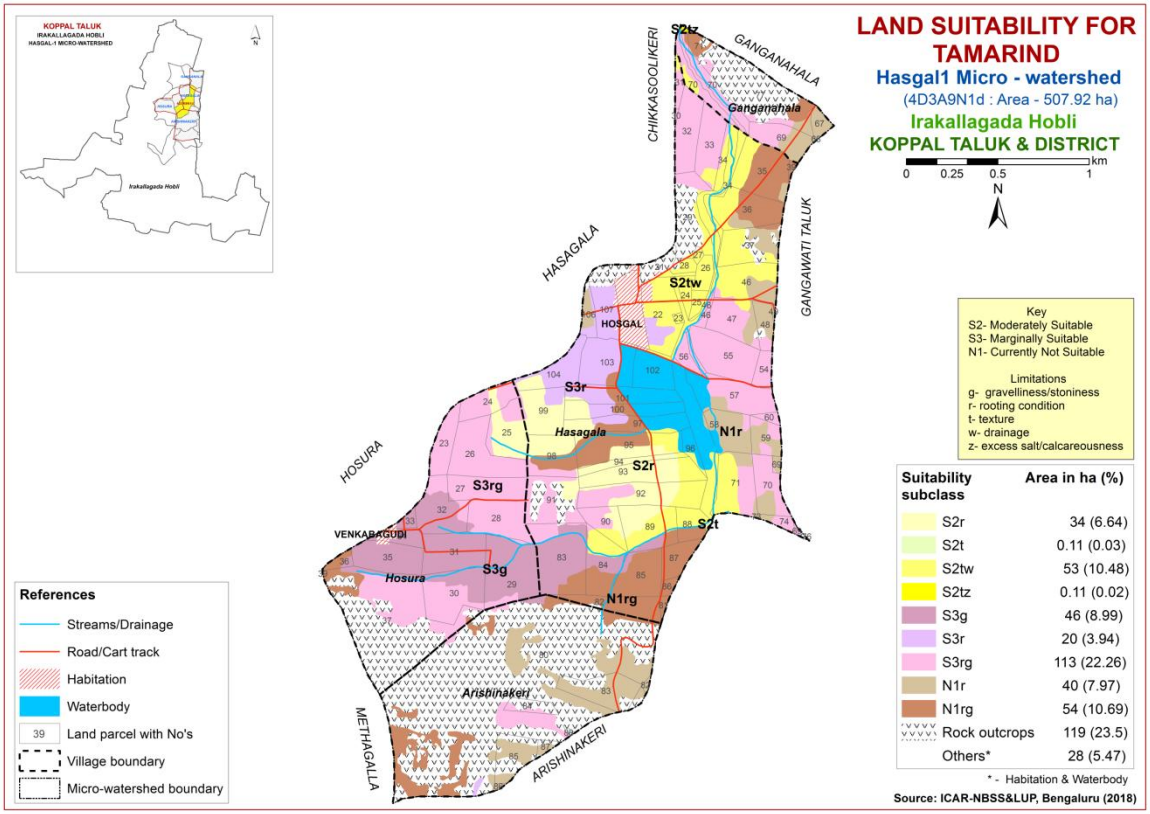


Fig. 7.26 Land Suitability map of Tamarind

7.27 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the state. The crop requirements for growing mulberry (Table 7.28) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.27.

An area of about 34 ha (7%) is highly suitable (Class S1) lands for growing Mulberry and distributed in the western and central part of the microwatershed. Maximum area of about 232 ha (45%) is moderately suitable (Class S2) and distributed in all parts of the microwatershed with minor limitations of texture, rooting depth, gravelliness and drainage. Marginally suitable (Class S3) lands cover an area of about 35 ha (7%) and distributed in the eastern and southern part of the microwatershed. They have moderate limitations of gravelliness, texture, calcareousness and rooting depth. An area of about 60 ha (12%) is currently not suitable (Class N1) for growing Mulberry and are distributed in the northern, central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

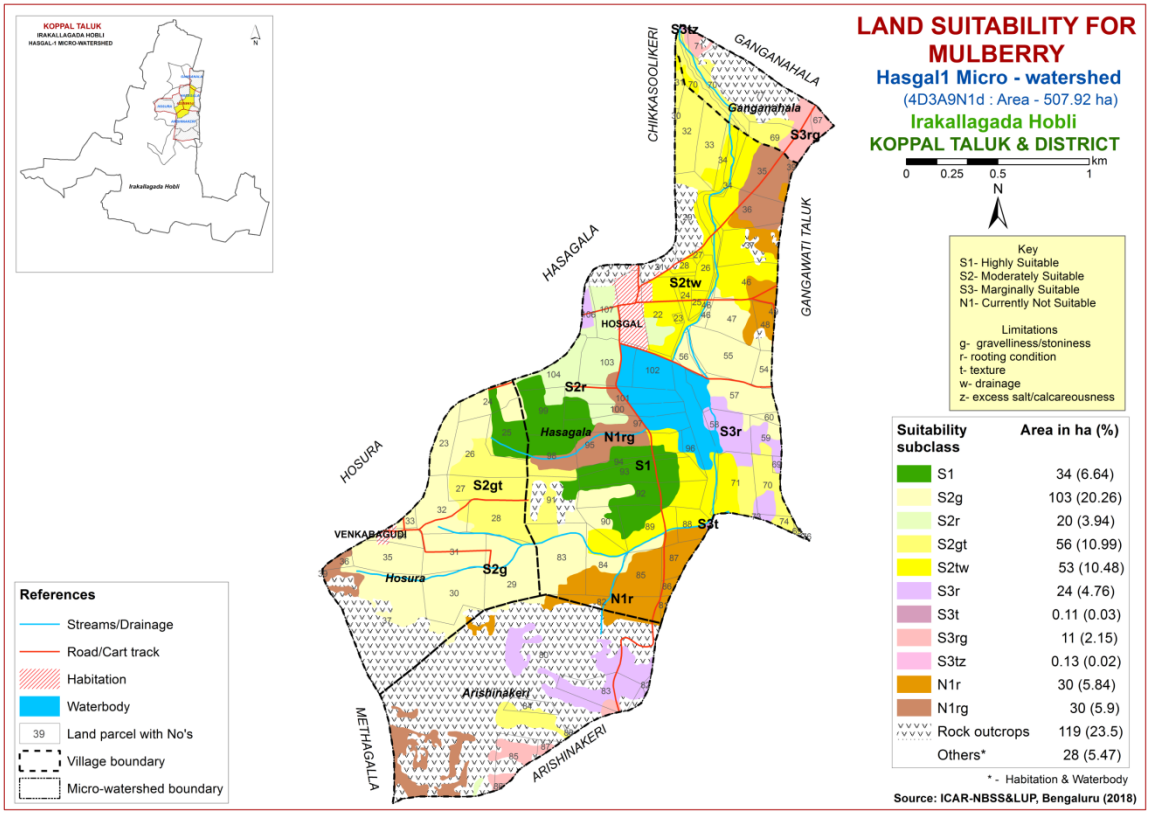


Fig. 7.27 Land Suitability map of Mulberry

7.28 Land Suitability for Marigold (*Tagetes erecta*)

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the state. The crop requirements (Table 7.29) for growing marigold were matched with the soil-site characteristics and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.28.

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Marigold and are distributed in the western and central part of the microwatershed. An area of about 101 ha (20%) is moderately suitable (Class S2) and are distributed in the northern, western, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, texture, drainage, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy a maximum area of about 225 ha (44%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth and gravelliness.

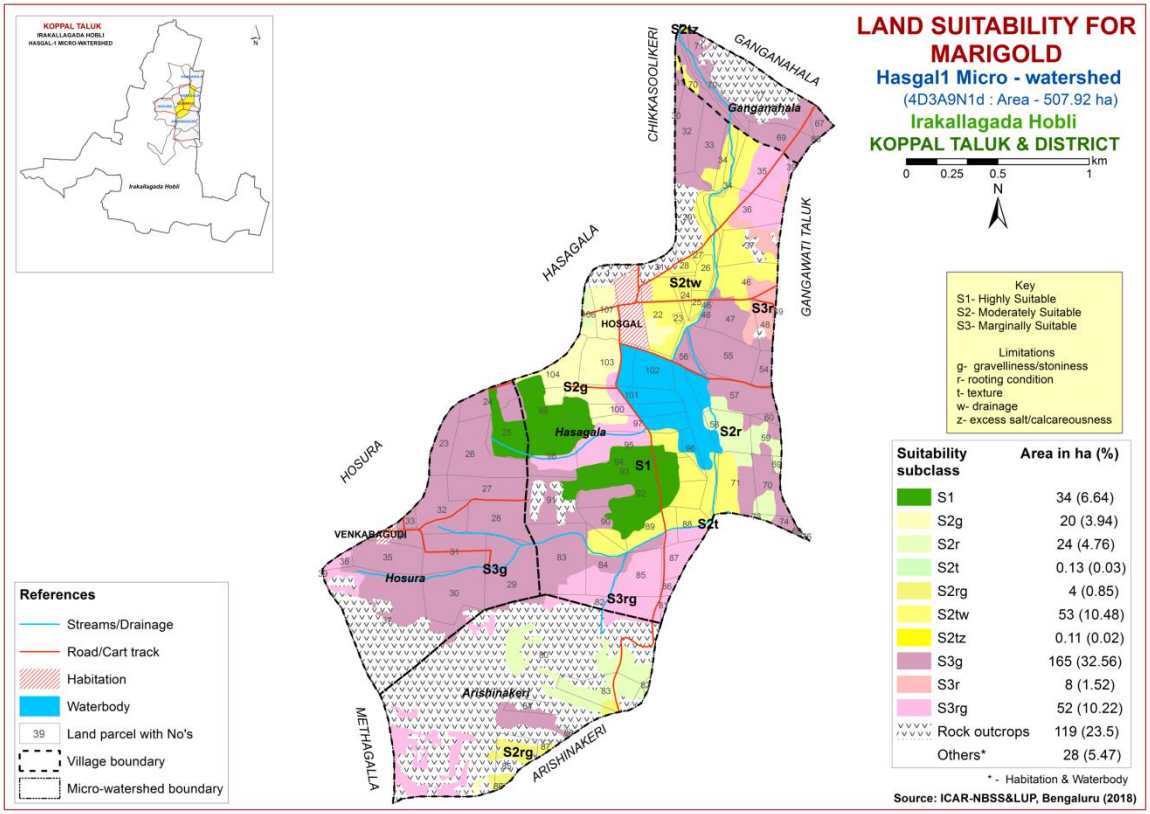


Fig. 7.28 Land Suitability map of Marigold

7.29 Land Suitability for Chrysanthemum (*Chrysanthemum indicum*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements (Table 7.30) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.29.

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Chrysanthemum and are distributed in the western and central part of the microwatershed. An area of about 101 ha (20%) is moderately suitable (Class S2) and are distributed in the northern, western, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, texture, drainage, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy a maximum area of about 225 ha (44%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth and gravelliness.

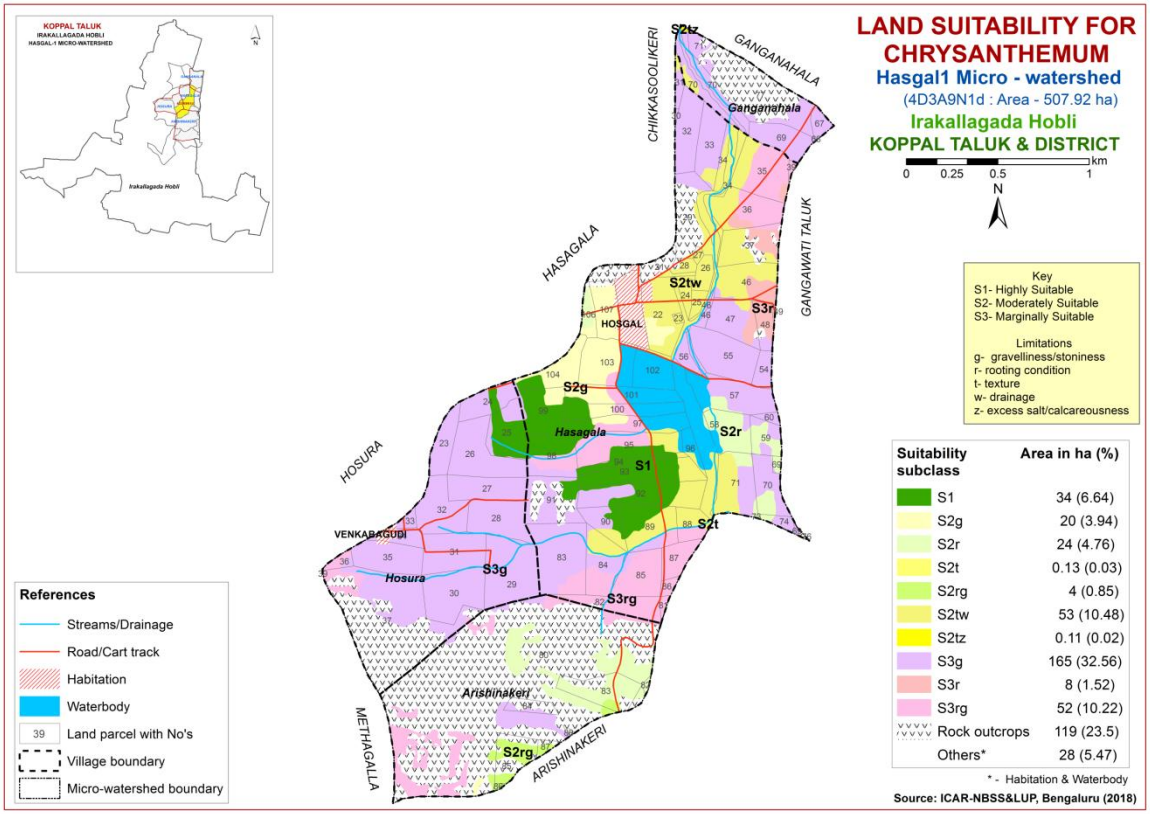


Fig. 7.29 Land Suitability map of Chrysanthemum

7. 30 Land Suitability for Jasmine *(Jasminum sp.)*

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.31) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.30.

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Jasmine and are distributed in the western and central part of the microwatershed. An area of about 48 ha (9%) is moderately suitable (Class S2) and are distributed in the western, eastern and southern part of the microwatershed. They have minor limitations of gravelliness and rooting depth. Marginally suitable (Class S3) lands occupy a maximum area of about 278 ha (55%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture, drainage, calcareousness and gravelliness.

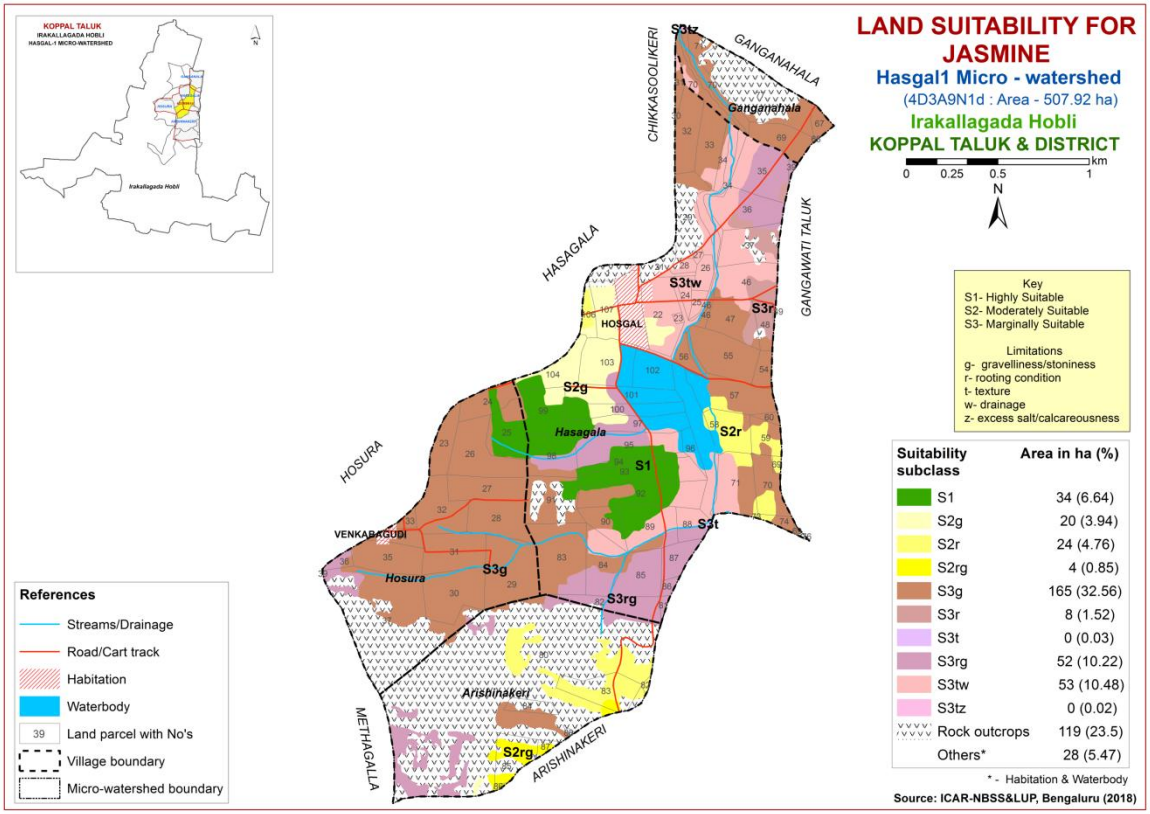


Fig. 7.30 Land Suitability map of Jasmine

7. 31 Land Suitability for Crossandra *(Crossandra infundibuliformis)*

Crossandra is one of the most important flower crop grown in almost all the districts of the State (Table 7.32). Land suitability map for growing crossandra was generated (Table 7.1). The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

An area of about 34 ha (7%) is highly suitable (Class S1) for growing Crossandra and are distributed in the western and central part of the microwatershed. An area of about 48 ha (9%) is moderately suitable (Class S2) and are distributed in the western, eastern and southern part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. Marginally suitable (Class S3) lands occupy a maximum area of about 278 ha (55%) and are distributed in all parts of the microwatershed with moderate limitations of rooting depth, texture, drainage, calcareousness and gravelliness.

