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

HALAWADI (4D4A2Q2c) MICRO WATERSHED

Alavandi Hobli, Koppal Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

About ICAR - NBSS&LUP

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

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

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PREFACE

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

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

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

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

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

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

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

Nagpur
Date: 30-07-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

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

The present study covers an area of 525 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 97 per cent is covered by soil and 3 per cent by habitation and water body. The salient findings from the land resource inventory are summarized briefly below

- *The soils belong to 16 soil series and 25 soil phases (management units) and 6 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 1 per cent of the soils are shallow (25-50 cm), 11 per cent of the soils are moderately shallow (50-75 cm), 49 per cent moderately deep (75- 100 cm) and 36 per cent is deep to very deep (100->150cm) soils.*
- *About 40 per cent loamy (sandy loam and sandy clay loam) and 57 per cent has clayey (sandy clay and clay) soils at the surface.*
- *About 63 per cent of the area has non-gravelly (<15%) soils, 26 per cent has gravelly soils (15-35 % gravel), 8 per cent very gravelly (35-60 %) and <1 per cent extremely gravelly (60-80 %) soils.*
- *With respect to available water capacity 29 per cent of the area has very low (<50mm/m), 46 per cent of the area has low (51-100 mm/m), 13 per cent medium*

(101-150 mm/m), 6 per cent high (151-200 mm/m) and 3 per cent area has very high (>200mm/m) in available water capacity.

- *An area of about 3 per cent has nearly level (0-1%) lands and 94 per cent has very gently sloping (1-3%) lands.*
- *An area of about 59 per cent is slightly eroded (e1) and 38 per cent is moderately eroded (e2) lands.*
- *An area of about 11 per cent is neutral (pH 6.5-7.3), 7 per cent is slightly alkaline (pH 7.3-7.8), 55 per cent is moderately alkaline (pH 7.8-8.4), 23 per cent is strongly alkaline (pH 8.4-9.0) and 2 per cent is very strongly alkaline (pH >9.00) in reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dSm^{-1} indicating that soils are non saline.*
- *Organic carbon is low (<0.5%) in 42 per cent, medium (0.5-0.75%) in 54 per cent and high (>0.75%) in 1 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 3 per cent, medium (145-337 kg/ha) in 59 per cent and high (>337 kg/ha) in 35 per cent of the soils.*
- *Available sulphur is low (<10 ppm) in the entire area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in 25 per cent and medium (0.5-1.0) in 72 per cent area of the microwatershed.*
- *Available iron is deficient (<4.5 ppm) in the entire area of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in 40 per cent and sufficient (>0.6 ppm) in 57 per cent area of the microwatershed.*
- *Available manganese and copper are 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	*124(24)*	*169(32)*	*Sapota*	*73(14)*	*234(44)*
Maize	*43(8)*	*250(48)*	*Pomegranate*	*73(14)*	*249(47)*
Bajra	*219(42)*	*159(30)*	*Musambi*	*89(17)*	*234(44)*
Groundnut	*142(27)*	*320(61)*	*Lime*	*89(17)*	*234(44)*
Sunflower	*89(17)*	*168(32)*	*Amla*	*235(45)*	*268(51)*
Redgram	*73(14)*	*183(35)*	*Cashew*	*73(14)*	*237(45)*
Bengal gram	*15(3)*	*297(57)*	*Jackfruit*	*73(14)*	*234(44)*
Cotton	*46(9)*	*247(47)*	*Jamun*	*31(6)*	*269(52)*
Chilli	*108(21)*	*184(35)*	*Custard apple*	*235(45)*	*268(51)*
Tomato	*108(21)*	*184(35)*	*Tamarind*	*31(6)*	*58(11)*
Brinjal	*188(36)*	*192(37)*	*Mulberry*	*73(14)*	*358(68)*
Onion	*153(29)*	*212(41)*	*Marigold*	*73(14)*	*219(42)*
Bhendi	*153(29)*	*227(44)*	*Chrysanthemum*	*73(14)*	*219(42)*
Drumstick	*73(14)*	*282(54)*	*Jasmine*	*73(14)*	*204(39)*
Mango	*31(6)*	*43(8)*	*Crossandra*	*73(14)*	*204(39)*
Guava	*73(14)*	*234(44)*			

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 6 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 Halawadi 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 Halawadi micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig2.1). It lies between $15^0$9' and $15^0$11' North latitudes and $75^0$56' and $75^0$58' East longitudes and covers an area of about 525 ha. It is about 23 km from Koppal town. It comprises and bounded by Kallahalli and Alavandi on the north, Hyderanagara on the west, Halavagali on the south and southeast and Kasalapura on the south and Byrapura on the eastern side of the microwatershed.

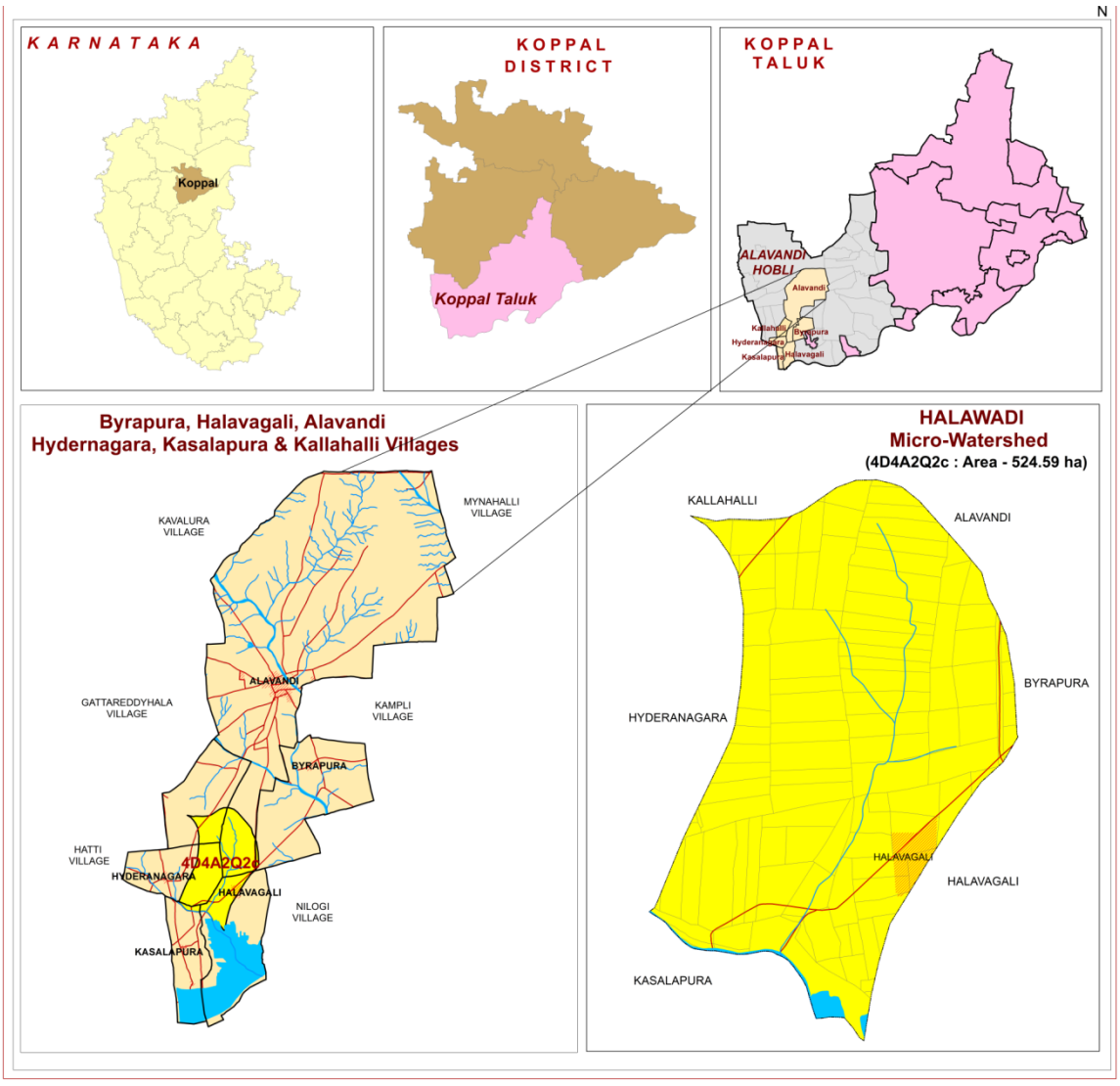

Fig.2.1 Location map of Halawadi Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss (Fig.2.2 a). 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 Halawadi village.

Fig.2.2 Granite and granite gneiss rocks

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss 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 533 to 546 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**	

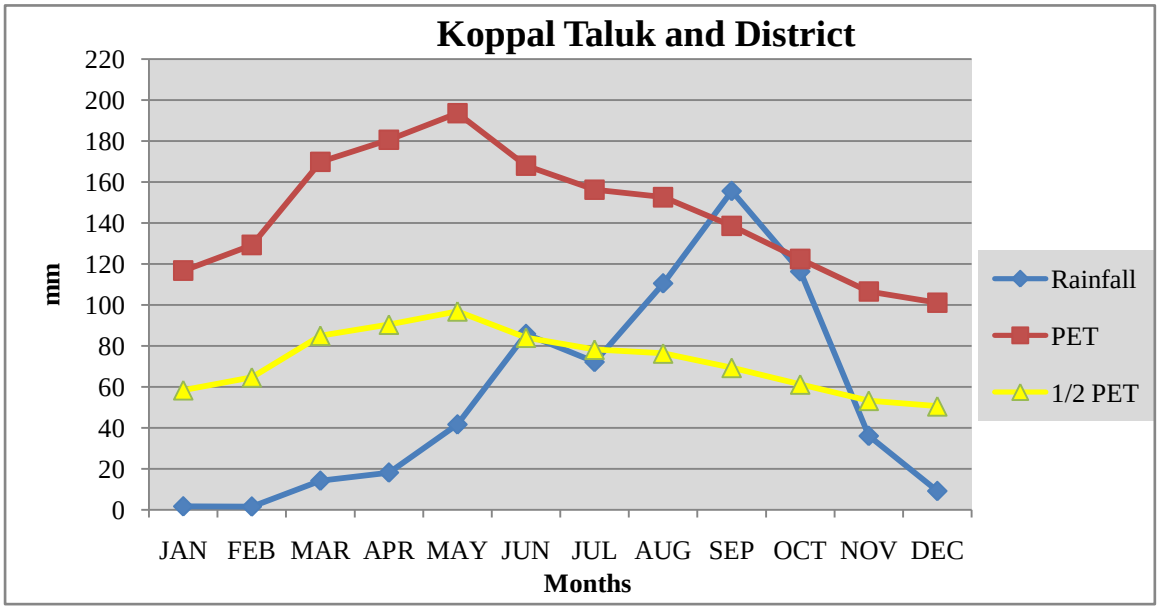

Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Halawadi 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 Halawadi microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells) is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells in Halawadi 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 Halawadi Microwatershed.

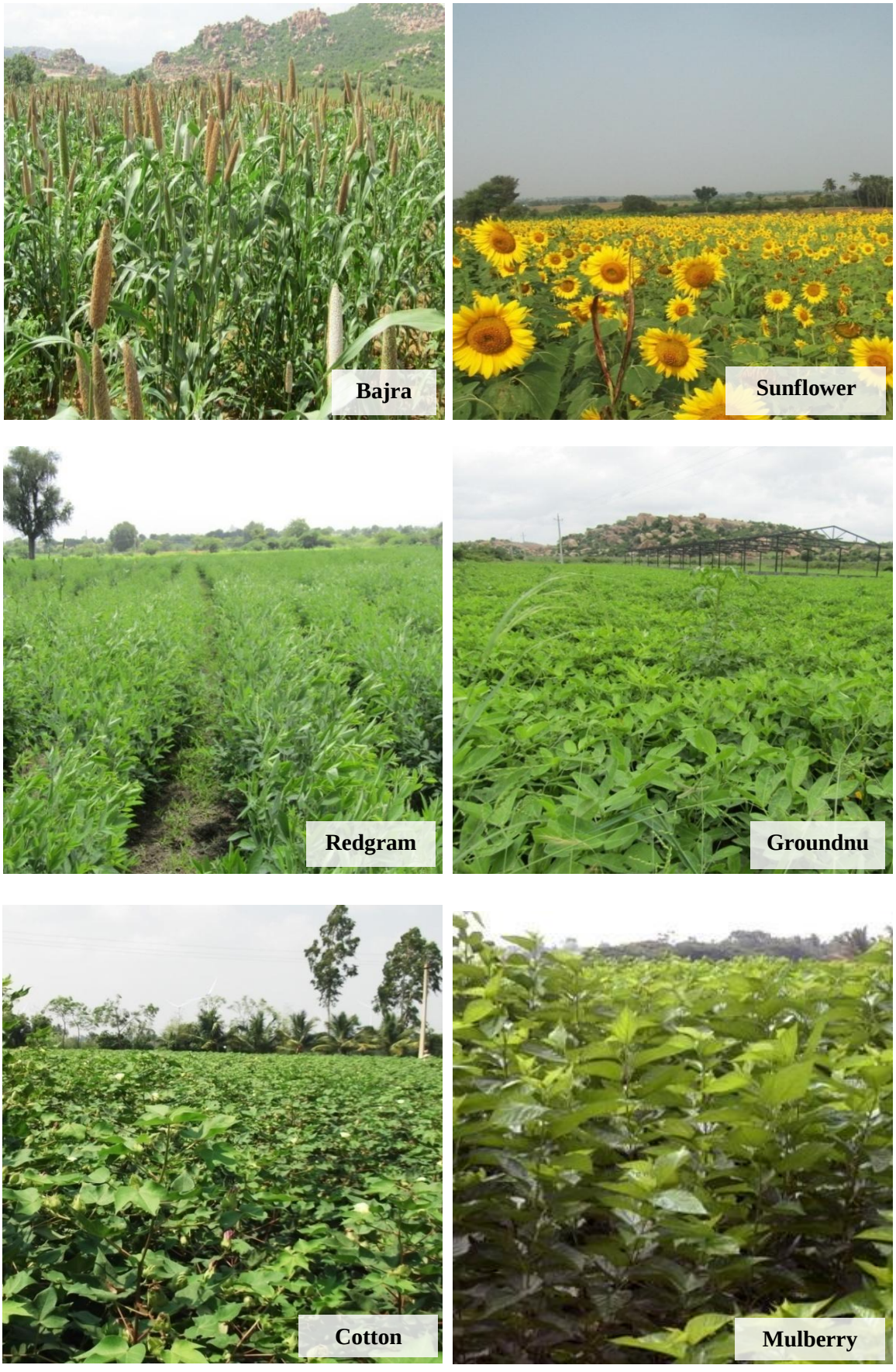

Fig.2.5 (b) Different crops and cropping systems in Halawadi Microwatershed.

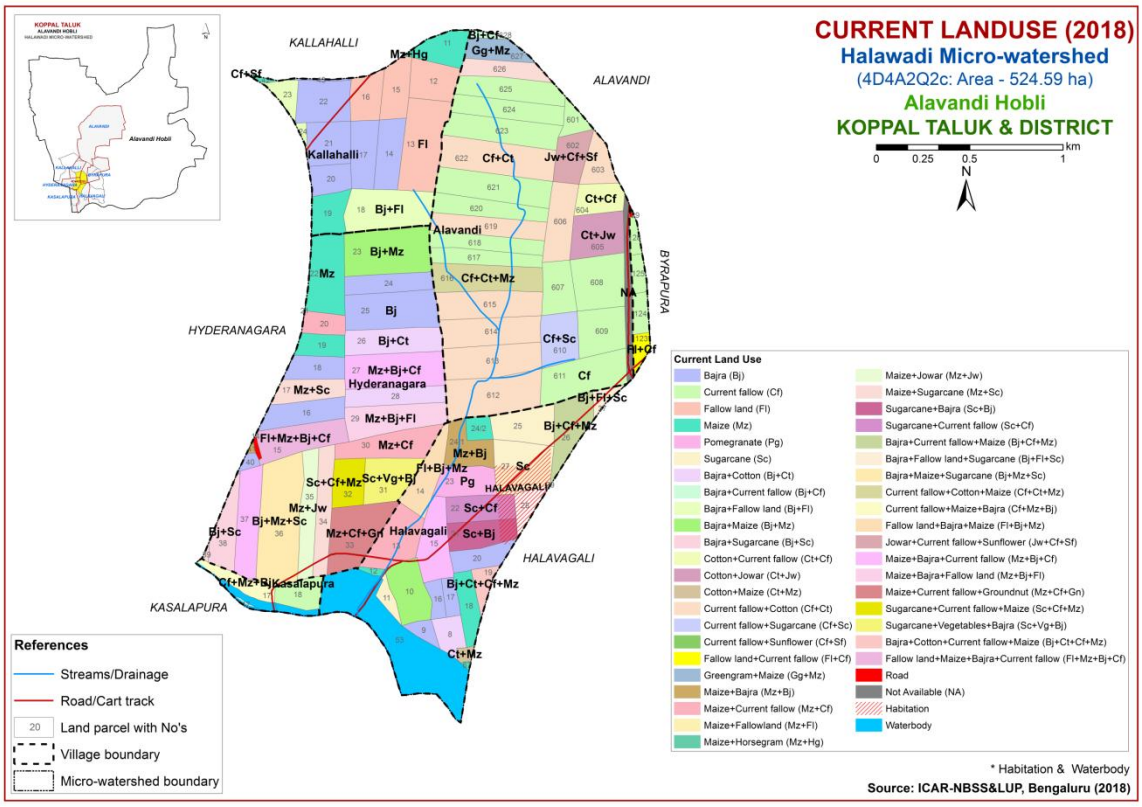

Fig.2.6 Current Land Use map of Halawadi Microwatershed

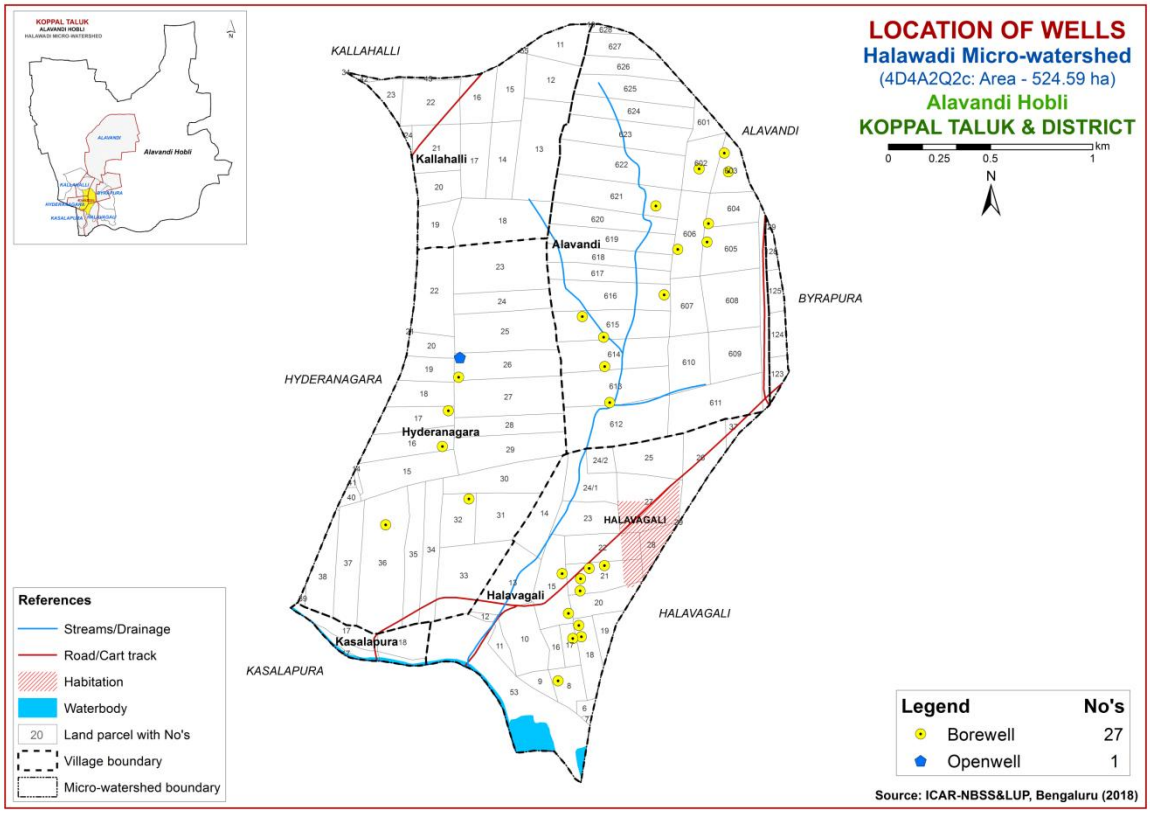

Fig.2.7 Location of wells map of Halawadi Microwatershed

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 Halawadi 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 525 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 landscape 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

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

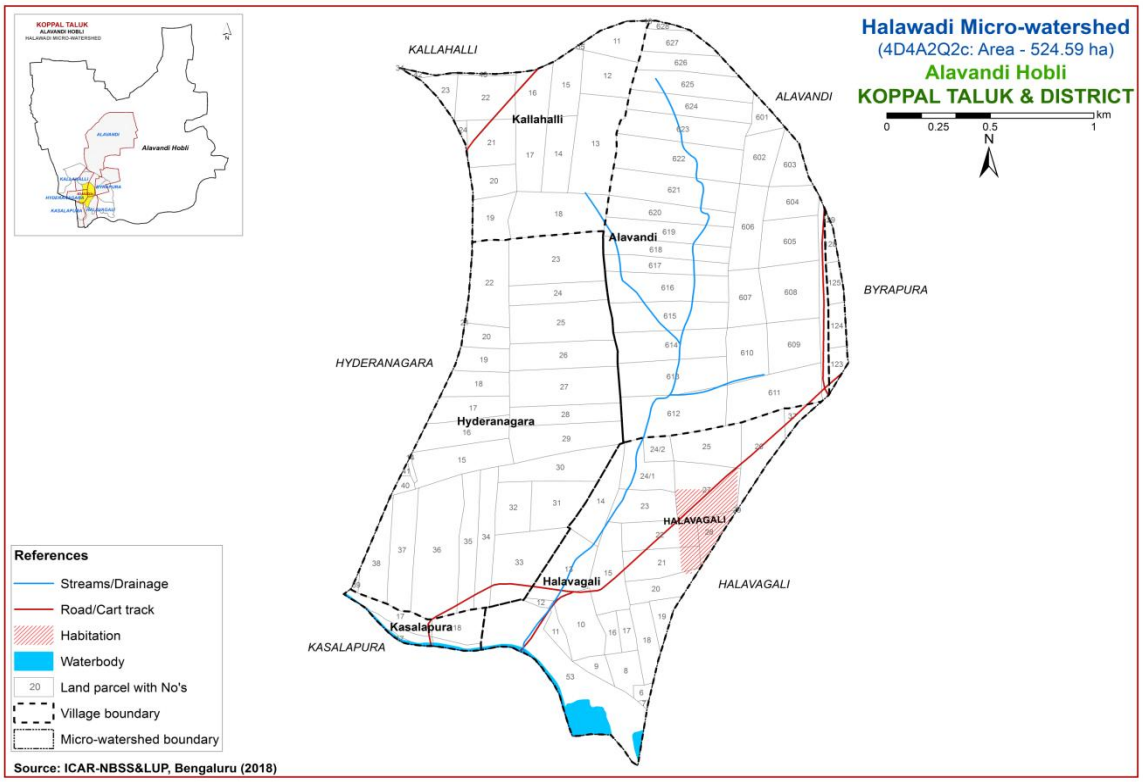

Fig 3.1 Scanned and Digitized Cadastral map of Halawadi Microwatershed

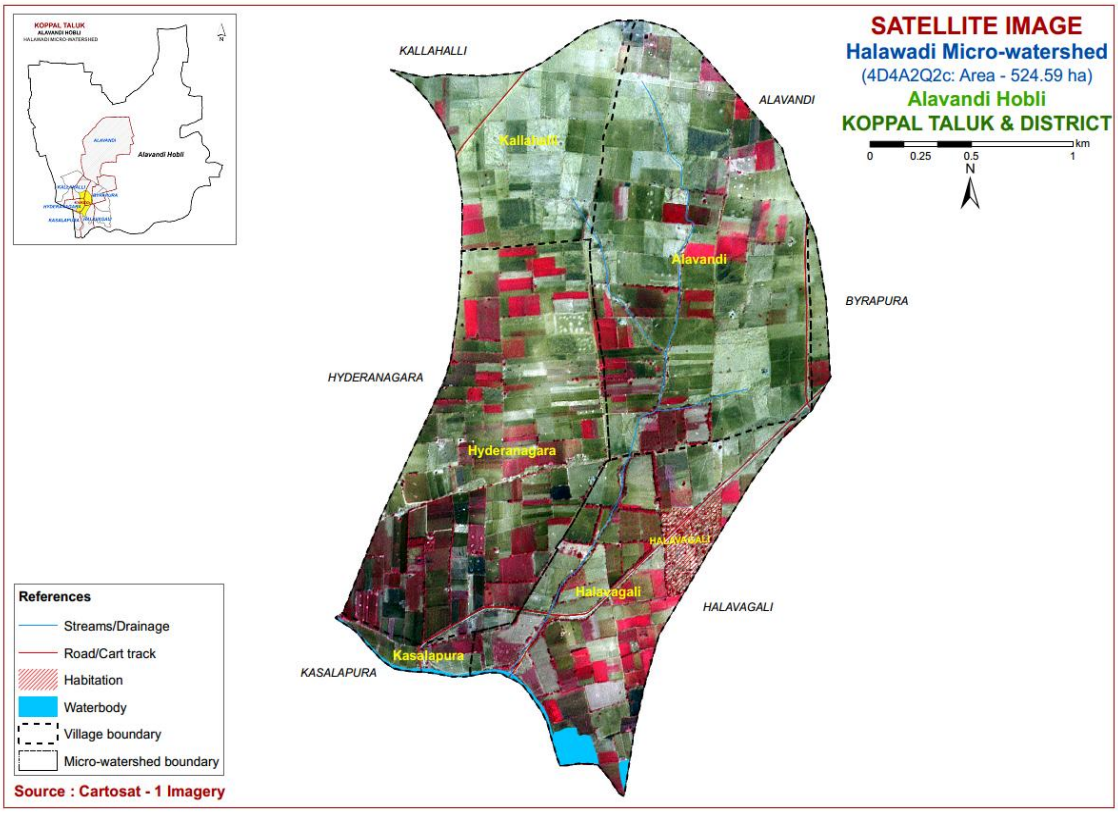

Fig.3.2 Satellite Image of Halawadi Microwatershed

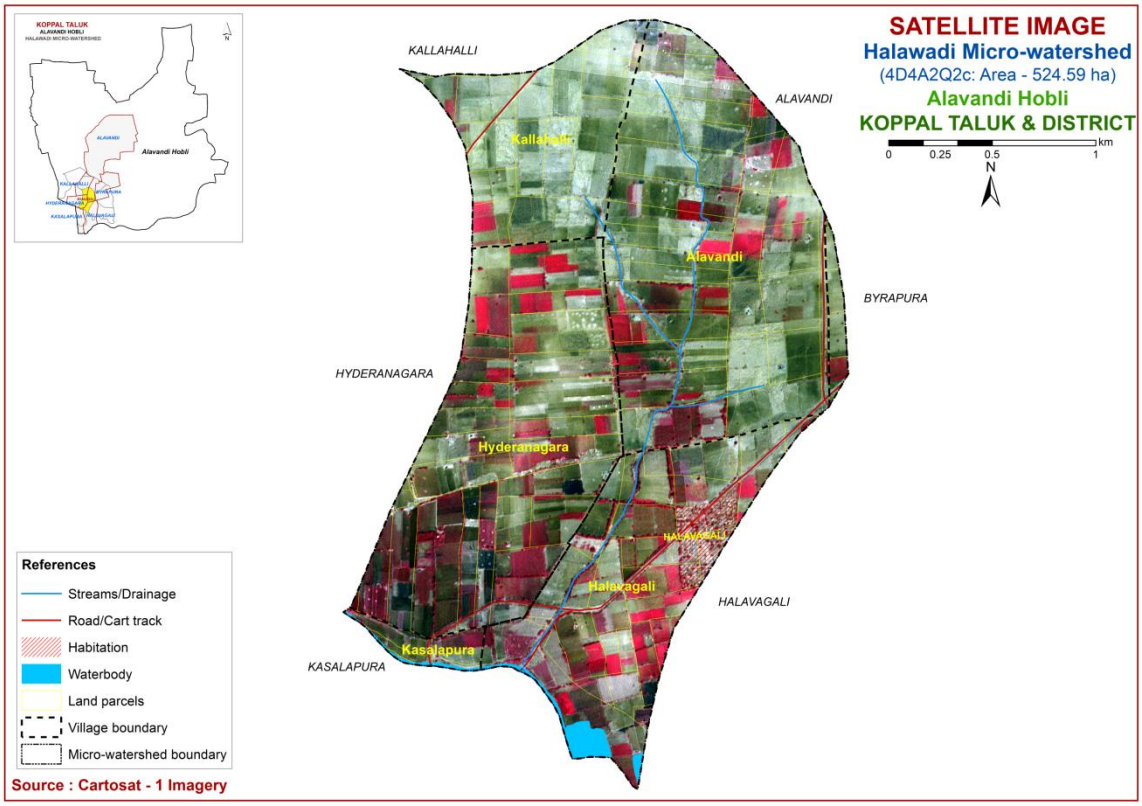

Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Halawadi Microwatershed

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).