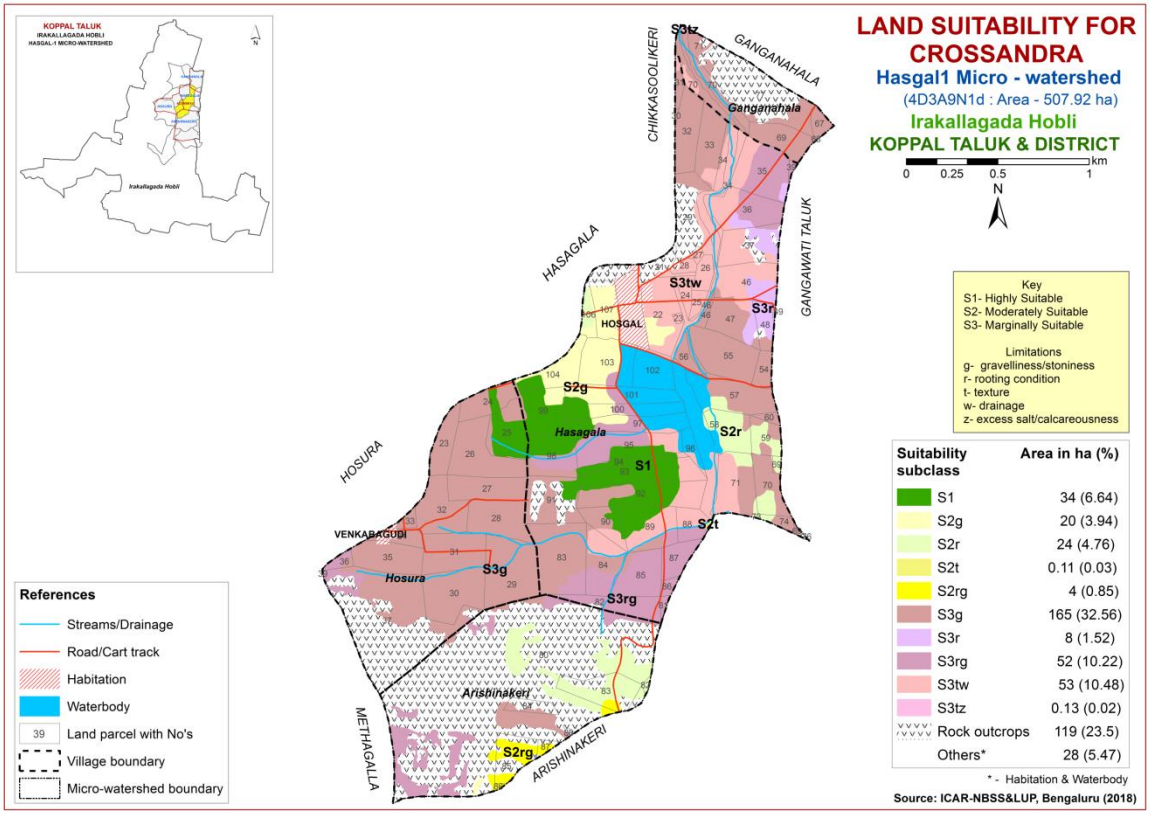


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Hasgal-1Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
KGPcB1g1	662	<90	WD	25-50	sl	gsc	15-35	15-35	<50	1-3	slight	-	-	-	-	-
KGPhB2g1	662	<90	WD	25-50	scl	gsc	15-35	15-35	<50	1-3	moderate	-	-	-	-	-
HRVcC2g2R2	662	<90	WD	25-50	sl	gscl	35-60	>35	<50	3-5	moderate	6.05	0.21	0.73	11.24	100
HRVhB2	662	<90	WD	25-50	scl	gscl	<15	>35	<50	1-3	moderate	6.05	0.21	0.73	11.24	100
HRVhB2g1	662	<90	WD	25-50	scl	gscl	15-35	>35	<50	1-3	moderate	6.05	0.21	0.73	11.24	100
HRVcB2g1	662	<90	WD	25-50	sl	gscl	15-35	>35	<50	1-3	moderate	6.05	0.21	0.73	11.24	100
KNHiB1g1	662	<90	WD	25-50	sc	sc	15-35	<15	51-100	1-3	slight	-	-	-	-	-
KGHbB2g1	662	<90	WD	50-75	ls	gscl	15-35	15-35	51-100	1-3	moderate	6.66	0.09	0.93	8.22	100
KGHcB1	662	<90	WD	50-75	sl	gscl	<15	15-35	51-100	1-3	slight	6.66	0.09	0.93	8.22	100
KGHcB2g1	662	<90	WD	50-75	sl	gscl	15-35	15-35	51-100	1-3	moderate	6.66	0.09	0.93	8.22	100
KGHcB2g2	662	<90	WD	50-75	sl	gscl	35-60	15-35	51-100	1-3	moderate	6.66	0.09	0.93	8.22	100
KGHhB2	662	<90	WD	50-75	scl	gscl	<15	15-35	51-100	1-3	moderate	6.66	0.09	0.93	8.22	100
MKHcB2g1	662	<90	WD	50-75	sl	gsc	15-35	>35	51-100	1-3	moderate	7.38	0.09	1.49	15.00	93.00
MKHcB2g2	662	<90	WD	50-75	sl	gsc	35-60	>35	51-100	1-3	moderate	7.38	0.09	1.49	15.00	93.00
MKHiB2g1	662	<90	WD	50-75	sc	gsc	15-35	>35	51-100	1-3	moderate	7.38	0.09	1.49	15.00	93.00
HDHbB2g1	662	<90	WD	75-100	ls	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.00
HDHcB2g1	662	<90	WD	75-100	sl	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.00
HDHcB2g2	662	<90	WD	75-100	sl	gsc-gc	35-60	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.00
HDHhB2	662	<90	WD	75-100	scl	gsc-gc	<15	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.00
HDHhB2g1	662	<90	WD	75-100	scl	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	5.84	84.00

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [$Cmol(p^{+})kg^{-1}$]	BS (%)
					Surface	Subsurface	Surface	Subsurface								
GHTcB2	662	<90	WD	75-100	sl	gscl	<15	15-35	51-100	1-3	moderate	5.70	0.06	4.10	3.17	73.00
GHThB1g1	662	<90	WD	75-100	scl	gscl	15-35	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.17	73.00
BDGcB1g1	662	<90	WD	75-100	sl	gc	15-35	35-60	<50	1-3	slight	6.24	0.06	0.35	3.76	52.56
BPRbB2g1	662	<90	WD	100-150	ls	gsc-gc	15-35	>35	51-100	1-3	moderate	6.64	0.03	0.51	5.45	63.48
BPRbB2g2	662	<90	WD	100-150	ls	gsc-gc	35-60	>35	51-100	1-3	moderate	6.64	0.03	0.51	5.45	63.48
MNLcB2	662	<90	WD	100-150	sl	gsc	<15	15-35	101-150	1-3	moderate	7.89	0.13	5.04	9.01	100
NGPbB1	662	<90	WD	100-150	ls	gsc	<15	>35	51-100	1-3	slight	6.77	0.09	0.46	7.10	83.00
NGPhB1g1	662	<90	WD	100-150	scl	gsc	15-35	>35	51-100	1-3	slight	6.77	0.09	0.46	7.10	83.00
TSDcB2	662	<90	MWD	>150	sl	c	<15	<15	>200	1-3	moderate	8.46	0.17	0.19	37.00	100
TSDiB1	662	<90	MWD	>150	sc	c	<15	<15	>200	1-3	slight	8.46	0.17	0.19	37.00	100
TSDmA1	662	<90	MWD	>150	c	c	<15	<15	>200	0-1	slight	8.46	0.17	0.19	37.00	100
TSDmB2	662	<90	MWD	>150	c	c	<15	<15	>200	1-3	moderate	8.46	0.17	0.19	37.00	100
KLRmA1	662	<90	MWD	>150	c	sc	<15	<15	>200	0-1	slight	7.50	0.32	4.26	23.20	100
BDRmB2	662	<90	WD	>150	c	c	<15	<15	>200	1-3	moderate	8.73	0.20	10.93	40.56	-

Table 7.2 Land suitability criteria for Sorghum

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

Table 7.3 Land suitability criteria for Maize

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

Table 7.4 Land suitability criteria for Bajra

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

Table 7.5 Land suitability criteria for Groundnut

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

Table 7.6 Land suitability criteria for Sunflower

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

Table 7.7 Land suitability criteria for Redgram

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

Table 7.8 Land suitability criteria for Bengal gram

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

Table 7.9 Land suitability criteria for Cotton

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

Table 7.10 Land suitability criteria for Chilli

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

Table 7.11 Land suitability criteria for Tomato

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

Table 7.12 Land suitability criteria for Brinjal

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

Table 7.13 Land suitability criteria for Onion

Land use requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable (S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable (N1)**
Climatic regime	Mean temperature in growing season	°C	20-30	30-35	35-40	>40
	Mean max. temp. in growing season	°C				
	Mean min. tempt. in growing season	°C				
	Mean RH in growing season	%				
	Total rainfall	mm				
	Rainfall in growing season	mm				
Land quality	Soil-site characteristic					
Moisture availability	Length of growing period for short duration	Days				
	Length of growing period for long duration					
	AWC	mm/m				
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately /imperfectly	-	Poorly to V poorly drained
	Water logging in growing season	Days				
Nutrient availability	Texture	Class	sl,scl,cl,sc,c (red)	-	c (Black),ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0 7.3-7.8	7.8-8.4	>8.4
	CEC	C mol (p+)/ Kg				
	BS	%				
	CaCO3 in root zone	%		<5	5-10	>10
	OC	%				
Rooting conditions	Effective soil depth	cm	>75	50-75	25-50	<25
	Stoniness	%				
	Coarse fragments	Vol %	<15	15-35	35-60	60-80
Soil toxicity	Salinity (EC saturation extract)	ds/m	<1.0	1.0-2.0	2.0-4.0	<4
	Sodicity (ESP)	%	<5	5-10	10-15	>15
Erosion hazard	Slope	%	<3	3-5	5-10	>10

Table 7.14 Land suitability criteria for Bhendi

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

Table 7.15 Land suitability criteria for Drumstick

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

Table 7.16 Land suitability criteria for Mango

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

Table 7.17 Land suitability criteria for Guava

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

Table 7.18 Land suitability criteria for Sapota

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

Table 7.19 Land suitability criteria for Pomegranate

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

Table 7.20 Land suitability criteria for Musambi

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

Table 7.21 Land suitability criteria for Lime

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

Table 7.22 Land suitability criteria for Amla

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

Table 7.23 Land suitability criteria for Cashew

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

Table 7.24 Land suitability criteria for Jackfruit

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

Table 7.25 Land suitability criteria for Jamun

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

Table 7.26 Land suitability criteria for Custard apple

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

Table 7.27 Land suitability criteria for Tamarind

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

Table 7.28 Land suitability criteria for Mulberry

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

Table 7.29 Land suitability criteria for Marigold

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

Table 7.30 Land suitability criteria for Chrysanthemum

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

Table 7.31 Land suitability criteria for Jasmine (irrigated)

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

7.32 Land suitability criteria for Crossandra

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

7.32 Land Management Units (LMUs)

The 34 soil map units identified in Hasgal-1microwatershed have been grouped into 7 Land Management Units (LMUs) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig.7.31) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The map units that have been grouped into 7 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	443.TSDcB2 445.TSDiB1 446.TSDmA1 447.TSDmB2 473.KLRmA1	Very deep (>150 cm), calcareous to non calcareous sandy clay to clay lowland soils, slope (0-3%), slight to moderate erosion
2	433.BDRmB2	Very deep (>150 cm), black calcareous clay soils, slope (1-3%), moderate erosion
3	105.HDHbB2g1 111.HDHcB2g1 112.HDHcB2g2 122.HDHhB2 123.HDHhB2g1 180.BDGcB1g1 217.BPRbB2g1 219.BPRbB2g2 249.NGPbB1 258.NGPhB1g1	Moderately deep to deep (75-150 cm), red gravelly sandy loam to sandy clay loam soils, slope (1-3%), slight to moderate erosion, gravelly to very gravelly (15-60%)
4	137.GHTcB2 141.GHThB1g1 204.MNLcB2	Moderately deep to deep (75-150 cm), red sandy loam to sandy clay loam soils, slope (1-3%), slight to moderate erosion, gravelly (15-35%)
5	77.MKHcB2g1 78.MKHcB2g2 90.MKHiB2g1	Moderately shallow (50-75 cm), gravelly red loamy to clayey soils, slope (1-3%), moderate erosion, gravelly to very gravelly (15-60%)
6	62.KGHbB2g1 64.KGHcB1 65.KGHcB2g1 66.KGHcB2g2 68.KGHhB2	Moderately shallow (50-75 cm), red loamy soils, slope (1-3%), slight to moderate erosion, gravelly to very gravelly (15-60%)
7	14.KGPcB1g1 17.KGPhB2g1 22.HRVcC2g2R2 25.HRVhB2 26.HRVhB2g1 465.HRVcB2g1 467.KNHiB1g1	Shallow (25-50 cm), red gravelly sandy loam to sandy clay loam soils, slope (1-5%), slight to moderate erosion, gravelly to very gravelly (15-60%), fairly rocky (2-10%)

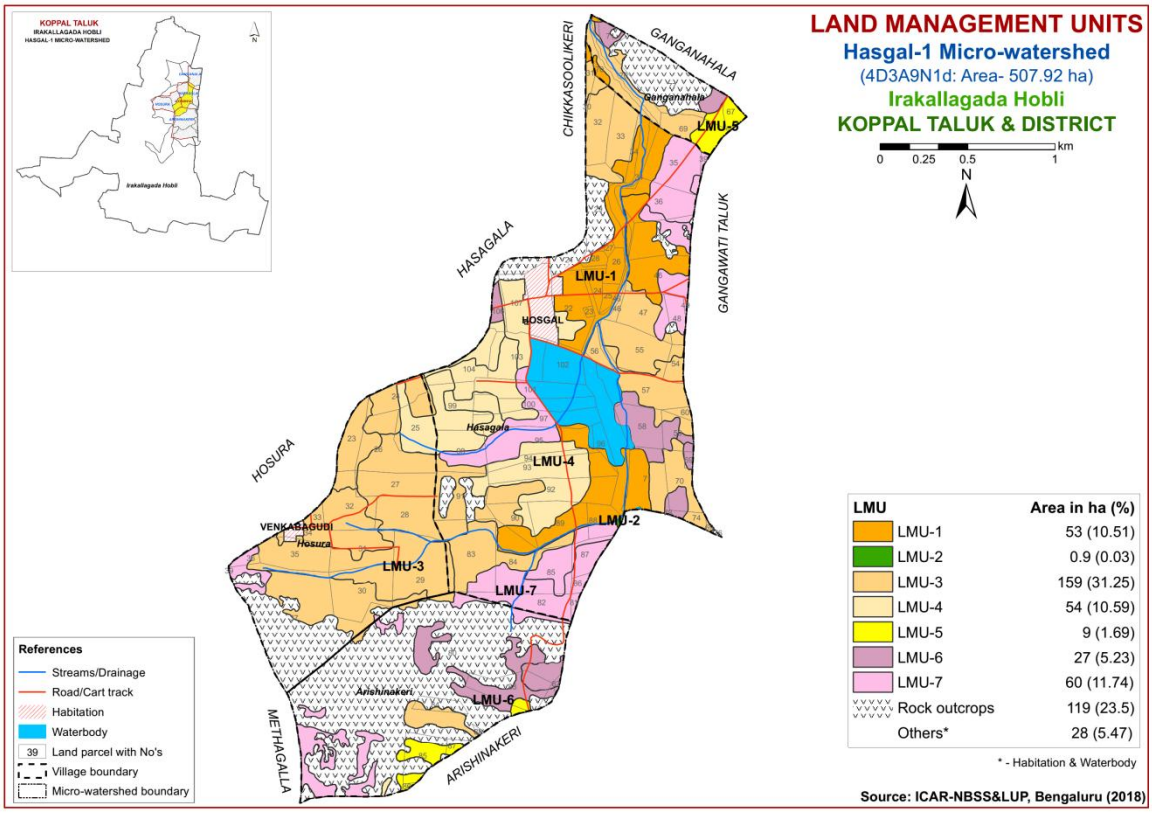


Fig 7.32 Land Management Units map of Hasgal-1microwatershed

7.33 Proposed Crop Plan for Hasgal-1Microwatershed

After assessing the land suitability for the 31 crops, the proposed crop plan has been prepared for the 7 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 31 crops. The resultant proposed crop plan is presented in Table 7.33.

Table 7.33 Proposed Crop Plan for Hasgal-1Microwatershed

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	443.TSDcB2 445.TSDiB1 446.TSDmA1 447.TSDmB2 473.KLRmA1	**Hasagala**:22,23,24,25,26,27, 28,34,37,46,71,88,89	Paddy, Maize, Sugarcane, cotton	**Fruit crops**: Custard Apple, Amla **Vegetable crops**: Brinjal, Tomato, Chillies, Drumstick, Bhendi, Coriander, leafy vegetables **Flower crops**: Marigold, Chrysanthemum, Jasmine	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practices
2	433.BDRmB2	**Hasagala**:71,88	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops**: Sapota, Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables**: Drumstick, Chilli, Coriander, Tomato, Bhendi **Flower crops**: Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
3	105.HDHbB2g1 111.HDHcB2g1 112.HDHcB2g2 122.HDHhB2 123.HDHhB2g1 180.BDGcB1g1 217.BPRbB2g1 219.BPRbB2g2 249.NGPbB1 258.NGPhB1g1	**Ganganahala**:69,70 **Hasagala**:30,31,32,33,47,54, 55,56,57,60,70,74,83,90,91, **Hosura**:23,24,26,27,28,29,30 ,31,32,33,34,35	Sorghum, Groundnut, Red gram, Bajra, Horse gram, Castor	**Fruit crops**: Musambi, Lime, Jamun, Jackfruit Amla, Custard apple, Tamarind **Vegetable crops**: Drumstick, Curry leaves	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
4	137.GHTcB2	**Hasagala**:92,93,94,98,99,103	Maize, Sorghum,	**Fruit crops**: Pomegranate,	Drip irrigation,

LMU	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
	141.GHThB1g1 204.MNLcB2	,104,107 **Hosura**:25	Sunflower, Bajra, Finger millet, Groundnut, Red gram, Cowpea, Field bean, Castor	Guava, Sapota, Jackfruit, Tamarind, Lime, Musambi, Amla, Custard apple **Vegetable crops**: Drumstick, Tomato, Chilli, Brinjal, Onion, Curry leaves **Flower crops**: Marigold, Chrysanthemum, Jasmine	mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
5	77.MKHcB2g1 78.MKHcB2g2 90.MKHiB2g1	**Arishinakeri**:85,86,87 **Ganganahala**:67,68	Sorghum, Groundnut, Bajra, Castor	**Fruit crops**: Lime, Musambi, Amla, Cashew, Custard apple,	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
6	62.KGHbB2g1 64.KGHcB1 65.KGHcB2g1 66.KGHcB2g2 68.KGHhB2	**Arishinakeri**:82,83 **Ganganahala**:71 **Hasagala**:58,59,69,73,106	Sorghum, Groundnut, Bajra, Green gram, Black gram, Cowpea, Horse gram, Castor,	**Fruit crops**: Lime, Musambi, Amla, Custard apple, Cashew **Flower crops**: Marigold, Chrysanthemum	Drip irrigation, Mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
7	14.KGPcB1g1 17.KGPhB2g1 22.HRVcC2g2R2 25.HRVhB2 26.HRVhB2g1 465.HRVcB2g1 467.KNHiB1g1	**Hasagala**:35,36,39,48,49,81, 82,84,85,86,87,95 **Hosura**:36,39	Green gram, Black gram, Horse gram	Agri-Silvi-Pasture: Custard apple, Amla, Hybrid Napier, Styloxanthes hamata, Glyricidia, Styloxanthes scabra	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Hasgal-1Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of HDH 57 ha (11%), BPR 56 ha (11%), TSD 53 ha (10%), BDG 34 ha (7%), MNL 34 ha (7%), HRV 30 ha (6%), KGH 27 ha (5%), KGP 22 ha (4%), GHT 20 ha (4%), NGP 11 ha (2%), MKH 9 ha (2%), KNH 8 ha (2%), KLR <1 ha (<1%) and BDR <1 ha (<1%).
- As per land capability classification, entire area in the microwatershed falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil, wetness and erosion.

- On the basis of soil reaction, an area of about 29 ha (6%) is strongly acid (pH 5.0-5.5), 21 ha (4%) is moderately acid (pH 5.5-6.0), 63 ha (12%) is slightly acid (pH 6.0-6.5), 94 ha (19%) is neutral (pH 6.5-7.3), 57 ha (11%) is slightly alkaline (pH 7.3-7.8), 71 ha (14%) is moderately alkaline (pH 7.8-8.4) and 26 ha (5%) is strongly alkaline (pH 8.4-9.0) in reaction.

Soil Health Management

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

Acid soils

About 113 ha (22%) is under acidic soils (moderately acidic to slightly acidic).

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

Liming materials:

1. $CaCO_3$ (Calcium Carbonate)
2. Dolomite [Ca Mg $(Co_3)_2$]
3. Quick lime (Cao)
4. Slaked lime [Ca $(OH)_2$]

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

Neutral soils

About 94 ha (19%) is under 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.

Alkaline soils

About 154 ha (30%) is under alkaline soils (slightly to strongly alkaline soils).

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area of about 86 ha (17%) is under slight erosion and 274 ha (54%) is under moderate erosion. The areas with moderate erosion need immediate soil and water conservation and other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

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

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

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

- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Hasgal-1Microwatershed.
- **Organic Carbon:** An area of about 90 ha (18%) is medium (0.5-0.75%) and 271 ha (53%) is high (>0.75) in OC content. The areas that are medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 90 ha area where OC is less than 0.75 per cent. For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Available phosphorus is medium (23-57 kg/ha) in the entire area of the microwatershed. The areas with medium phosphorus content additional 25% phosphorus from the RDF to be applied.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 241 ha (47%), medium (145-337 kg/ha) in 88 ha (17%) and high (>337 kg/ha) in 31 ha (6%) area of the microwatershed. The areas with high potassium content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium.
- **Available Sulphur:** Available sulphur is low (<10 ppm) in 111 ha (22%) and medium (10-20 ppm) in 249 ha (49%) area of the microwatershed. Areas with low and medium in available sulphur 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.
- **Available Iron:** Available iron is deficient (<4.5 ppm) in 37 ha (7%) and sufficient (>4.5 ppm) in 323 ha (64%) area of the microwatershed. Application of iron sulphate @ 25 kg/ha for 2-3 years to correct the deficiency.
- **Available Zinc:** Available zinc is deficient (<0.6 ppm) in 191 ha (26%) and sufficient (>0.6 ppm) in 232 ha (32%) area of the microwatershed. Application of zinc sulphate @ 25 kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low in (<0.5ppm) 354 ha (70%) and medium (0.5-1.0 ppm) in 7 ha (1%) area in the microwatershed. The areas with low and medium in boron content need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Available Manganese**: It is sufficient in the entire area of the microwatershed.

- **Available Copper:** It is sufficient in the entire area of the microwatershed.
- **Soil Alkalinity:** An area of about 154 ha (30%) in the microwatershed has soils that are slightly to strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

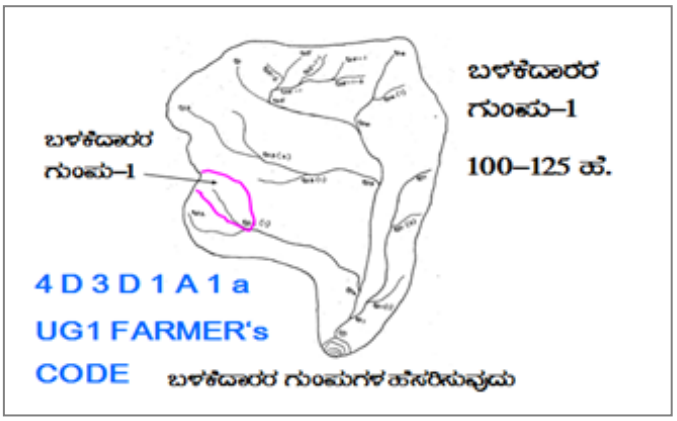
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content,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

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

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

- Soil depth
- Surface soil texture
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability maps
- Rainfall map
- Hydrology
- Water Resources
- Socio-economic data
- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)



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

Steps for Survey and Preparation of Treatment Plan

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

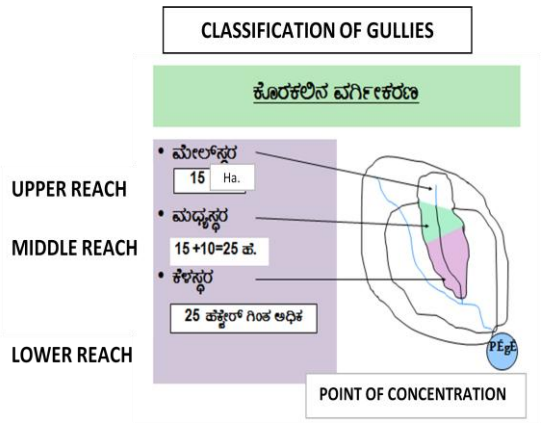
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

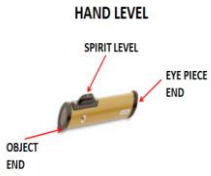
9.1.1 Arable Land Treatment

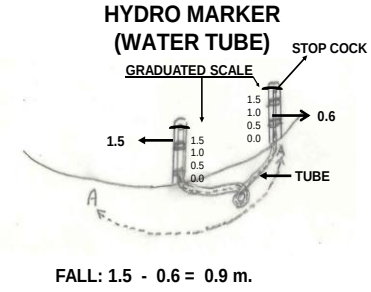
A. BUNDING

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

Measurement of Land Slope

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





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

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

Note: i) The above intervals are maximum.

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

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

Section of the Bund

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

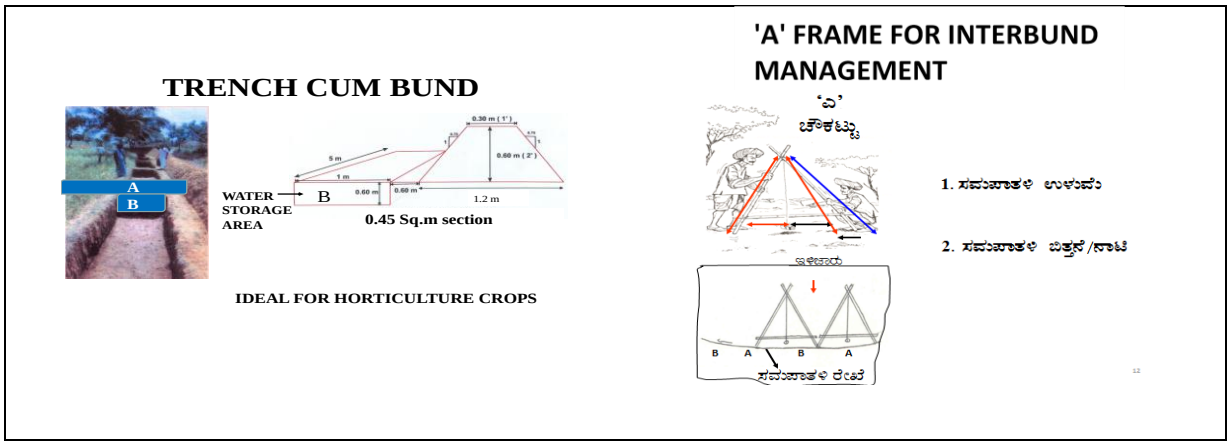
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

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

B. Waterways

a) Existing waterways are marked on the cadastral map (1:7920 scale) and their dimensions are recorded.

b) Considering the contour plan of the MWS, additional waterways/ modernization of the existing ones can be thought of.

c) The design details are given in the Manual.

C. Farm Ponds

Waterways and the catchment area will give an indication on the size of the Farm Pond. Location of the pond can be decided based on the contour plan/ field condition and farmers' need/desire.

D. Diversion Channel

Existing EPT/ CPT are marked on the cadastral map. Looking to the need, these can be modernized or fresh diversion channel can be proposed and runoff from this can be stored in *Gokatte*/ Recharge Ponds.

9.1.2 Non-Arable Land Treatment

Depending on the gravelliness and crops preferred by the farmers, the concerned authorities can decide appropriate treatment plan. The recommended treatments may be Contour Trench, Staggered Trench, Crescent Bund, Boulder Bund or Pebble Bund.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainge lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented .
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. A maximum area of about 307 ha (60%) needs trench cum bunding. An area of about 43 ha (8%) needs graded bunding. 11 ha (2%) area needs strengthening of existing bunds/bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalized in a participatory approach.

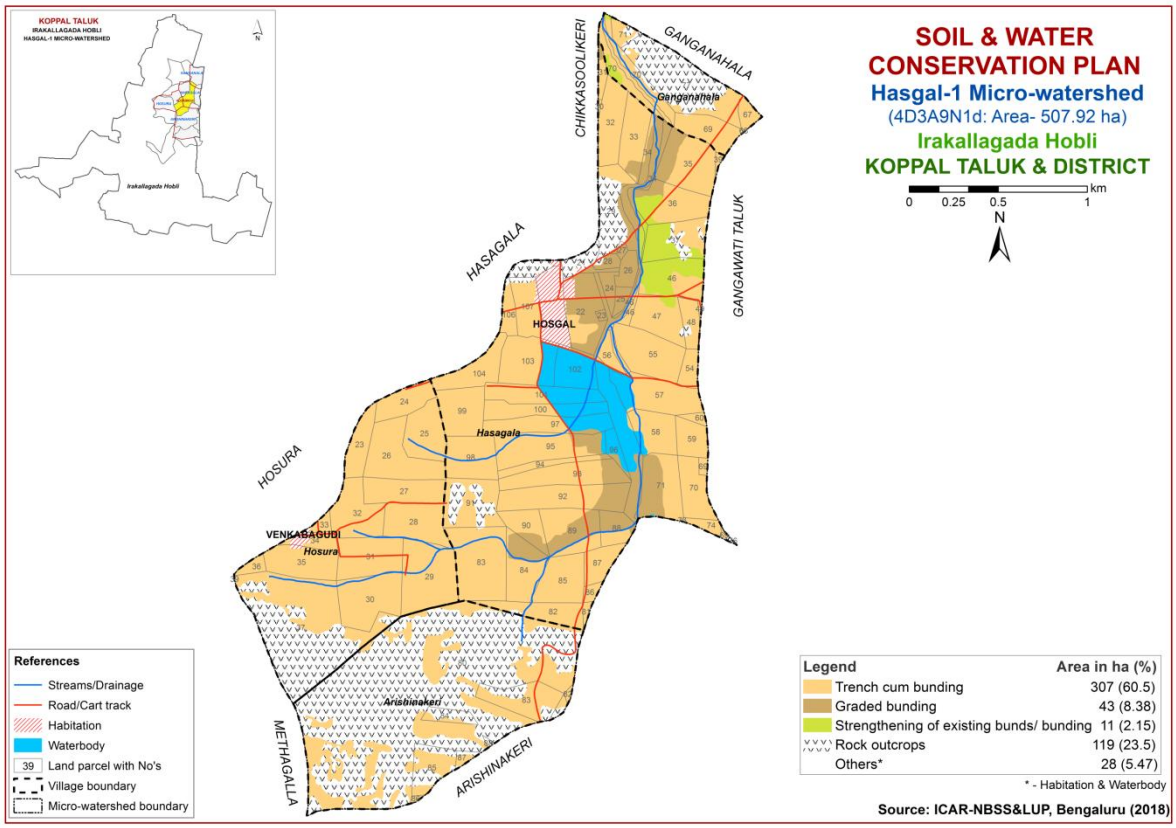


Fig. 9.1 Soil and Water Conservation Plan map of Hasgal-1Microwatershed

9.3 Greening of Microwatershed

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

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

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

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

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Appendix-I

Hasgal-1 Microwatershed

Soil Phase Information

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Hasagala	1	1.81	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available	Ro	Ro
Hasagala	21	2.3	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available	Ro	Ro
Hasagala	22	7.28	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Paddy (Rg+Pd)	Not Available	IIIew	Graded bunding
Hasagala	23	0.28	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available	Not Available	IIIew	Graded bunding
Hasagala	24	1.3	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIew	Graded bunding
Hasagala	25	0.97	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIew	Graded bunding
Hasagala	26	1.76	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIew	Graded bunding
Hasagala	27	0.36	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available	Not Available	IIIew	Graded bunding
Hasagala	28	1.02	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIew	Graded bunding
Hasagala	29	7.24	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Not Available	Ro	Ro
Hasagala	30	0.12	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hasagala	31	1.06	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIIes	TCB
Hasagala	32	5.46	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hasagala	33	5.21	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hasagala	34	2.93	TSDmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Waterbody	Not Available	IIIew	Graded bunding
Hasagala	35	7.98	HRVhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	1 Borewell	IIIes	TCB
Hasagala	36	6.84	HRVhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Groundnut (Mz+Gn)	1 Borewell	IIIes	TCB
Hasagala	37	6.23	TSDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Redgram+Cultivated Fallow Land (Rg+CFL)	Not Available	IIw	Graded bunding
Hasagala	39	0.3	HRVhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hasagala	46	7.62	TSDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Redgram (Rg)	Not Available	IIw	Graded bunding
Hasagala	47	5.59	HDHhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIes	TCB
Hasagala	48	2.32	KNHiB1g1	LMU-7	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIIs	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Hasagala	49	0.15	KNHiB1g1	LMU-7	Shallow (25-50 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Hasagala	54	1.79	HDHcB2g2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	55	7.64	HDHhB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	Not Available	IIes	TCB
Hasagala	56	1.43	HDHcB2g2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow Land (CFL)	Not Available	IIes	TCB
Hasagala	57	7.77	HDHcB2g2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cultivated Fallow Land (Rg+CFL)	Not Available	IIes	TCB
Hasagala	58	4.98	KGHhB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	59	3.11	KGHhB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Jowar (Rg+Jw)	Not Available	IIes	TCB
Hasagala	60	0.61	HDHcB2g2	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cultivated Fallow Land (CFL)	Not Available	IIes	TCB
Hasagala	69	0.58	KGHcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	70	4.54	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Horsegram (Rg+Hg)	Not Available	IIIes	TCB
Hasagala	71	7.09	TSDiB1	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Cultivated Fallow Land (Bj+CFL)	Not Available	IIw	Graded bunding
Hasagala	73	0.02	KGHcB1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	TCB
Hasagala	74	1.07	BPRbB2g2	LMU-3	Deep (100-150 cm)	Loamy sand	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram (Hg)	Not Available	IIIes	TCB
Hasagala	76	0.07	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Redgram+Horsegram+Ro (Rg+Hg+Ro)	Not Available	Ro	Ro
Hasagala	81	0.42	KGPcB1g1	LMU-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Groundnut (Mz+Gn)	Not Available	IIIs	TCB
Hasagala	82	4.66	KGPcB1g1	LMU-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIIs	TCB
Hasagala	83	10.76	BDGcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIIs	TCB
Hasagala	84	6.11	KGPcB1g1	LMU-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Hasagala	85	5.83	KGPhB2g1	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIIes	TCB
Hasagala	86	0.73	KGPcB1g1	LMU-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIIs	TCB
Hasagala	87	2.96	KGPcB1g1	LMU-7	Shallow (25-50 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Chilli (Rg+Ch)	Not Available	IIIs	TCB
Hasagala	88	2.87	TSDcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIew	Graded bunding
Hasagala	89	7.08	TSDcB2	LMU-1	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cultivated Fallow Land (Rg+CFL)	1 Borewell	IIew	Graded bunding
Hasagala	90	3.4	HDHcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Hasagala	91	7.49	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Ro (Mz+Ro)	Not Available	IIIes	TCB
Hasagala	92	8.74	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Borewell	IIes	TCB
Hasagala	93	7.06	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Chilli (Rg+Ch)	2 Borewell	IIes	TCB
Hasagala	94	1.97	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	95	8.51	HRVhB2	LMU-7	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Groundnut (Rg+Gn)	1 Borewell	IIIes	TCB
Hasagala	96	1.45	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Hasagala	97	6.02	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	1 Borewell	Others	Others
Hasagala	98	6.08	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	99	5.84	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hasagala	100	4.88	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram+Tank (Rg+Ta)	Not Available	Others	Others
Hasagala	101	5.59	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram+Tank (Rg+Ta)	1 Borewell	Others	Others
Hasagala	102	4.42	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Hasagala	103	7.24	GHTcB2	LMU-4	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	TCB
Hasagala	104	4.9	GHTcB2	LMU-4	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	1 Borewell	IIes	TCB
Hasagala	106	1.91	KGHbB2g1	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Hasagala	107	4.21	GHTcB2	LMU-4	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Arishinakeri	80	96.53	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	2 Borewell	Ro	Ro
Arishinakeri	82	0.23	KGHcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Arishinakeri	83	5.99	KGHbB2g1	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Arishinakeri	84	1.79	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Redgram (Rg)	Not Available	Ro	Ro
Arishinakeri	85	4.58	MKHcB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram+Groundnut (Hg+Gn)	Not Available	IIIes	TCB
Arishinakeri	86	0.18	MKHcB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Arishinakeri	87	0.69	MKHcB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Horsegram (Hg)	Not Available	IIIes	TCB
Arishinakeri	88	0.16	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Redgram (Rg)	Not Available	Ro	Ro
Ganganahala	67	1.32	MKHcB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	1 Farm Pond,1 Borewell	IIIes	TCB

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	Wells	Land Capability	Conservation Plan
Ganganahalla	68	0.02	MKHcB2g2	LMU-5	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Ganganahalla	69	4.51	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Currently fallow + Fallow land + Redgram(Cf+Fl+Rg)	Not Available	IIIes	TCB
Ganganahalla	70	5.41	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Ganganahalla	71	1.42	KGHcB2g2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Ganganahalla	77	13.85	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Fallow Land (Fl)	Not Available	Ro	Ro
Hosura	23	3.7	HDHbB2g1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hosura	24	4	HDHbB2g1	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	TCB
Hosura	25	5.76	MNLcB2	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Hosura	26	8.37	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hosura	27	5.52	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hosura	28	6.45	BPRbB2g1	LMU-3	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hosura	29	10.08	BDGcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Groundnut+Paddy+Redgram (Gn+Pd+Rg)	Not Available	IIIs	TCB
Hosura	30	8.19	HDHhB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	TCB
Hosura	31	7.07	BDGcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram+Watermelon (Mz+Rg+Wm)	Not Available	IIIs	TCB
Hosura	32	6.68	NGPbB1	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Hosura	33	0.84	NGPbB1	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram+Groundnut (Rg+Gn)	Not Available	IIIs	TCB
Hosura	34	2.15	NGPbB1	LMU-3	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIIs	TCB
Hosura	35	6.01	BDGcB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	TCB
Hosura	36	1.01	HRVcC2g2R2	LMU-7	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Hosura	37	28.39	RO	RO	RO	RO	RO	RO	RO	RO	Redgram (Rg)	Not Available	RO	RO
Hosura	39	0	HRVcC2g2R2	LMU-7	Shallow (25-50 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Gently sloping (3-5%)	Moderate	Maize+Redgram+RO (Mz+Rg+Rc)	Not Available	IIIes	TCB