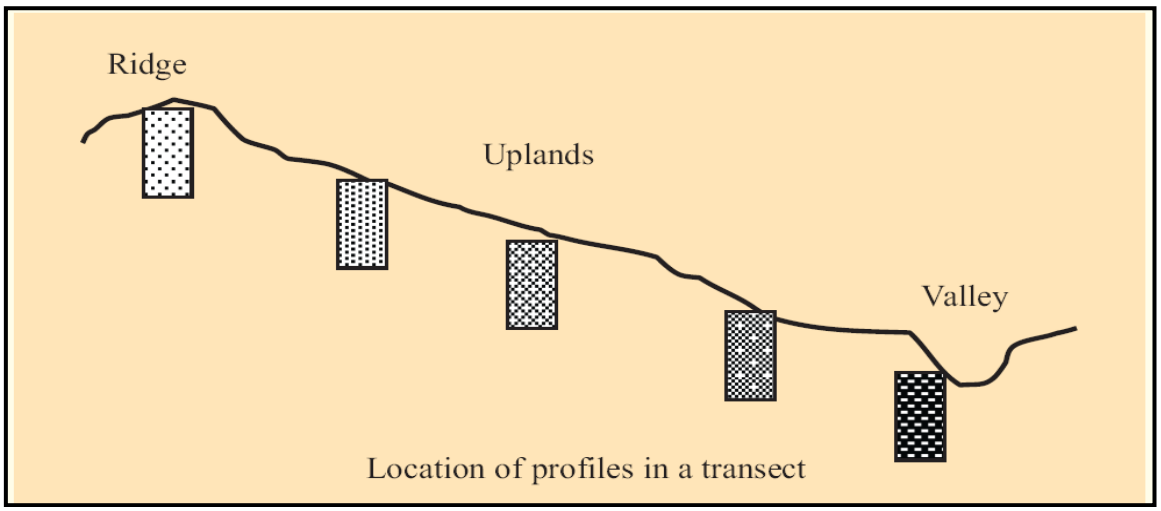

Fig: 3.4. Location of profiles in a transect

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, 16 soil series were identified in Halawadi 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	Mukhadahalli (MKH)	50-75	5YR3/3,3/4,4/3, 5/4,6/6 2.5YR3/4	gsc	>35	Ap-Bt-Cr	-
4	Lakkur (LKR)	50-75	2.5YR 2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
5	Hooradhahalli (HDH)	75-100	2.5YR2.5/4,3/4,3/6	gsc-gc	>35	Ap-Bt-Cr	-
6	Gollarahatti (GHT)	75-100	2.5YR3/4,3/6, 4/4,4/6	gscl	15-35	Ap-Bt-Cr	-
7	TGR (Tigari)	75-100	5YR 3/3, 4/3, 2.5YR 2/3, 3/3, 3/4	gscl	15-35	Ap-Bt-Cr	e-es
8	Bisarahalli (BSR)	75-100	5 YR 3/3, 3/4	gsc	15-35	Ap-Bt-Cr	-
9	Chikkamegheri (CKM)	75-100	2.5YR2.5/3,3/4, 3/6	sc	-	Ap-Bt-Cr	-
10	Bidanagere (BDG)	75-100	5YR3/3,3/4,4/3,5/4 2.5 YR 3/4	gc	35-60	Ap-Bt-Cr	-
11	Kumchahalli (KMH)	100-150	2.5YR3/4,3/6	sc	<15	Bt-Cr	-
12	Balapur (BPR)	100-150	2.5YR2.5/4,3/4	gsc-gc	>35	Ap-Bt-Cr	-
13	Nagalapur (NGP)	100-150	5YR2.5/2,3/2, 2.5YR3/6,4/6	gsc	>35	Ap-Bt-Cr	-
14	Ranatur (RTR)	>150	2.5YR2.5/3,2.5/4, 3/3,4/6	c	<15	Ap-Bt	-
15	Sirur (SRR)	100-150	10 YR 3/2,3/1,3/3,5/2	c	-	Ap-Bw-Bck-Crk	es-ev
16	Kavalakkeri (KLR)	>150	10 YR 2/1,3/1,3/2 7.5 YR 2.5/1,3/2	sc	-	Ap-Bw	e-es

3.4 Soil Mapping

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

symbols. During the survey many soil profile pits, few mini pits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of mini pits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 25 mapping units representing 16 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 25 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 25 soil phases identified and mapped in the microwatershed were regrouped into 6 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 Halawadi 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 2017 from farmer's fields in Halawadi microwatershed (51samples) 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 Halawadi Microwatershed

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		**6 (1.09)**
17		KGPhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	6 (1.09)
	HRV	Harve soils are shallow (25-50 cm), well drained, dark red to dark reddish brown, red gravelly loamy soils occurring on nearly level to gently sloping uplands under cultivation		**2 (0.35)**
28		HRVhB2g3	Sandy clay loam surface, slope 1-3%, moderate erosion, extremely gravelly (60-80%)	2 (0.35)
	MKH	Mukhadahalli soils are moderately shallow (50-75 cm), well drained, have dark brown to reddish brown red gravelly sandy clay soils occurring on gently very gently to gently sloping uplands under cultivation		**36 (6.91)**
81		MKHhB1	Sandy clay loam surface, slope 1-3%, slight erosion	36 (6.91)
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		**20 (3.72)**
452		LKRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	20 (3.72)
	HDH	Hooradhahalli soils are moderately deep (75-100 cm), well drained, have dark red to dark reddish brown, red gravelly sandy clay to clay soils occurring on nearly level to moderately sloping uplands under cultivation		**67 (12.57)**
121		HDHhB1g2	Sandy clay loam surface, slope 1-3%, slight erosion, very gravelly (35-60%)	1 (0.1)
124		HDHhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	25 (4.72)
125		HDHiB1	Sandy clay surface, slope 1-3%, slight erosion	17 (3.15)
128		HDHiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	24 (4.6)
	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		**111 (21.15)**
138		GHTcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	19 (3.69)
140		GHThB1	Sandy clay loam surface, slope 1-3%, slight erosion	4 (0.79)
141		GHThB1g1	Sandy clay loam surface, slope 1-3%, slight	10 (1.9)

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
			erosion, gravelly (15-35%)	
142		GHThB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	6 (1.14)
144		GHTiB1	Sandy clay surface, slope 1-3%, slight erosion	72 (13.63)
	TGR	Tigari soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown red calcareous gravelly sandy clay loam soils occurring on very gently sloping uplands under cultivation		**22 (4.21)**
148		TGRiB1	Sandy clay surface, slope 1-3%, slight erosion	22 (4.21)
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**11 (2.07)**
167		BSRiB2	Sandy clay surface, slope 1-3%, moderate erosion	11 (2.07)
	CKM	Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**24 (4.58)**
178		CKMiB1	Sandy clay surface, slope 1-3%, slight erosion	24 (4.58)
	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		**25 (4.77)**
185		BDGhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	25 (4.77)
	KMH	Kumchahalli soils are deep (100-150cm), well drained, have dark reddish brown to dark red sandy clay soils occurring on nearly level to very gently sloping uplands under cultivation		**43 (8.11)**
201		KMHiB2	Sandy clay surface, slope 1-3%, moderate erosion	43 (8.11)
	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 (10.59)**
222		BPRcB1	Sandy loam surface, slope 1-3%, slight erosion	41 (7.81)
232		BPRhB2g2	Sandy clay loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	15 (2.78)
	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		**43 (8.25)**
262		NGPiB1	Sandy clay surface, slope 1-3%, slight erosion	17 (3.28)
263		NGPiB1g1	Sandy clay surface, slope 1-3%, slight erosion,	26 (4.97)

Soil map unit No*	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
			gravelly (15-35%)	
	RTR	Ranatur soils are very deep (>150 cm), well drained, have dark reddish brown to dark red clay soils occurring on nearly level to very gently sloping uplands under cultivation		**31 (5.89)**
288		RTRiB2	Sandy clay surface, slope 1-3%, moderate erosion	31 (5.89)
	SRR	Sirur soils are deep (100-150 cm), moderately well drained, have very dark gray to dark brown calcareous cracking clay soils occurring on nearly level to gently sloping low lands under cultivation		**11 (2.16)**
474		SRRmA1	Clay surface, slope 0-1%, slight erosion	11 (2.16)
	KLR	Kavalakkeri soils are very deep (>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		**4 (0.8)**
473		KLRmA1	Clay surface, slope 0-1%, slight erosion	4 (0.8)
1000	Others		Habitation and waterbody	**15 (2.8)**

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

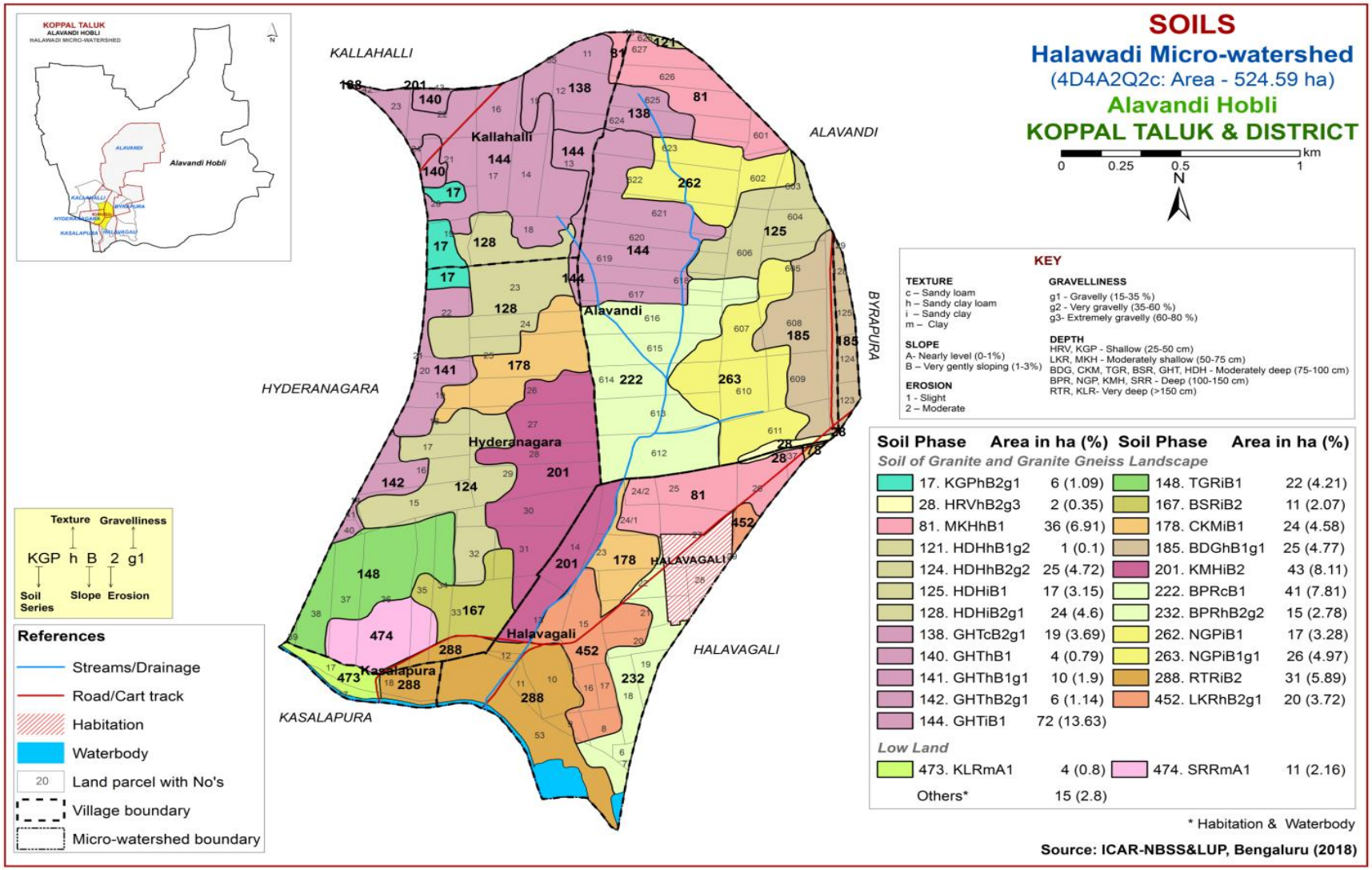

Fig 3.5 Soil Phase or Management Units of Halawadi Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Halawadi microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscape based on geology. In all, 16 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 16 soil series identified followed by 25 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Halawadi microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite and Granite gneiss Landscape

In this landscape, 16 soil series were identified and mapped. Of these series, GHT series occupies maximum area of 111 ha (21%) followed by HDH 67 ha (12%), BPR 56 ha (11%), KMH 43 ha (8%), NGP 43 ha (8%), MKH 36 (7%), RTR 31 ha (6%), BDG 25 ha (5%), CKM 24 ha (5%), TGR 22 ha (4%), LKR 20 ha (4%), BSR 11 ha (2%), SRR 11 ha (2%), KGP 6 ha (1%), KLR 4 ha (1%) and HRV 2 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 weathered granite gneiss and occur on very gently sloping uplands. The Kaggalipura series has been classified as a member of the fine, mixed, isohyperthermic family of (Paralithic) Rhodustalfs.

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

Landscape and soil profile characteristics of Harve (HRV) Series

4.1.3 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). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Mukhadahalli (MKH) Series

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

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

Landscape and soil profile characteristics of Lakkur (LKR) Series

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

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

Landscape and soil profile characteristics of Hooradhahalli (HDH) Series

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

The thickness of the solum ranges from 78 to 98 cm. The thickness of A-horizon ranges from 12 to 18cm. Its colour is in 5 YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture varies from loamy sand to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 66 to 81cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay loam with 15 to 35 per cent gravel. The available water capacity is Low (51-100 mm/m). Five soil phases were identified and mapped.

Landscape and soil profile characteristics of Gollarahatti (GHT) Series

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

The thickness of the solum ranges from 77 to 100 cm. The thickness of A horizon ranges from 11 to 21 cm. Its colour is in 5 YR and 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture is sandy clay to clay. The thickness of B horizon ranges from 56 to 87 cm. Its colour is in 2.5 YR and 5 YR hue with value and chroma 2 to 4. Its texture ranges from gravelly sandy clay loam to sandy clay and is calcareous. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

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

The thickness of the solum ranges from 75 to 98 cm. The thickness of A horizon ranges from 17 to 25 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 3 to 6. The texture ranges from sandy clay loam to sandy clay with 15 to 35 per cent gravel. The thickness of B horizon ranges from 61 to 79 cm. Its colour is in 5 YR hue with value 3 and chroma 3 to 4. Its texture is gravelly sandy clay with gravel content of 15-35 per cent. The available water capacity is low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Bisarahalli (BSR) Series

4.1.9 Chikkamegheri (CKM) Series: Chikkamegheri soils are moderately deep (75-100 cm), well drained, have dark brown to dark reddish brown and red sandy clay soils. They have developed from granite gneiss and occur on nearly level to very gently sloping uplands. The Chikkamegheri series has been classified as a member of the fine, 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 24 cm. Its colour is in 7.5 YR, 5YR and 2.5 YR hue with value 2 to 4 and chroma 3 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 65 to 86 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is dominantly sandy clay to clay. The available water capacity is medium (101-150 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Chikkamegheri (CKM) Series

4.1.10 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 low (51-100 mm/m). Only one soil phase was identified and mapped.

Landscape Soil Profile Characteristics of Bidanagere (BDG) Series

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

The thickness of the solum ranges from 102 to 150 cm. The thickness of surface horizon ranges from 11 to 23 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. The texture is dominantly sandy clay. The thickness of B horizon ranges from 95 to 132 cm. Its colour is in 2.5 YR hue with value 3 and chroma 4 to 6. Its texture is dominantly sandy clay loam to sandy clay. The available water capacity is medium (101-150 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Kumchahalli (KMH) Series

4.1.12 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

4.1.13 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, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 80 per cent gravel. The available water capacity is low (51-100 mm/m). Two soil phases were identified and mapped.

Landscape Soil Profile Characteristics of Nagalapur (NGP) Series

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

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 8 to 14 cm. Its colour is in 5 YR and 2.5 YR hue with value 2.5 to 4 and chroma 3 to 6. The texture varies from sandy loam to sand clay. The thickness of B horizon is more than 150 cm. Its colour is in 2.5 YR hue with value 2.5 to 3 and chroma 3 to 6. Its texture is clay. The available water capacity is high (101-150 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Ranatur (RTR) Series

4.1.15 Sirur (SRR) Series: Sirur soils are deep (100-150 cm), moderately well drained, very dark grayish brown to grayish brown, calcareous cracking clay soils. They have developed from colluvio-alluvium and occur on nearly level to very gently sloping lowlands under cultivation. The Sirur series has been classified as a member of the fine, mixed, isohyperthermic family of Vertic Haplustepts.

The thickness of the solum ranges from 108 to 146 cm. The thickness of A horizon ranges from 14 to 22 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 3. The texture is dominantly clay. The thickness of B horizon ranges from 98 to 128 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Its texture is dominantly clay and are calcareous. The available water capacity is high (150-200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Sirur (SRR) Series

4.1.16 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 colluvio-alluvium 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 Typic 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

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Halawadi microwatershed

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

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

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

Contd…

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 Name: Bisarahalli (BSR), **Pedon:** R-9
Location: $15^0$25'21.0"N, $76^0$11'42.0"E Hatti village, Koppal taluk and district
Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Fine, 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
0-14	Ap	70.11	9.29	20.60	22.31	15.97	11.98	9.83	10.03	20	scl	13.22	7.81
14-57	Bt1	47.27	7.52	45.20	27.04	8.28	4.61	2.10	5.24	25	sc	16.39	13.31
57-80	Bt2	41.93	8.67	49.40	21.95	6.83	4.76	4.66	3.73	30	c	21.41	15.41
80-99	Bt3	49.02	9.87	41.11	19.90	10.78	6.84	6.42	5.08	40	sc	21.82	14.24

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}							%	%
0-14	6.59	-	-	0.12	0.73	-	4.47	1.77	0.06	0.53	6.82	8.80	0.43	77.55	6.00
14-57	7.02	-	-	0.04	0.48	-	5.85	2.31	0.06	0.20	8.43	14.70	0.33	57.32	1.36
57-80	7.00	-	-	0.05	0.28	-	11.74	2.26	0.08	0.22	14.31	15.60	0.32	91.73	1.44
80-99	6.90	-	-	0.06	0.18	-	13.70	2.16	0.08	0.14	16.08	16.50	0.40	97.44	0.83

Contd…

Series Name: Chikkamegheri (CKM), **Pedon:** RM-2
Location: $15^0$21'40"N, $76^0$16'43"E, Gudanahalli 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
0-10	Ap	66.80	5.51	27.69	10.14	10.04	20.29	14.75	11.58	-	scl	20.59	7.15
10-25	Bt1	39.52	7.17	53.32	8.75	9.59	7.27	8.43	5.48	-	c	26.96	13.99
25-38	Bt2	42.00	7.16	50.84	13.16	8.74	6.42	8.53	5.16	-	c	26.51	13.42
38-55	Bt3	41.77	10.31	47.92	15.19	8.54	6.33	7.38	4.32	10	c	25.28	14.10
55-70	Bt4	44.03	8.96	47.01	15.72	9.22	6.92	6.81	5.35	20	c	24.30	14.35
70-90	Bt5	56.02	8.46	35.52	11.41	17.07	12.36	10.26	4.92	25	sc	20.59	13.06

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}							%	%
0-10	7.99	-	-	0.326	0.83	4.44	9.35	4.76	0.28	0.54	14.93	12.50	0.45	119	1.73
10-25	7.36	-	-	0.345	0.99	2.40	10.37	4.84	0.10	1.18	16.48	17.60	0.33	94	2.67
25-38	6.69	-	-	0.477	0.79	0.00	10.25	4.20	0.09	1.61	16.15	16.10	0.32	100	4.00
38-55	6.45	-	-	0.548	0.63	0.00	9.43	2.86	0.10	1.52	13.91	14.80	0.31	94	4.11
55-70	6.35	-	-	0.532	0.71	0.00	9.59	2.79	0.11	1.66	14.16	14.60	0.31	97	4.56
70-90	6.44	-	-	0.613	0.27	0.00	9.58	3.10	0.19	1.87	14.74	14.70	0.41	100	5.08

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…

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-13	Ap	51.76	9.05	39.19	7.99	8.84	13.42	14.38	7.14	-	sc	20.08	13.69
13-27	A21	53.50	8.12	38.38	7.00	11.05	15.21	14.33	5.91	-	sc	17.05	12.32
27-43	A22	63.60	5.01	31.40	3.85	11.56	24.52	18.52	5.14	-	scl	11.76	9.09
43-64	Bt1	48.74	5.91	45.35	8.87	9.31	12.49	12.27	5.81	10	sc	16.68	13.35
64-84	Bt2	45.13	8.90	45.97	9.86	7.12	10.95	10.62	6.57	20	sc	17.45	13.42
84-114	BC	65.04	6.94	28.02	10.49	16.21	17.80	13.88	6.67	40	scl	13.20	9.75

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

Contd…

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: 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

Contd…

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

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

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

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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) 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
0-21	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

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 25 soil map units identified in the Halawadi microwatershed are grouped under 2 land capability classes and 6 land capability subclasses (Fig. 5.1).

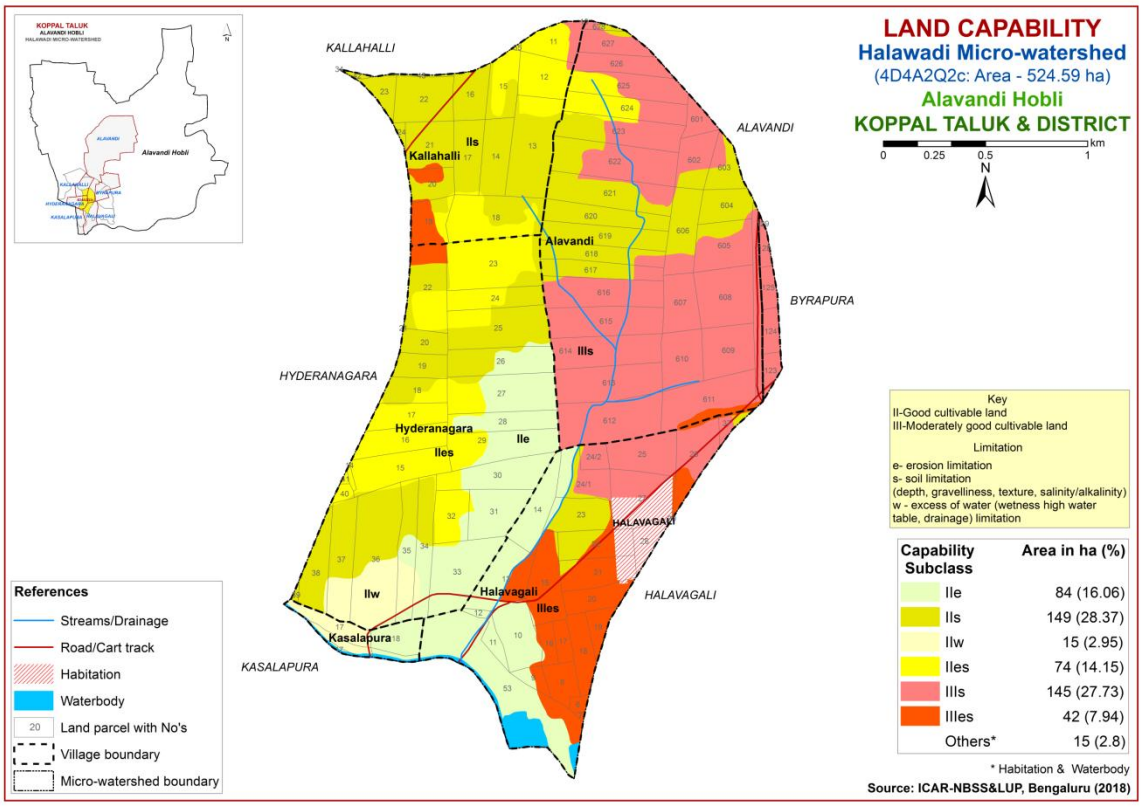


Fig. 5.1 Land Capability classification map of Halawadi Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good lands (Class II) cover a maximum area of about 322 ha (61%) and distributed in the major part of the microwatershed with minor problems of soil, drainage and erosion. Moderately good cultivable (Class III) occupy an area of about 187 ha (36%) and distributed in the northern, eastern, central and southern part of the microwatershed with severe limitations of soil and erosion. An area of about 15 ha (3%) 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.

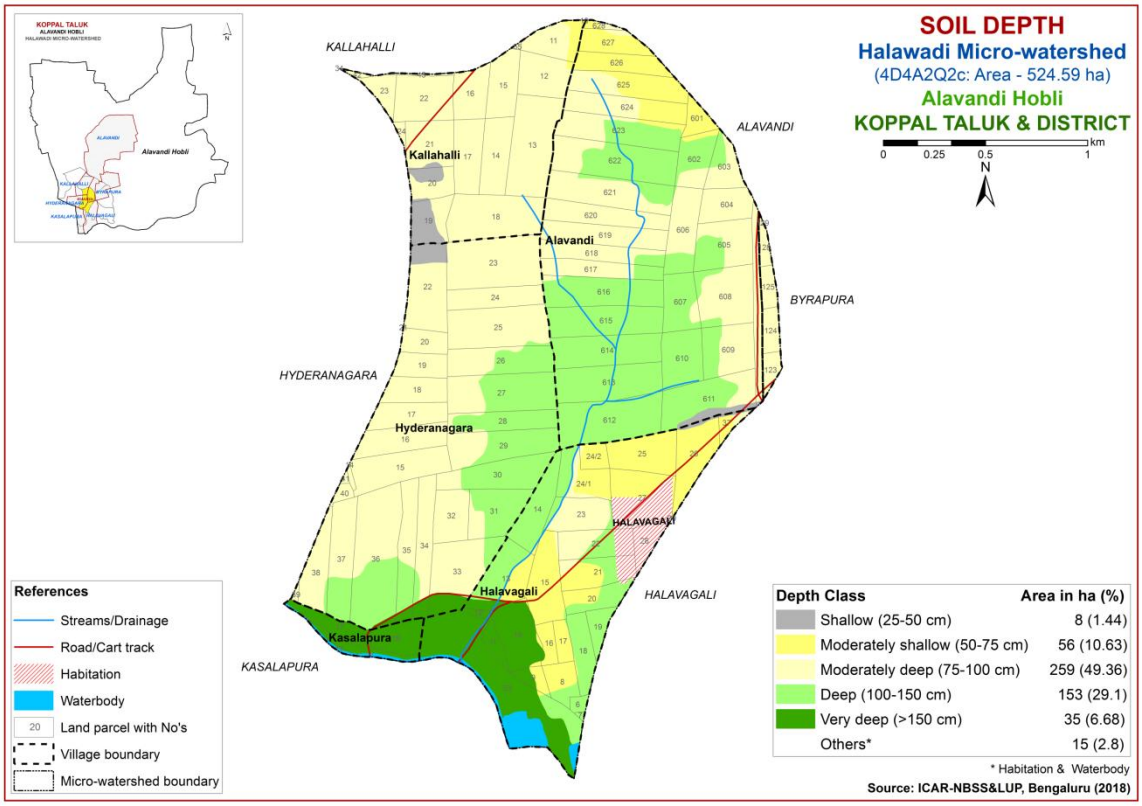


Fig. 5.2 Soil Depth map of Halawadi Microwatershed

Shallow (25-50 cm) soils cover an area of about 8 ha (1%) and are distributed in the northwestern and eastern part of the microwatershed. Moderately shallow (50-75 cm)

soils cover an area of about 56 ha (11%) and distributed in the northern, southern and eastern part of the microwatershed. Maximum area of about 259 ha (49%) is moderately deep soils (75-100 cm) and are distributed in all part of the microwatershed. Deep to very deep (100- >150 cm) soils occupy an area of about 188 ha (36%) and are distributed in the northern, central and southern part of the microwatershed.

The most productive lands cover about 188 ha (36%) where all climatically adopted long 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 208 ha (40%) is loamy at the surface and are distributed in the northern, central, western, eastern and southern part of the microwatershed. Maximum area of about 301 ha (57%) is clayey at the surface and are distributed in the major part of the microwatershed.

The most productive lands with respect to surface soil texture are clayey soils that (57%) 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 (40%) soils which also have high potential for soil- water retention and nutrient availability but have no drainage or other physical problems.

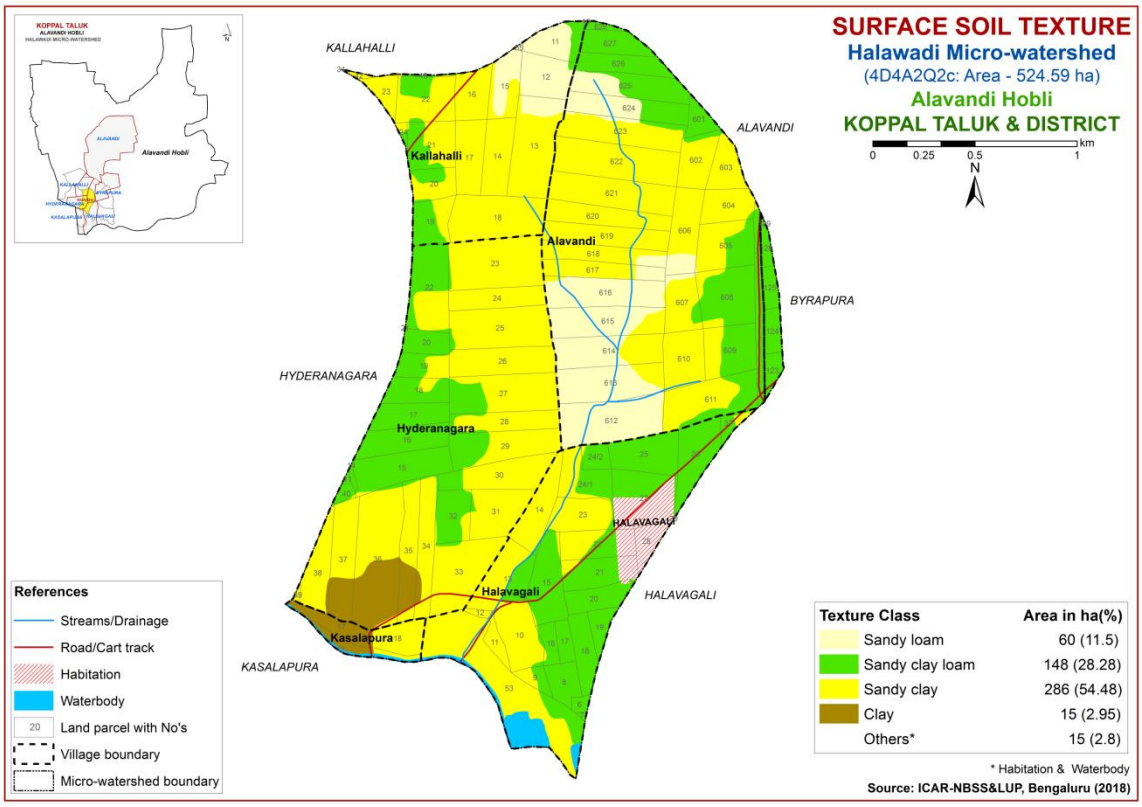


Fig. 5.3 Surface Soil Texture map of Halawadi Microwatershed

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover a maximum area of about 332 ha (63%) and distributed in all part of the microwatershed. An area of about 136 ha (26%) is covered by gravelly (15-35% gravel) soils and are distributed in northern, western, eastern and southern part of the microwatershed. Very gravelly (35-60%) soils cover an area of about 40 ha (8%) and are distributed in the southern part of the microwatershed. Extremely gravelly (60-80%) soils cover an area of 2 ha (<1%) and are distributed in the eastern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 63 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 to extremely gravelly (35-80%) cover an area of about 8 per cent where only short duration crops can be grown.