Appendix II

Hasgal-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
Hasagala	1	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	21	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	22	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)
Hasagala	23	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	24	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	25	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	26	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	27	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	28	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	29	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	30	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	31	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	33	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)	Deficient (< 0.6 ppm)
Hasagala	34	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	35	Slightly acid (pH 6.0 – 6.5)	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)
Hasagala	36	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	37	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	39	Slightly acid (pH 6.0 – 6.5)	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)
Hasagala	46	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	47	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	48	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	49	Neutral (pH 6.5 –	Non saline	Medium (0.5	Medium (23	Low (<145	Low (<10	Low (< 0.5	Sufficient	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		7.3)	(<2 dsm)	– 0.75 %)	– 57 kg/ha)	kg/ha)	ppm)	ppm)	(>4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Hasagala	54	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	55	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)	Deficient (< 0.6 ppm)
Hasagala	56	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	57	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)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	58	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)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	59	Slightly acid (pH 6.0 – 6.5)	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)	Deficient (< 0.6 ppm)
Hasagala	60	Slightly acid (pH 6.0 – 6.5)	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)	Deficient (< 0.6 ppm)
Hasagala	69	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)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	70	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	71	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	73	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	74	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	76	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	81	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	82	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	83	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	84	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	85	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	86	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	87	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	88	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	89	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	90	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey NO	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Hasagala	91	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)
Hasagala	92	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	93	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	94	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)
Hasagala	95	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)
Hasagala	96	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	97	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	98	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)
Hasagala	99	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	100	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	101	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	102	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	103	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)
Hasagala	104	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	106	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hasagala	107	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	80	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Arishinakeri	82	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	83	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	84	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Arishinakeri	85	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	86	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	87	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Arishinakeri	88	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Ganganahala	67	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	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
Ganganahala	68	Slightly acid (pH 6.0 – 6.5)	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)
Ganganahala	69	Slightly acid (pH 6.0 – 6.5)	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)
Ganganahala	70	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Ganganahala	71	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Ganganahala	77	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hosura	23	Slightly acid (pH 6.0 – 6.5)	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)
Hosura	24	Neutral (pH 6.5 – 7.3)	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)
Hosura	25	Neutral (pH 6.5 – 7.3)	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)
Hosura	26	Slightly acid (pH 6.0 – 6.5)	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)
Hosura	27	Slightly acid (pH 6.0 – 6.5)	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)
Hosura	28	Slightly acid (pH 6.0 – 6.5)	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)
Hosura	29	Slightly acid (pH 6.0 – 6.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	30	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	31	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	32	Strongly acid (pH 5.0 – 5.5)	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)
Hosura	33	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	34	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	35	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	36	Strongly acid (pH 5.0 – 5.5)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hosura	37	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Hosura	39	Moderately acid (pH 5.5 – 6.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Ro-RO

Appendix III

Hasgal-1 Microwatershed

Soil Suitability Information

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Hasagala	1	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	21	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	22	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	23	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	24	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	25	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	26	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	27	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	28	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	29	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	30	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	31	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	32	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	33	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	34	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	35	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Hasagala	36	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Hasagala	37	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	39	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Hasagala	46	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	47	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	48	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	N1r
Hasagala	49	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	N1r	N1r	N1r	S3r	S3r	S3r	S3r	S3r	S3r	N1r	S3r	S3r	S3r	S3r	S3r	N1r	N1r
Hasagala	54	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	55	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	56	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	57	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Hasagala	58	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Hasagala	59	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Hasagala	60	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	69	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Hasagala	70	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	71	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	73	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Hasagala	74	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	76	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hasagala	81	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	82	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	83	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Hasagala	84	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	85	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	86	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	87	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3r	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3r	S3rg	S3r	S3rg	N1r	N1r
Hasagala	88	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	89	S3tw	S2t	S3tw	S2w	S3tw	S2w	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw	S2tw	S3tw	S2tw	S2tw
Hasagala	90	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hasagala	91	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hasagala	92	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hasagala	93	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hasagala	94	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hasagala	95	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Hasagala	96	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	97	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	98	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hasagala	99	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hasagala	100	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	101	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Hasagala	102	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Hasagala	103	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S1	S2g	S2g	S2g	S2g	S2r	S1	S1	S2g	S1	S2g	S2rg	S2r
Hasagala	104	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S1	S2g	S2g	S2g	S2g	S2r	S1	S1	S2g	S1	S2g	S2rg	S2r
Hasagala	106	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Hasagala	107	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S1	S2g	S2g	S2g	S2g	S2r	S1	S1	S2g	S1	S2g	S2rg	S2r
Arishinakeri	80	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Arishinakeri	82	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Arishinakeri	83	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2rt	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S3r
Arishinakeri	84	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Arishinakeri	85	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Arishinakeri	86	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Arishinakeri	87	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3g	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg
Arishinakeri	88	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Ganganahala	67	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Ganganahala	68	N1r	S3rg	S3rg	S3rg	S3rg	S3g	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3g	S3g	S3rg	S3rg
Ganganahala	69	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Ganganahala	70	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Ganganahala	71	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S3g	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2r	S3g	S3g	S3g	S3g	S3rg	S2rg	S2r	S3g	S2r	S3g	S3rg	S3rg
Ganganahala	77	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro	Ro
Hosura	23	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hosura	24	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hosura	25	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	N1z	S2r	S1	S1	S2z	S1	S1	S1	S1	S1	S1	S2z	S1	S2z	S1	S1	S1
Hosura	26	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hosura	27	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hosura	28	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2gt
Hosura	29	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Hosura	30	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g
Hosura	31	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Hosura	32	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g
Hosura	33	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Onion	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Brinjal	Jasmine	Bhendi	Crossandra	Drumstick	Mulberry
Hosura	34	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S2g	S2g
Hosura	35	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S2tg	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S3g	S2tg	S3g	S3g	S2g
Hosura	36	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg
Hosura	37	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO	RO
Hosura	39	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	N1rg	N1rg	S3rg	N1rg	S3rg	N1rg	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	N1rg

Ro-Rock outcrops

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 125 (53.42%) men and 109 (46.58%) women among the sampled households.*
- *The average family size of landless farmers' was 4.1, marginal farmers' was 4, small farmers' was 5.06, semi medium farmers' was 4.4 and medium farmers' was 6.4.*
- *The data indicated that, 52 (22.22%) people were in 0-15 years of age, 96 (41.03%) were in 16-35 years of age, 67 (28.63%) were in 36-60 years of age and 19 (8.12 %) were above 61 years of age.*
- *The results indicated that Hasgal-2 had 26.92 per cent illiterates, 0.85 per cent functional literates, 34.62 per cent of them had primary school education, 10.68 per cent of them had middle school education, 14.53 per cent of them had high school education, 6.41 per cent of them had PUC education, 0.85 per cent did diploma, 0.43 per cent of them did ITI, 2.14 per cent of them had degree education and 0.43 per cent were in masters.*
- *The results indicate that, 76 per cent of households practicing agriculture, 4 per cent of the households were agricultural labourers, 20 per cent were general labourers, 2 per cent of them were housewives and 2 per cent of them were children.*
- *The results indicate that agriculture was the major occupation for 48.72 per cent of the household members, 8.12 per cent were agricultural laborers, 12.39 per cent were general labour, 2.56 per cent were in private, 23.50 per cent were students, 1.71 per cent were housewives and 2.14 per cent were children.*
- *The results show that 100 per cent of the population in the micro watershed has not participated in any local institutions.*
- *The results indicate that 14 per cent of the households possess thatched house, 74 per cent of the households possess Katcha house 4 per cent of them possess pucca house and 8 per cent of them possess semi pucca house.*
- *The results show that 84 per cent of the households possess TV, 56 per cent of the households possess Mixer grinder, 46 per cent of the households possess bicycle, 38 per cent of the households possess motor cycle, 4 per cent of them possess landline and 88 per cent of the households possess mobile phones.*
- *The results show that the average value of television was Rs.7571, mixer grinder was Rs.1846, bicycle was Rs. 3347, motor cycle was Rs.37315, landline phone was Rs.3333 and mobile phone was Rs.1653.*
- *About 20 per cent of the households possess bullock cart, 34 per cent of them possess plough, 2 per cent of them possess tractor, 22 per cent of them possess sprayer, 2 per cent of them possess sprinkler, 80 per cent of them possess weeder, 4 per cent of them possess harvester, 2 per cent of them possess thresher, 10 per cent of them possess chaff cutter and 2 per cent of them possess JCB/Hitachi.*

- *The results show that the average value of bullock cart was Rs.21200, plough was Rs.1016, the average value of tractor was Rs.300000, the average value of sprayer was Rs.2844, the average value of sprinkler was Rs. 3300, the average value of harvester was Rs.6942, the average value of thresher was Rs.50000, the average value of chaff cutter was Rs.2800, and the average value of weeder was Rs.77.*
- *The results indicate that, 36 per cent of the households possess bullocks, 16 per cent of the households possess local cow, 6 per cent of the households possess buffalo, 4 per cent of them possess sheep, 2 per cent of the households possess goat and 2 per cent of them possess poultry birds.*
- *The results indicate that, average own labour men available in the micro watershed was 8.85, average own labour (women) available was 5.55, average hired labour (men) available was 11.40 and average hired labour (women) available was 10.79.*
- *The results indicate that, 80 per cent of the households opined that the hired labour was adequate.*
- *The results indicate that, households of the Hasgal-2 micro watershed possess 42.85 ha (64.97%) of dry land and 23.11 ha (35.03%) of irrigated land. Marginal farmers possess 4.80 ha (84.35%) of dry land and 0.89 ha (15.65%). Small farmers possess 18.34 ha (91.39%) of dry land and 1.73 ha (8.61%) of irrigated land. Semi medium farmers possess 8.38 ha (37.95%) of dry land and 13.70 ha (62.05%) of irrigated land. Medium farmers possess 11.33 ha (62.53%) of dry land and 6.79 ha (37.47%) of the farmers possess irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 293003 and average value of irrigated land was Rs. 514763. In case of marginal famers, the average land value was Rs. 470674 for dry land and Rs.1347272 for irrigated land. In case of small famers, the average land value was Rs. 414210 for dry land and Rs. 925526 for irrigated land. In case of semi medium famers, the average land value was Rs. 155120 for dry land and Rs. 474298 for irrigated land. In case of medium famers, the average land value was Rs. 123500 for dry land and Rs.382717 for irrigated land.*
- *The results indicate that, there were 14 functioning and 2 de-functioning bore wells in the micro watershed.*
- *The results indicate that, there was 1 functioning open well in the micro watershed.*
- *The results indicate that, bore well was the major irrigation source in the micro water shed for 28 per cent of the farmers, and open well was the source of irrigation for 2 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 24.14 meters and the depth of open well was found to be 1.83 meters.*

- *The results indicate that, marginal, small, semi medium and medium farmers had irrigated area of 0.81 ha, 3.72 ha, 13.91 ha and 5.51 ha respectively.*
- *The results indicate that, farmers have grown bajra (11.62 ha), cotton (1.78 ha), groundnut (5.15 ha), horsegram (1.21 ha), maize (21.74 ha), navane (1.70 ha), paddy (2.83 ha), redgram (1.62 ha), sorghum (2.18 ha), tomato (0.89 ha), and watermelon (2.91 ha).*
- *Marginal farmers have grown bajra, maize, watermelon and groundnut. Small farmers have grown bajra, cotton, groundnut, maize, navane, paddy and watermelon. Semi medium farmers have grown bajra, cotton, maize, paddy, sorghum, tomato, watermelon and groundnut. Medium farmers have grown bajra, groundnut, horsegram, paddy, redgram sorghum and maize.*
- *The results indicate that, the cropping intensity in Hasgal-2 micro watershed was found to be 98.20 per cent. In case of marginal and semi medium farmers it was 100 per cent, in case of small farmers it was 101.67 per cent, and medium farmers had cropping intensity of 87.23 per cent.*
- *The results indicate that, 62 per cent of the households have bank account and 40 per cent of the households have savings.*
- *The results indicate that, 44 per cent of the households have availed credit from different sources.*
- *The results indicate that, 31.82 per cent of the households availed loan from commercial bank, 13.64 per cent availed loan from cooperative bank, 22.73 per cent availed loan from grameena bank, 13.64 per cent availed loan from money lenders and 36.36 per cent of the households obtained loan from SHGs/CBOs.*
- *The results indicate that, marginal, small, semi medium and medium farmers have availed Rs.19285, Rs.90714, Rs.104285, and Rs.50000 respectively.*
- *The results indicate that, 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production.*
- *The results indicate that, the main purpose of borrowing credit from private sources was agricultural production which accounted for 63.64 per cent of those who borrowed credit. Another 18.18 per cent of the households borrowed for social functions, 9.09 per cent of the households borrowed for the purpose of construction of house or cattle shed and 9.09 per cent borrowed for household consumption.*
- *The results indicated that 80 per cent of the households did not repay their loan borrowed from institutional sources, 13.33 per cent of the households partially paid and 6.67 per cent of the households fully repaid their loan.*
- *Results indicated that 81.82 per cent of the households partially paid their loan borrowed from private sources, 9.09 per cent of the households did not repay their loan and 9.09 per cent of the households fully paid their loans.*

- *The results indicate that, around 46.67 per cent of the households opined that the rate of interest was higher in institutional sources; another 40 per cent opined that the loan amount helped to perform timely agricultural operations.*
- *The results indicate that, around 9.09 per cent of the households opined that credit was easily accessible, 18.18 per cent of the households opined that the credit helped to perform timely agricultural operations and 27.27 per cent opined that the rate of interest was high in non institutional source of credits.*
- *The results indicate that, the total cost of cultivation for sorghum was Rs. 37771.28. The gross income realized by the farmers was Rs. 70523.07. The net income from Sorghum cultivation was Rs. 32751.80, thus the benefit cost ratio was found to be 1:1.87.*
- *The total cost of cultivation for groundnut was Rs. 46621.42. The gross income realized by the farmers was Rs. 67059.85. The net income from groundnut cultivation was Rs. 20438.43. Thus the benefit cost ratio was found to be 1:1.44.*
- *The total cost of cultivation for navane was Rs. 16260.02. The gross income realized by the farmers was Rs. 23523.81. The net income from navane cultivation was Rs. 7263.79. Thus the benefit cost ratio was found to be 1:1.45.*
- *The total cost of cultivation for maize was Rs. 32823.70. The gross income realized by the farmers was Rs. 38634.10. The net income from maize cultivation was Rs. 5810.40. Thus the benefit cost ratio was found to be 1:1.18.*
- *The total cost of cultivation for bajra was Rs. 22880. The gross income realized by the farmers was Rs. 20415.02. The net income from bajra cultivation was Rs. -2464.98. Thus the benefit cost ratio was found to be 1:0.89.*
- *The total cost of cultivation for redgram was Rs. 18070.78. The gross income realized by the farmers was Rs. 46930. The net income from redgram cultivation was Rs. 28859.22. Thus the benefit cost ratio was found to be 1:2.6.*
- *The total cost of cultivation for horsegram was Rs. 19107.60. The gross income realized by the farmers was Rs. 29640. The net income from horsegram cultivation was Rs. 10532.40. Thus the benefit cost ratio was found to be 1:1.55.*
- *The total cost of cultivation for watermelon was Rs. 53952.66. The gross income realized by the farmers was Rs. 1264061.94. The net income from watermelon cultivation was Rs. 1210109.29. Thus the benefit cost ratio was found to be 1:23.43.*
- *The total cost of cultivation for cotton was Rs. 29826.92. The gross income realized by the farmers was Rs. 84288.75. The net income from cotton cultivation was Rs. 54461.83. Thus the benefit cost ratio was found to be 1:2.83.*
- *the total cost of cultivation for paddy was Rs. 41184.13. The gross income realized by the farmers was Rs. 71007.93. The net income from paddy cultivation was Rs. 29823.79. Thus the benefit cost ratio was found to be 1:1.72.*

- *the total cost of cultivation for tomato was Rs. 24868.79. The gross income realized by the farmers was Rs. 158304.54. The net income from tomato cultivation was Rs. 133435.75. Thus the benefit cost ratio was found to be 1:6.37.*
- *The results indicate that, 40 per cent of the households opined that dry fodder was adequate and 34 per cent of the households opined that green fodder was adequate.*
- *The results indicate that the average annual gross income was Rs. 88,100 for landless farmers, for marginal farmers it was Rs. 113,218.75, for small farmers it was Rs. 107,086.67, for semi medium farmers it was Rs. 167,966.67, and for medium farmers it was Rs. 134,600.*
- *The results indicate that the average annual expenditure is Rs. 7,539.89. For landless households it was Rs. 7,100, for marginal farmers it was Rs. 7,000, for small farmers it was Rs. 4,611.85, for semi medium farmers it was Rs. 8,368.06, and for medium farmers it was Rs. 16,080.*
- *The results indicate that, sampled households have grown 19 coconuts and 27 mangoes in their fields. They have also grown 5 coconut and 1 mango tree in their backyard.*
- *The results indicate that, households have planted 23 teak trees, 79 neem trees, 4 tamarind trees, 2 acacia trees and 1 peepul tree in their field.*
- *The results indicate that, the average additional investment capacity with the households for land development was Rs. 1,280, for irrigation facility Rs. 260, for improved crop production Rs. 720 and for improved livestock management Rs. 420.*
- *The results indicate that, loan from bank was the source of additional investment capacity for 16 per cent of the households for land development, 4 per cent for irrigation facility, 12 per cent for improved crop production and 14 per cent for improved livestock management. Soft loan was the source of funds for 2 per cent of the households for improved crop production.*
- *The results indicated that, bajra, cotton, horsegram, maize, navane, paddy, redgram, tomato and watermelon were sold to the extent of 100 per cent. Groundnut was sold to the extent of 77.37 per cent.*
- *The results indicated that, about 30 per cent of the famers have sold their produce in regulated markets, 38 per cent have sold their produce to local/village merchants, 24 per cent of the farmers have sold through agents/traders and 8 per cent of the farmers have sold their produce in cooperative marketing society.*
- *The results indicated that, 84 per cent of the households have used tractor as a mode of transportation for their agricultural produce, 2 per cent have used truck and 12 per cent have used cart as a mode of transportation.*
- *The results indicated that, 20 per cent of the households have experienced soil and water erosion problems in the farm i.e., 12.50 per cent of marginal farmers, 33.33*

per cent of small farmers, 8.33 per cent of semi medium farmers and 60 per cent of medium farmers have experienced soil and water erosion problems.

- *The results indicated that, 58 per cent have shown interest in soil test.*
- *The results indicated that, 96 per cent used fire wood and 8 per cent of the households used LPG.*
- *Piped supply was the major source of drinking water for 86 per cent of the households and bore well was the source of drinking water for 12 per cent of the households.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 42 per cent of the households possess sanitary toilet i.e. 50 per cent of the landless, 50 per cent of the marginal, 26.67 per cent of the small, 25 per cent of the semi medium and 100 per cent of the medium farmers.*
- *The results indicated that, 96 per cent of the sampled households possessed BPL card, 2 per cent of the sampled households possessed APL card and 2 per cent did not possess PDS card.*
- *The results indicated that, 54 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 96 per cent of the households, pulses were adequate for 56 per cent, oilseeds were adequate for 16 per cent, vegetables were adequate for 56 per cent, fruits were adequate for 52 per cent, milk was adequate for 90 per cent, eggs were adequate for 84 per cent and meat was adequate for 66 per cent of the households.*
- *The results indicated that, cereals were inadequate for 4 per cent, pulses were inadequate for 46 per cent, oilseeds were inadequate for 80 per cent, vegetables were inadequate for 42 per cent, fruits were inadequate for 40 per cent, milk was inadequate for 6 per cent, eggs were inadequate for 6 per cent and meat was inadequate for 24 per cent of the households.*
- *The results indicated that, lower fertility status of the soil was the constraint experienced by 58 per cent of the households, wild animal menace on farm field (72%), frequent incidence of pest and diseases (48%), inadequacy of irrigation water (42%), high cost of fertilizers and plant protection chemicals (50%), high rate of interest on credit (54%), low price for the agricultural commodities (52%), lack of marketing facilities in the area (50%), lack of transport for safe transport of the agricultural produce to the market (56%), less rainfall (20%), inadequate extension services (44%), and source of agri-technology information (newspaper/TV/mobile) (12%).*

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

Description of the study area

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

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

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

Description of the micro watershed

Hasgal-2 micro-watershed (Ganganal sub-watershed, Koppal Taluk and District) is located at North latitude $15^0$32’ 35.044’’ to 15^0 31’ 0.822’’ and East longitude 76^0 17’ 51.92’’ to 76^0 15’ 44.719’’ covering an area of 491.86 ha and spread across Chikkasoolikeri, Hiresoolikeri, Hosuru and Hasagal villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 50 households located in the micro watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Hasgal-2 micro watershed is presented in Table 1 and it indicated that 50 farmers were sampled in Hasgal-2 micro watershed among them 10 (20%) were landless, 8 (16%) were marginal farmers, 15 (30%) were small farmers, 12 (24%) were semi medium farmers, and 5 (10%) were medium farmers.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	10	20.00	8	16.00	15	30.00	12	24.00	5	10.00	50	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Hasgal-2 micro watershed is presented in Table 2. The data indicated that there were 125 (53.42%) men and 109 (46.58%) women among the sampled households. The average family size of landless farmers' was 4.1, marginal farmers' was 4, small farmers' was 5.06, semi medium farmers' was 4.4 and medium farmers' was 6.4.