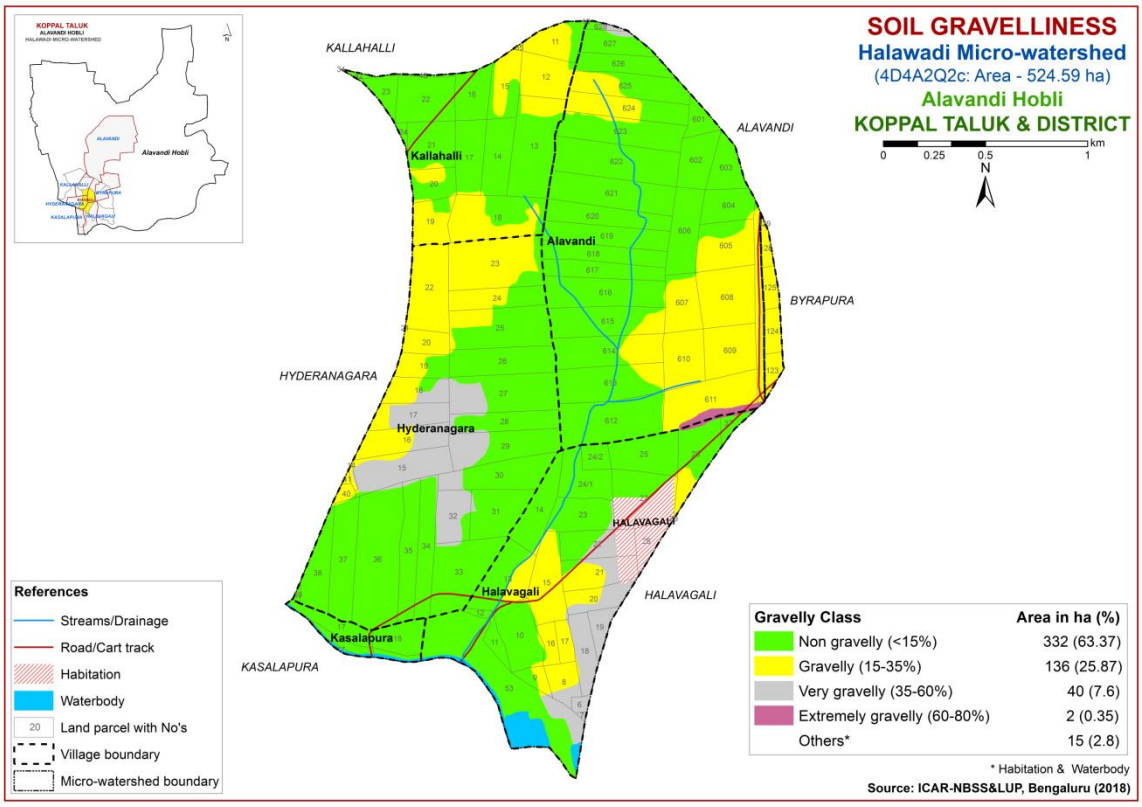


Fig. 5.4 Soil Gravelliness map of Halawadi Microwatershed

5.5 Available Water Capacity

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

An area of about 154 ha (29%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northern, eastern, western and southern part of the microwatershed. Maximum area of about 243 ha (46%) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the major part of the microwatershed. An area of about 67 ha (13%) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the central and southern part of the microwatershed. An area of about 31 ha (6%) is high (151-200mm/m) in available water capacity and are distributed in the southern part of the microwatershed. An area of about 15 ha (3%) is very high (>200 mm/min) in available water capacity and distributed in the southern part of the microwatershed.

An area of about 397 ha (75%) 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 46 ha (9%) has soils that have high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long du ration crops can be grown successfully.

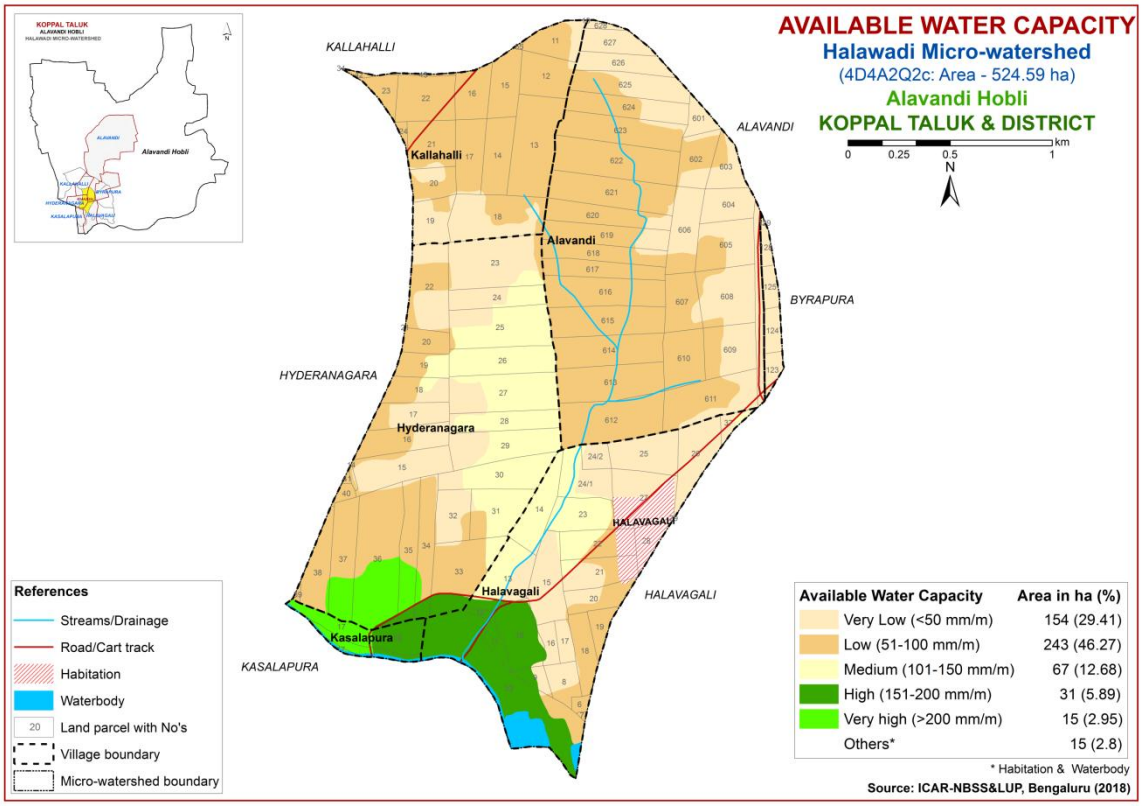


Fig. 5.5 Soil Available Water Capacity map of Halawadi Microwatershed

5.6 Soil Slope

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

An area of about 15 ha (3%) in the microwatershed falls under nearly level (0-1%) lands and are distributed in the southern part of the microwatershed. Very gently sloping (1-3%) lands cover a maximum area of about 494 ha (94%) and are distributed in all parts 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.

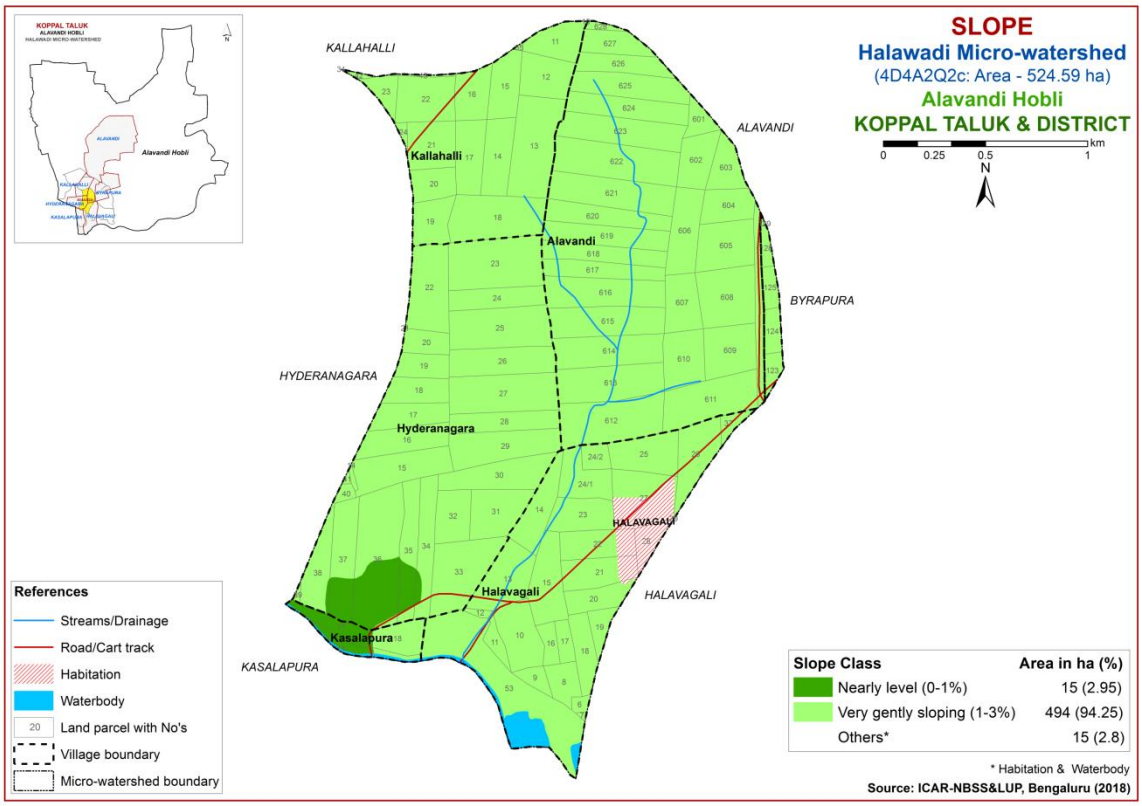


Fig. 5.6 Soil Slope map of Halawadi Microwatershed

5.7 Soil Erosion

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

Slightly eroded lands cover a maximum area of about 310 ha (59%) and are distributed in all part of the microwatershed. An area of about 200 ha (38%) is moderately eroded (e2 class) and distributed in the northern, eastern, western, southwestern and southern part of the microwatershed. Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

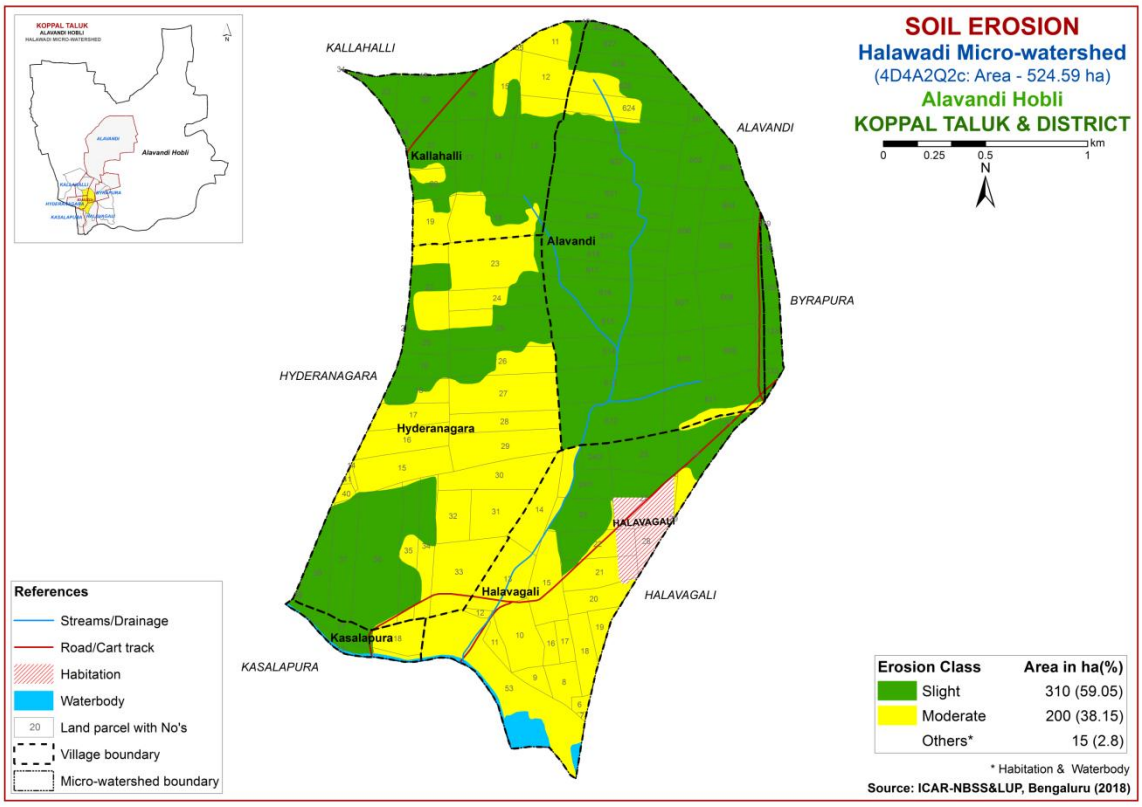


Fig. 5.7 Soil Erosion map of Halawadi Microwatershed

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 Halawadi microwatershed for soil reaction (pH) showed that an area of 57 ha (11%) is neutral (pH 6.5-7.3) and are distributed in the northern part of the microwatershed. An area of 35 ha (7%) is slightly alkaline (pH 7.3-7.8) and are distributed in the northern part of the microwatershed. Maximum area of about 287 ha (55%) is moderately alkaline (pH 7.8-8.4) and are distributed in all part of the microwatershed. An area of about 120 ha (23%) is strongly alkaline (pH 8.4-9.0) and are distributed in the central and southern part of the microwatershed. Very strongly alkaline (pH >9.0) soils covers an area of about 11 ha (2%) and distributed in the southern part of the microwatershed. Thus, major soils in the microwatershed are alkaline 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 223 ha (42%) is low (<0.5%) in organic carbon and are distributed in the northern, eastern, central and western part of the microwatershed. Maximum area of about 283 ha (54%) is medium (0.5-0.75%) in organic carbon content and distributed in all part of the microwatershed. An area of about 3 ha (1%) is high (>0.75%) in organic carbon and distributed in the southern part of the microwatershed (Fig.6.3).

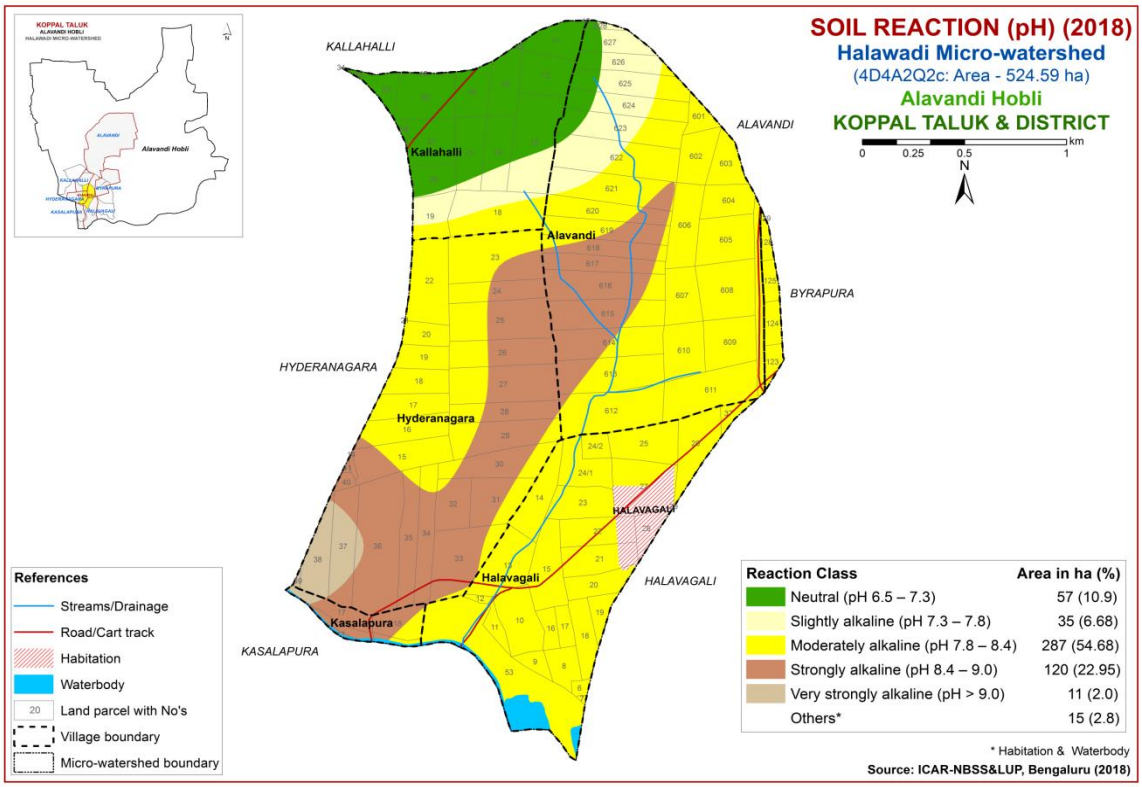


Fig.6.1 Soil Reaction (pH) map of Halawadi Microwatershed

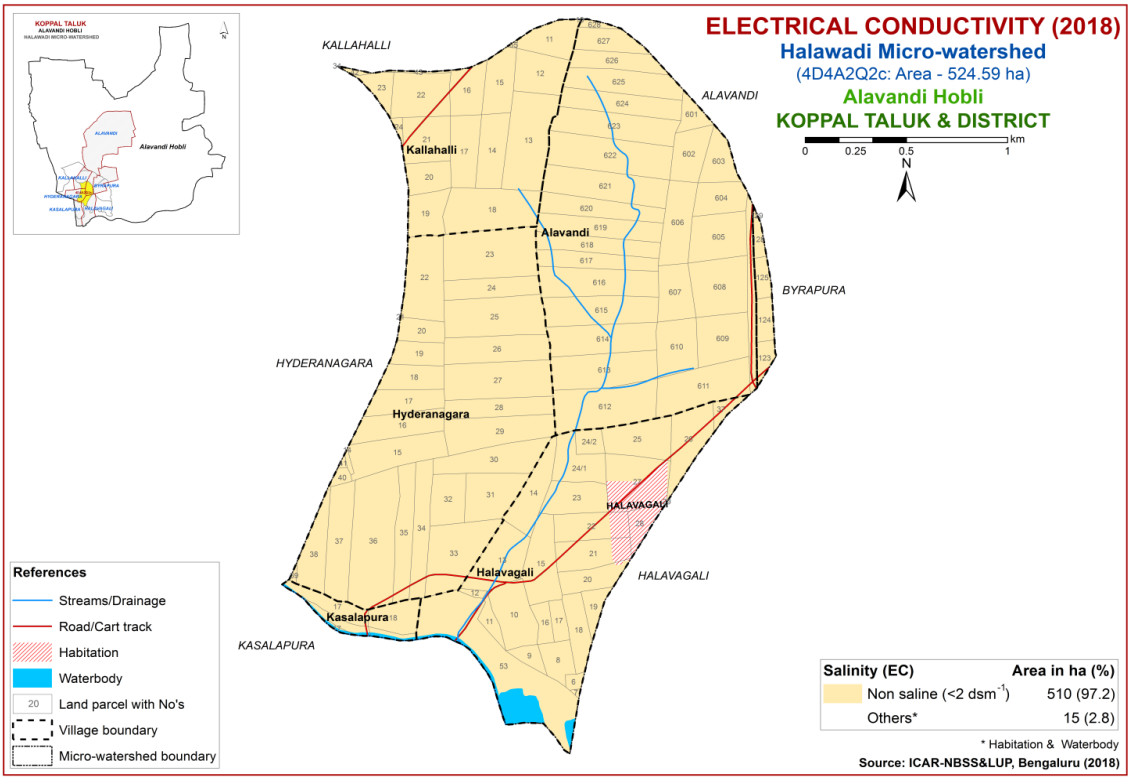


Fig.6.2 Electrical Conductivity (EC) map of Halawadi Microwatershed

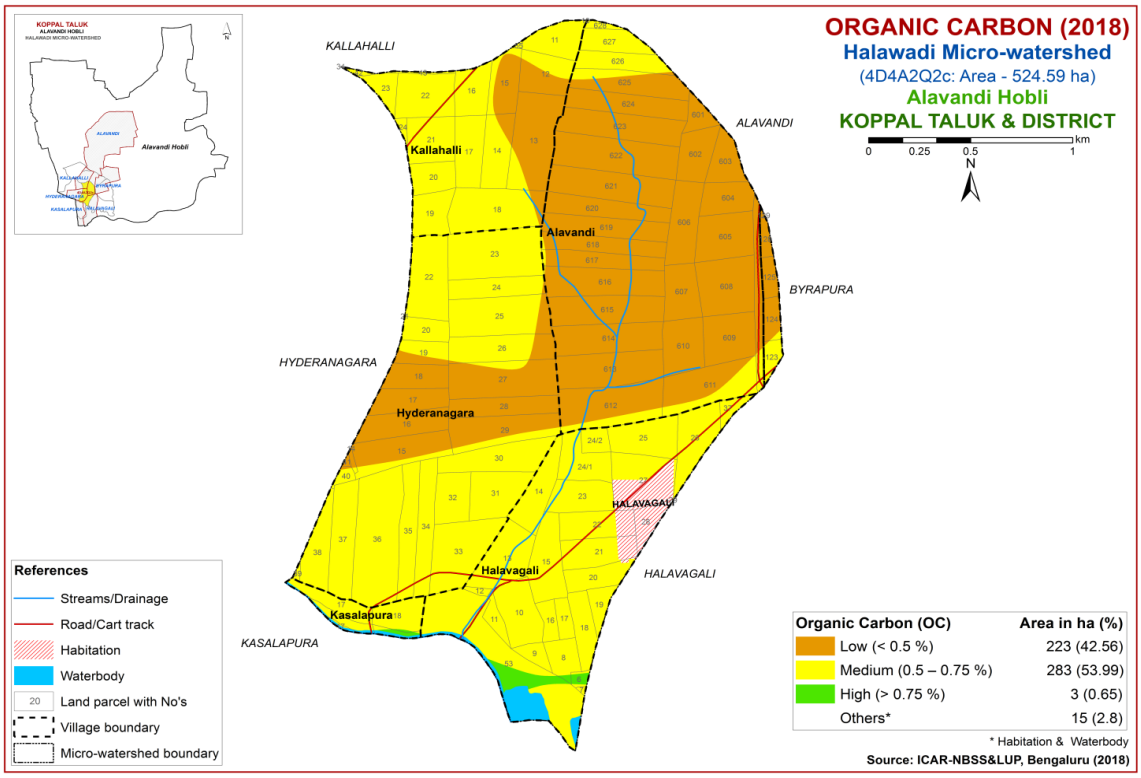


Fig.6.3 Soil Organic Carbon map of Halawadi Microwatershed

6.4 Available Phosphorus

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

6.5 Available Potassium

Available potassium content is low (<145 kg/ha) in an area of about 18 ha (3%) and are distributed in the northern part of the microwatershed. Medium (145-337 kg/ha) in a maximum area of about 308 ha (59%) and are distributed in all part of the microwatershed (Fig. 6.5). High (>337 kg/ha) in an area of 184 ha (35%) and are distributed in the northern, eastern, western and southern part of the microwatershed. Apply additional 25% potassium in areas where it is medium.

6.6 Available Sulphur

Available sulphur content is low (<10 ppm) in the entire area of the microwatershed (Fig.6.6). The areas that are low 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 Halawadi microwatershed is low (< 0.5ppm) in an area of about 131 ha (25%) and distributed in the northern and eastern part of the

microwatershed. Maximum area of about 379 ha (72%) is medium (0.5-1.0 ppm) and distributed in all part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content is deficient (<4.5 ppm) in the entire microwatershed area (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in an area of about 209 ha (40%) and are distributed in the northern, western and southern part of the microwatershed (Fig 6.11). Maximum area of about 301 ha (57%) is sufficient (>0.6 ppm) in available zinc and are distributed in all part of the microwatershed.