Table 2: Population characteristics of Hasgal-2 micro-watershed

Sl.No.	Particulars	LL (41)		MF (32)		SF (76)		SMF (53)		MDF (32)		All (234)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Male	21	51.22	17	53.13	43	56.58	27	50.94	17	53.13	125	53.42
2	Female	20	48.78	15	46.88	33	43.42	26	49.06	15	46.88	109	46.58
Total		41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00
Average		4.1		4		5.06		4.4		6.4		4.6	

Age wise classification of population: The age wise classification of household members in Hasgal-2 micro watershed is presented in Table 3. The data indicated that, 52 (22.22%) people were in 0-15 years of age, 96 (41.03%) were in 16-35 years of age, 67 (28.63%) were in 36-60 years of age and 19 (8.12 %) were above 61 years of age.

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

Sl.No.	Particulars	LL (41)		MF (32)		SF (76)		SMF (53)		MDF (32)		All (234)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	8	19.51	6	18.75	16	21.05	16	30.19	6	18.75	52	22.22
2	16-35 years of age	16	39.02	13	40.63	37	48.68	15	28.30	15	46.88	96	41.03
3	36-60 years of age	15	36.59	9	28.13	15	19.74	20	37.74	8	25.00	67	28.63
4	> 61 years	2	4.88	4	12.50	8	10.53	2	3.77	3	9.38	19	8.12
Total		41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00

Education level of household members: Education level of household members in Hasgal-2 micro watershed is presented in Table 4. The results indicated that Hasgal-2 had 26.92 per cent illiterates, 0.85 per cent functional literates, 34.62 per cent of them had primary school education, 10.68 per cent of them had middle school education, 14.53 per cent of them had high school education, 6.41 per cent of them had PUC education, 0.85

per cent did diploma, 0.43 per cent of them did ITI, 2.14 per cent of them had degree education and 0.43 per cent were in masters.

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

Sl.No.	Particulars	LL (41)		MF (32)		SF (76)		SMF (53)		MDF (32)		All (234)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	9	21.95	10	31.25	19	25.00	17	32.08	8	25.00	63	26.92
2	Functional Literate	0	0.00	0	0.00	0	0.00	1	1.89	1	3.13	2	0.85
3	Primary School	21	51.22	10	31.25	24	31.58	22	41.51	4	12.50	81	34.62
4	Middle School	4	9.76	4	12.50	10	13.16	0	0.00	7	21.88	25	10.68
5	High School	4	9.76	3	9.38	14	18.42	5	9.43	8	25.00	34	14.53
6	PUC	1	2.44	4	12.50	6	7.89	2	3.77	2	6.25	15	6.41
7	Diploma	1	2.44	0	0.00	0	0.00	1	1.89	0	0.00	2	0.85
8	ITI	0	0.00	0	0.00	1	1.32	0	0.00	0	0.00	1	0.43
9	Degree	1	2.44	1	3.13	1	1.32	1	1.89	1	3.13	5	2.14
10	Masters	0	0.00	0	0.00	0	0.00	0	0.00	1	3.13	1	0.43
12	Others	0	0.00	0	0.00	1	1.32	4	7.55	0	0.00	5	2.14
Total		41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Hasgal-2 micro watershed is presented in Table 5. The results indicate that, 76 per cent of households practicing agriculture, 4 per cent of the households were agricultural labourers, 20 per cent were general labourers, 2 per cent of them were housewives and 2 per cent of them were children.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	8	100.00	14	93.33	12	100.00	4	80.00	38	76.00
2	Agricultural Labour	0	0.00	0	0.00	1	6.67	1	8.33	0	0.00	2	4.00
3	General Labour	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00	10	20.00
4	Housewife	0	0.00	0	0.00	0	0.00	0	0.00	1	20.00	1	2.00
5	Children	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00
Total		10	100.00	8	100.00	15	100.00	14	100.00	5	100.00	52	100.00

Occupation of the household members: The data regarding the occupation of the household members in Hasgal-2 micro watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 48.72 per cent of the household members, 8.12 per cent were agricultural laborers, 12.39 per cent were general labour, 2.56 per cent were in private, 23.50 per cent were students, 1.71 per cent were housewives and 2.14 per cent were children. In case of landless farmers, 65.85 per cent were general labourers, 2.44 per cent were in private service, 29.27 per cent of them were student and 2.44 per cent of them were housewives. In case of marginal farmers 68.75 per cent of them were practicing agriculture and 31.25 per cent were students. In case of small farmers, 59.21 per cent were agriculturists, 11.84 per cent were agricultural labourers, 1.32 per cent of them were general labourers, 25 per cent were students and 1.32 per cent of them were housewives. In case of semi medium farmers 56.60 per cent

were agriculturists, 9.43 per cent were agricultural labourers, 3.77 per cent were in private service, 18.87 per cent were students and 7.55 per cent were children. In case of medium farmers 53.13 per cent were doing agriculture, 15.63 per cent were agricultural labourers, 9.38 per cent were in private service, and 6.25 per cent were housewives.

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

Sl.No.	Particulars	LL (41)		MF (32)		SF (76)		SMF (53)		MDF (32)		All (234)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	22	68.75	45	59.21	30	56.60	17	53.13	114	48.72
2	Agricultural Labour	0	0.00	0	0.00	9	11.84	5	9.43	5	15.63	19	8.12
3	General Labour	27	65.85	0	0.00	1	1.32	0	0.00	1	3.13	29	12.39
4	Private Service	1	2.44	0	0.00	0	0.00	2	3.77	3	9.38	6	2.56
5	Student	12	29.27	10	31.25	19	25.00	10	18.87	4	12.50	55	23.50
6	Others	0	0.00	0	0.00	0	0.00	2	3.77	0	0.00	2	0.85
7	Housewife	1	2.44	0	0.00	1	1.32	0	0.00	2	6.25	4	1.71
8	Children	0	0.00	0	0.00	1	1.32	4	7.55	0	0.00	5	2.14
Total		41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00

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

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

Sl.No.	Particulars	LL (41)		MF (32)		SF (76)		SMF (53)		MDF (32)		All (234)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00
Total		41	100.00	32	100.00	76	100.00	53	100.00	32	100.00	234	100.00

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0.00	0	0.00	4	26.67	1	8.33	2	40.00	7	14.00
2	Katcha	10	100.00	7	87.50	8	53.33	11	91.67	1	20.00	37	74.00
3	Pucca/RCC	0	0.00	0	0.00	1	6.67	0	0.00	1	20.00	2	4.00
4	Semi pacca	0	0.00	1	12.50	2	13.33	0	0.00	1	20.00	4	8.00
Total		10	100.00	8	100.00	15	100.00	12	100.00	5	100.00	50	100.00

Type of house owned: The data regarding the type of house owned by the households in Hasgal-2 micro watershed is presented in Table 8. The results indicate that 14 per cent of the households possess thatched house, 74 per cent of the households possess Katcha house 4 per cent of them possess pucca house and 8 per cent of them possess semi pucca house. 100 per cent of landless farmers possess katcha house. In case of marginal farmers, 87.50 per cent of the households possess katcha house and 12.50 per cent possess semi pucca house. In case of small farmers, 26.67 per cent of the households possess thatched house, 53.33 per cent of the households possess katcha house, 6.67 per cent of them possess pucca house and 13.33 per cent of them possess semi pucca. In case of semi

medium farmers, 8.33 per cent of them possess thatched house, and 91.67 per cent of the households possess katcha house. In case of medium farmers 40 per cent possess thatched house, 20 per cent of them possess katcha house, 20 per cent possess pucca house and another 20 per cent possess semi pucca house.

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Hasgal-2 micro watershed is presented in Table 9. The results show that 84 per cent of the households possess TV, 56 per cent of the households possess Mixer grinder, 46 per cent of the households possess bicycle, 38 per cent of the households possess motor cycle, 4 per cent of them possess landline and 88 per cent of the households possess mobile phones.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	10	100.00	8	100.00	12	80.00	8	66.67	4	80.00	42	84.00
2	Mixer/Grinder	4	40.00	4	50.00	10	66.67	6	50.00	4	80.00	28	56.00
3	Bicycle	7	70.00	4	50.00	7	46.67	4	33.33	1	20.00	23	46.00
4	Motor Cycle	2	20.00	4	50.00	4	26.67	5	41.67	4	80.00	19	38.00
5	Landline Phone	0	0.00	1	12.50	0	0.00	1	8.33	0	0.00	2	4.00
6	Mobile Phone	8	80.00	7	87.50	15	100.00	9	75.00	5	100.00	44	88.00
7	Blank	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Hasgal-2 micro watershed is presented in Table 10. The results show that the average value of television was Rs.7571, mixer grinder was Rs.1846, bicycle was Rs. 3347, motor cycle was Rs.37315, landline phone was Rs.3333 and mobile phone was Rs.1653.

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

Average value (Rs.)

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Television	10,200.00	6,000.00	7,583.00	6,000.00	7,250.00	7,571.00
2	Mixer/Grinder	2,000.00	1,375.00	2,000.00	2,033.00	1,500.00	1,846.00
3	Bicycle	2,000.00	1,250.00	7,000.00	1,500.00	3,000.00	3,347.00
4	Motor Cycle	30,000.00	28,250.00	52,250.00	37,000.00	35,500.00	37,315.00
5	Landline Phone	0.00	4,000.00	0.00	2,000.00	0.00	3,333.00
6	Mobile Phone	2,100.00	1,885.00	1,760.00	1,528.00	1,083.00	1,653.00

Farm Implements owned: The data regarding the farm implements owned by the households in Hasgal-2 micro watershed is presented in Table 11. About 20 per cent of the households possess bullock cart, 34 per cent of them possess plough, 2 per cent of them possess tractor, 22 per cent of them possess sprayer, 2 per cent of them possess sprinkler, 80 per cent of them possess weeder, 4 per cent of them possess harvester, 2 per cent of them possess thresher, 10 per cent of them possess chaff cutter and 2 per cent of them possess JCB/Hitachi.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0.00	0	0.00	5	33.33	2	16.67	3	60.00	10	20.00
2	Plough	0	0.00	2	25.00	8	53.33	4	33.33	3	60.00	17	34.00
3	Tractor	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00
4	Sprayer	0	0.00	0	0.00	5	33.33	3	25.00	3	60.00	11	22.00
5	Sprinkler	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00
6	Weeder	9	90.00	7	87.50	13	86.67	8	66.67	3	60.00	40	80.00
7	Harvester	0	0.00	0	0.00	1	6.67	1	8.33	0	0.00	2	4.00
8	Thresher	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00
9	Chaff Cutter	0	0.00	2	25.00	1	6.67	2	16.67	0	0.00	5	10.00
10	Blank	1	10.00	1	12.50	1	6.67	3	25.00	2	40.00	8	16.00

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Hasgal-2 micro watershed is presented in Table 12. The results show that the average value of bullock cart was Rs.21200, plough was Rs.1016, the average value of tractor was Rs.300000, the average value of sprayer was Rs.2844, the average value of sprinkler was Rs. 3300, the average value of harvester was Rs.6942, the average value of thresher was Rs.50000, the average value of chaff cutter was Rs.2800, and the average value of weeder was Rs.77.

Table 12. Average value of farm implements owned by households in Hasgal-2 micro watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Bullock Cart	0	0	20,200	27,500	18,666	21,200
2	Plough	0	666	1,066	1,000	1,500	1,016
3	Tractor	0	0	0	300,000	0	300,000
4	Sprayer	0	0	3,500	1,800	3,493	2,844
5	Sprinkler	0	0	0	3,300	0	3,300
6	Weeder	100	55	89	64	50	77
7	Harvester	0	0	100	48,000	0	6,942
8	Thresher	0	0	0	50,000	0	50,000
9	Chaff Cutter	0	3,000	2,000	3,000	0	2,800

Livestock possession by the households: The data regarding the Livestock possession by the households in Hasgal-2 micro watershed is presented in Table 13. The results indicate that, 36 per cent of the households possess bullocks, 16 per cent of the households possess local cow, 6 per cent of the households possess buffalo, 4 per cent of them possess sheep, 2 per cent of the households possess goat and 2 per cent of them possess poultry birds.

In case of marginal households, 25 per cent of them possess bullocks, 25 per cent of them possess local cow and 12.50 per cent possess poultry birds. Among small farmers, 53.33 per cent of the households possess bullock, 20 per cent possess local cow, 6.67 per cent possess buffalo, 6.67 per cent possess sheep and 6.67 per cent possess goat. In case of semi medium farmers, 33.33 per cent of households possess bullock, 25 per

cent of households possess local cow, and 8.33 per cent of them possess buffalo. 80 per cent of medium farmers possess bullock, 20 per cent possess buffalo and 20 per cent possess sheep.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	2	25.00	8	53.33	4	33.33	4	80.00	18	36.00
2	Local cow	0	0.00	2	25.00	3	20.00	3	25.00	0	0.00	8	16.00
3	Buffalo	0	0.00	0	0.00	1	6.67	1	8.33	1	20.00	3	6.00
4	Sheep	0	0.00	0	0.00	1	6.67	0	0.00	1	20.00	2	4.00
5	Goat	0	0.00	0	0.00	1	6.67	0	0.00	0	0.00	1	2.00
6	Poultry birds	0	0.00	1	12.50	0	0.00	0	0.00	0	0.00	1	2.00
7	blank	10	100.00	5	62.50	5	33.33	6	50.00	1	20.00	27	54.00

Average Labour availability: The data regarding the average labour availability in Hasgal-2 micro watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 8.85, average own labour (women) available was 5.55, average hired labour (men) available was 11.40 and average hired labour (women) available was 10.79.

In case of marginal farmers, average own labour men available was 18.75, average own labour (women) was 11.13, average hired labour (men) was 8.38 and average hired labour (women) available was 8. In case of small farmers, average own labour men available was 11.60, average own labour (women) was 7, average hired labour (men) was 12.13 and average hired labour (women) available was 11. In case of semi medium farmers, average own labour men available was 1.58, average own labour (women) was 1.50, average hired labour (men) was 14.58 and average hired labour (women) available was 14.58. In case of medium farmers, average own labour men available was 2.20, average own labour (women) was 2, average hired labour (men) was 6.40 and average hired labour (women) available was 5.60.

Table 14. Average Labour availability in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
		N	N	N	N	N	N
1	Own labour Male	0.00	18.75	11.60	1.58	2.20	8.85
2	Own Labour Female	0.00	11.13	7.00	1.50	2.00	5.55
3	Hired labour Male	0.00	8.38	12.13	14.58	6.40	11.40
4	Hired labour Female	0.00	8.00	11.00	14.58	5.60	10.79

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	8	100	15	100	12	100	5	100	40	80

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Hasgal-2 micro watershed is presented in Table 15. The results indicate that, 80 per cent of the households opined that the hired labour was adequate.

Distribution of land (ha): The data regarding the distribution of land (ha) in Hasgal-2 micro watershed is presented in Table 16. The results indicate that, households of the Hasgal-2 micro watershed possess 42.85 ha (64.97%) of dry land and 23.11 ha (35.03%) of irrigated land. Marginal farmers possess 4.80 ha (84.35%) of dry land and 0.89 ha (15.65%). Small farmers possess 18.34 ha (91.39%) of dry land and 1.73 ha (8.61%) of irrigated land. Semi medium farmers possess 8.38 ha (37.95%) of dry land and 13.70 ha (62.05%) of irrigated land. Medium farmers possess 11.33 ha (62.53%) of dry land and 6.79 ha (37.47%) of the farmers possess irrigated land.

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

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	4.80	84.35	18.34	91.39	8.38	37.95	11.33	62.53	42.85	64.97
2	Irrigated	0	0	0.89	15.65	1.73	8.61	13.70	62.05	6.79	37.47	23.11	35.03
Total		0	100	5.69	100	20.07	100	22.08	100	18.12	100	65.96	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Hasgal-2 micro watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 293003 and average value of irrigated land was Rs. 514763. In case of marginal famers, the average land value was Rs. 470674 for dry land and Rs.1347272 for irrigated land. In case of small famers, the average land value was Rs. 414210 for dry land and Rs. 925526 for irrigated land. In case of semi medium famers, the average land value was Rs. 155120 for dry land and Rs. 474298 for irrigated land. In case of medium famers, the average land value was Rs. 123500 for dry land and Rs.382717 for irrigated land.

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

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
		N	N	N	N	N	N
1	Dry	0	470,674.55	414,210.07	155,120.77	123,500	293,003.40
2	Irrigated	0	1,347,272.70	925,526.94	474,298.38	382,717.52	514,763.57

Status of bore wells: The data regarding the status of bore wells in Hasgal-2 micro watershed is presented in Table 18. The results indicate that, there were 14 functioning and 2 de-functioning bore wells in the micro watershed.

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

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
		N	N	N	N	N	N
1	De-functioning	0	0	1	1	0	2
2	Functioning	0	1	3	8	2	14

Table 19. Status of open wells in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
		N	N	N	N	N	N
1	De-functioning	0	0	0	0	0	0
2	Functioning	0	0	0	1	0	1

Status of open wells: The data regarding the status of open wells in Hasgal-2 micro watershed is presented in Table 19. The results indicate that, there was 1 functioning open well in the micro watershed.

Source of irrigation: The data regarding the source of irrigation in Hasgal-2 micro watershed is presented in Table 20. The results indicate that, bore well was the major irrigation source in the micro water shed for 28 per cent of the farmers, and open well was the source of irrigation for 2 per cent of the farmers.

Table 20. Source of irrigation in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	1	12.50	3	20.00	8	66.67	2	40.00	14	28.00
2	Open Well	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00

Depth of water (Avg in meters): The data regarding the depth of water in Hasgal-2 micro watershed is presented in Table 21. The results indicate that, the depth of bore well was found to be 24.14 meters and the depth of open well was found to be 1.83 meters.

Table 21. Depth of water (Avg in meters) in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
		N	N	N	N	N	N
1	Bore Well	0.00	9.53	19.30	54.86	36.58	24.14
2	Open Well	0.00	0.00	0.00	7.62	0.00	1.83

Irrigated Area (ha): The data regarding the irrigated area (ha) in Hasgal-2 micro watershed is presented in Table 22. The results indicate that, marginal, small, semi medium and medium farmers had irrigated area of 0.81 ha, 3.72 ha, 13.91 ha and 5.51 ha respectively.

Table 22. Irrigated Area (ha) in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Kharif	0.00	0.40	2.91	10.92	3.89	18.13
3	Rabi	0.00	0.40	0.81	2.99	1.62	5.82
Total		0.00	0.81	3.72	13.91	5.51	23.95

Cropping pattern: The data regarding the cropping pattern in Hasgal-2 micro watershed is presented in Table 23. The results indicate that, farmers have grown bajra (11.62 ha), cotton (1.78 ha), groundnut (5.15 ha), horsegram (1.21 ha), maize (21.74 ha), navane (1.70 ha), paddy (2.83 ha), redgram (1.62 ha), sorghum (2.18 ha), tomato (0.89 ha), and watermelon (2.91 ha). Marginal farmers have grown bajra, maize, watermelon and groundnut. Small farmers have grown bajra, cotton, groundnut, maize, navane, paddy and watermelon. Semi medium farmers have grown bajra, cotton, maize, paddy, sorghum, tomato, watermelon and groundnut. Medium farmers have grown bajra, groundnut, horsegram, paddy, redgram sorghum and maize.

Table 23. Cropping pattern in Hasgal-2 micro watershed (Area in ha)

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Kharif - Bajra	0.00	1.36	5.40	4.05	0.81	11.62
2	Kharif - Cotton	0.00	0.00	0.89	0.89	0.00	1.78
3	Kharif - Groundnut	0.00	0.00	1.26	0.00	3.89	5.15
4	Kharif - Horsegram	0.00	0.00	0.00	0.00	1.21	1.21
5	Kharif - Maize	0.00	3.80	9.77	8.18	0.00	21.74
6	Kharif - Navane (Fox Millet)	0.00	0.00	1.70	0.00	0.00	1.70
7	Kharif - Paddy	0.00	0.00	1.21	1.21	0.40	2.83
8	Kharif - Red gram (togari)	0.00	0.00	0.00	0.00	1.62	1.62
9	Kharif - Sorghum	0.00	0.00	0.00	1.77	0.40	2.18
10	Kharif - Tomato	0.00	0.00	0.00	0.89	0.00	0.89
11	Kharif - Water melon	0.00	0.49	1.21	1.21	0.00	2.91
12	Rabi - Groundnut	0.00	0.40	0.00	4.61	0.00	5.01
13	Rabi - Maize	0.00	0.00	0.00	0.00	1.62	1.62
Total		0.00	6.05	21.45	22.82	9.96	60.28

Cropping intensity: The data regarding the cropping intensity in Hasgal-2 micro watershed is presented in Table 24. The results indicate that, the cropping intensity in Hasgal-2 micro watershed was found to be 98.20 per cent. In case of marginal and semi medium farmers it was 100 per cent, in case of small farmers it was 101.67 per cent, and medium farmers had cropping intensity of 87.23 per cent.

Table 24. Cropping intensity (%) in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Cropping Intensity	0.00	100.00	101.67	100.00	87.23	98.20

Possession of Bank account and savings: The data regarding the cropping intensity in Hasgal-2 micro watershed is presented in Table 25. The results indicate that, 62 per cent of the households have bank account and 40 per cent of the households have savings.

Table 25. Possession of Bank account and savings in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0.00	7	87.50	12	80.00	8	66.67	4	80.00	31	62.00
2	Savings	0	0.00	6	75.00	7	46.67	7	58.33	0	0.00	20	40.00

Borrowing status: The data regarding the cropping intensity in Hasgal-2 micro watershed is presented in Table 26. The results indicate that, 44 per cent of the households have availed credit from different sources.

Table 26. Borrowing status in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0.00	7	87.50	7	46.67	7	58.33	1	20.00	22	44.00

Source of credit availed by households: The data regarding the cropping intensity in Hasgal-2 micro watershed is presented in Table 27. The results indicate that, 31.82 per cent of the households availed loan from commercial bank, 13.64 per cent availed loan from cooperative bank, 22.73 per cent availed loan from grameena bank, 13.64 per cent

availed loan from money lenders and 36.36 per cent of the households obtained loan from SHGs/CBOs.

Table 27. Source of credit availed by households in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (0)		MF (7)		SF (7)		SMF (7)		MDF (1)		All (22)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Commercial Bank	0	0.00	0	0.00	4	57.14	3	42.86	0	0.00	7	31.82
2	Cooperative Bank	0	0.00	0	0.00	2	28.57	1	14.29	0	0.00	3	13.64
3	Grameena Bank	0	0.00	0	0.00	3	42.86	1	14.29	1	100.00	5	22.73
4	Money Lender	0	0.00	1	14.29	1	14.29	1	14.29	0	0.00	3	13.64
5	SHGs/CBOs	0	0.00	3	42.86	3	42.86	2	28.57	0	0.00	8	36.36

Average Credit amount: The data regarding the average credit amount availed by households in Hasgal-2 micro watershed is presented in Table 28. The results indicate that, marginal, small, semi medium and medium farmers have availed Rs.19285, Rs.90714, Rs.104285, and Rs.50000 respectively.

Table 28. Average Credit amount availed by households in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (0)	MF (7)	SF (7)	SMF (7)	MDF (1)	All (22)
		N	N	N	N	N	N
1	Average Credit	0.00	19,285.71	90,714.29	104,285.71	50,000.00	70,454.55

Purpose of credit borrowed - Institutional Credit: The data regarding the purpose of credit borrowed from institutional sources by households in Hasgal-2 micro watershed is presented in Table 29. The results indicate that, 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production.

Table 29. Purpose of credit borrowed (institutional Source) by households in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (0)		MF (0)		SF (9)		SMF (5)		MDF (1)		All (15)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture production	0	0	0	0	9	100	5	100	1	100	15	100

Purpose of credit borrowed - Private Credit: The data regarding the purpose of credit borrowed from private sources by households in Hasgal-2 micro watershed is presented in Table 30. The results indicate that, the main purpose of borrowing credit from private sources was agricultural production which accounted for 63.64 per cent of those who borrowed credit. Another 18.18 per cent of the households borrowed for social functions, 9.09 per cent of the households borrowed for the purpose of construction of house or cattle shed and 9.09 per cent borrowed for household consumption.

Table 30. Purpose of credit borrowed (Private Credit) by households in Hasgal-2 micro watershed

Sl. No.	Particulars	MF (4)		SF (4)		SMF(3)		All (11)	
		N	%	N	%	N	%	N	%
1	Agriculture production	4	100	2	50	1	33.33	7	63.64
2	Construction-house, Construction-cattle shed	0	0	1	25	0	0	1	9.09
3	Household consumption	0	0	0	0	1	33.33	1	9.09
4	Social functions like marriage	0	0	1	25	1	33.33	2	18.18

Repayment status of households – Institutional: The results (Table 31) indicated that 80 per cent of the households did not repay their loan, 13.33 per cent of the households partially paid and 6.67 per cent of the households fully repaid their loan.

Table 31. Repayment status of households (institutional sources) in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (0)		MF (0)		SF (9)		SMF (5)		MDF (1)		All (15)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Partially paid	0	0.00	0	0.00	0	0.00	2	40.00	0	0.00	2	13.33
2	Un paid	0	0.00	0	0.00	8	88.89	3	60.00	1	100.00	12	80.00
3	Fully paid	0	0.00	0	0.00	1	11.11	0	0.00	0	0.00	1	6.67

Repayment status of households – Private: Results (Table 32) indicated that 81.82 per cent of the households partially paid their loan, 9.09 per cent of the households did not repay their loan and 9.09 per cent of the households fully paid their loans.

Table 32. Repayment status of households (private sources) in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (0)		MF (4)		SF (4)		SMF (3)		MDF (0)		All (11)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Partially paid	0	0.00	4	100.00	4	100.00	1	33.33	0	0.00	9	81.82
2	Un paid	0	0.00	0	0.00	0	0.00	1	33.33	0	0.00	1	9.09
3	Fully paid	0	0.00	0	0.00	0	0.00	1	33.33	0	0.00	1	9.09

Opinion on institutional sources of credit: The results (Table 33) indicate that, around 46.67 per cent of the households opined that the rate of interest was higher in institutional sources; another 40 per cent opined that the loan amount helped to perform timely agricultural operations.

Table 33. Opinion on institutional sources of credit in Hasgal-2 micro watershed

Sl. No.	Particulars	SF (9)		SMF(5)		MDF (1)		All(15)	
		N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural perations	4	44.44	2	40	0	0	6	40
2	Higher rate of interest	5	55.56	1	20	1	100	7	46.67

Opinion on non-institutional sources of credit: The results (Table 34) indicate that, around 9.09 per cent of the households opined that credit was easily accessible, 18.18 per cent of the households opined that the credit helped to perform timely agricultural operations and 27.27 per cent opined that the rate of interest was high in non institutional source of credits.

Table 34. Opinion on non-institutional sources of credit in Hasgal-2 micro watershed

Sl. No.	Particulars	MF (4)		SF (4)		SMF (3)		All (11)	
		N	%	N	%	N	%	N	%
1	Easy accessibility of credit	0	0	1	25	0	0	1	9.09
2	Helped to perform timely agricultural operations	1	25	0	0	1	33.33	2	18.18
3	Higher rate of interest	1	25	2	50	0	0	3	27.27

Cost of Cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Hasgal-2 micro watershed is presented in Table 35. The results indicate that, the total cost of cultivation for sorghum was Rs. 37771.28. The gross income realized by the farmers was Rs. 70523.07. The net income from Sorghum cultivation was Rs. 32751.80, thus the benefit cost ratio was found to be 1:1.87.

Table 35. Cost of Cultivation of sorghum in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	55.79	9177.31	24.30
2	Bullock		Pairs/day	6.46	3847.94	10.19
3	Tractor		Hours	3.33	2243.58	5.94
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	15.78	2854.22	7.56
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	27.56	3307.06	8.76
8	Fertilizer + micronutrients		Quintal	3.61	3294.48	8.72
9	Pesticides (PPC)		Kgs / ltrs	2.47	2470.00	6.54
10	Irrigation		Number	0.57	0.00	0.00
13	Depreciation charges			0.00	644.21	1.71
14	Land revenue and Taxes			0.00	4.94	0.01
II	**Cost B1**					
16	Interest on working capital				1431.09	3.79
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				29274.83	77.51
III	**Cost B2**					
18	Rental Value of Land				400.00	1.06
19	**Cost B2 = (Cost B1 + Rental value)**				29674.83	78.56
IV	**Cost C1**					
20	Family Human Labour			21.58	4662.70	12.34
21	**Cost C1 = (Cost B2 + Family Labour)**				34337.53	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				34337.53	90.91
VI	**Cost C3**					
24	Managerial Cost				3433.75	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				37771.28	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		39.57	69240.05	
		b) Main Crop Sales Price (Rs.)			1750.00	
	By Product	e) Main Product (q)		21.38	1283.03	
		f) Main Crop Sales Price (Rs.)			60.00	
b.	Gross Income (Rs.)				70523.07	
c.	Net Income (Rs.)				32751.80	
d.	Cost per Quintal (Rs./q.)				954.65	
e.	Benefit Cost Ratio (BC Ratio)				1:1.87	

Cost of cultivation of Groundnut: The data regarding the cost of cultivation of groundnut in Hasgal-2 micro watershed is presented in Table 36. The results indicate that, the total cost of cultivation for groundnut was Rs. 46621.42. The gross income realized by the farmers was Rs. 67059.85. The net income from groundnut cultivation was Rs. 20438.43. Thus the benefit cost ratio was found to be 1:1.44.

Table 36. Cost of Cultivation of groundnut in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	34.92	5648.81	12.12
2	Bullock		Pairs/day	1.86	1433.12	3.07
3	Tractor		Hours	3.85	2566.45	5.50
4	Machinery		Hours	0.62	494.00	1.06
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	129.51	16321.47	35.01
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	2.06	1399.67	3.00
8	Fertilizer + micronutrients		Quintal	6.16	4987.83	10.70
9	Pesticides (PPC)		Kgs / ltrs	1.32	1193.83	2.56
10	Irrigation		Number	6.80	0.00	0.00
13	Depreciation charges			0.00	202.47	0.43
14	Land revenue and Taxes			0.00	3.91	0.01
II	**Cost B1**					
16	Interest on working capital				2868.41	6.15
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				37119.97	79.62
III	**Cost B2**					
18	Rental Value of Land				808.33	1.73
19	**Cost B2 = (Cost B1 + Rental value)**				37928.30	81.35
IV	**Cost C1**					
20	Family Human Labour			22.80	4454.18	9.55
21	**Cost C1 = (Cost B2 + Family Labour)**				42382.48	90.91
V	**Cost C2**					
22	Risk Premium				0.63	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				42383.11	90.91
VI	**Cost C3**					
24	Managerial Cost				4238.31	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				46621.42	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		19.66	66598.80	
		b) Main Crop Sales Price (Rs.)			3387.50	
	By Product	e) Main Product (q)		3.07	461.05	
		f) Main Crop Sales Price (Rs.)			150.00	
b.	Gross Income (Rs.)				67059.85	
c.	Net Income (Rs.)				20438.43	
d.	Cost per Quintal (Rs./q.)				2371.36	
e.	Benefit Cost Ratio (BC Ratio)				1:1.44	

Cost of cultivation of navane: The data regarding the cost of cultivation of navane in Hasgal-2 micro watershed is presented in Table 37. The results indicate that, the total cost of cultivation for navane was Rs. 16260.02. The gross income realized by the farmers was Rs. 23523.81. The net income from navane cultivation was Rs. 7263.79. Thus the benefit cost ratio was found to be 1:1.45.

Table 37. Cost of Cultivation of navane in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	20.58	3381.55	20.80
2	Bullock		Pairs/day	1.76	1058.57	6.51
3	Tractor		Hours	2.35	1881.90	11.57
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	11.76	882.14	5.43
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	2.94	588.10	3.62
8	Fertilizer + micronutrients		Quintal	4.12	3493.29	21.48
9	Pesticides (PPC)		Kgs / ltrs	0.00	0.00	0.00
10	Irrigation		Number	0.00	0.00	0.00
13	Depreciation charges			0.00	298.75	1.84
14	Land revenue and Taxes			0.00	3.29	0.02
II	**Cost B1**					
16	Interest on working capital				595.74	3.66
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				12183.34	74.93
III	**Cost B2**					
18	Rental Value of Land				333.33	2.05
19	**Cost B2 = (Cost B1 + Rental value)**				12516.67	76.98
IV	**Cost C1**					
20	Family Human Labour			12.35	2264.17	13.92
21	**Cost C1 = (Cost B2 + Family Labour)**				14780.84	90.90
V	**Cost C2**					
22	Risk Premium				1.00	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				14781.84	90.91
VI	**Cost C3**					
24	Managerial Cost				1478.18	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				16260.02	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		11.76	23523.81	
		b) Main Crop Sales Price (Rs.)			2000.00	
b.	Gross Income (Rs.)				23523.81	
c.	Net Income (Rs.)				7263.79	
d.	Cost per Quintal (Rs./q.)				1382.43	
e.	Benefit Cost Ratio (BC Ratio)				1:1.45	

Cost of Cultivation of Maize: The data regarding the cost of cultivation of maize in Hasgal-2 micro watershed is presented in Table 38. The results indicate that, the total cost of cultivation for maize was Rs. 32823.70. The gross income realized by the farmers was Rs. 38634.10. The net income from maize cultivation was Rs. 5810.40. Thus the benefit cost ratio was found to be 1:1.18.

Table 38. Cost of Cultivation of Maize in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	31.74	5569.38	16.97
2	Bullock		Pairs/day	1.48	1064.64	3.24
3	Tractor		Hours	3.05	2019.44	6.15
4	Machinery		Hours	0.10	68.29	0.21
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	16.26	2044.47	6.23
6	Seed Inter Crop		Kgs.	0.10	11.62	0.04
7	FYM		Quintal	7.01	5808.96	17.70
8	Fertilizer + micronutrients		Quintal	6.59	5372.19	16.37
9	Pesticides (PPC)		Kgs / ltrs	1.23	1433.69	4.37
10	Irrigation		Number	12.23	0.00	0.00
13	Depreciation charges			0.00	120.68	0.37
14	Land revenue and Taxes			0.00	3.68	0.01
II	**Cost B1**					
16	Interest on working capital				1760.60	5.36
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				25277.63	77.01
III	**Cost B2**					
18	Rental Value of Land				396.08	1.21
19	**Cost B2 = (Cost B1 + Rental value)**				25673.71	78.22
IV	**Cost C1**					
20	Family Human Labour			20.77	4165.25	12.69
21	**Cost C1 = (Cost B2 + Family Labour)**				29838.96	90.91
V	**Cost C2**					
22	Risk Premium				0.76	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				29839.72	90.91
VI	**Cost C3**					
24	Managerial Cost				2983.97	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				32823.70	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		26.49	35062.19	
		b) Main Crop Sales Price (Rs.)			1323.53	
	By Product	e) Main Product (q)		15.61	3571.91	
		f) Main Crop Sales Price (Rs.)			228.82	
b.	Gross Income (Rs.)				38634.10	
c.	Net Income (Rs.)				5810.40	
d.	Cost per Quintal (Rs./q.)				1239.03	
e.	Benefit Cost Ratio (BC Ratio)				1:1.18	

Cost of Cultivation of bajra: The data regarding the cost of cultivation of bajra in Hasgal-2 micro watershed is presented in Table 39. The results indicate that, the total cost of cultivation for bajra was Rs. 22880. The gross income realized by the farmers was Rs. 20415.02. The net income from bajra cultivation was Rs. -2464.98. Thus the benefit cost ratio was found to be 1:0.89.

Table 39. Cost of Cultivation of bajra in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	20.70	3713.61	16.23
2	Bullock		Pairs/day	2.10	1432.90	6.26
3	Tractor		Hours	2.28	1507.43	6.59
4	Machinery		Hours	0.08	46.31	0.20
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.01	972.70	4.25
6	Seed Inter Crop		Kgs.	0.54	27.79	0.12
7	FYM		Quintal	8.78	2034.12	8.89
8	Fertilizer + micronutrients		Quintal	4.69	3488.68	15.25
9	Pesticides (PPC)		Kgs / ltrs	1.24	988.00	4.32
10	Irrigation		Number	0.00	0.00	0.00
13	Depreciation charges			0.00	69.66	0.30
14	Land revenue and Taxes			0.00	3.50	0.02
II	**Cost B1**					
16	Interest on working capital				901.44	3.94
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15186.14	66.37
III	**Cost B2**					
18	Rental Value of Land				350.00	1.53
19	**Cost B2 = (Cost B1 + Rental value)**				15536.14	67.90
IV	**Cost C1**					
20	Family Human Labour			23.91	5263.10	23.00
21	**Cost C1 = (Cost B2 + Family Labour)**				20799.25	90.91
V	**Cost C2**					
22	Risk Premium				0.75	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				20800.00	90.91
VI	**Cost C3**					
24	Managerial Cost				2080.00	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				22880.00	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		15.50	19465.61	
		b) Main Crop Sales Price (Rs.)			1256.25	
	By Product	e) Main Product (q)		4.22	949.41	
		f) Main Crop Sales Price (Rs.)			225.00	
b.	Gross Income (Rs.)				20415.02	
c.	Net Income (Rs.)				-2464.98	
d.	Cost per Quintal (Rs./q.)				1476.60	
e.	Benefit Cost Ratio (BC Ratio)				1:0.89	

Cost of Cultivation of Redgram: The data regarding the cost of cultivation of redgram in Hasgal-2 micro watershed is presented in Table 40. The results indicate that, the total cost of cultivation for redgram was Rs. 18070.78. The gross income realized by the farmers was Rs. 46930. The net income from redgram cultivation was Rs. 28859.22. Thus the benefit cost ratio was found to be 1:2.6.