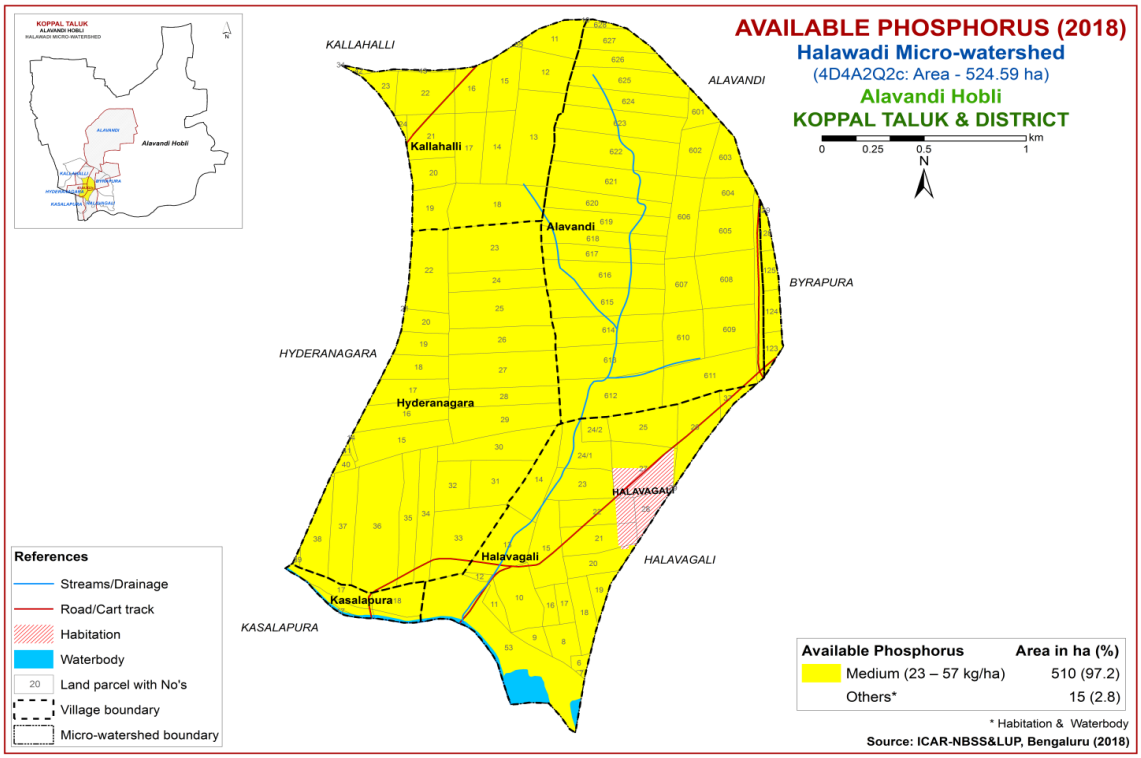


Fig.6.4 Soil Available Phosphorus map of Halawadi Microwatershed

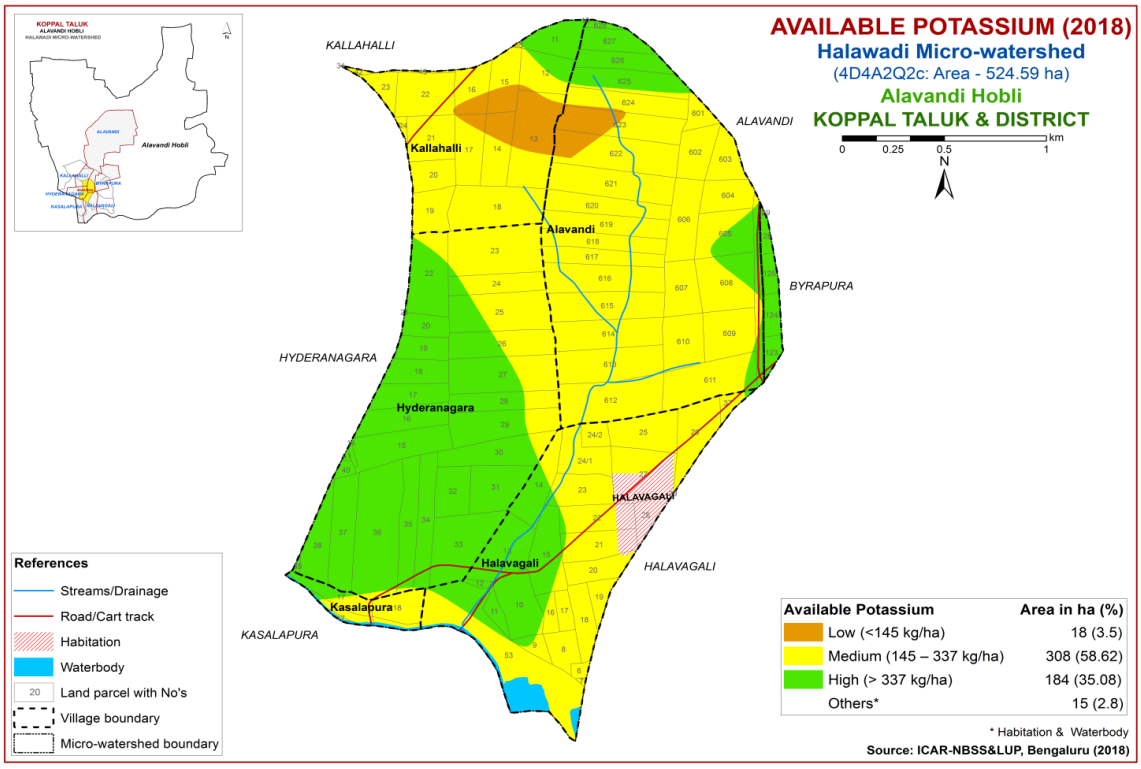


Fig.6.5 Soil Available Potassium map of Halawadi Microwatershed

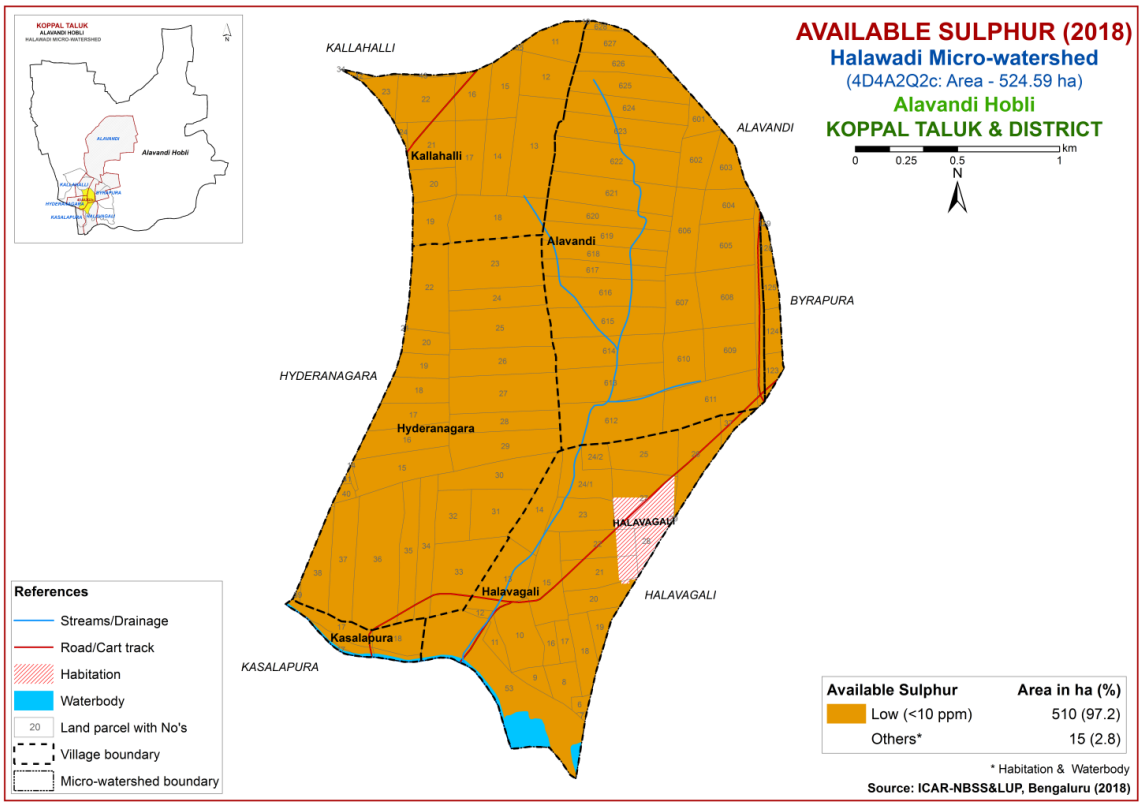


Fig.6.6 Soil Available Sulphur map of Halawadi Microwatershed

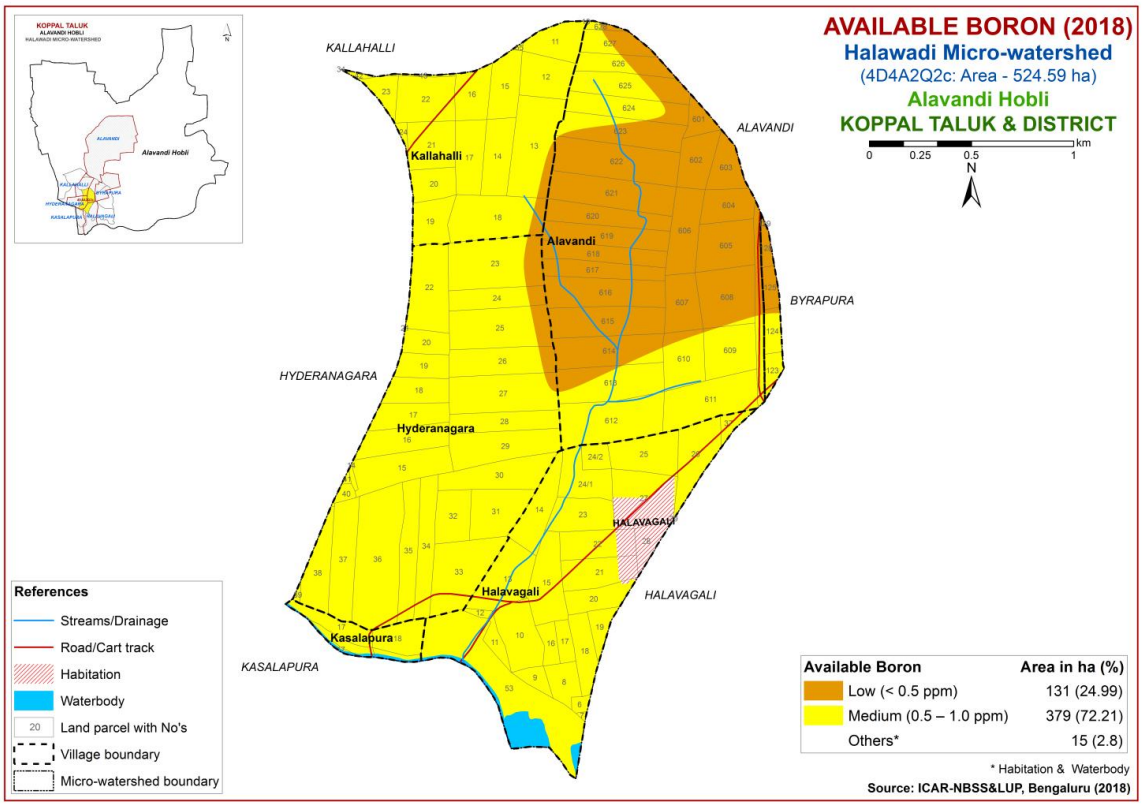


Fig.6.7 Soil Available Boron map of Halawadi Microwatershed

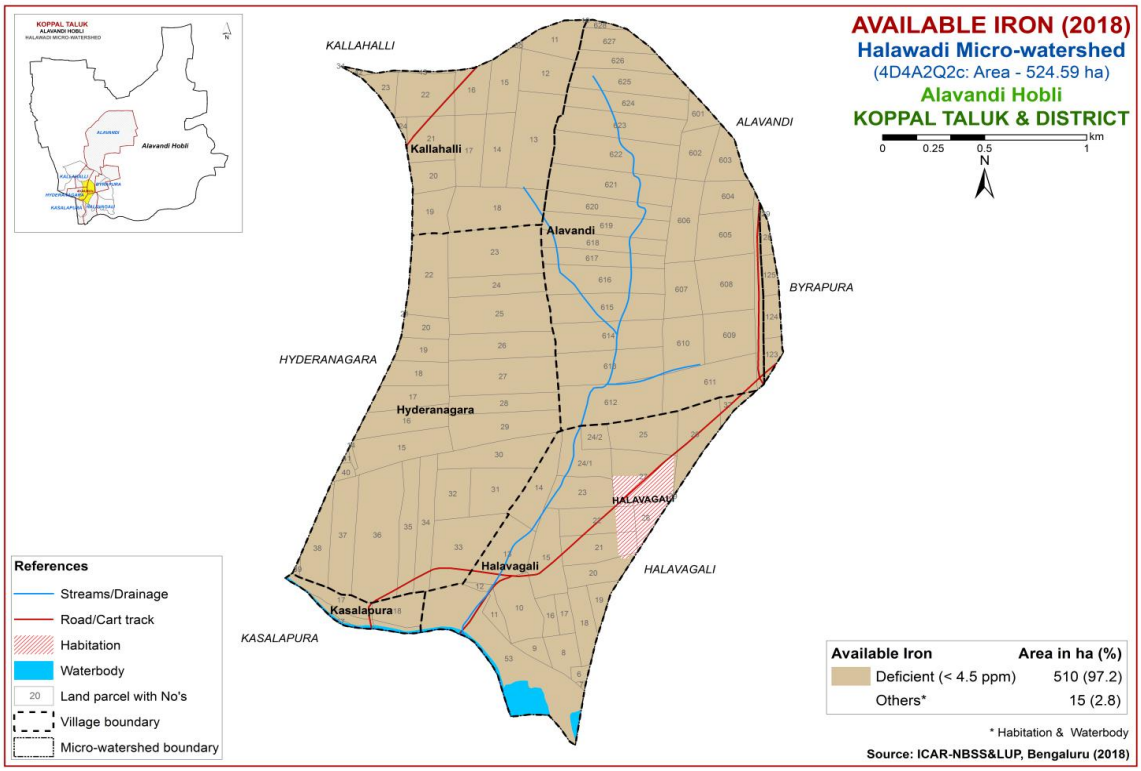


Fig.6.8 Soil Available Iron map of Halawadi Microwatershed

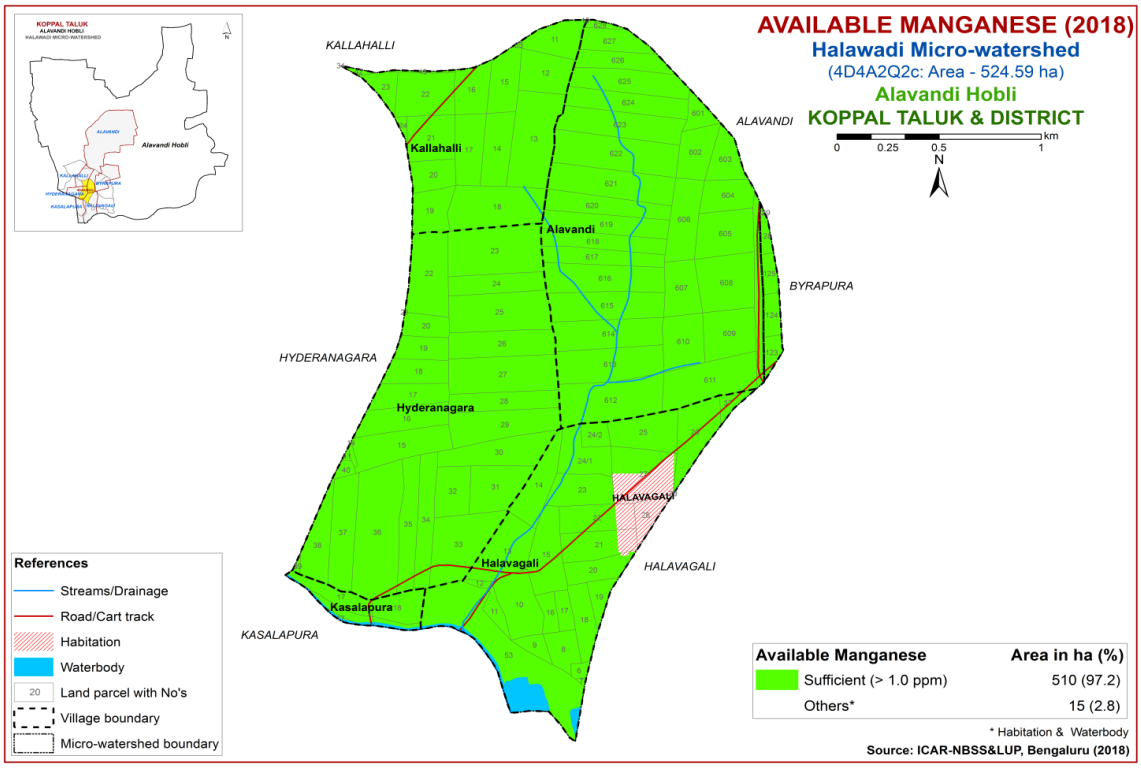


Fig.6.9 Soil Available Manganese map of Halawadi Microwatershed

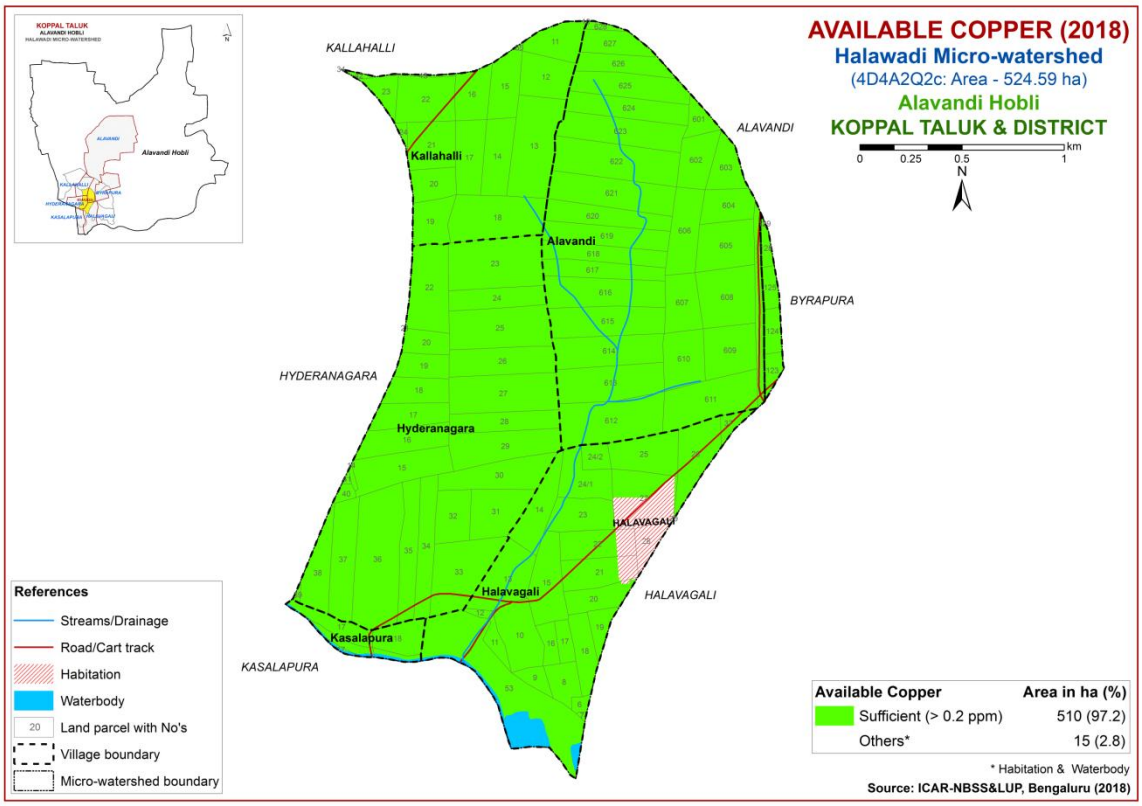


Fig.6.10 Soil Available Copper map of Halawadi Microwatershed

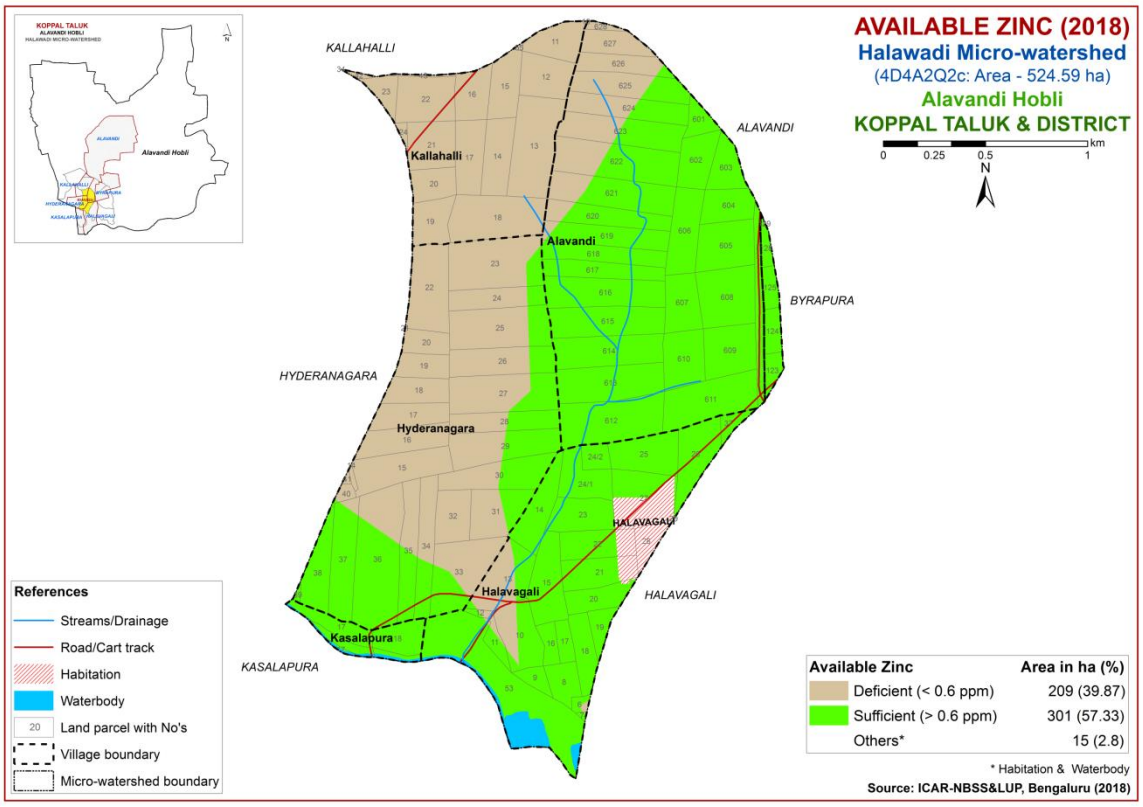


Fig.6.11 Soil Available Zinc map of Halawadi Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Halawadi microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The 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. 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 124 ha (24%) for growing sorghum and occur in the central and southern part of the microwatershed. An area of about 169 ha (32%) is moderately suitable (Class S2) for growing sorghum and

distributed in the northern, western and eastern part of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Maximum area of about 215 ha (41%) is marginally suitable (Class S3) for growing sorghum and distributed in all part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. Currently not suitable land (Class N1) occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitation of gravelliness.

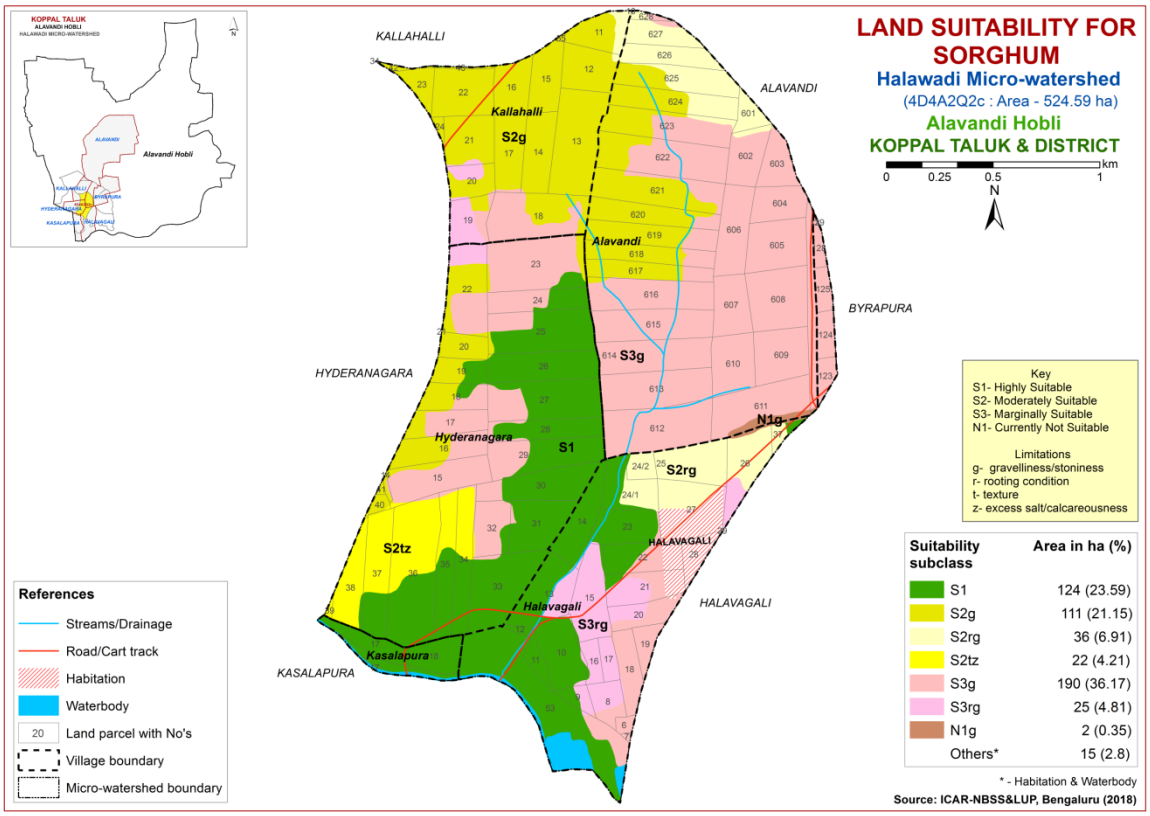


Fig. 7.1 Land Suitability map of Sorghum

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 43 ha (8%) for growing maize and distributed in the central and southern part of the microwatershed. Maximum area of about 250 ha (48%) is moderately suitable (Class S2) and distributed in all part of the microwatershed with minor limitations of calcareousness, texture, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 215 ha (41%) and occur in the northern, central, western, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth.

Currently not suitable (Class N1) lands occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitation of gravelliness.

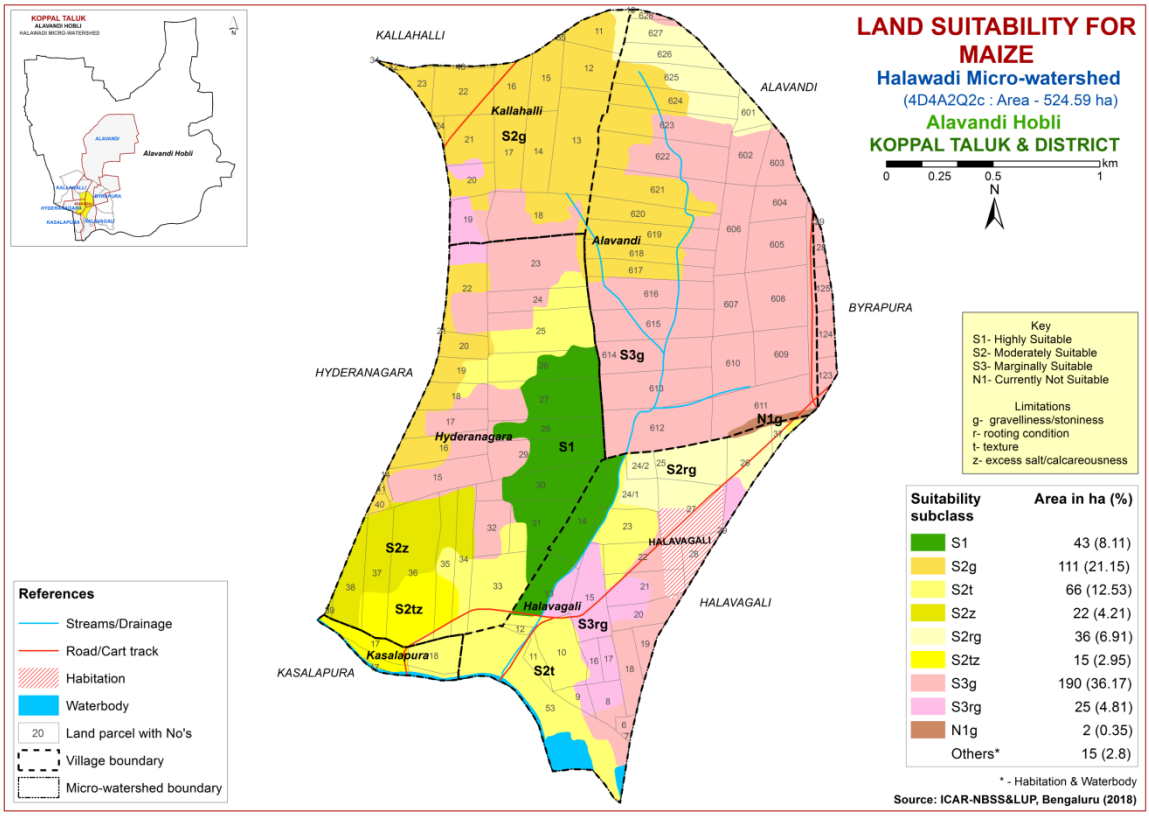


Fig. 7.2 Land Suitability map of Maize

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 a maximum area of about 219 ha (42%) for growing Bajra and occur in all part of the microwatershed. An area of about 159 ha (30%) is moderately suitable (Class S2) for growing Bajra and distributed in the northern, eastern, western and southern part of the microwatershed with minor limitations of texture, calcareousness, rooting depth and gravelliness. Marginally suitable (Class S3) lands cover an area of about 130 ha (25%) and occur in the northern, central, western, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness and rooting depth. Currently not suitable (Class N1) lands occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitation of gravelliness.

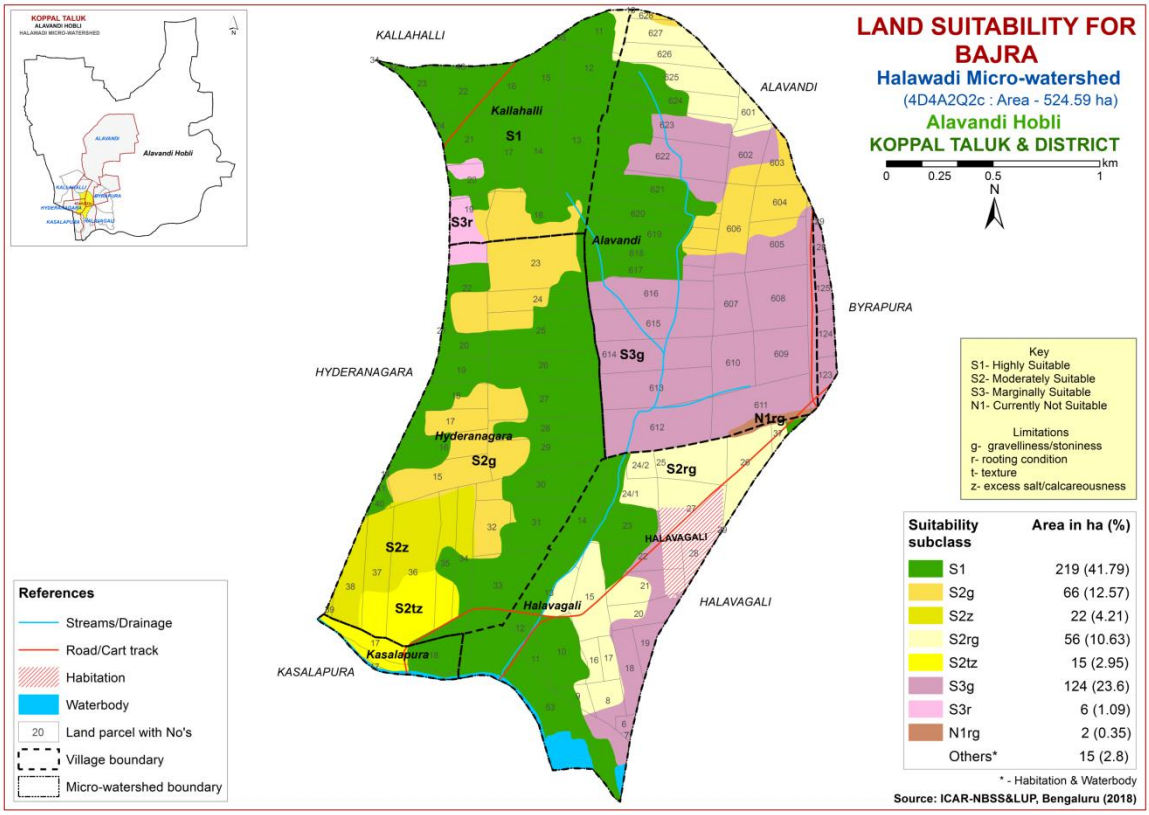


Fig. 7.3 Land Suitability map of Bajra

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.

An area of about 142 ha (27%) is highly suitable (Class S1) for growing groundnut and are distributed in the northern, western and southern part of the microwatershed. A maximum area of about 320 ha (61%) is moderately suitable (Class S2) for growing groundnut and distributed in the major part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. An area of about 48 ha (9%) is marginally suitable (Class S3) for growing groundnut and are distributed in the western, southern and eastern part of the microwatershed with moderate limitations of gravelliness, texture and rooting depth.

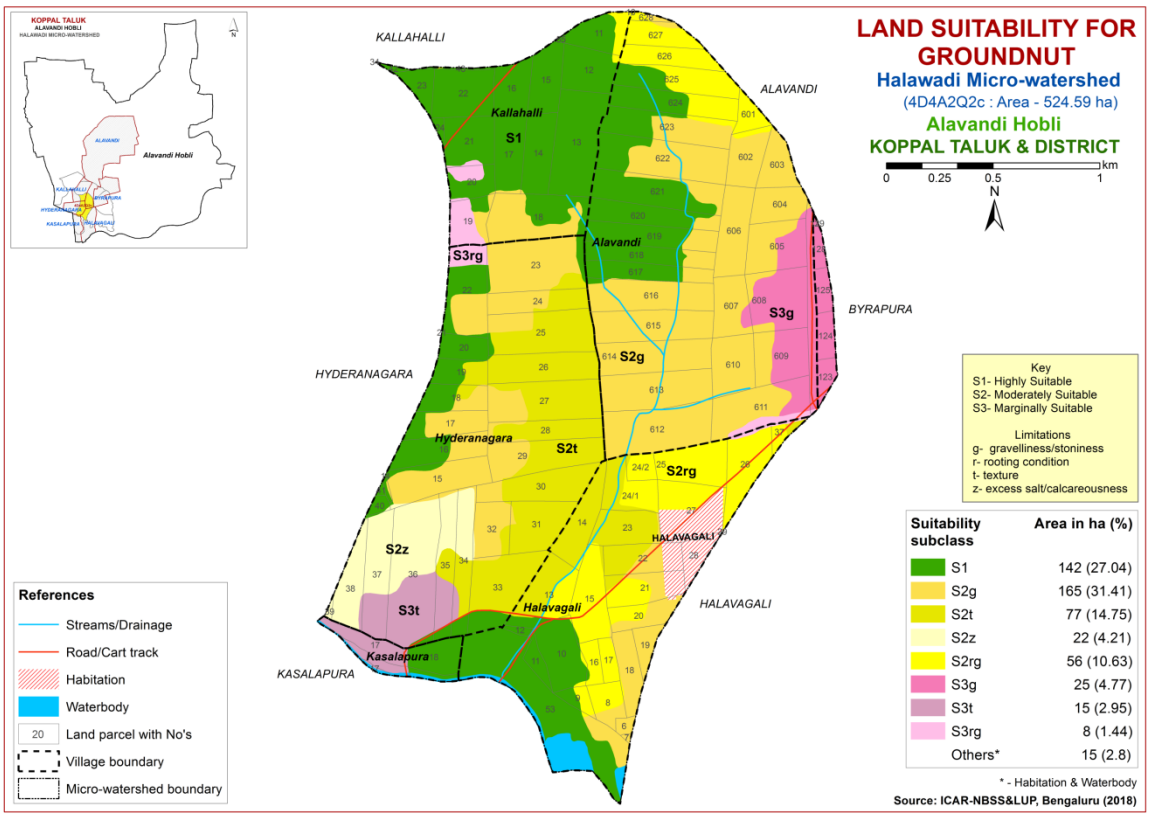


Fig. 7.4 Land Suitability map of Groundnut

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 89 ha (17%) is highly suitable (Class S1) for growing sunflower and are distributed in the central and southern part of the microwatershed. An area of about 168 ha (32%) is moderately suitable (Class S2) and are distributed in the northern, western and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 251 ha (48%) and are distributed in all part of the microwatershed with moderate limitations of rooting depth and gravelliness. An area of about 2 ha (<1%) is currently not suitable (Class N1) for growing sunflower and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

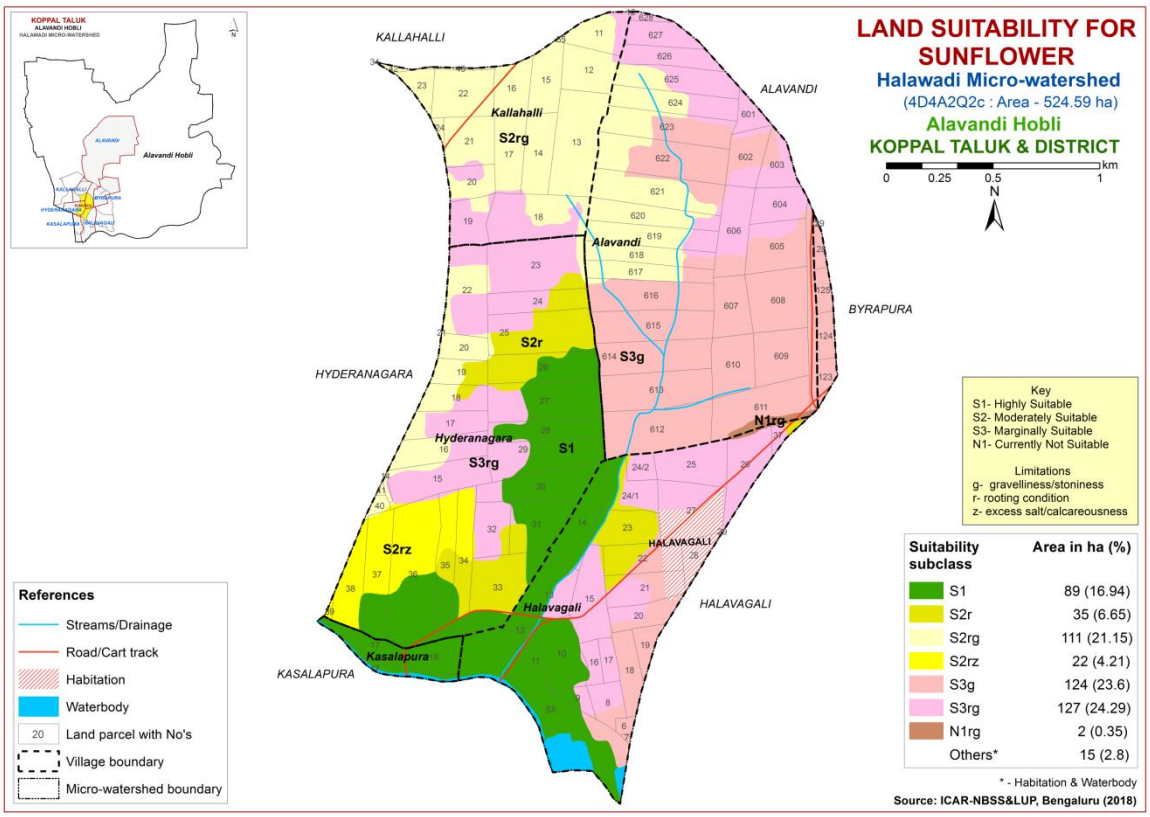


Fig. 7.5 Land Suitability map of Sunflower

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.

Highly suitable (Class S1) lands for growing Redgram occupy an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. An area of about 183 ha (35%) is moderately suitable (Class S2) for Redgram and are distributed in the northern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and texture. Maximum area of about 246 ha (47%) is marginally suitable lands (Class S3) for growing Redgram and are distributed in all part of the microwatershed with major limitations of rooting depth and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Redgram and distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

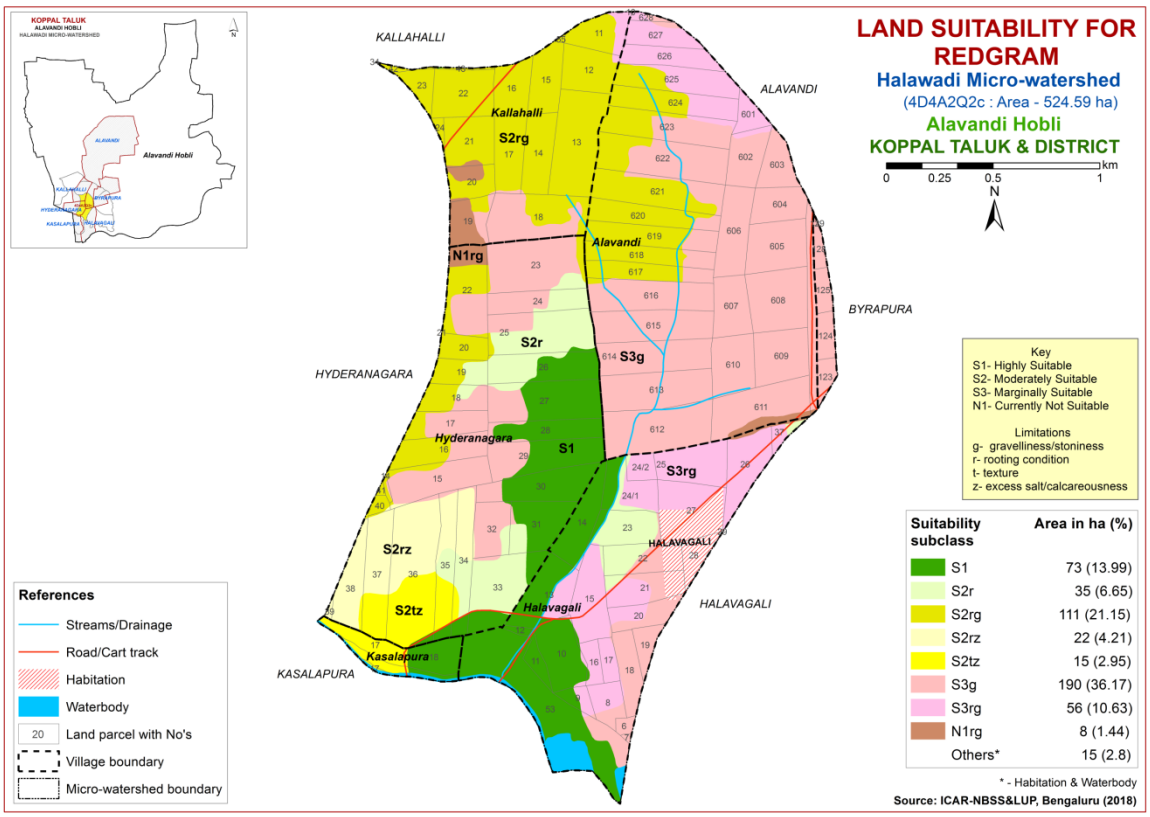


Fig. 7.6 Land Suitability map of Redgram

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 15 ha (3%) is highly suitable (Class S1) for growing Bengal gram and are distributed in the southern part of the microwatershed. Maximum area of about 297 ha (57%) is moderately suitable (Class S2) and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 196 ha (37%) and are distributed in the northern, western, central, eastern and southern part of the microwatershed with moderate limitations of rooting depth, texture and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

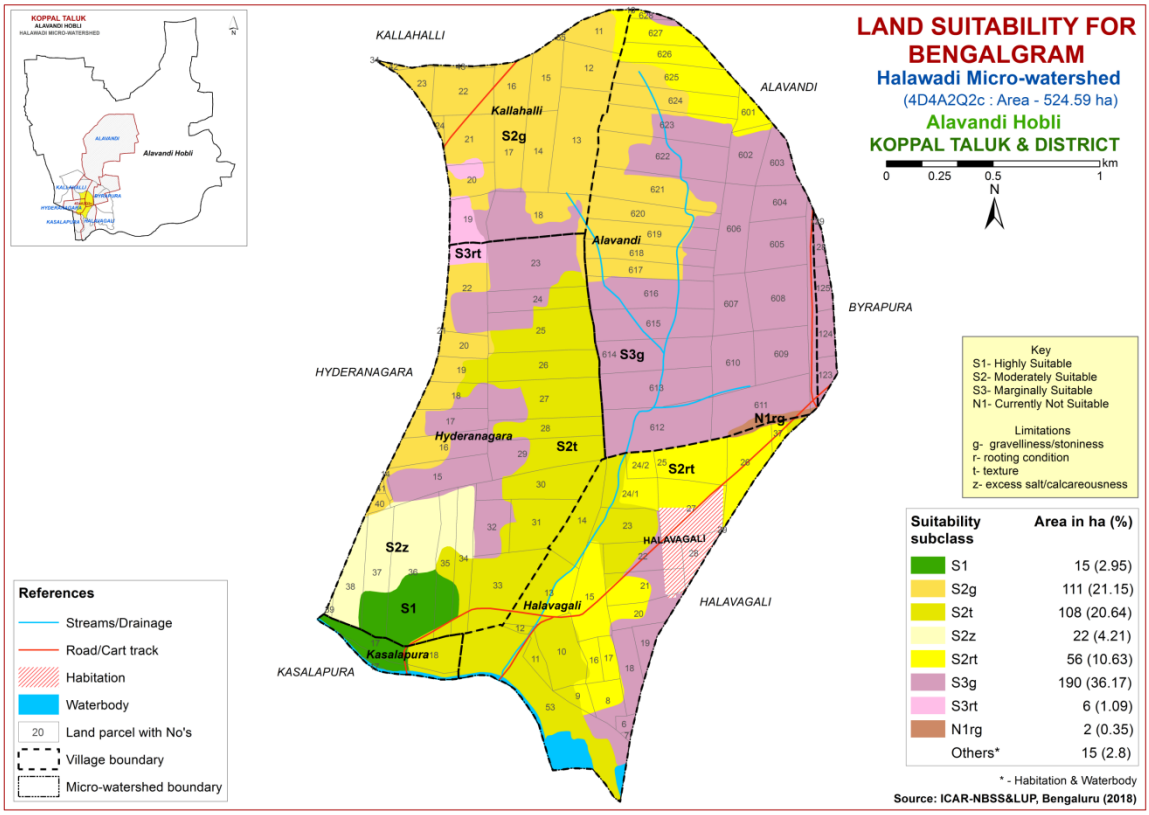


Fig. 7.7 Land Suitability map of Bengal gram

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.

An area of about 46 ha (9%) is highly suitable (Class S1) for growing cotton and are distributed in the southern part of the microwatershed. Maximum area of about 247 ha (47%) is moderately suitable (Class S2) and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 215 ha (41%) and are distributed in the northern, northwestern, central and eastern part of the microwatershed with moderate limitations of rooting depth, texture, calcareousness and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

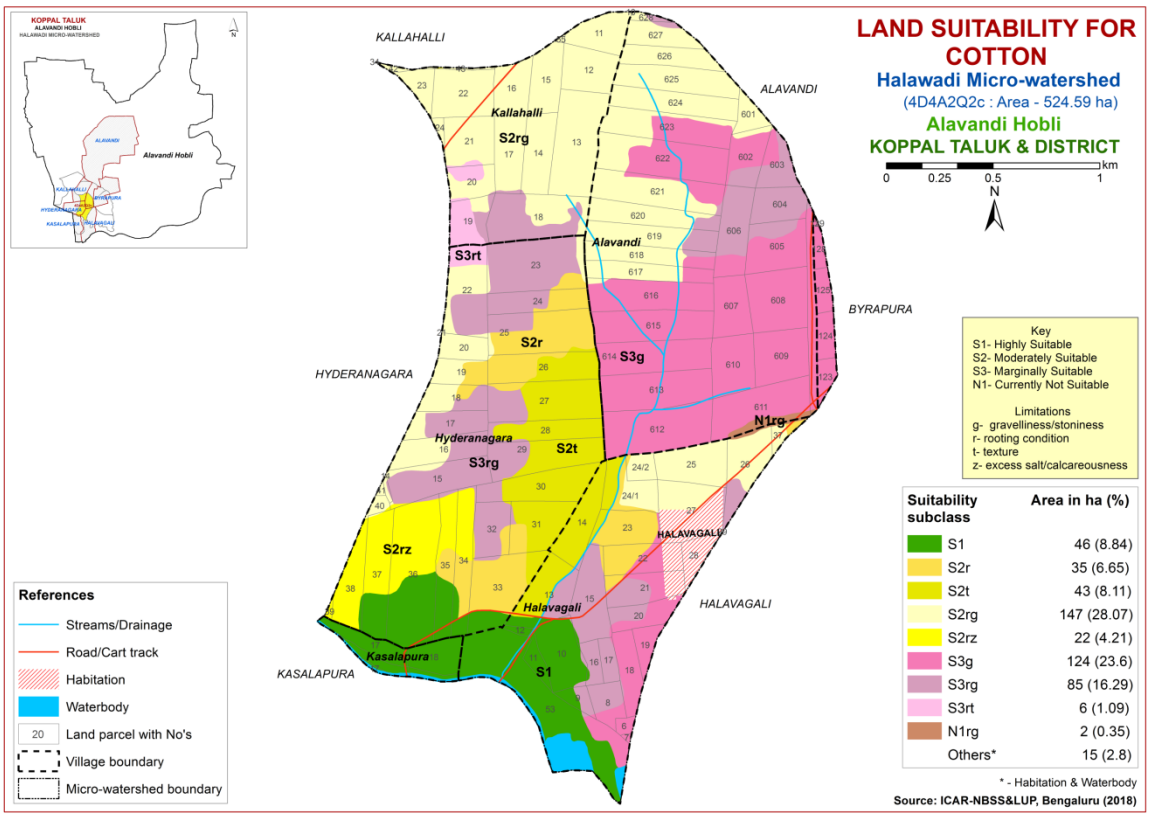


Fig. 7.8 Land Suitability map of Cotton

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 108 ha (21%) is highly suitable (Class S1) for growing Chilli and are distributed in the central and southern part of the microwatershed. An area of about 184 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, western, eastern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 215 ha (41%) and are distributed in all part of the microwatershed with moderate limitations of rooting depth and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

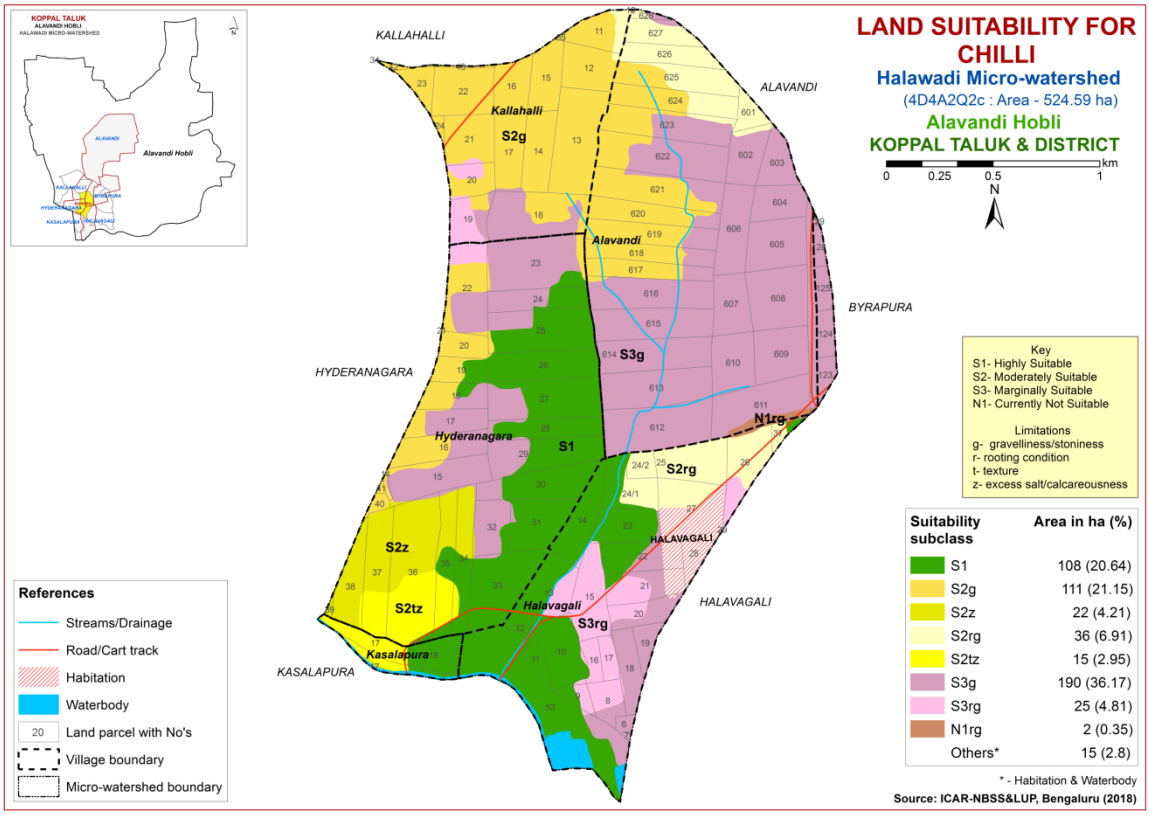


Fig. 7.9 Land Suitability map of Chilli

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 108 ha (21%) is highly suitable (Class S1) for growing Tomato and are distributed in the central and southern part of the microwatershed. An area of about 184 ha (35%) is moderately suitable (Class S2) and are distributed in the northern, western, eastern and southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable (Class S3) lands occupy a maximum area of about 215 ha (41%) and are distributed in all part of the microwatershed with moderate limitations of rooting depth and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

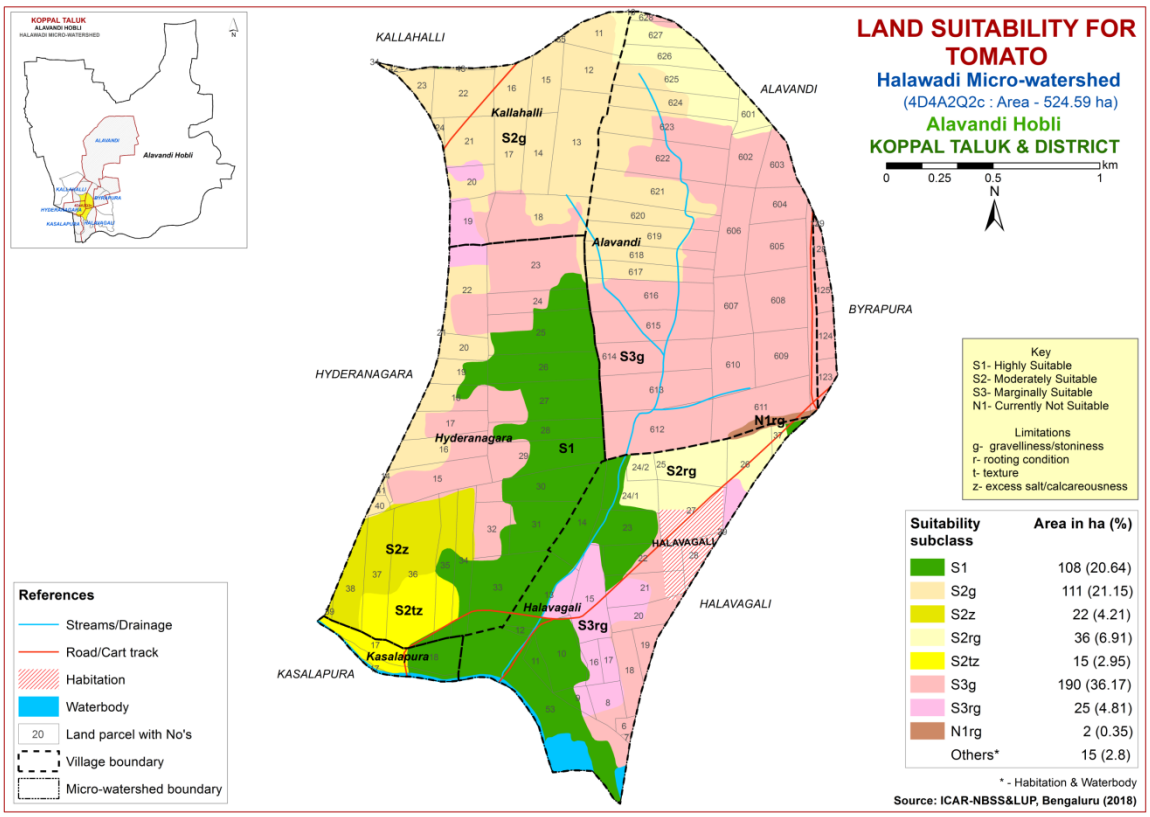


Fig. 7.10 Land Suitability map of Tomato

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.

Highly (Class S1) suitable lands for growing brinjal occur in an area of about 188 ha (36%) and are distributed in the northern, western, central and southern part of the microwatershed. Maximum area of about 192 ha (37%) is moderately suitable (Class S2) for growing brinjal and are distributed in all part of the microwatershed. They have minor limitations of texture, gravelliness and calcareousness. An area of 128 ha (24%) is marginally suitable for growing brinjal and are distributed in the northern, western, eastern and southern part of the microwatershed with major limitations of rooting depth and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitation of gravelliness.

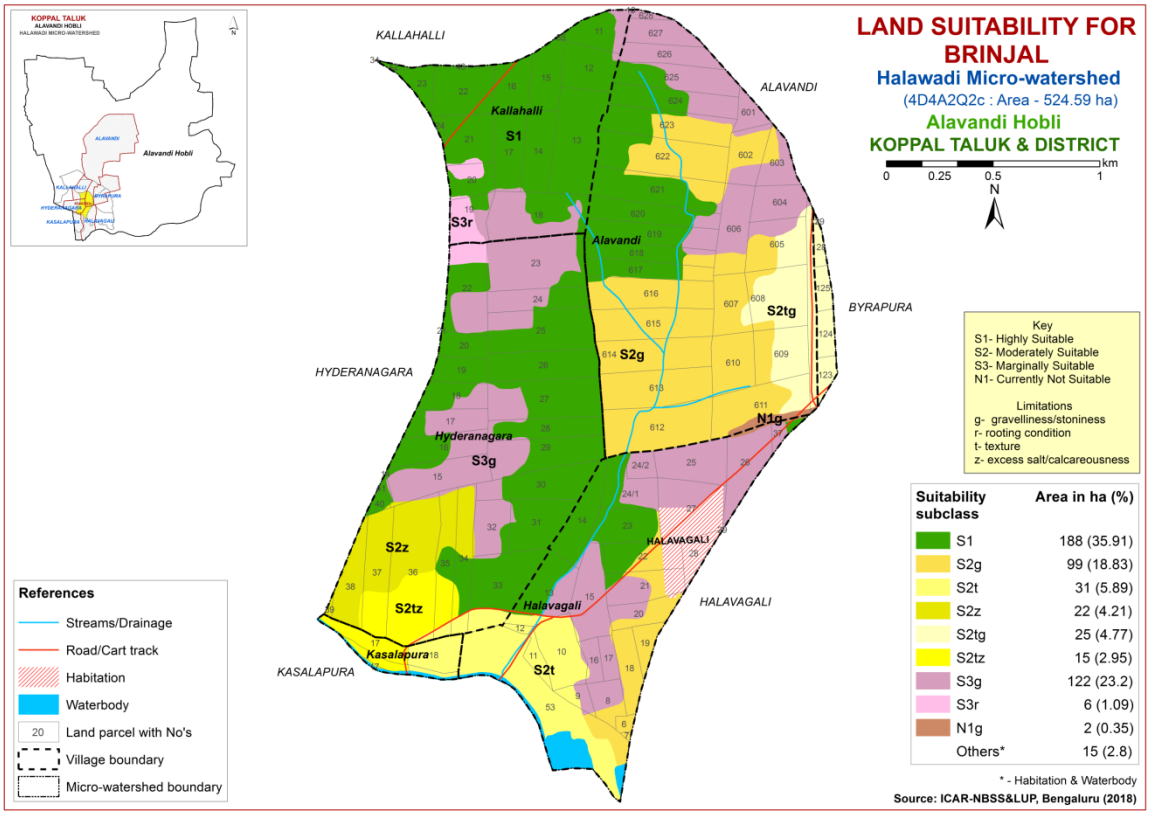


Fig 7.11 Land Suitability map of Brinjal

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.

Highly (Class S1) suitable lands for growing brinjal occur in an area of about 153 ha (29%) and are distributed in the northern, western, central and southern part of the microwatershed. Maximum area of about 212 ha (41%) is moderately suitable (Class S2) for growing brinjal and are distributed in all part of the microwatershed. They have minor limitations of texture, gravelliness and calcareousness. An area of 143 ha (27%) is marginally suitable (Class S3) for growing brinjal and are distributed in the northern, western, eastern and southern part of the microwatershed with major limitations of rooting depth, texture and calcareousness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitation of gravelliness.

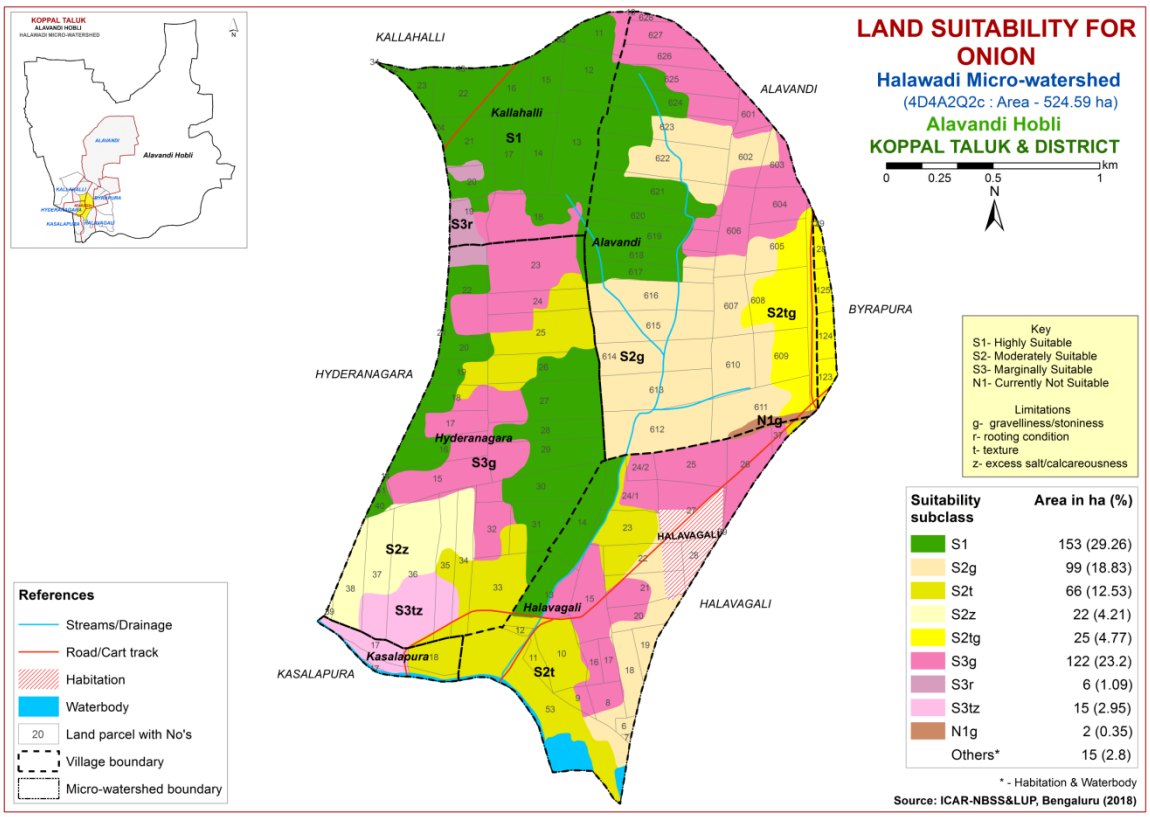


Fig 7.12 Land Suitability map of Onion

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.