Table 40. Cost of Cultivation of Redgram in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	23.46	4137.25	22.89
2	Bullock		Pairs/day	0.62	308.75	1.71
3	Tractor		Hours	7.41	4446.00	24.60
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.35	1111.50	6.15
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	12.35	1482.00	8.20
8	Fertilizer + micronutrients		Quintal	2.47	1914.25	10.59
9	Pesticides (PPC)		Kgs / ltrs	0.62	617.50	3.42
10	Irrigation		Number	0.00	0.00	0.00
13	Depreciation charges			0.00	0.01	0.00
14	Land revenue and Taxes			0.00	4.94	0.03
II	**Cost B1**					
16	Interest on working capital				615.03	3.40
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				14637.23	81.00
III	**Cost B2**					
18	Rental Value of Land				0.00	0.00
19	**Cost B2 = (Cost B1 + Rental value)**				14637.23	81.00
IV	**Cost C1**					
20	Family Human Labour			8.65	1790.75	9.91
21	**Cost C1 = (Cost B2 + Family Labour)**				16427.98	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				16427.98	90.91
VI	**Cost C3**					
24	Managerial Cost				1642.80	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				18070.78	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.35	46930.00	
		b) Main Crop Sales Price (Rs.)			3800.00	
b.	Gross Income (Rs.)				46930.00	
c.	Net Income (Rs.)				28859.22	
d.	Cost per Quintal (Rs./q.)				1463.22	
e.	Benefit Cost Ratio (BC Ratio)				1:2.6	

Cost of cultivation of Horsegram: The data regarding the cost of cultivation of horsegram in Hasgal-2 micro watershed is presented in Table 41. The results indicate that, the total cost of cultivation for horsegram was Rs. 19107.60. The gross income realized by the farmers was Rs. 29640. The net income from horsegram cultivation was Rs. 10532.40. Thus the benefit cost ratio was found to be 1:1.55.

Table 41. Cost of Cultivation of horsegram in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	34.58	6051.50	31.67
2	Bullock		Pairs/day	1.24	617.50	3.23
3	Tractor		Hours	3.71	2223.00	11.63
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	12.35	1235.00	6.46
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	2.47	2173.60	11.38
9	Pesticides (PPC)		Kgs / ltrs	1.24	1235.00	6.46
10	Irrigation		Number	0.00	0.00	0.00
13	Depreciation charges			0.00	0.02	0.00
14	Land revenue and Taxes			0.00	4.94	0.03
II	**Cost B1**					
16	Interest on working capital				557.23	2.92
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				14097.80	73.78
III	**Cost B2**					
18	Rental Value of Land				0.00	0.00
19	**Cost B2 = (Cost B1 + Rental value)**				14097.80	73.78
IV	**Cost C1**					
20	Family Human Labour			16.06	3272.75	17.13
21	**Cost C1 = (Cost B2 + Family Labour)**				17370.55	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				17370.55	90.91
VI	**Cost C3**					
24	Managerial Cost				1737.05	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				19107.60	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		7.41	29640.00	
		b) Main Crop Sales Price (Rs.)			4000.00	
b.	Gross Income (Rs.)				29640.00	
c.	Net Income (Rs.)				10532.40	
d.	Cost per Quintal (Rs./q.)				2578.62	
e.	Benefit Cost Ratio (BC Ratio)				1:1.55	

Cost of cultivation of watermelon: The data regarding the cost of cultivation of watermelon in Hasgal-2 micro watershed is presented in Table 42. The results indicate that, the total cost of cultivation for watermelon was Rs. 53952.66. The gross income realized by the farmers was Rs. 1264061.94. The net income from watermelon cultivation was Rs. 1210109.29. Thus the benefit cost ratio was found to be 1:23.43.

Table 42. Cost of Cultivation of watermelon in Hasgal-2 micro watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	53.59	8860.58	16.42
2	Bullock	Pairs/day	3.29	1976.00	3.66
3	Tractor	Hours	5.04	3515.28	6.52
4	Machinery	Hours	0.82	658.67	1.22
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	4.35	2948.49	5.46
6	Seed Inter Crop	Kgs.	0.00	0.00	0.00
7	FYM	Quintal	12.35	2470.00	4.58
8	Fertilizer + micronutrients	Quintal	12.87	11359.67	21.05
9	Pesticides (PPC)	Kgs / ltrs	1.91	1907.19	3.53
10	Irrigation	Number	28.26	0.00	0.00
13	Depreciation charges		0.00	6608.59	12.25
14	Land revenue and Taxes		0.00	4.39	0.01
II	**Cost B1**				
16	Interest on working capital			2242.28	4.16
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			42551.14	78.87
III	**Cost B2**				
18	Rental Value of Land			377.78	0.70
19	**Cost B2 = (Cost B1 + Rental value)**			42928.92	79.57
IV	**Cost C1**				
20	Family Human Labour		31.64	6118.62	11.34
21	**Cost C1 = (Cost B2 + Family Labour)**			49047.54	90.91
V	**Cost C2**				
22	Risk Premium			0.33	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**			49047.87	90.91
VI	**Cost C3**				
24	Managerial Cost			4904.79	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			53952.66	100.00
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	29170.66	1264061.94	
		b) Main Crop Sales Price (Rs.)		43.33	
b.	Gross Income (Rs.)			1264061.94	
c.	Net Income (Rs.)			1210109.29	
d.	Cost per Quintal (Rs./q.)			1.85	
e.	Benefit Cost Ratio (BC Ratio)			1:23.43	

Cost of cultivation of cotton: The data regarding the cost of cultivation of cotton in Hasgal-2 micro watershed is presented in Table 43. The results indicate that, the total cost of cultivation for cotton was Rs. 29826.92. The gross income realized by the farmers was Rs. 84288.75. The net income from cotton cultivation was Rs. 54461.83. Thus the benefit cost ratio was found to be 1:2.83.

Table 43. Cost of Cultivation of cotton in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	26.38	4434.77	14.87
2	Bullock		Pairs/day	1.12	673.64	2.26
3	Tractor		Hours	2.81	1908.64	6.40
4	Machinery		Hours	1.12	673.64	2.26
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.49	4518.98	15.15
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	14.03	1908.64	6.40
8	Fertilizer + micronutrients		Quintal	5.61	5226.30	17.52
9	Pesticides (PPC)		Kgs / ltrs	1.12	1122.73	3.76
10	Irrigation		Number	21.33	0.00	0.00
13	Depreciation charges			0.00	28.07	0.09
14	Land revenue and Taxes			0.00	4.12	0.01
II	**Cost B1**					
16	Interest on working capital				1533.26	5.14
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				22032.76	73.87
III	**Cost B2**					
18	Rental Value of Land				366.67	1.23
19	**Cost B2 = (Cost B1 + Rental value)**				22399.43	75.10
IV	**Cost C1**					
20	Family Human Labour			24.70	4715.45	15.81
21	**Cost C1 = (Cost B2 + Family Labour)**				27114.88	90.91
V	**Cost C2**					
22	Risk Premium				0.50	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				27115.38	90.91
VI	**Cost C3**					
24	Managerial Cost				2711.54	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				29826.92	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		18.52	84288.75	
		b) Main Crop Sales Price (Rs.)			4550.00	
b.	Gross Income (Rs.)				84288.75	
c.	Net Income (Rs.)				54461.83	
d.	Cost per Quintal (Rs./q.)				1610.09	
e.	Benefit Cost Ratio (BC Ratio)				1:2.83	

Cost of cultivation of paddy: The data regarding the cost of cultivation of paddy in Hasgal-2 micro watershed is presented in Table 44. The results indicate that, the total cost of cultivation for paddy was Rs. 41184.13. The gross income realized by the farmers was Rs. 71007.93. The net income from paddy cultivation was Rs. 29823.79. Thus the benefit cost ratio was found to be 1:1.72.

Table 44. Cost of Cultivation of paddy in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	35.40	5804.50	14.09
2	Bullock		Pairs/day	1.92	960.56	2.33
3	Tractor		Hours	3.02	1811.33	4.40
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	96.06	10977.78	26.66
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	49.40	5928.00	14.39
8	Fertilizer + micronutrients		Quintal	3.02	2456.28	5.96
9	Pesticides (PPC)		Kgs / liters	1.37	1372.22	3.33
10	Irrigation		Number	1.65	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	406.18	0.99
14	Land revenue and Taxes			0.00	4.94	0.01
II	**Cost B1**					
16	Interest on working capital				2488.11	6.04
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				32209.90	78.21
III	**Cost B2**					
18	Rental Value of Land				400.00	0.97
19	**Cost B2 = (Cost B1 + Rental value)**				32609.90	79.18
IV	**Cost C1**					
20	Family Human Labour			22.50	4830.22	11.73
21	**Cost C1 = (Cost B2 + Family Labour)**				37440.12	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				37440.12	90.91
VI	**Cost C3**					
24	Managerial Cost				3744.01	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				41184.13	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		46.11	68391.56	
		b) Main Crop Sales Price (Rs.)			1483.33	
	By Product	e) Main Product (q)		35.68	2616.37	
		f) Main Crop Sales Price (Rs.)			73.33	
b.	Gross Income (Rs.)				71007.93	
c.	Net Income (Rs.)				29823.79	
d.	Cost per Quintal (Rs./q.)				893.24	
e.	Benefit Cost Ratio (BC Ratio)				1:1.72	

Cost of cultivation of tomato: The data regarding the cost of cultivation of tomato in Hasgal-2 micro watershed is presented in Table 45. The results indicate that, the total cost of cultivation for tomato was Rs. 24868.79. The gross income realized by the farmers was Rs. 158304.54. The net income from tomato cultivation was Rs. 133435.75. Thus the benefit cost ratio was found to be 1:6.37.

Table 45. Cost of Cultivation of tomato in Hasgal-2 micro watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	28.07	4771.59	19.19
2	Bullock		Pairs/day	0.00	0.00	0.00
3	Tractor		Hours	3.37	2020.91	8.13
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	3.37	2189.32	8.80
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	22.45	2694.55	10.84
8	Fertilizer + micronutrients		Quintal	4.49	3480.45	14.00
9	Pesticides (PPC)		Kgs / ltrs	1.12	1122.73	4.51
10	Irrigation		Number	89.82	0.00	0.00
13	Depreciation charges			0.00	181.88	0.73
14	Land revenue and Taxes			0.00	4.94	0.02
II	**Cost B1**					
16	Interest on working capital				1138.45	4.58
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17604.81	70.79
III	**Cost B2**					
18	Rental Value of Land				400.00	1.61
19	**Cost B2 = (Cost B1 + Rental value)**				18004.81	72.40
IV	**Cost C1**					
20	Family Human Labour			20.21	4603.18	18.51
21	**Cost C1 = (Cost B2 + Family Labour)**				22607.99	90.91
V	**Cost C2**					
22	Risk Premium				0.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				22607.99	90.91
VI	**Cost C3**					
24	Managerial Cost				2260.80	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				24868.79	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		263.84	158304.54	
		b) Main Crop Sales Price (Rs.)			600.00	
b.	Gross Income (Rs.)				158304.54	
c.	Net Income (Rs.)				133435.75	
d.	Cost per Quintal (Rs./q.)				94.26	
e.	Benefit Cost Ratio (BC Ratio)				1:6.37	

Adequacy of fodder: The data regarding the adequacy of fodder in Hasgal-2 micro watershed is presented in Table 46. The results indicate that, 40 per cent of the households opined that dry fodder was adequate and 34 per cent of the households opined that green fodder was adequate.

Table 46. Adequacy of fodder in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0.00	2	25.00	9	60.00	5	41.67	4	80.00	20	40.00
2	Adequate-Green Fodder	0	0.00	0	0.00	8	53.33	6	50.00	3	60.00	17	34.00

Average annual gross income: The data regarding the average annual gross income in Hasgal-2 micro watershed is presented in Table 47. The results indicate that the average annual gross income was Rs. 88,100 for landless farmers, for marginal farmers it was Rs. 113,218.75, for small farmers it was Rs. 107,086.67, for semi medium farmers it was Rs. 167,966.67, and for medium farmers it was Rs. 134,600.

Table 47. Average annual gross income in Hasgal-2 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Service/salary	0.00	0.00	0.00	0.00	36,000.00	3,600.00
2	Business	5,800.00	0.00	0.00	0.00	0.00	1,160.00
3	Wage	82,300.00	20,625.00	14,666.67	4,416.67	5,000.00	25,720.00
4	Agriculture	0.00	89,812.50	82,453.33	161,800.00	81,600.00	86,098.00
5	Dairy Farm	0.00	2,781.25	2,633.33	1,750.00	0.00	1,655.00
6	Goat Farming	0.00	0.00	7,333.33	0.00	12,000.00	3,400.00
Income(Rs.)		88,100.00	113,218.75	107,086.67	167,966.67	134,600.00	121,633.00

Average annual expenditure: The data regarding the average annual expenditure in Hasgal-2 micro watershed is presented in Table 48. The results indicate that the average annual expenditure is Rs. 7,539.89. For landless households it was Rs. 7,100, for marginal farmers it was Rs. 7,000, for small farmers it was Rs. 4,611.85, for semi medium farmers it was Rs. 8,368.06, and for medium farmers it was Rs. 16,080.

Table 48. Average annual expenditure in Hasgal-2 micro watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Service/salary	0.00	0.00	0.00	0.00	45,000.00	900.00
2	Business	28,000.00	0.00	0.00	0.00	0.00	560.00
3	Wage	43,000.00	7,250.00	11,111.11	11,500.00	5,000.00	11,740.00
4	Agriculture	0.00	40,750.00	37,733.33	79,916.67	18,400.00	38,860.00
5	Dairy Farm	0.00	8,000.00	5,333.33	9,000.00	0.00	660.00
6	Goat Farming	0.00	0.00	15,000.00	0.00	12,000.00	840.00
Total		71,000.00	56,000.00	69,177.78	100,416.67	80,400.00	376,994.44
Average		7,100.00	7,000.00	4,611.85	8,368.06	16,080.00	7,539.89

Horticulture species grown: The data regarding horticulture species grown in Hasgal-2 micro watershed is presented in Table 49. The results indicate that, sampled households

have grown 19 coconuts and 27 mangoes in their fields. They have also grown 5 coconut and 1 mango tree in their backyard.

Table 49. Horticulture species grown in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	0	1	2	2	17	2	0	0	19	5
2	Mango	0	0	0	0	3	0	3	1	21	0	27	1

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

Forest species grown: The data regarding forest species grown in Hasgal-2 micro watershed is presented in Table 50. The results indicate that, households have planted 23 teak trees, 79 neem trees, 4 tamarind trees, 2 acacia trees and 1 peepul tree in their field.

Table 50: Forest species grown in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	0	23	0	0	0	0	0	23	0
2	Neem	0	0	20	0	20	0	23	0	16	0	79	0
3	Tamarind	0	0	0	0	2	0	2	0	0	0	4	0
4	Acacia	0	0	0	0	1	0	1	0	0	0	2	0
5	Peepul Tree	0	0	1	0	0	0	0	0	0	0	1	0

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

Average Additional investment capacity: The data regarding average additional investment capacity in Hasgal-2 micro watershed is presented in Table 51. The results indicate that, the average additional investment capacity with the households for land development was Rs. 1,280, for irrigation facility Rs. 260, for improved crop production Rs. 720 and for improved livestock management Rs. 420.

Table 51. Average Additional investment capacity in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)	MF (8)	SF (15)	SMF (12)	MDF (5)	All (50)
1	Land development	0	750	2,666.67	250	3,000	1,280
2	Irrigation facility	0	625	0	0	1,600	260
3	Improved crop production	0	0	1,733.33	166.67	1,600	720
4	Improved livestock management	0	375	800	250	600	420

Table 52: Source of additional investment in Hasgal-2 micro watershed

Sl. No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Loan from bank	8	16.0	2	4.0	6	12.0	7	14.0
2	Soft loan	0	0.0	0	0.0	1	2.0	0	0.0

Source of additional investment: The data regarding Source of additional investment in Hasgal-2 micro watershed is presented in Table 52. The results indicate that, loan from bank was the source of additional investment capacity for 16 per cent of the households for land development, 4 per cent for irrigation facility, 12 per cent for improved crop

production and 14 per cent for improved livestock management. Soft loan was the source of funds for 2 per cent of the households for improved crop production.

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Hasgal-2 micro watershed is presented in Table 53. The results indicated that, bajra, cotton, horsegram, maize, navane, paddy, redgram, tomato and watermelon were sold to the extent of 100 per cent. Groundnut was sold to the extent of 77.37 per cent.

Table 53. Marketing of the agricultural produce in Hasgal-2 micro watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	164.0	0.0	164.0	100.0	1283.33
2	Cotton	33.0	0.0	33.0	100.0	4550.0
3	Groundnut	190.0	43.0	147.0	77.37	3871.43
4	Horsegram	6.0	0.0	6.0	100.0	4000.0
5	Maize	598.0	0.0	598.0	100.0	1326.32
6	Navane	20.0	0.0	20.0	100.0	2000.0
7	Paddy	148.0	0.0	148.0	100.0	1483.33
8	Redgram	20.0	0.0	20.0	100.0	3800.0
9	Sorghum	72.0	0.0	72.0	100.0	1166.67
10	Tomato	235.0	0.0	235.0	100.0	600.0
11	Water Melon	44000.0	0.0	44000.0	100.0	43.33

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Hasgal-2 micro watershed is presented in Table 54. The results indicated that, about 30 per cent of the famers have sold their produce in regulated markets, 38 per cent have sold their produce to local/village merchants, 24 per cent of the farmers have sold through agents/traders and 8 per cent of the farmers have sold their produce in cooperative marketing society.

Table 54. Marketing Channels used for sale of agricultural produce in Hasgal-2 micro watershed

Sl. No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	1	12.50	3	20	7	58.33	1	20	12	24
2	Local/village Merchant	0	0	3	37.50	4	26.67	6	50	6	120	19	38
3	Regulated Market	0	0	5	62.50	5	33.33	5	41.67	0	0	15	30
4	Cooperative marketing Society	0	0	0	0	3	20	0	0	1	20	4	8

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Hasgal-2 micro watershed is presented in Table 55. The results indicated that, 84 per cent of the households have used tractor as a mode of transportation for their agricultural produce, 2 per cent have used truck and 12 per cent have used cart as a mode of transportation.

Table 55. Mode of transport of agricultural produce in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	0	0.00	1	12.50	0	0.00	4	33.33	1	20.00	6	12.00
2	Tractor	0	0.00	8	100.00	14	93.33	13	108.33	7	140.00	42	84.00
3	Truck	0	0.00	0	0.00	1	6.67	0	0.00	0	0.00	1	2.00

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Hasgal-2 micro watershed is presented in Table 56. The results indicated that, 20 per cent of the households have experienced soil and water erosion problems in the farm i.e., 12.50 per cent of marginal farmers, 33.33 per cent of small farmers, 8.33 per cent of semi medium farmers and 60 per cent of medium farmers have experienced soil and water erosion problems.

Table 56. Incidence of soil and water erosion problems in Hasgal-2 micro watershed

Sl. No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0.00	1	12.50	5	33.33	1	8.33	3	60.00	10	20.00

Interest shown towards soil testing: The data regarding incidence of soil and water erosion problems in Hasgal-2 micro watershed is presented in Table 57. The results indicated that, 58 per cent have shown interest in soil test.

Table 57. Interest shown towards soil testing in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0.00	5	62.50	12	80.00	8	66.67	4	80.00	29	58.00

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Hasgal-2 micro watershed is presented in Table 58. The results indicated that, 96 per cent used fire wood and 8 per cent of the households used LPG.

Table 58. Usage pattern of fuel for domestic use in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	10	100.00	7	87.50	14	93.33	13	108.33	4	80.00	48	96.00
2	LPG	0	0.00	1	12.50	1	6.67	0	0.00	2	40.00	4	8.00

Source of drinking water: The data regarding source of drinking water in Hasgal-2 micro watershed is presented in Table 59. The results indicated that, piped supply was the major source of drinking water for 86 per cent of the households and bore well was the source of drinking water for 12 per cent of the households.

Table 59. Source of drinking water in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	10	100.00	8	100.00	13	86.67	10	83.33	2	40.00	43	86.00
2	Bore Well	0	0.00	0	0.00	2	13.33	2	16.67	2	40.00	6	12.00

Source of light: The data regarding source of light in Hasgal-2 micro watershed is presented in Table 60. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 60. Source of light in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	10	100.00	8	100.00	15	100.00	12	100.00	5	100.00	50	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Hasgal-2 micro watershed is presented in Table 61. The results indicated that, 42 per cent of the households possess sanitary toilet i.e. 50 per cent of the landless, 50 per cent of the marginal, 26.67 per cent of the small, 25 per cent of the semi medium and 100 per cent of the medium farmers.