Highly (Class S1) suitable lands for growing Bhendi occur in an area of about 153 ha (29%) and are distributed in the northern, western and southern part of the microwatershed. Maximum area of about 227 ha (44%) is moderately suitable (Class S2) for growing Bhendi and are distributed in all part of the microwatershed. They have minor limitations of texture, rooting depth, gravelliness and calcareousness. An area of 128 ha (24%) is marginally suitable for growing Bhendi and are distributed in the northern, western, eastern and southern part of the microwatershed with major limitations of rooting depth and gravelliness. Currently not suitable (Class N1) land occupy an area of about 2 ha (<1%) and are distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

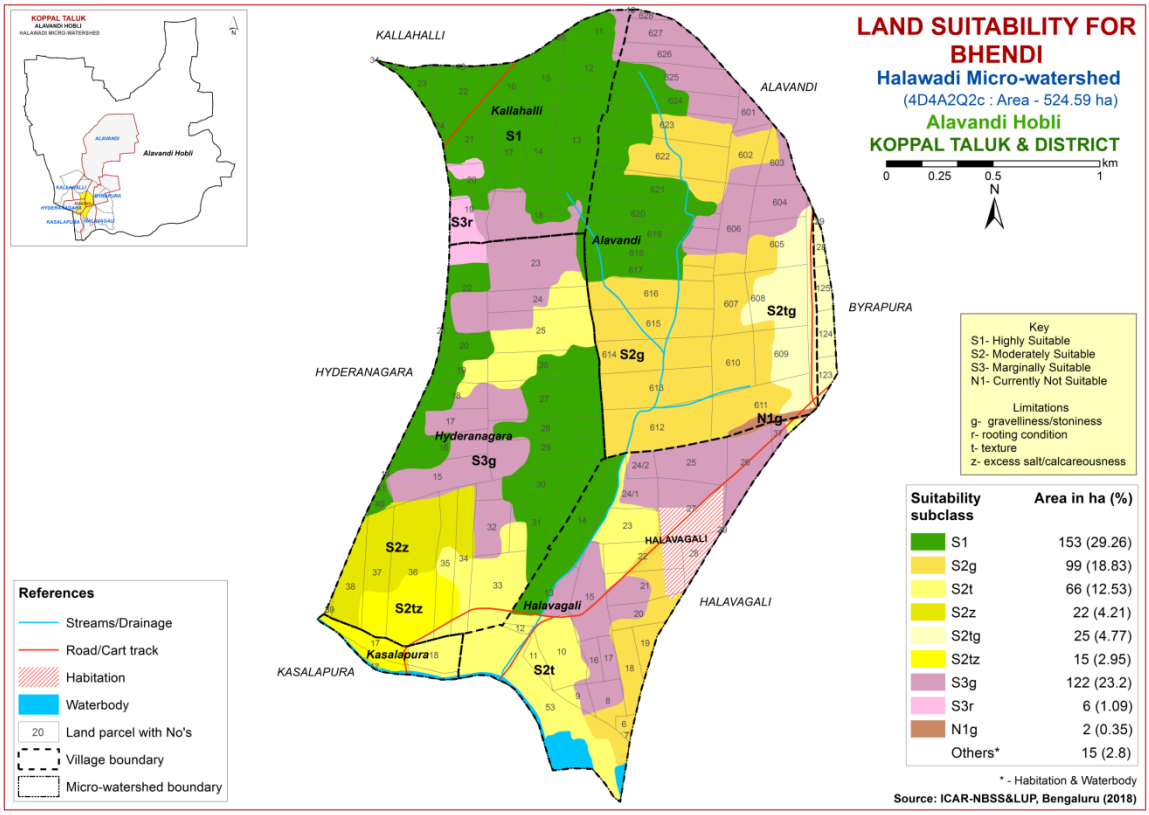


Fig 7.13 Land Suitability map of Bhendi

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.

Highly suitable (Class S1) lands for growing Drumstick occupy an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 282 ha (54%) is moderately suitable (Class S2) for Drumstick and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 147 ha (28%) is marginally suitable lands (Class S3) for growing Drumstick and are distributed in the northern, western, eastern and southern part of the microwatershed with major limitations of rooting depth, calcareousness, texture and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Drumstick and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

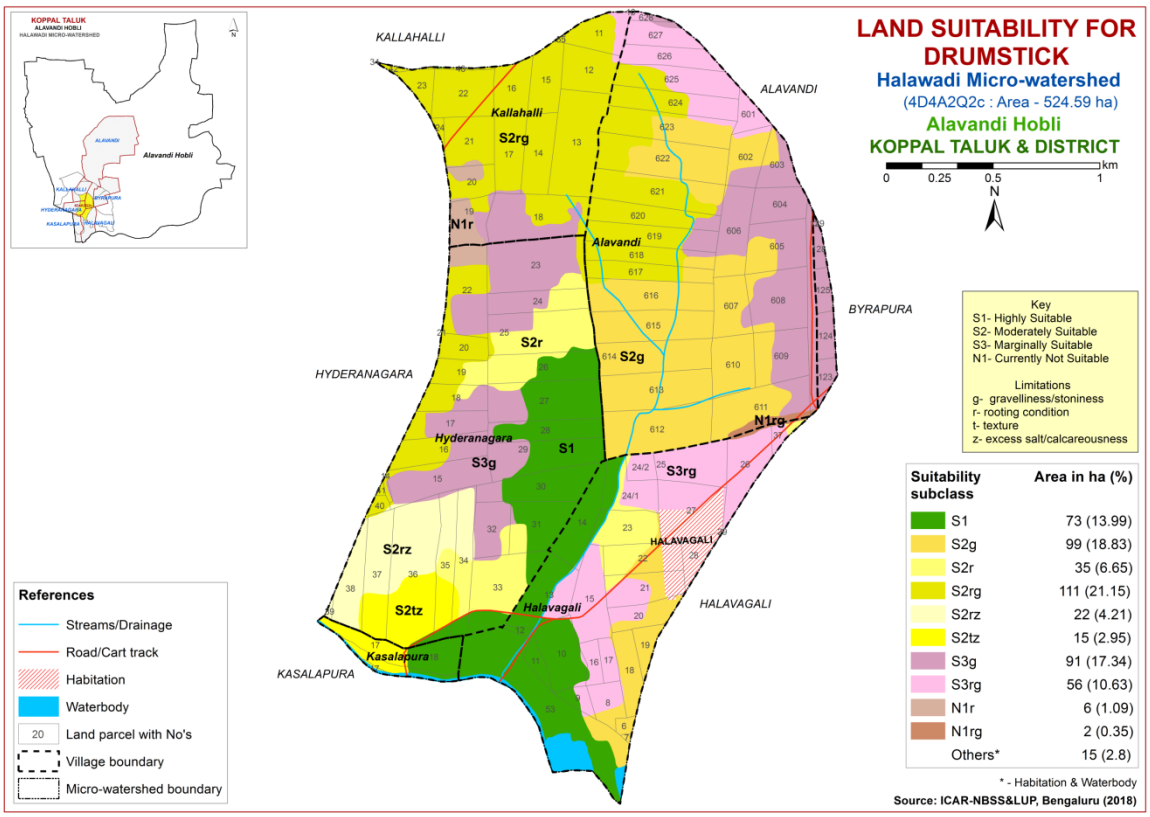


Fig. 7.14 Land Suitability map of Drumstick

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.

Highly suitable (Class S1) lands for growing Mango occupy an area of about 31 ha (6%) and are distributed in the southeastern part of the microwatershed. Moderately suitable (Class S2) lands occupy an area of about 43 ha (8%) and are distributed in the central and southern part of the microwatershed with minor limitation of rooting depth. Maximum area of about 373 ha (71%) is marginally suitable lands (Class S3) for growing Mango and are distributed in all part of the microwatershed with major limitations of rooting depth, texture, calcareousness and gravelliness. An area of about 63 ha (12%) is currently not suitable (Class N1) for growing Mango and are distributed in the northern, eastern, southern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

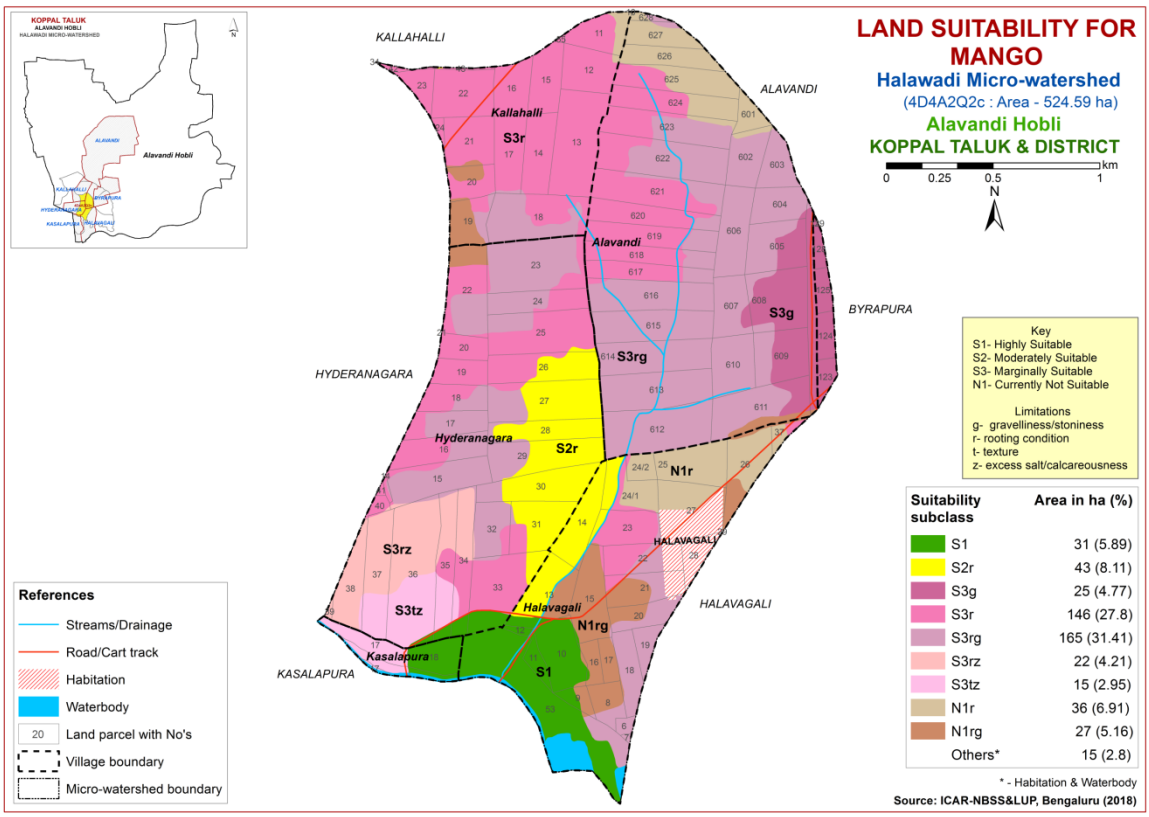


Fig. 7.15 Land Suitability map of Mango

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.

Highly suitable (Class S1) lands for growing guava in an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 234 ha (44%) is moderately suitable (Class S2) for guava and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 195 ha (38%) is marginally suitable lands (Class S3) for growing guava and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth, texture, calcareousness and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing guava and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

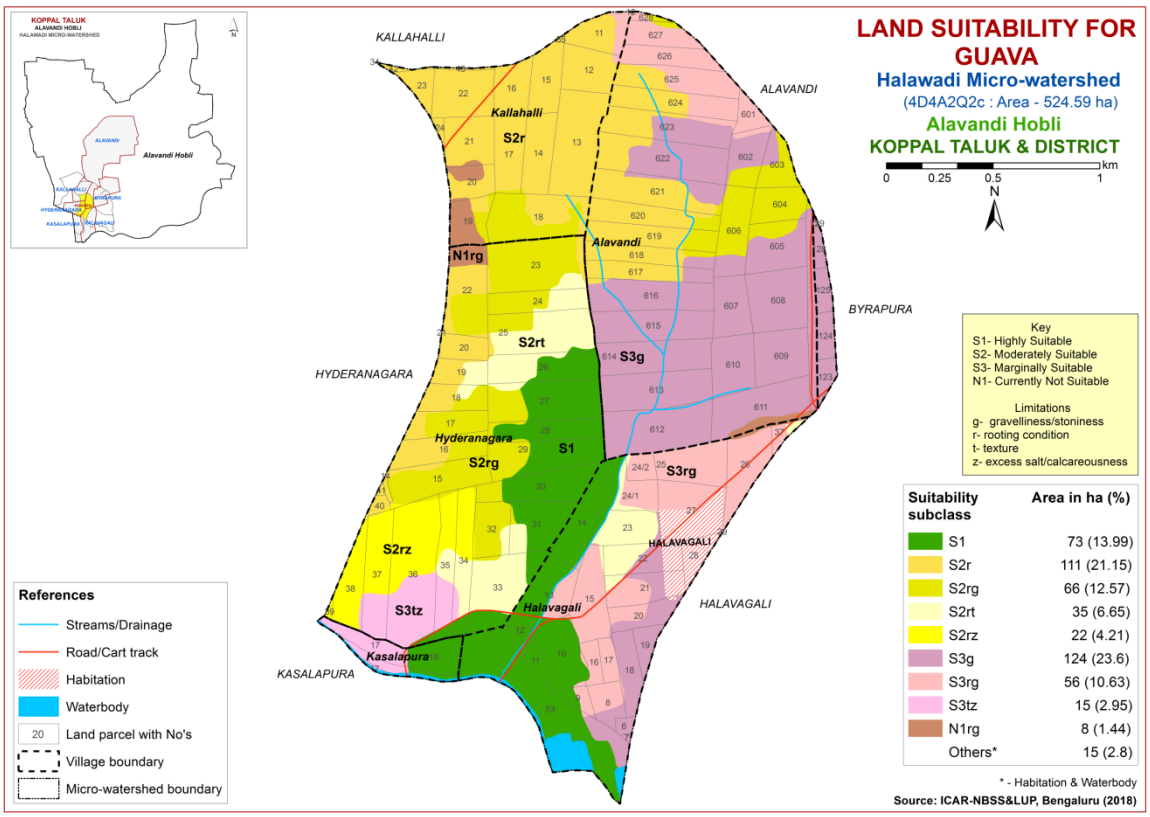


Fig. 7.16 Land Suitability map of Guava

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.

Highly suitable (Class S1) lands for growing Sapota occur in an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 234 ha (44%) is moderately suitable (Class S2) for Sapota and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 195 ha (38%) is marginally suitable lands (Class S3) for growing Sapota and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth, texture, calcareousness and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Sapota and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

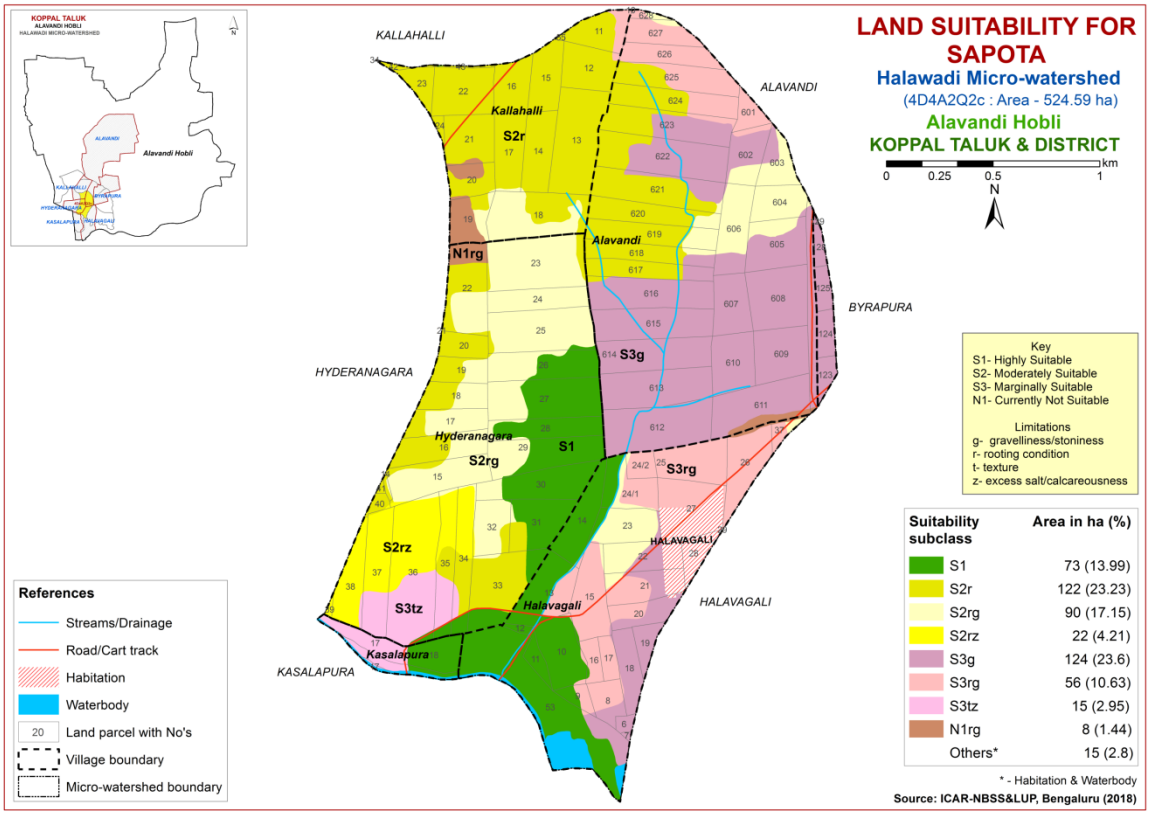


Fig. 7.17 Land Suitability map of Sapota

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.

Highly suitable (Class S1) lands for growing Pomegranate occupy an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 249 ha (47%) is moderately suitable (Class S2) for Pomegranate and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness, calcareousness and texture. An area of about 180 ha (35%) is marginally suitable lands (Class S3) for growing Pomegranate and are distributed in the northern, eastern, central and southern part of the microwatershed with major limitations of rooting depth and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Pomegranate and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

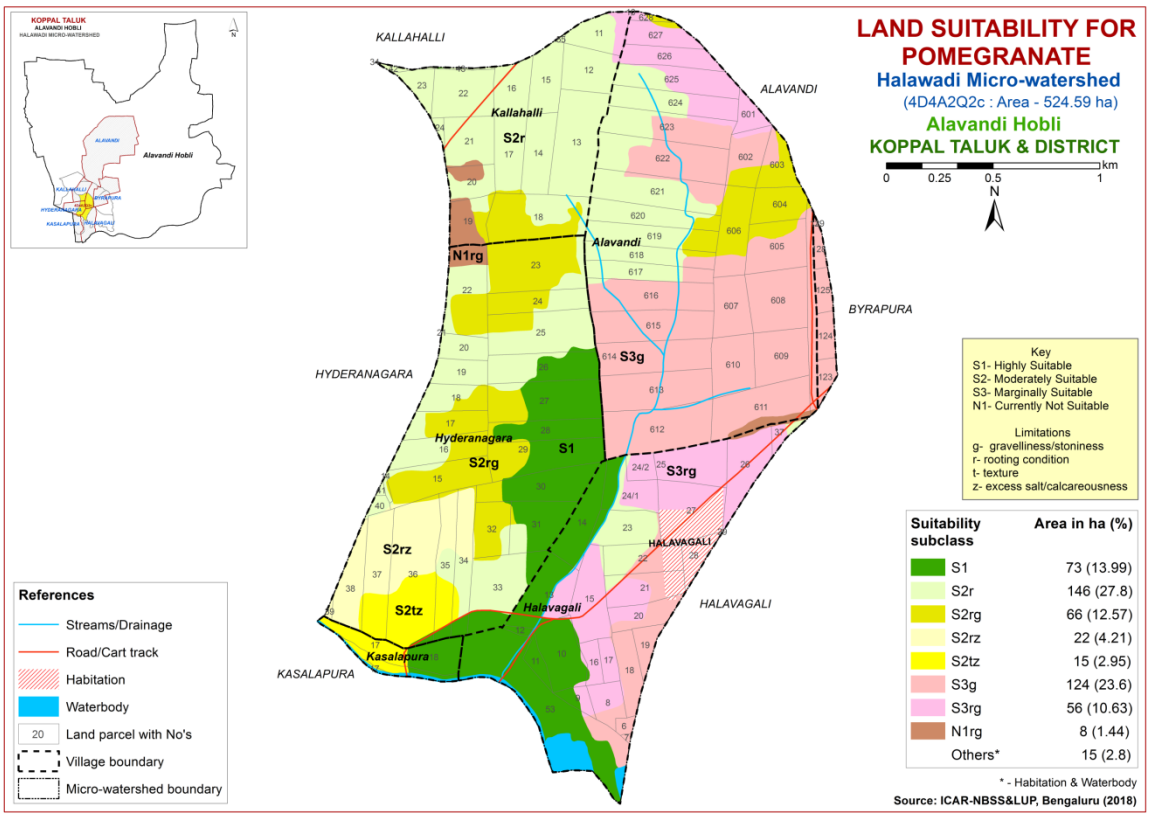


Fig. 7.18 Land Suitability map of Pomegranate

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.

Highly suitable (Class S1) lands for growing Musambi occupy an area of about 89 ha (17%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 234 ha (44%) is moderately suitable (Class S2) for Musambi and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 180 ha (35%) is marginally suitable lands (Class S3) for growing Musambi and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Musambi and are distributed in the western and eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

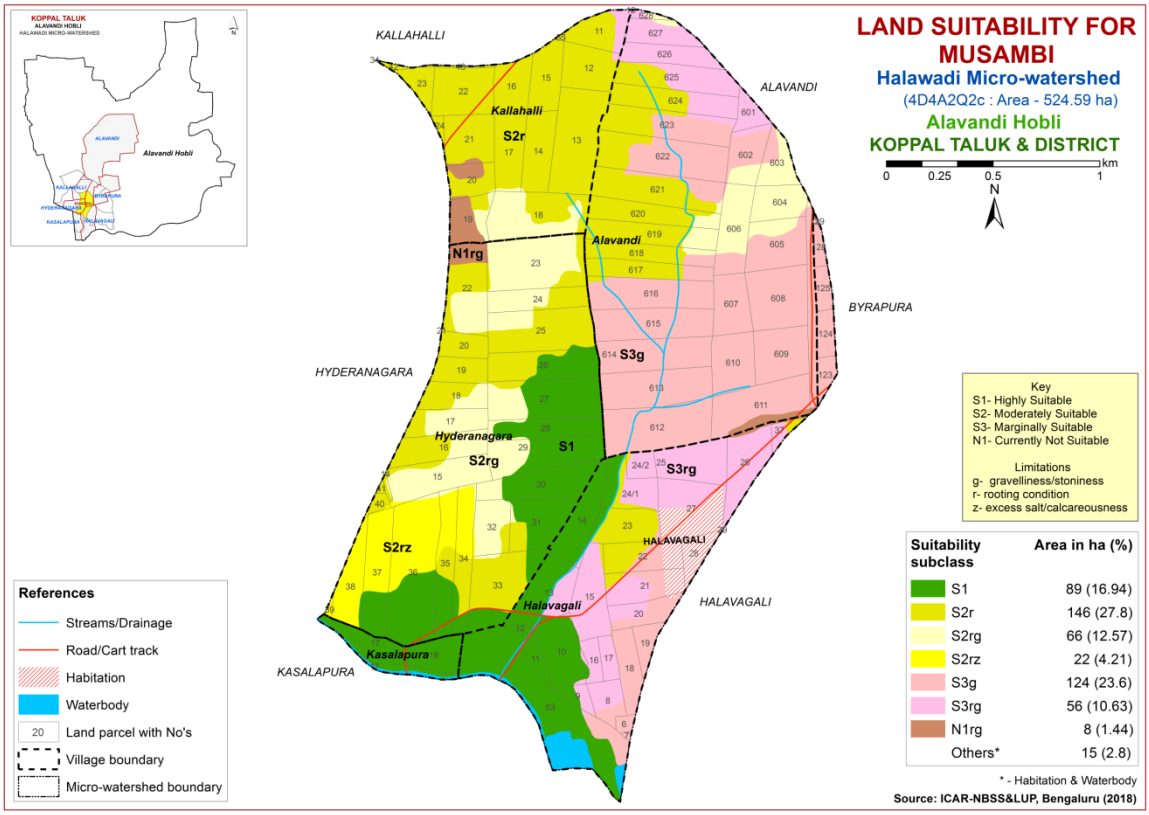


Fig. 7.19 Land Suitability map of Musambi

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.

Highly suitable (Class S1) lands for growing Lime occupy an area of about 89 ha (17%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 234 ha (44%) is moderately suitable (Class S2) for Lime and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 180 ha (35%) is marginally suitable lands (Class S3) for growing Lime and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Lime and are distributed in the western and eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

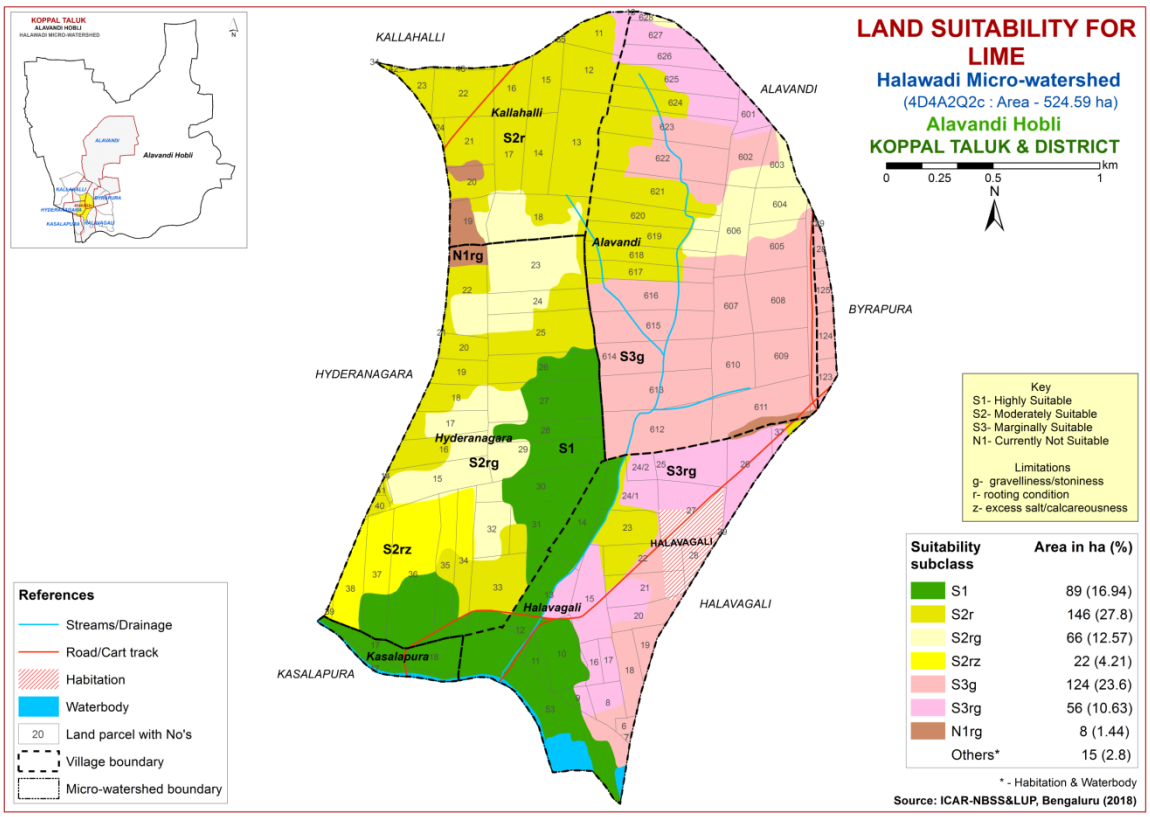


Fig. 7.20 Land Suitability map of Lime

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 235 ha (45%) is highly suitable (Class S1) for growing Amla and are distributed in the northern, western and southern part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 268 ha (51%) and occur in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 8 ha (1%) is marginally suitable lands (Class S3) for growing Amla and are distributed in the eastern and western part of the microwatershed with major limitations of rooting depth and gravelliness.

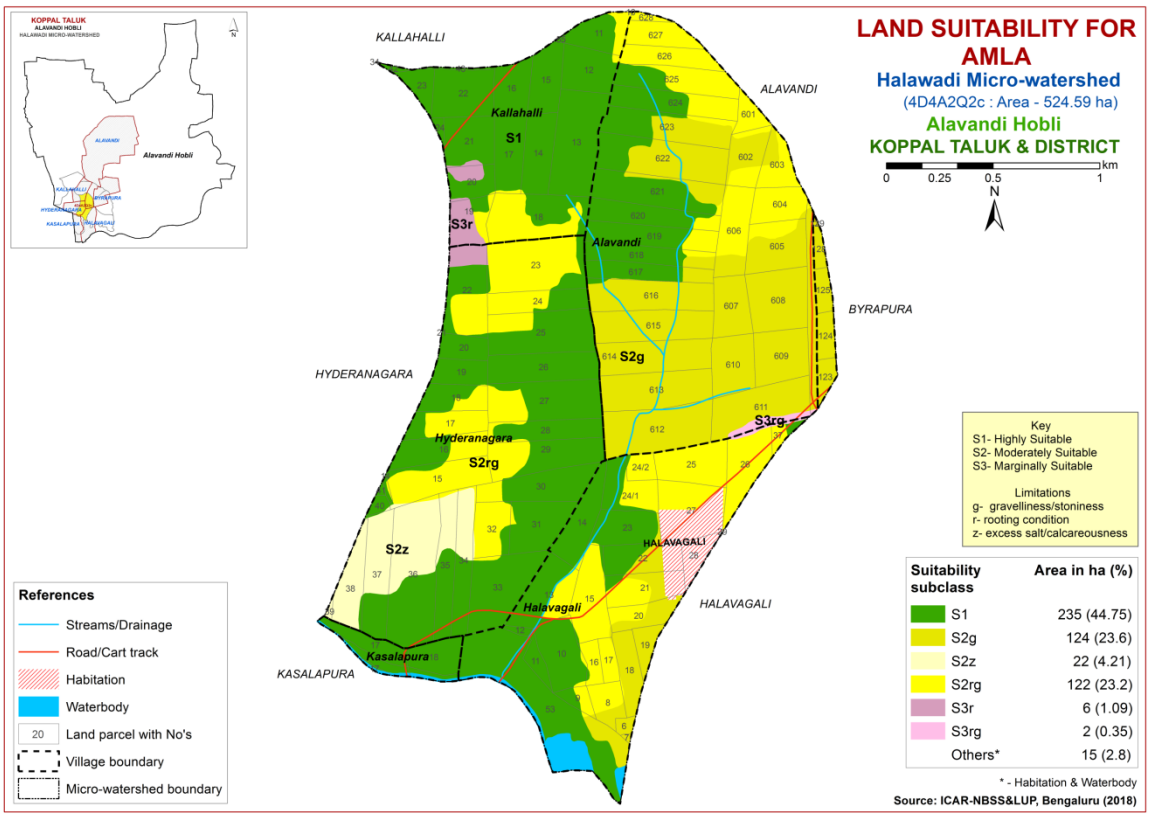


Fig. 7.21 Land Suitability map of Amla

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.

Highly suitable (Class S1) lands occupy an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 237 ha (45%) is moderately suitable (Class S2) and occur in all part of the microwatershed. They have minor limitations of gravelliness, texture and rooting depth. An area of about 155 ha (30%) is marginally suitable (Class S3) for growing cashew and are distributed in the northern, eastern and southern part of the microwatershed with moderate limitations of gravelliness and rooting depth. An area of about 45 ha (8%) is currently not suitable (Class N1) for growing cashew and distributed in the western and southern part of the microwatershed with severe limitations of texture, rooting depth, gravelliness and calcareousness.

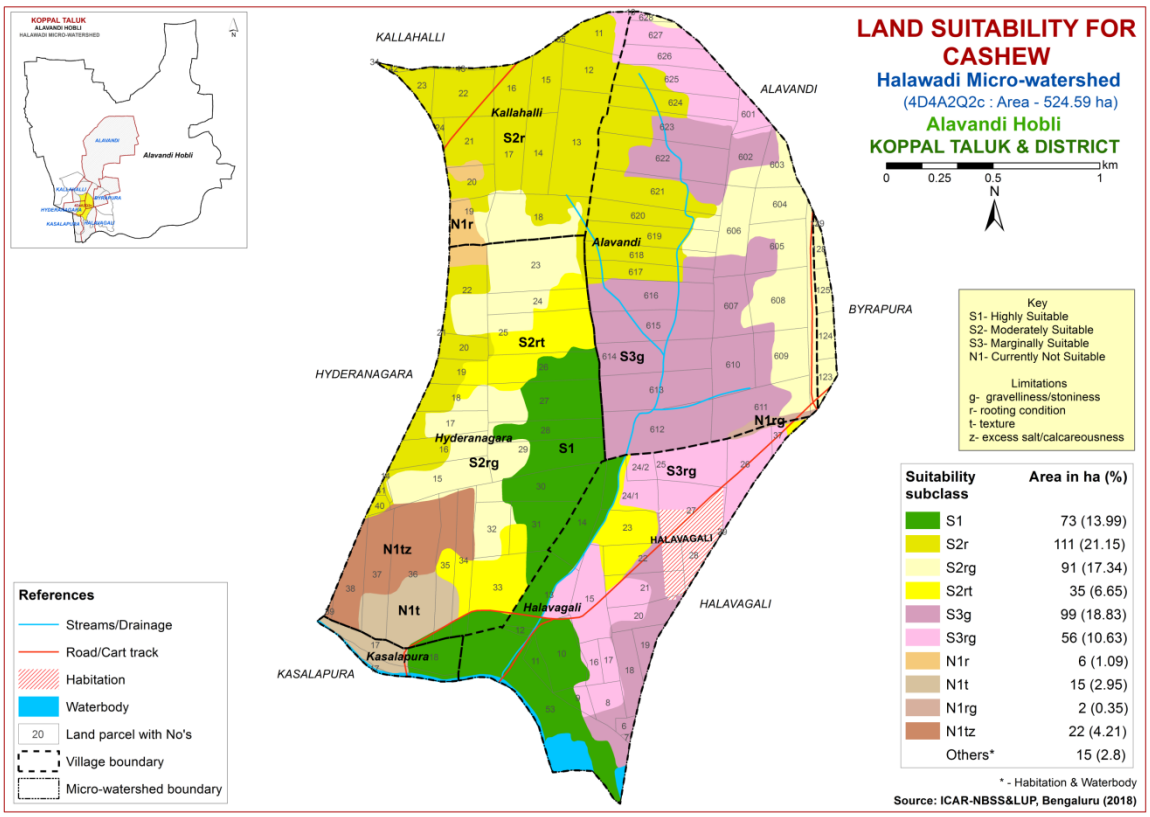


Fig. 7.22 Land Suitability map of Cashew

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.

Highly suitable (Class S1) lands for growing Jackfruit in an area of about 73 ha (14%) and are distributed in the central and southern part of the microwatershed. Maximum area of about 234 ha (44%) is moderately suitable (Class S2) for Jackfruit and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 195 ha (38%) is marginally suitable lands (Class S3) for growing Jackfruit and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth, texture, calcareousness and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Jackfruit and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

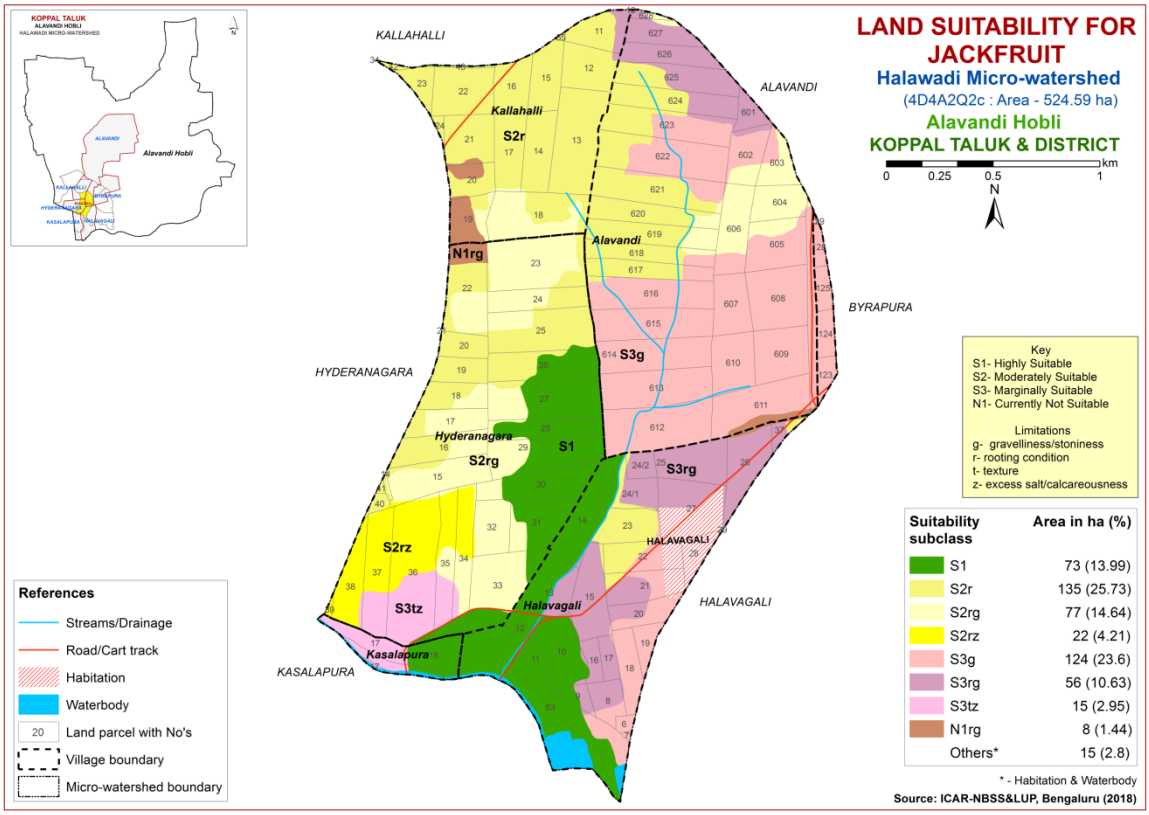


Fig. 7.23 Land Suitability map of Jackfruit

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 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 7.24.

Highly suitable (Class S1) lands for growing Jamun occupy an area of about 31 ha (6%) and are distributed in the southern part of the microwatershed. Maximum area of about 269 ha (52%) is moderately suitable (Class S2) for Jamun and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. An area of about 202 ha (38%) is marginally suitable lands (Class S3) for growing Jamun and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth, calcareousness and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Jamun and are distributed in the western and eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

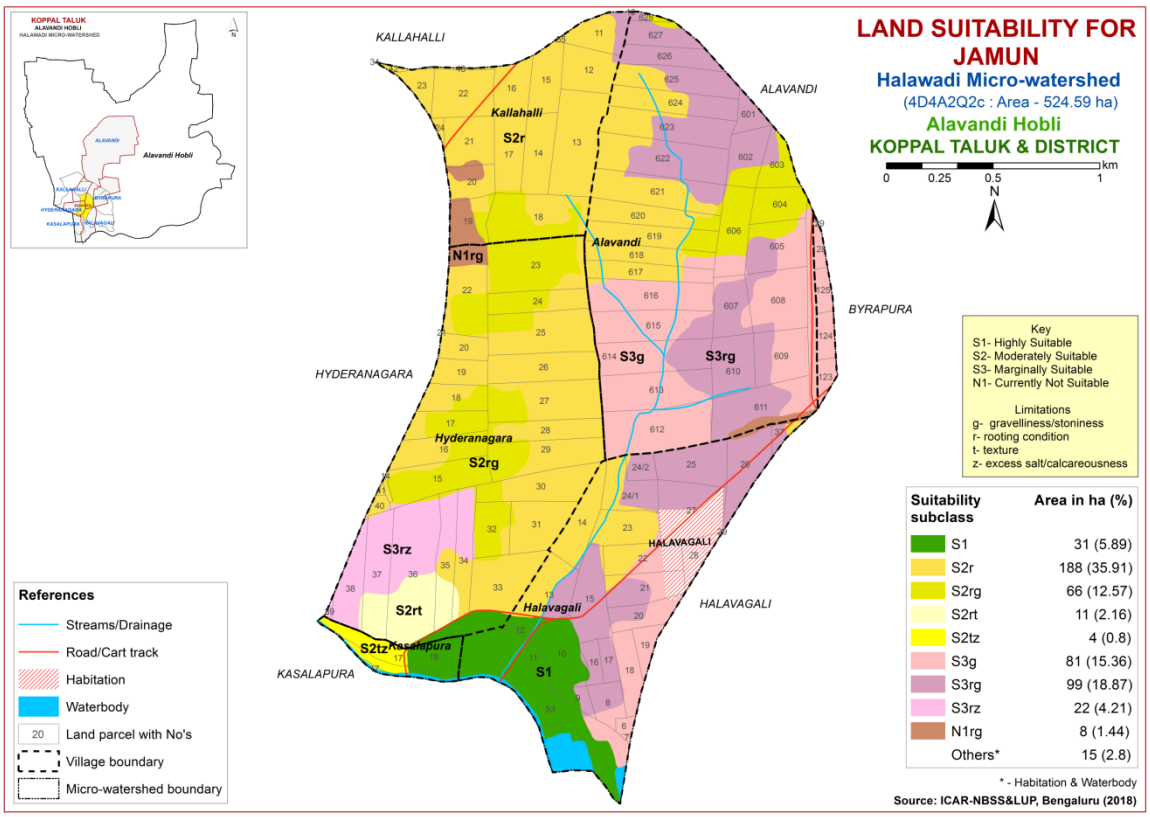


Fig. 7.24 Land Suitability map of Jamun

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 235 ha (45%) is highly suitable (Class S1) for growing custard apple and are distributed in the northern, western and southern part of the microwatershed. Moderately suitable (Class S2) lands cover a maximum area of about 268 ha (51%) and occur in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 8 ha (1%) is marginally suitable lands (Class S3) for growing custard apple and are distributed in the eastern and western part of the microwatershed with major limitations of rooting depth and gravelliness.

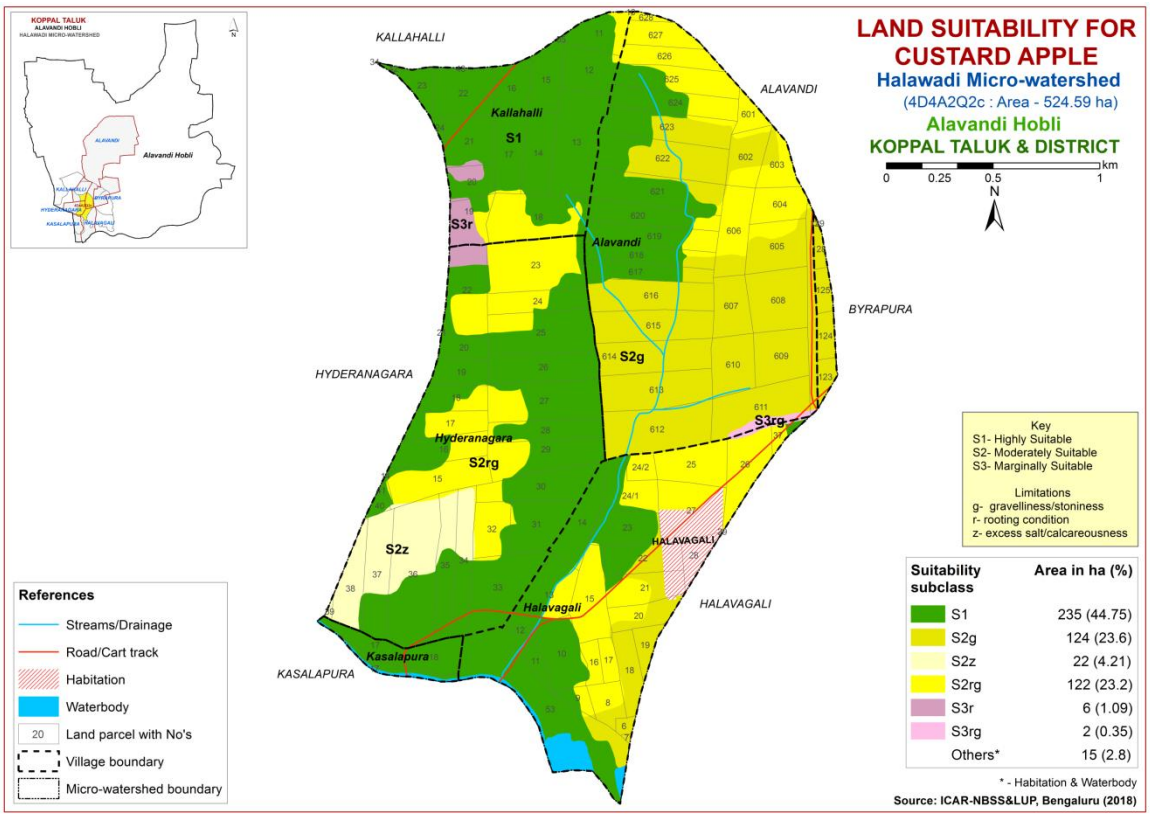


Fig. 7.25 Land Suitability map of Custard Apple

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.

Highly suitable (Class S1) lands for growing Tamarind occupy an area of about 31 ha (6%) and are distributed in the southern part of the microwatershed. An area of about 58 ha (11%) is moderately suitable (Class S2) for Tamarind and are distributed in the central and southern part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. Maximum area of about 358 ha (68%) is marginally suitable lands (Class S3) for growing Tamarind and are distributed in all part of the microwatershed with major limitations of rooting, calcareousness and gravelliness. An area of about 63 ha (12%) is currently not suitable (Class N1) for growing Tamarind and are distributed in the northern, southern, eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

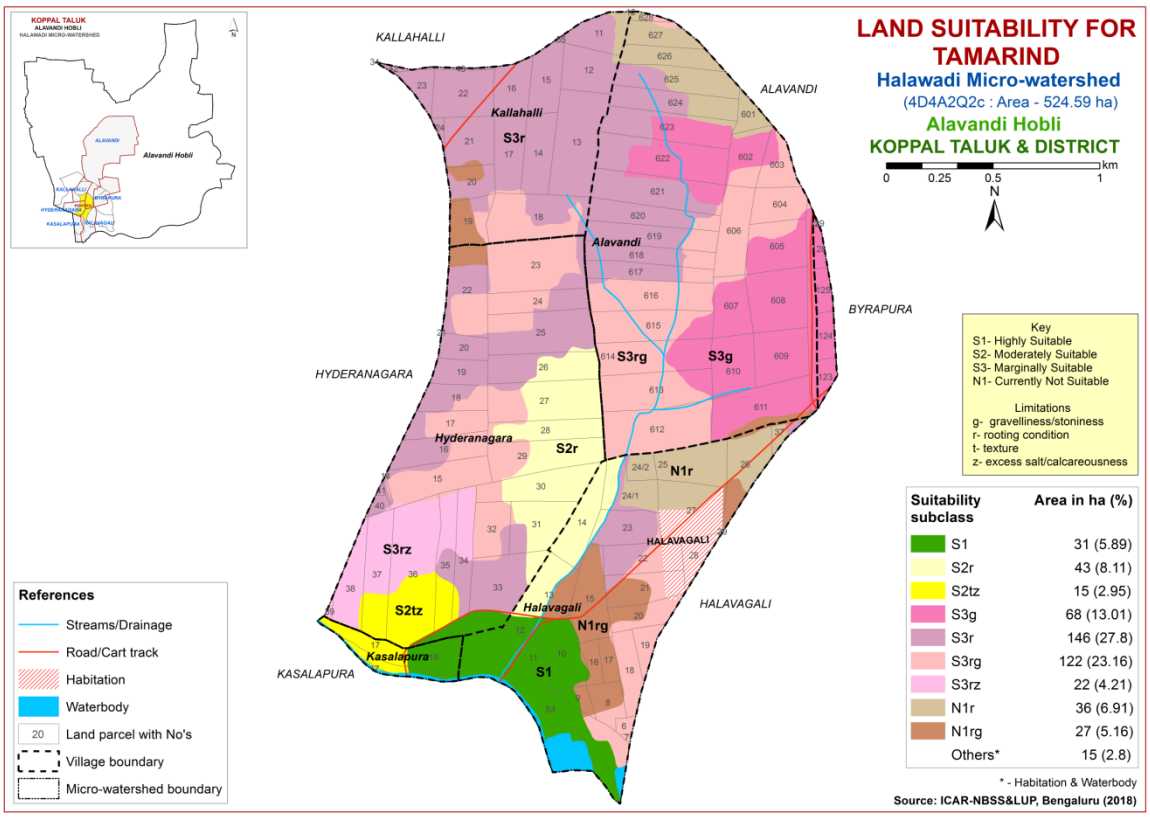


Fig. 7.26 Land Suitability map of Tamarind

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.

Highly suitable (Class S1) lands for growing Mulberry occupy an area of about 73 ha (14%) and are distributed in the central and south part of the microwatershed. Maximum area of about 358 ha (68%) is moderately suitable (Class S2) for Mulberry and are distributed in all part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 71 ha (14%) is marginally suitable lands (Class S3) for growing Mulberry and are distributed in the northern, eastern and southern part of the microwatershed with major limitations of rooting depth, calcareousness, texture and gravelliness. An area of about 8 ha (1%) is currently not suitable (Class N1) for growing Mulberry and are distributed in the eastern and western part of the microwatershed with severe limitations of rooting depth and gravelliness.

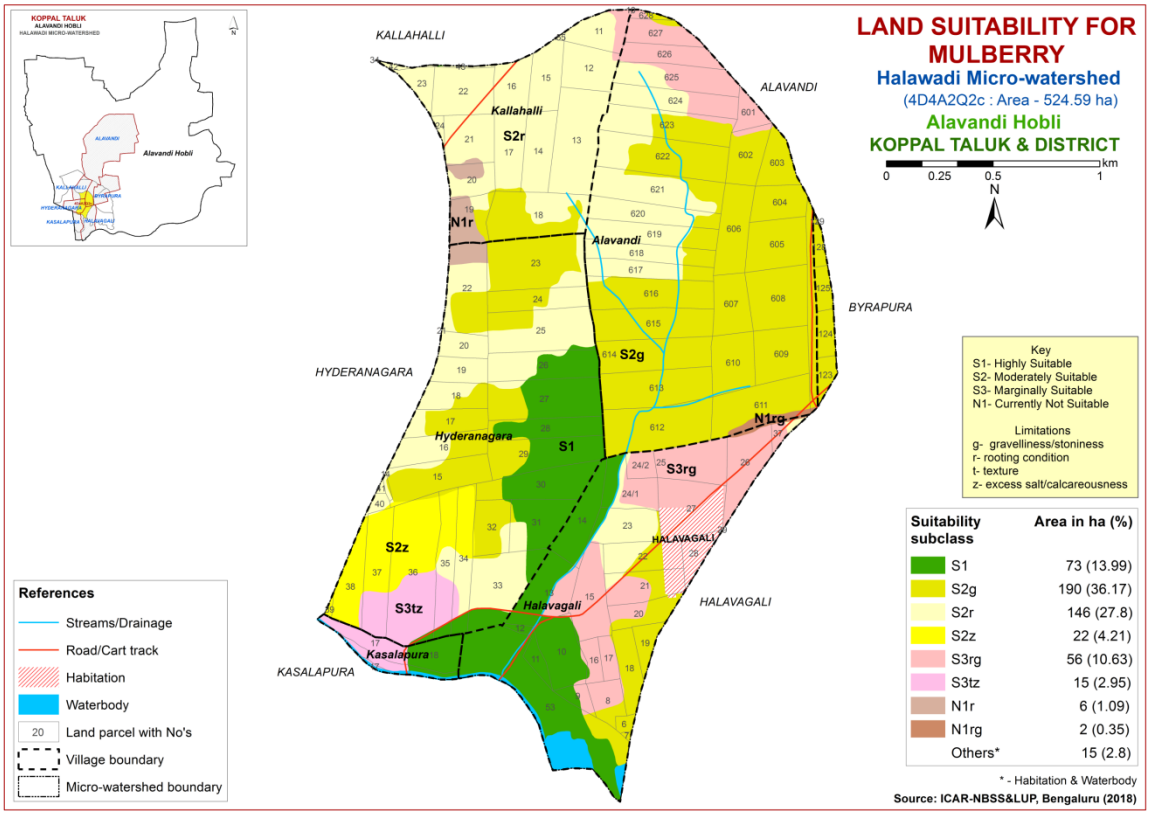


Fig. 7.27 Land Suitability map of Mulberry

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 73 ha (14%) is highly suitable (Class S1) for growing Marigold and are distributed in the southern and central part of the microwatershed. Maximum area of about 219 ha (42%) is moderately suitable (Class S2) and occur in all part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. An area of about 215 ha (41%) is marginally suitable (Class S3) for growing Marigold and are distributed in the northern, western, eastern and southern part of the microwatershed with moderate limitations of gravelliness and rooting depth. Currently not suitable soil occupy an area of about 2 ha (<1%) and distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

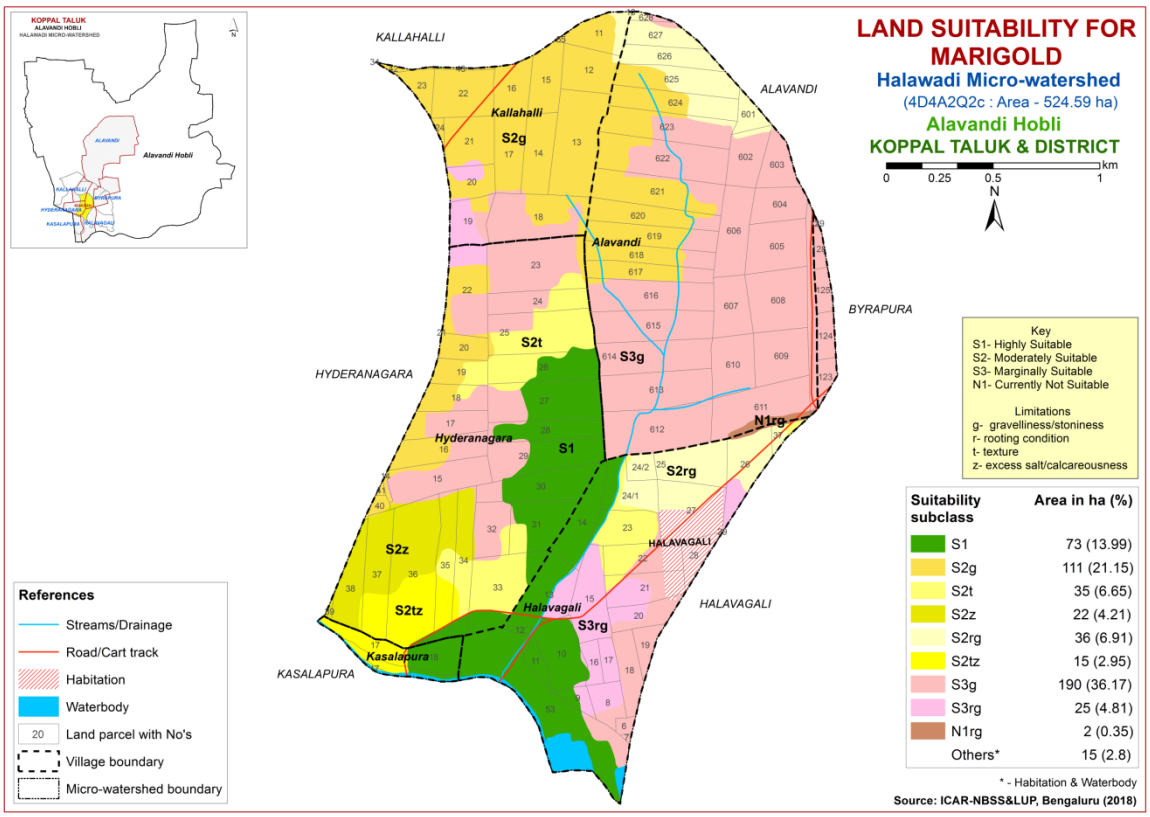


Fig. 7.28 Land Suitability map of Marigold

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 73 ha (14%) is highly suitable (Class S1) for growing Chrysanthemum and are distributed in the southern and central part of the microwatershed. Maximum area of about 219 ha (42%) is moderately suitable (Class S2) and occur in all part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. An area of about 215 ha (41%) is marginally suitable (Class S3) for growing Chrysanthemum and are distributed in the northern, western, eastern and southern part of the microwatershed with moderate limitations of gravelliness and rooting depth. Currently not suitable soil occupy an area of about 2 ha (<1%) and distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

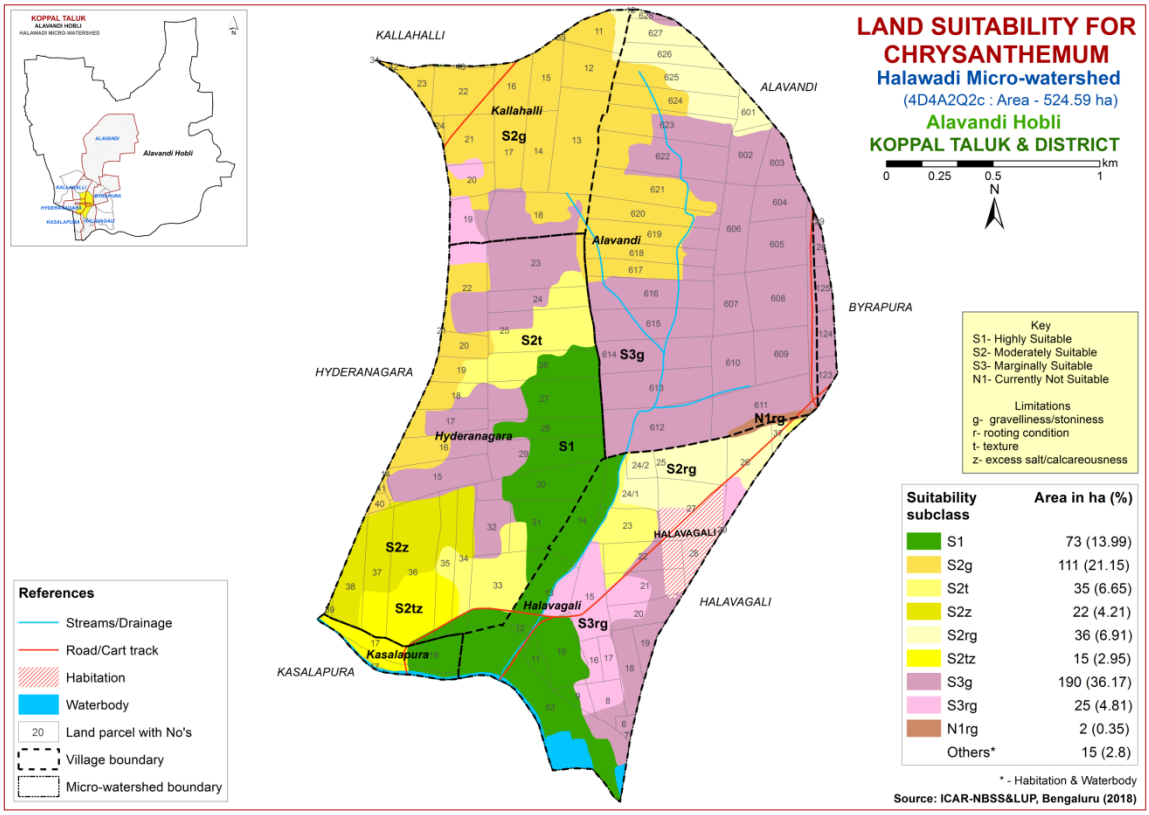


Fig. 7.29 Land Suitability map of Chrysanthemum

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 73 ha (14%) is highly suitable (Class S1) for growing jasmine and are distributed in the central and southern part of the microwatershed. An area of about 204 ha (39%) is moderately suitable (Class S2) and occur in the northern, western, central and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. Maximum area of about 232 ha (44%) is marginally suitable (Class S3) for growing jasmine and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness.

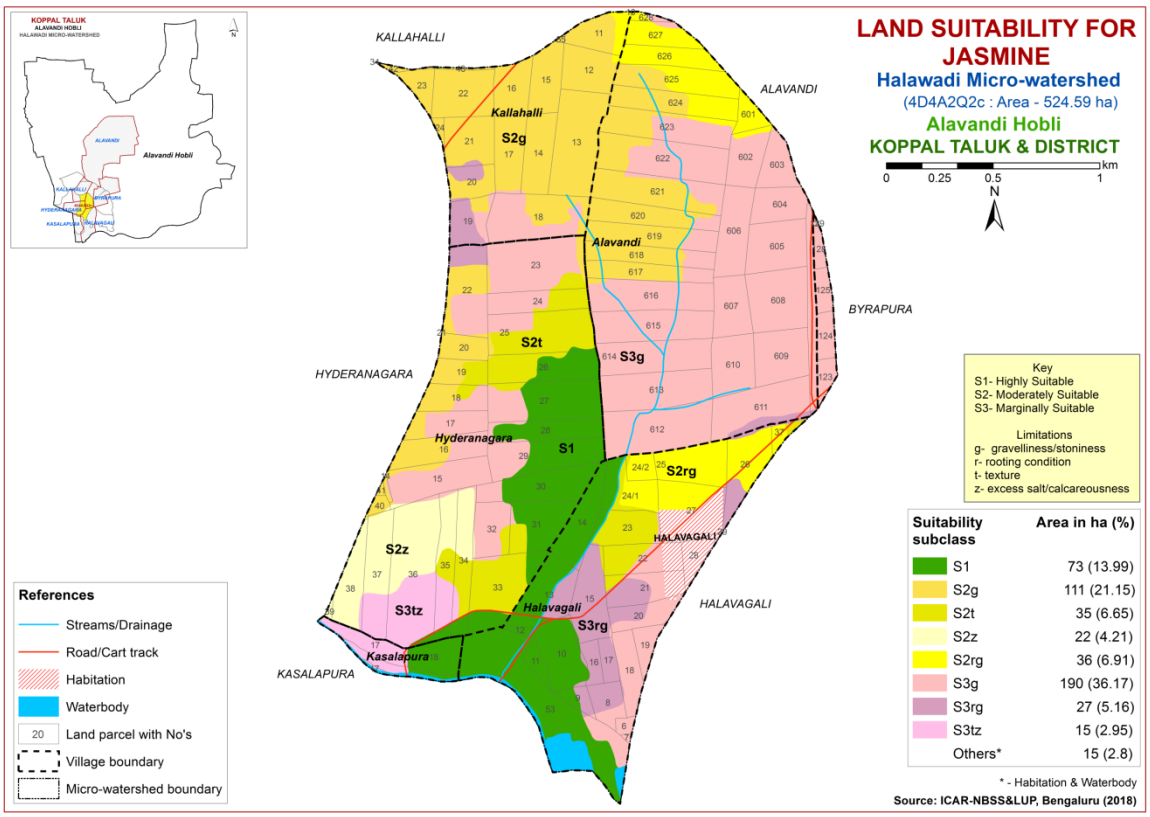


Fig. 7.30 Land Suitability map of Jasmine

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 73 ha (14%) is highly suitable (Class S1) for growing Crossandra and are distributed in the southern and central part of the microwatershed. An area of about 204 ha (39%) is moderately suitable (Class S2) and occur in the northern, western, central and southern part of the microwatershed. They have minor limitations of gravelliness, rooting depth, calcareousness and texture. Maximum area of about 230 ha (44%) is marginally suitable (Class S3) for growing Crossandra and are distributed in the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness. Currently not suitable soil occupy an area of about 2 ha (<1%) and distributed in the eastern part of the microwatershed with severe limitations of rooting depth and gravelliness.