Table 61. Existence of Sanitary toilet facility in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	5	50.00	4	50.00	4	26.67	3	25.00	5	100.00	21	42.00

Possession of PDS card: The data regarding possession of PDS card in Hasgal-2 micro watershed is presented in Table 62. The results indicated that, 96 per cent of the sampled households possessed BPL card, 2 per cent of the sampled households possessed APL card and 2 per cent did not possess PDS card.

Table 62. Possession of PDS card in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0.00	0	0.00	1	6.67	0	0.00	0	0.00	1	2.00
2	BPL	10	100.00	8	100.00	14	93.33	11	91.67	5	100.00	48	96.00
3	Not Possessed	0	0.00	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00

Participation in NREGA program: The data regarding participation in NREGA programme in Hasgal-2 micro watershed is presented in Table 63. The results indicated that, 54 per cent of the households participated in NREGA programme.

Table 63. Participation in NREGA programme in Hasgal-2 micro watershed

Sl.No.	Particulars	LL(10)		MF (8)		SF (15)		SMF(12)		MDF(5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	4	40.00	1	12.50	15	100.00	2	16.67	5	100.00	27	54.00

Adequacy of food items: The data regarding adequacy of food items in Hasgal-2 micro watershed is presented in Table 64. The results indicated that, cereals were adequate for 96 per cent of the households, pulses were adequate for 56 per cent, oilseeds were adequate for 16 per cent, vegetables were adequate for 56 per cent, fruits were adequate for 52 per cent, milk was adequate for 90 per cent, eggs were adequate for 84 per cent and meat was adequate for 66 per cent of the households.

Table 64. Adequacy of food items in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	8	80	8	100	15	100	12	100	5	100	48	96
2	Pulses	5	50	6	75	7	46.67	7	58.33	3	60	28	56
3	Oilseed	0	0	2	25	3	20	2	16.67	1	20	8	16
4	Vegetables	5	50	2	25	11	73.33	7	58.33	3	60	28	56
5	Fruits	5	50	2	25	10	66.67	7	58.33	2	40	26	52
6	Milk	9	90	7	87.50	14	93.33	11	91.67	4	80	45	90
7	Egg	9	90	7	87.50	12	80	12	100	2	40	42	84
8	Meat	8	80	4	50	11	73.33	9	75	1	20	33	66

Response on Inadequacy of food items: The data regarding inadequacy of food items in Hasgal-2 micro watershed is presented in Table 65. The results indicated that, cereals were inadequate for 4 per cent, pulses were inadequate for 46 per cent, oilseeds were inadequate for 80 per cent, vegetables were inadequate for 42 per cent, fruits were inadequate for 40 per cent, milk was inadequate for 6 per cent, eggs were inadequate for 6 per cent and meat was inadequate for 24 per cent of the households.

Table 65. Response on Inadequacy of food items in Hasgal-2 micro watershed

Sl.No.	Particulars	LL (10)		MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	2	20.00	0	0.00	0	0.00	0	0.00	0	0.00	2	4.00
2	Pulses	5	50.00	2	25.00	8	53.33	5	41.67	3	60.00	23	46.00
3	Oilseed	10	100.00	6	75.00	11	73.33	10	83.33	3	60.00	40	80.00
4	Vegetables	5	50.00	5	62.50	4	26.67	5	41.67	2	40.00	21	42.00
5	Fruits	5	50.00	5	62.50	3	20.00	5	41.67	2	40.00	20	40.00
6	Milk	1	10.00	0	0.00	0	0.00	1	8.33	1	20.00	3	6.00
7	Egg	1	10.00	0	0.00	0	0.00	0	0.00	2	40.00	3	6.00
8	Meat	1	10.00	3	37.50	2	13.33	3	25.00	3	60.00	12	24.00

Table 66. Farming constraints Experienced in Hasgal-2 micro watershed

Sl. No.	Particulars	MF (8)		SF (15)		SMF (12)		MDF (5)		All (50)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	7	87.50	11	73.33	8	66.67	3	60	29	58
2	Wild animal menace on farm field	7	87.50	14	93.33	11	91.67	4	80	36	72
3	Frequent incidence of pest and diseases	6	75	8	53.33	9	75	1	20	24	48
4	Inadequacy of irrigation water	5	62.50	9	60	6	50	1	20	21	42
5	High cost of Fertilizers and plant protection chemicals	6	75	8	53.33	9	75	2	40	25	50
6	High rate of interest on credit	8	100	9	60	7	58.33	3	60	27	54
7	Low price for the agricultural commodities	6	75	11	73.33	7	58.33	2	40	26	52
8	Lack of marketing facilities in the area	4	50	10	66.67	8	66.67	3	60	25	50
9	Inadequate extension services	6	75	8	53.33	6	50	2	40	22	44
10	Lack of transport for safe transport of the Agril produce to the market.	5	62.50	11	73.33	9	75	3	60	28	56
11	Less rainfall	1	12.50	3	20	4	33.33	2	40	10	20
12	Source of Agri-technology information(Newspaper/TV/Mobile)	1	12.50	2	13.33	2	16.67	1	20	6	12

Farming constraints: The data regarding farming constraints experienced by households in Hasgal-2 micro watershed is presented in Table 66. The results indicated that, lower fertility status of the soil was the constraint experienced by 58 per cent of the households, wild animal menace on farm field (72%), frequent incidence of pest and diseases (48%), inadequacy of irrigation water (42%), high cost of fertilizers and plant protection chemicals (50%), high rate of interest on credit (54%), low price for the agricultural commodities (52%), lack of marketing facilities in the area (50%), lack of transport for safe transport of the agricultural produce to the market (56%), less rainfall (20%), inadequate extension services (44%), and source of agri-technology information (newspaper/TV/mobile) (12%).

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 50 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 125 (53.42%) men and 109 (46.58%) women among the sampled households. The average family size of landless farmers' was 4.1, marginal farmers' was 4, small farmers' was 5.06, semi medium farmers' was 4.4 and medium farmers' was 6.4.

The data indicated that, 52 (22.22%) people were in 0-15 years of age, 96 (41.03%) were in 16-35 years of age, 67 (28.63%) were in 36-60 years of age and 19 (8.12 %) were above 61 years of age.

The results indicated that Hasgal-2 had 26.92 per cent illiterates, 0.85 per cent functional literates, 34.62 per cent of them had primary school education, 10.68 per cent of them had middle school education, 14.53 per cent of them had high school education, 6.41 per cent of them had PUC education, 0.85 per cent did diploma, 0.43 per cent of them did ITI, 2.14 per cent of them had degree education and 0.43 per cent were in masters.

The results indicate that, 76 per cent of households practicing agriculture, 4 per cent of the households were agricultural labourers, 20 per cent were general labourers, 2 per cent of them were housewives and 2 per cent of them were children.

The results indicate that agriculture was the major occupation for 48.72 per cent of the household members, 8.12 per cent were agricultural laborers, 12.39 per cent were general labour, 2.56 per cent were in private, 23.50 per cent were students, 1.71 per cent were housewives and 2.14 per cent were children.

The results show that 100 per cent of the population in the micro watershed has not participated in any local institutions. The results indicate that 14 per cent of the households possess thatched house, 74 per cent of the households possess Katcha house 4 per cent of them possess pucca house and 8 per cent of them possess semi pucca house.

The results show that 84 per cent of the households possess TV, 56 per cent of the households possess Mixer grinder, 46 per cent of the households possess bicycle, 38 per cent of the households possess motor cycle, 4 per cent of them possess landline and 88 per cent of the households possess mobile phones. The results show that the average

value of television was Rs.7571, mixer grinder was Rs.1846, bicycle was Rs. 3347, motor cycle was Rs.37315, landline phone was Rs.3333 and mobile phone was Rs.1653.

About 20 per cent of the households possess bullock cart, 34 per cent of them possess plough, 2 per cent of them possess tractor, 22 per cent of them possess sprayer, 2 per cent of them possess sprinkler, 80 per cent of them possess weeder, 4 per cent of them possess harvester, 2 per cent of them possess thresher, 10 per cent of them possess chaff cutter and 2 per cent of them possess JCB/Hitachi. The results show that the average value of bullock cart was Rs.21200, plough was Rs.1016, the average value of tractor was Rs.300000, the average value of sprayer was Rs.2844, the average value of sprinkler was Rs. 3300, the average value of harvester was Rs.6942, the average value of thresher was Rs.50000, the average value of chaff cutter was Rs.2800, and the average value of weeder was Rs.77.

The results indicate that, 36 per cent of the households possess bullocks, 16 per cent of the households possess local cow, 6 per cent of the households possess buffalo, 4 per cent of them possess sheep, 2 per cent of the households possess goat and 2 per cent of them possess poultry birds.

The results indicate that, average own labour men available in the micro watershed was 8.85, average own labour (women) available was 5.55, average hired labour (men) available was 11.40 and average hired labour (women) available was 10.79. About 80 per cent of the households opined that the hired labour was adequate.

The results indicate that, households of the Hasgal-2 micro watershed possess 42.85 ha (64.97%) of dry land and 23.11 ha (35.03%) of irrigated land. Marginal farmers possess 4.80 ha (84.35%) of dry land and 0.89 ha (15.65%). Small farmers possess 18.34 ha (91.39%) of dry land and 1.73 ha (8.61%) of irrigated land. Semi medium farmers possess 8.38 ha (37.95%) of dry land and 13.70 ha (62.05%) of irrigated land. Medium farmers possess 11.33 ha (62.53%) of dry land and 6.79 ha (37.47%) of the farmers possess irrigated land.

The results indicate that, the average value of dry land was Rs. 293003 and average value of irrigated land was Rs. 514763. In case of marginal famers, the average land value was Rs. 470674 for dry land and Rs.1347272 for irrigated land. In case of small famers, the average land value was Rs. 414210 for dry land and Rs. 925526 for irrigated land. In case of semi medium famers, the average land value was Rs. 155120 for dry land and Rs. 474298 for irrigated land. In case of medium famers, the average land value was Rs. 123500 for dry land and Rs.382717 for irrigated land.

The results indicate that, there were 14 functioning and 2 de-functioning bore wells in the micro watershed. There was 1 functioning open well in the micro watershed. Bore well was the major irrigation source in the micro water shed for 28 per cent of the farmers, and open well was the source of irrigation for 2 per cent of the farmers. The

depth of bore well was found to be 24.14 meters and the depth of open well was found to be 1.83 meters.

The results indicate that, marginal, small, semi medium and medium farmers had irrigated area of 0.81 ha, 3.72 ha, 13.91 ha and 5.51 ha respectively. Farmers have grown bajra (11.62 ha), cotton (1.78 ha), groundnut (5.15 ha), horsegram (1.21 ha), maize (21.74 ha), navane (1.70 ha), paddy (2.83 ha), redgram (1.62 ha), sorghum (2.18 ha), tomato (0.89 ha), and watermelon (2.91 ha). Marginal farmers have grown bajra, maize, watermelon and groundnut. Small farmers have grown bajra, cotton, groundnut, maize, navane, paddy and watermelon. Semi medium farmers have grown bajra, cotton, maize, paddy, sorghum, tomato, watermelon and groundnut. Medium farmers have grown bajra, groundnut, horsegram, paddy, redgram sorghum and maize.

The results indicate that, the cropping intensity in Hasgal-2 micro watershed was found to be 98.20 per cent. In case of marginal and semi medium farmers it was 100 per cent, in case of small farmers it was 101.67 per cent, and medium farmers had cropping intensity of 87.23 per cent.

The results indicate that, 62 per cent of the households have bank account and 40 per cent of the households have savings. The results indicate that, 44 per cent of the households have availed credit from different sources. The results indicate that, 31.82 per cent of the households availed loan from commercial bank, 13.64 per cent availed loan from cooperative bank, 22.73 per cent availed loan from grameena bank, 13.64 per cent availed loan from money lenders and 36.36 per cent of the households obtained loan from SHGs/CBOs. The results indicate that, marginal, small, semi medium and medium farmers have availed Rs.19285, Rs.90714, Rs.104285, and Rs.50000 respectively. 100 per cent of the households have borrowed loan from institutional sources for the purpose of agricultural production. The main purpose of borrowing credit from private sources was agricultural production which accounted for 63.64 per cent of those who borrowed credit. Another 18.18 per cent of the households borrowed for social functions, 9.09 per cent of the households borrowed for the purpose of construction of house or cattle shed and 9.09 per cent borrowed for household consumption.

The results indicated that 80 per cent of the households did not repay their loan borrowed from institutional sources, 13.33 per cent of the households partially paid and 6.67 per cent of the households fully repaid their loan. Results indicated that 81.82 per cent of the households partially paid their loan borrowed from private sources, 9.09 per cent of the households did not repay their loan and 9.09 per cent of the households fully paid their loans.

The results indicate that, around 46.67 per cent of the households opined that the rate of interest was higher in institutional sources; another 40 per cent opined that the loan amount helped to perform timely agricultural operations.

The results indicate that, around 9.09 per cent of the households opined that credit was easily accessible, 18.18 per cent of the households opined that the credit helped to perform timely agricultural operations and 27.27 per cent opined that the rate of interest was high in non institutional source of credits.

The results indicate that, the total cost of cultivation for sorghum was Rs. 37771.28. The gross income realized by the farmers was Rs. 70523.07. The net income from Sorghum cultivation was Rs. 32751.80, thus the benefit cost ratio was found to be 1:1.87. The total cost of cultivation for groundnut was Rs. 46621.42. The gross income realized by the farmers was Rs. 67059.85. The net income from groundnut cultivation was Rs. 20438.43. Thus the benefit cost ratio was found to be 1:1.44. The total cost of cultivation for navane was Rs. 16260.02. The gross income realized by the farmers was Rs. 23523.81. The net income from navane cultivation was Rs. 7263.79. Thus the benefit cost ratio was found to be 1:1.45. The total cost of cultivation for maize was Rs. 32823.70. The gross income realized by the farmers was Rs. 38634.10. The net income from maize cultivation was Rs. 5810.40. Thus the benefit cost ratio was found to be 1:1.18. The total cost of cultivation for bajra was Rs. 22880. The gross income realized by the farmers was Rs. 20415.02. The net income from bajra cultivation was Rs. -2464.98. Thus the benefit cost ratio was found to be 1:0.89. The total cost of cultivation for redgram was Rs. 18070.78. The gross income realized by the farmers was Rs. 46930. The net income from redgram cultivation was Rs. 28859.22. Thus the benefit cost ratio was found to be 1:2.6. The total cost of cultivation for horsegram was Rs. 19107.60. The gross income realized by the farmers was Rs. 29640. The net income from horsegram cultivation was Rs. 10532.40. Thus the benefit cost ratio was found to be 1:1.55. The total cost of cultivation for watermelon was Rs. 53952.66. The gross income realized by the farmers was Rs. 1264061.94. The net income from watermelon cultivation was Rs. 1210109.29. Thus the benefit cost ratio was found to be 1:23.43. The total cost of cultivation for cotton was Rs. 29826.92. The gross income realized by the farmers was Rs. 84288.75. The net income from cotton cultivation was Rs. 54461.83. Thus the benefit cost ratio was found to be 1:2.83. The total cost of cultivation for paddy was Rs. 41184.13. The gross income realized by the farmers was Rs. 71007.93. The net income from paddy cultivation was Rs. 29823.79. Thus the benefit cost ratio was found to be 1:1.72. The total cost of cultivation for tomato was Rs. 24868.79. The gross income realized by the farmers was Rs. 158304.54. The net income from tomato cultivation was Rs. 133435.75. Thus the benefit cost ratio was found to be 1:6.37.

The results indicate that, 40 per cent of the households opined that dry fodder was adequate and 34 per cent of the households opined that green fodder was adequate.

The results indicate that the average annual gross income was Rs. 88,100 for landless farmers, for marginal farmers it was Rs. 113,218.75, for small farmers it was Rs. 107,086.67, for semi medium farmers it was Rs. 167,966.67, and for medium farmers it

was Rs. 134,600. The results indicate that the average annual expenditure is Rs. 7,539.89. For landless households it was Rs. 7,100, for marginal farmers it was Rs. 7,000, for small farmers it was Rs. 4,611.85, for semi medium farmers it was Rs. 8,368.06, and for medium farmers it was Rs. 16,080.

The results indicate that, sampled households have grown 19 coconuts and 27 mangoes in their fields. They have also grown 5 coconut and 1 mango tree in their backyard. The results indicate that, households have planted 23 teak trees, 79 neem trees, 4 tamarind trees, 2 acacia trees and 1 peepul tree in their field.

The results indicate that, the average additional investment capacity with the households for land development was Rs. 1,280, for irrigation facility Rs. 260, for improved crop production Rs. 720 and for improved livestock management Rs. 420.

The results indicate that, loan from bank was the source of additional investment capacity for 16 per cent of the households for land development, 4 per cent for irrigation facility, 12 per cent for improved crop production and 14 per cent for improved livestock management. Soft loan was the source of funds for 2 per cent of the households for improved crop production.

The results indicated that, bajra, cotton, horsegram, maize, navane, paddy, redgram, tomato and watermelon were sold to the extent of 100 per cent. Groundnut was sold to the extent of 77.37 per cent. About 30 per cent of the famers have sold their produce in regulated markets, 38 per cent have sold their produce to local/village merchants, 24 per cent of the farmers have sold through agents/traders and 8 per cent of the farmers have sold their produce in cooperative marketing society. 84 per cent of the households have used tractor as a mode of transportation for their agricultural produce, 2 per cent have used truck and 12 per cent have used cart as a mode of transportation.

The results indicated that, 20 per cent of the households have experienced soil and water erosion problems in the farm i.e., 12.50 per cent of marginal farmers, 33.33 per cent of small farmers, 8.33 per cent of semi medium farmers and 60 per cent of medium farmers have experienced soil and water erosion problems. About 58 per cent have shown interest in soil test.

The results indicated that, 96 per cent used fire wood and 8 per cent of the households used LPG. Piped supply was the major source of drinking water for 86 per cent of the households and bore well was the source of drinking water for 12 per cent of the households. Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 42 per cent of the households possess sanitary toilet i.e. 50 per cent of the landless, 50 per cent of the marginal, 26.67 per cent of the small, 25 per cent of the semi medium and 100 per cent of the medium farmers. The results indicated that, 96 per cent of the sampled household possessed BPL card, 2 per cent of the sampled households possessed APL card and 2 per cent did not

possess PDS card. The results indicated that, 54 per cent of the households participated in NREGA programme. The results indicated that, cereals were adequate for 96 per cent of the households, pulses were adequate for 56 per cent, oilseeds were adequate for 16 per cent, vegetables were adequate for 56 per cent, fruits were adequate for 52 per cent, milk was adequate for 90 per cent, eggs were adequate for 84 per cent and meat was adequate for 66 per cent of the households.

The results indicated that, cereals were inadequate for 4 per cent, pulses were inadequate for 46 per cent, oilseeds were inadequate for 80 per cent, vegetables were inadequate for 42 per cent, fruits were inadequate for 40 per cent, milk was inadequate for 6 per cent, eggs were inadequate for 6 per cent and meat was inadequate for 24 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 58 per cent of the households, wild animal menace on farm field (72%), frequent incidence of pest and diseases (48%), inadequacy of irrigation water (42%), high cost of fertilizers and plant protection chemicals (50%), high rate of interest on credit (54%), low price for the agricultural commodities (52%), lack of marketing facilities in the area (50%), lack of transport for safe transport of the agricultural produce to the market (56%), less rainfall (20%), inadequate extension services (44%), and source of agri-technology information (newspaper/TV/mobile) (12%).