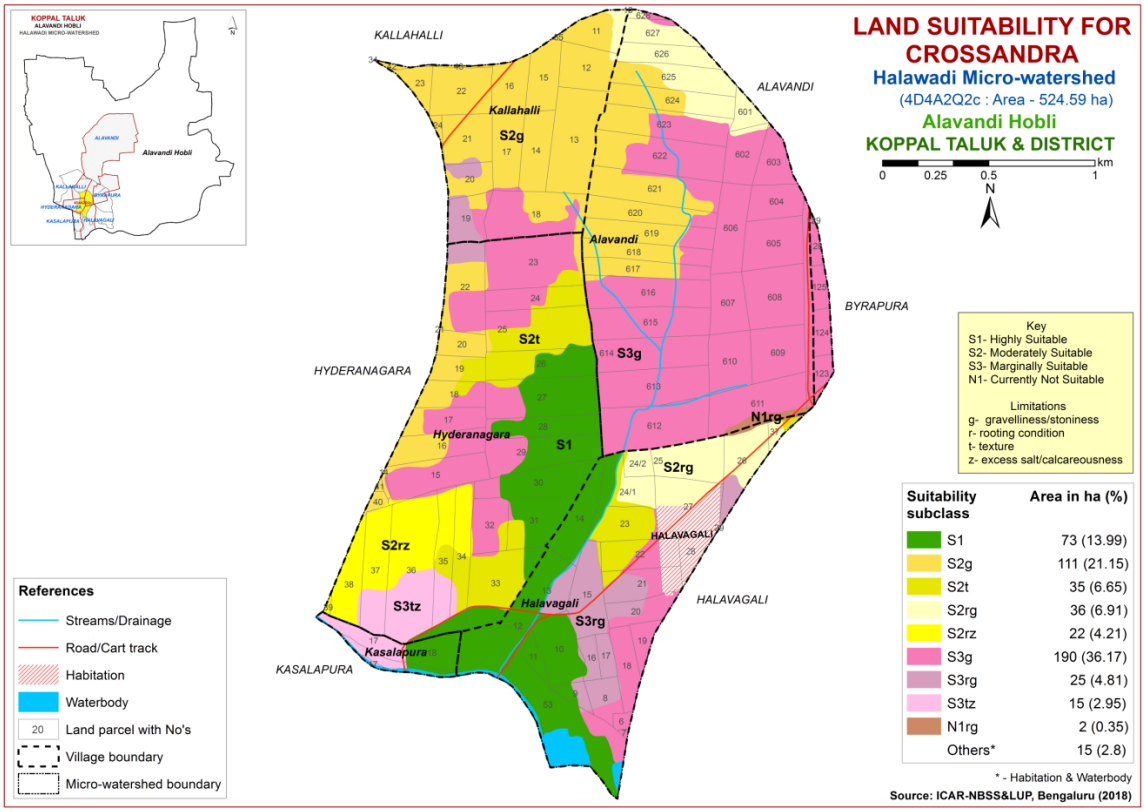


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Irakalgudda Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
KGPhB2g1	662	<90	WD	25-50	scl	gsc	15-35	15-35	<50	1-3	moderate	-	-	-	-	-
HRVhB2g3	662	<90	WD	25-50	scl	gscl	60-80	>35	<50	1-3	moderate	6.05	0.21	0.73	11.24	100
MKHhB1	662	<90	WD	50-75	scl	gsc	<15	>35	<50	1-3	slight	7.38	0.09	1.49	14.84	93
LKRhB2g1	662	<90	WD	50-75	scl	gsc	15-35	40-60	<50	1-3	moderate	8.18	0.30	4.51	12.19	100
HDHhB1g2	662	<90	WD	75-100	scl	gsc-gc	35-60	>35	51-100	1-3	slight	6.54	0.07	7.11	3.84	84.70
HDHhB2g2	662	<90	WD	75-100	scl	gsc-gc	35-60	>35	51-100	1-3	moderate	6.54	0.07	7.11	3.84	84.70
HDHiB1	662	<90	WD	75-100	sc	gsc-gc	<15	>35	51-100	1-3	slight	6.54	0.07	7.11	3.84	84.70
HDHiB2g1	662	<90	WD	75-100	sc	gsc-gc	15-35	>35	51-100	1-3	moderate	6.54	0.07	7.11	3.84	84.70
GHTcB2g1	662	<90	WD	75-100	sl	gscl	15-35	15-35	51-100	1-3	moderate	5.70	0.06	4.10	3.20	73.00
GHThB1	662	<90	WD	75-100	scl	gscl	<15	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.20	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	3.20	73.00
GHThB2g1	662	<90	WD	75-100	scl	gscl	15-35	15-35	51-100	1-3	moderate	5.70	0.06	4.10	3.20	73.00
GHTiB1	662	<90	WD	75-100	sc	gscl	<15	15-35	51-100	1-3	slight	5.70	0.06	4.10	3.20	73.00
TGRiB1	662	<90	WD	75-100	sc	gscl	<15	15-35	51-100	1-3	slight	-	-	-	-	-
BSRiB2	662	<90	WD	75-100	sc	gsc	<15	15-35	51-100	1-3	moderate	6.60	0.12	6.00	8.80	77.55
CKMiB1	662	<90	WD	75-100	sc	sc	15-35	<15	101-150	1-3	slight	7.99	0.32	1.73	12.5	100
BDGhB1g1	662	<90	WD	75-100	scl	gc	15-35	35-60	51-100	1-3	slight	6.24	0.06	3.76	3.76	52.56
KMHiB2	662	<90	WD	100-150	sc	sc	<15	<15	101-150	1-3	moderate	7.20	0.20	0.54	15.07	100
BPRcB1	662	<90	WD	100-150	sl	gsc-gc	<15	>35	51-100	1-3	slight	6.64	0.03	0.51	5.45	63.48
BPRhB2g2	662	<90	WD	100-150	scl	gsc-gc	35-60	>35	51-100	1-3	moderate	6.64	0.03	0.51	5.45	63.48
NGPiB1	662	<90	WD	100-150	sc	gsc	<15	>35	51-100	1-3	slight	6.77	0.09	0.46	7.10	83.00
NGPiB1g1	662	<90	WD	100-150	sc	gsc	15-35	>35	51-100	1-3	slight	6.77	0.09	0.46	7.10	83.00
RTRiB2	662	<90	WD	>150	sc	c	<15	<15	101-150	1-3	moderate	5.08	0.03	2.06	9.21	50.50
SRRmA1	662	<90	MWD	100-150	c	c	<15	<15	150	0-1	slight	-	-	-	-	-
KLRmA1	662	<90	MWD	>150	c	sc	<15	<15	>200	0-1	slight	7.11	0.33	19.50	100	3.42

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 25 soil map units identified in Halawadi microwatershed have been grouped into 6 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 6 Land Management Units along with brief description of soil and site characteristics are given below.

LMU	Mapping unit	Soil and site characteristics
1	473.KLRmA1 474.SRRmA1	Deep to very deep (100->150 cm), calcareous clay lowland soils, slope (0-1%), slight erosion
2	288.RTRiB2	Very deep (>150 cm), red clayey soils, slope (1-3%), moderate erosion
3	201.KMHiB2 167.BSRiB2 178.CKMiB1 138.GHTcB2g1 140.GHThB1 141.GHThB1g1 142.GHThB2g1 144.GHTiB1 148.TGRiB1	Moderately deep to deep (75-150 cm), red calcareous to non calcareous sandy clay to sandy clay loam soils, slope (1-3%), slight to moderate erosion, gravelly (15-35%)
4	222.BPRcB1 232.BPRhB2g2 262.NGPiB1 263.NGPiB1g1 185.BDGhB1g1 121.HDHhB1g2 124.HDHhB2g2 125.HDHiB1 128.HDHiB2g1	Moderately deep to deep (75-150 cm), red gravelly sandy clay to sandy clay loam soils, slope (1-3%), slight to moderate erosion, gravelly to very gravelly(15-60%)
5	452.LKRhB2g1 81.MKHhB1	Moderately shallow (50-75 cm), red gravelly loamy soils, slope (1-3%), slight to moderate erosion, gravelly (15-35%)
6	28.HRVhB2g3 17.KGPhB2g1	Shallow (25-50 cm), red gravelly sandy clay loam soils, slope (1-3%), moderate erosion, gravelly to extremely gravelly (15-80%)

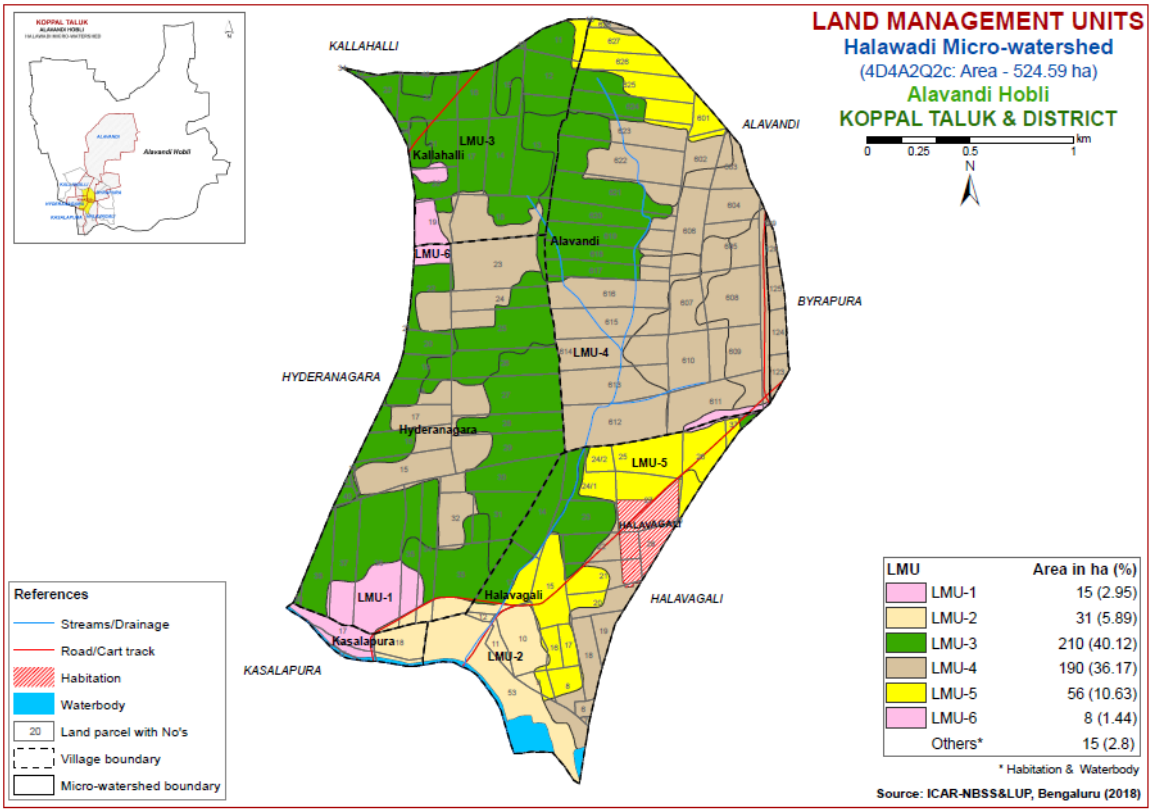


Fig 7.32 Land Management Units map of Halawadi microwatershed

7.33 Proposed Crop Plan for Halawadi Microwatershed

After assessing the land suitability for the 31 crops, the proposed crop plan has been prepared for the 6 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 Halawadi Microwatershed

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
1	473.KLRmA1 474.SRRmA1	Hyderanagara:17,34,35,36, 37, 38	Deep to very deep (100->150 cm), calcareous clay lowland soils, slope (0-1%), slight erosion	Paddy, Maize, Sugarcane,	**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	288.RTRiB2	Halavagali : 10,11,12,53 Hyderanagara: 18	Very deep (>150 cm), red clayey soils, slope (1-3%), moderate erosion	Maize, Finger millet, Sorghum, Sunflower, Redgram, Cowpea, Field bean, Castor	**Fruit crops:** Mango, Pomegranate, Guava, Sapota, Jackfruit, Tamarind, Lime, Musambi, Amla, Custard apple, Cashew **Vegetable crops:** Drumstick, Tomato, Chilli, Brinjal, Curry leaves **Flower crops:** Marigold, Chrysanthemum, Jasmine	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
3	201.KMHiB2 167.BSRiB2 178.CKMiB1 138.GHTcB2g1 140.GHThB1 141.GHThB1g1 142.GHThB2g1	Alavandi:617,618,619,620, 621,624 Halavagali :13,14,22,23 Hyderanagara:14,16,19,20, 21,22,25,26,27,28,29,30,31, 33,34,35,36,37,38,39,40,41 Kallahalli:11,12,13,14,15,1	Moderately deep to deep (75-150 cm), red calcareous to non calcareous sandy clay to sandy clay loam soils, slope (1-3%), slight to moderate	Maize, Sorghum, Sunflower, Bajra, Finger millet, Groundnut, Red gram,	**Fruit crops:** Pomegranate, Guava, Sapota, Jackfruit, Tamarind, Lime, Musambi, Amla, Custard apple **Vegetable crops:** Drumstick, Tomato, Chilli,	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
	144.GHTiB1 148.TGRiB1	6,17,20,21,22,23,24,34,42,43,55	erosion, gravelly (15-35%)	Cowpea, Field bean, Castor	Brinjal, Onion, Curry leaves **Flower crops:** Marigold, Chrysanthemum, Jasmine	
4	222.BPRcB1 232.BPRhB2g2 262.NGPiB1 263.NGPiB1g1 185.BDGhB1g1 121.HDHhB1g2 124.HDHhB2g2 125.HDHiB1 128.HDHiB2g1	**Alavandi:**602,603,604,605,606,607,608,609,610,611,612,613,614,615,616,622,623 **Byrapura:**123,124,125,128,129 **Halavagali :**6,7,18,19,20 **Hyderanagara:**15,17,23,24,32 **Kallahalli :**18	Moderately deep to deep (75-150 cm), red gravelly sandy clay to sandy clay loam soils, slope (1-3%), slight to moderate erosion, gravelly to very gravelly(15-60%)	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)
5	452.LKRhB2g1 81.MKHhB1	**Alavandi:**601,625,626,627,628 **Halavagali:**8,9,15,16,17,21,24/1,24/2,25,26,37 **Kallahalli :**10	Moderately shallow (50-75 cm), red gravelly loamy soils, slope (1-3%), slight to moderate erosion, gravelly (15-35%)	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	28.HRVhB2g3 17.KGPhB2g1	Kallahalli : 19	Shallow (25-50 cm), red gravelly sandy clay loam soils, slope (1-3%), moderate erosion, gravelly to extremely gravelly (15-80%)	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 Halawadi Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of GHT 111 ha (21%), HDH 67 ha (12%), BPR 56 ha (11%), KMH 43 ha (8%), NGP 43 ha (8%), MKH 36 (7%), RTR 31 ha (6%), BDG 25 ha (5%), CKM 24 ha (5%), TGR 22 ha (4%), LKR 20 ha (4%), BSR 11 ha (2%), SRR 11 ha (2%), KGP 6 ha (1%), KLR 4 ha (1%) and HRV 2 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 57 ha (11%) is neutral (pH 6.5-7.3), 35 ha (7%) is slightly alkaline (pH 7.3-7.8), 287 ha (55%) is moderately alkaline (pH 7.8-8.4), 120 ha (23%) is strongly alkaline (pH 8.4-9.0) and 11 ha (2%) is very strongly alkaline (pH >9.00) 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.

Neutral soils

About 57 ha (11%) 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 453 ha (86%) is under alkaline soils (slightly to very 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 factors affecting the soil health in the microwatershed. An area of about 200 ha (38%) 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 Halawadi Microwatershed.
- **Organic Carbon:** An area of about 223 ha (42%) is low (<0.5%), 283 ha (54%) is medium (0.5-0.75%) and 3 ha (1%) is high (>0.75) in OC content. The areas that are

low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.

- **Promoting green manuring:** Growing of green manuring crops 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 5056 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 an additional 25% phosphorus from the RDF.
- **Available Potassium:** Available potassium is low (<145 kg/ha) in 18 ha (3%), medium (145-337 kg/ha) in 308 ha (59%) and high in 184 ha (35%) area of the microwatershed. The areas with high potassium content reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is low and medium.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low (<10ppm) in the entire area of the microwatershed. Areas with low 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:** It is deficient in the entire area of the microwatershed.
- **Available Zinc:** It is deficient (<0.6 ppm) in 209 ha (40%) and sufficient (>0.6 ppm) in 301 ha (57%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- **Available Boron:** Available boron is low in (<0.5ppm) 131 ha (25%) and medium (0.5-1.0 ppm) in 379 ha (72%) 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 entire area of the microwatershed.
- **Available Copper:** It is sufficient in entire area of the microwatershed.
- **Soil Alkalinity:** An area of about 453 ha (86%) in the microwatershed has soils that are slightly to very strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.

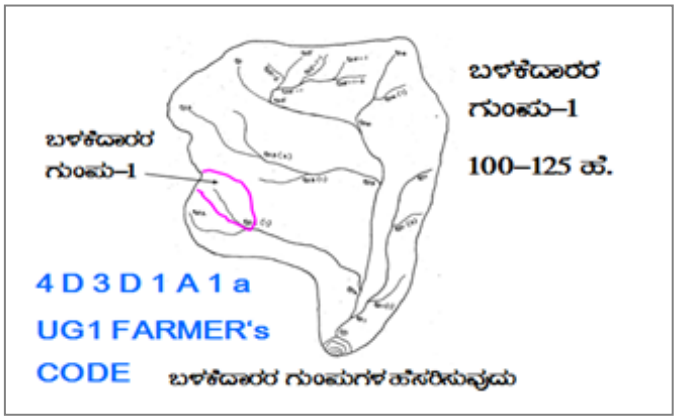
Land Suitability for various crops: Areas that are highly, moderately and marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content,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

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

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

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



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

Steps for Survey and Preparation of Treatment Plan

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

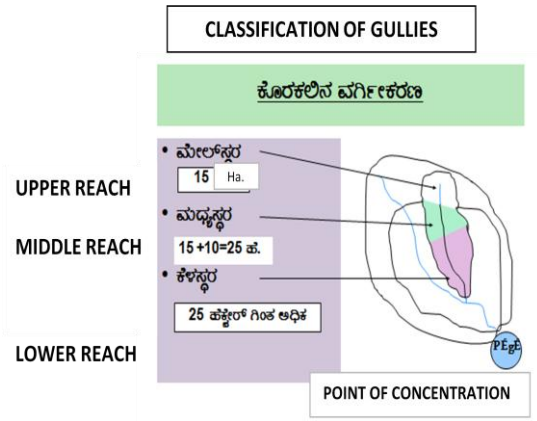
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

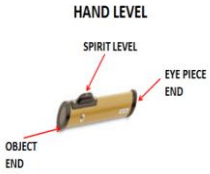
9.1.1 Arable Land Treatment

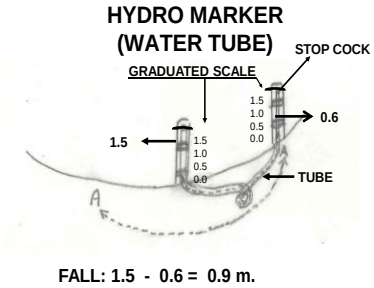
A. BUNDING

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

Measurement of Land Slope

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





FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: i) The above intervals are maximum.

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

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

Section of the Bund

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

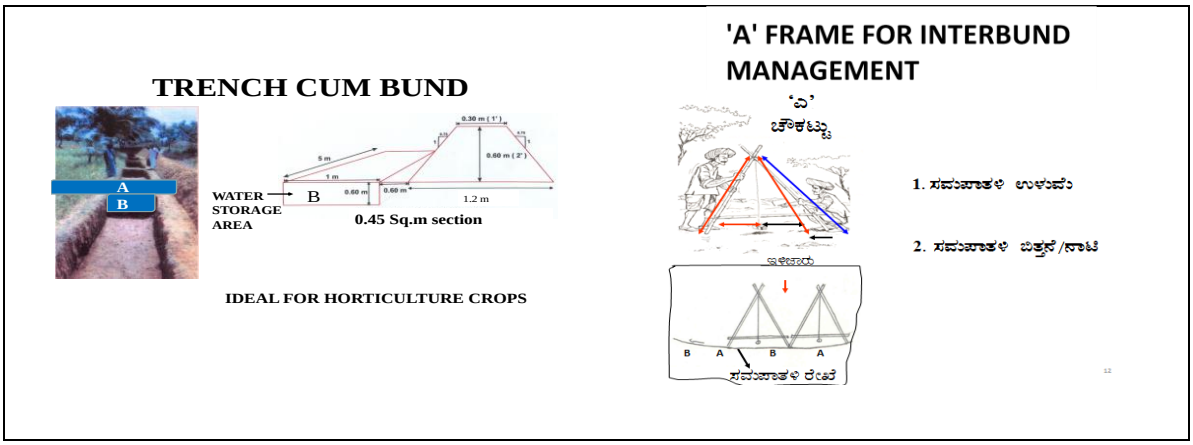
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below



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

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

B. Waterways

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

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

c) The design details are given in the Manual.

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainge lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented (Fig.9.1).

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

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

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

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

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

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

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

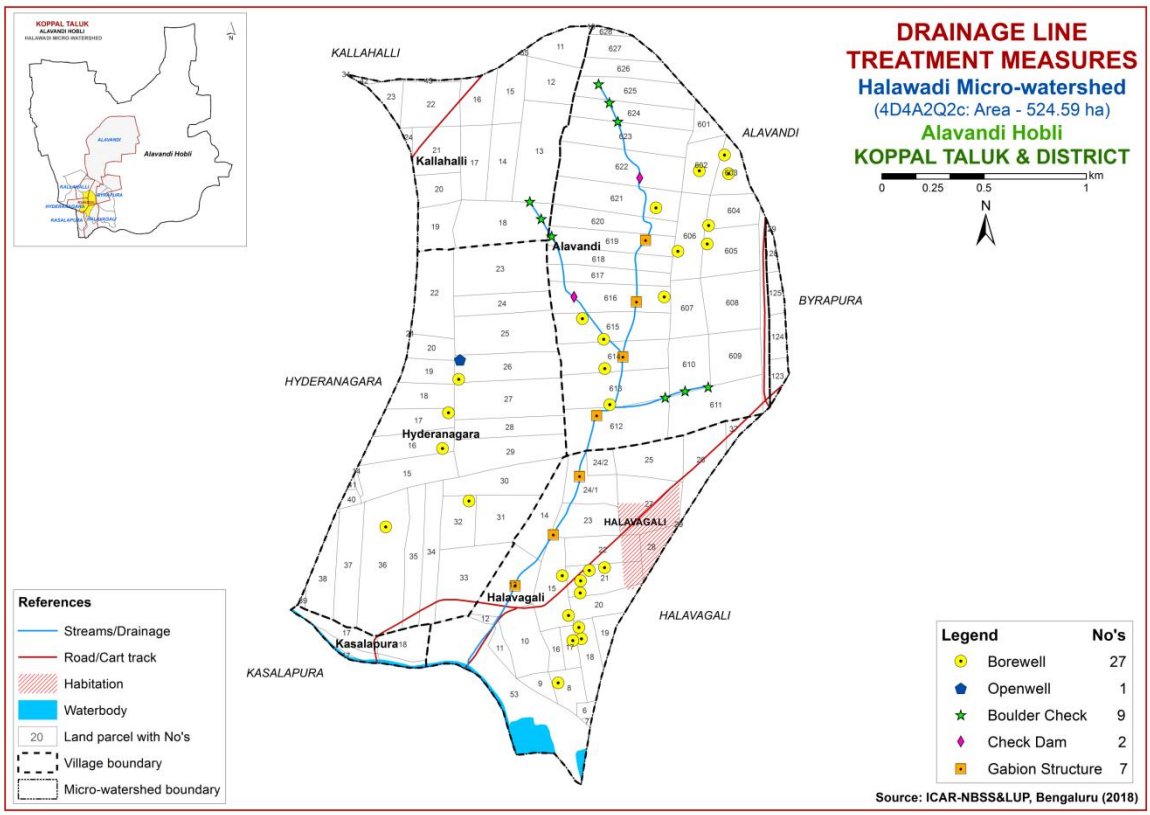


Fig. 9.1 Drainage line treatment map of Halawadi Microwatershed

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.2) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. A maximum area of about 494 ha (94%) needs trench cum bunding. An area of about 15 ha (3%) 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.

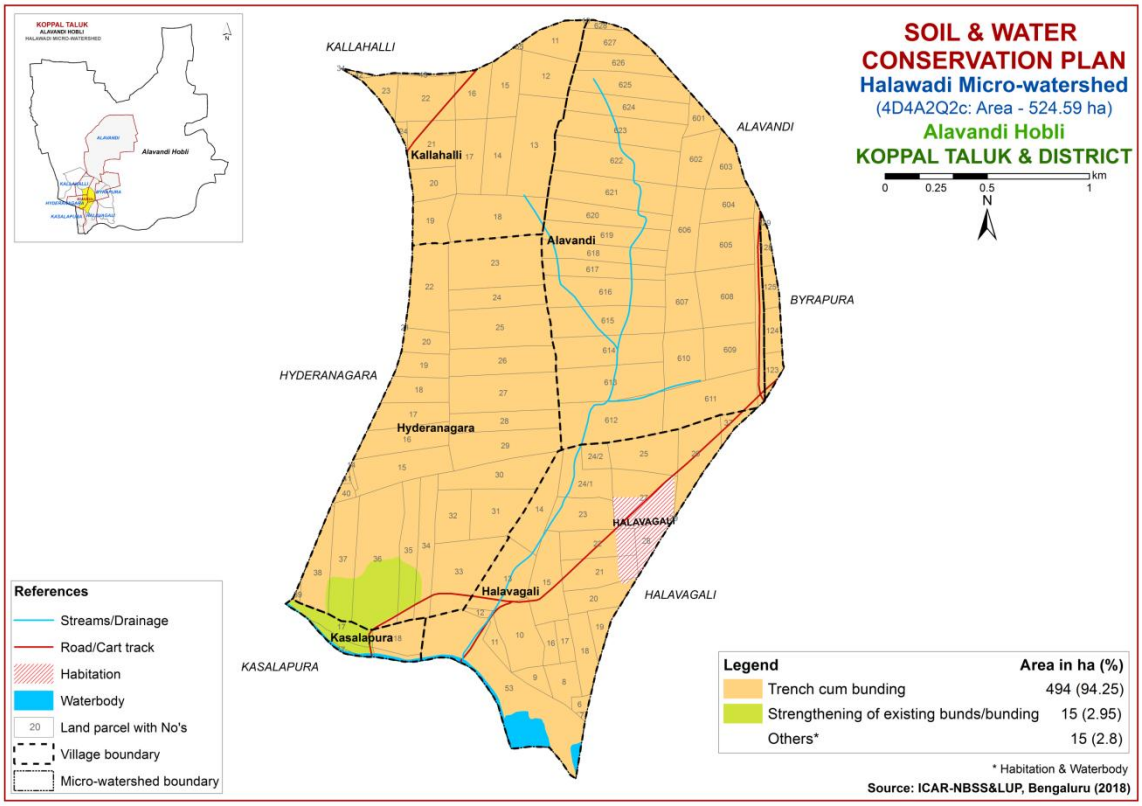


Fig. 9.2 Soil and Water Conservation Plan map of Halawadi Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that

are suitable for greening programme are non-arable lands (land capability classes V, VI VII and VIII) and also the lands that are not suitable or marginally suitable for growing annual and perennial crops. The method of planting these trees is given below.

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

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

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

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Appendix-I

Halawadi (2Q2c) 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
Alavandi	601	1.85	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	602	4.35	NGPiB1	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Jowar+Currentfallow+Sun flower (Jw+Cf+Sf)	1 Borewell	IIIs	TCB
Alavandi	603	3.47	HDHiB1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	2 Borewell	IIs	TCB
Alavandi	604	3.99	HDHiB1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Cotton+Current fallow (Ct+Cf)	1 Borewell	IIs	TCB
Alavandi	605	6.38	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Cotton+Jowar (Ct+Jw)	1 Borewell	IIIs	TCB
Alavandi	606	5.96	HDHiB1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	1 Borewell	IIs	TCB
Alavandi	607	4.67	NGPiB1g1	LMU-4	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	608	7.75	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	609	6.1	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	610	5.4	NGPiB1g1	LMU-4	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Sugarcane (Cf+Sc)	Not Available	IIIs	TCB
Alavandi	611	8.99	NGPiB1g1	LMU-4	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	612	10.41	BPRcB1	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	Not Available	IIIs	TCB
Alavandi	613	8.66	BPRcB1	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	1 Borewell	IIIs	TCB
Alavandi	614	7.83	BPRcB1	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	1 Borewell	IIIs	TCB
Alavandi	615	8.01	BPRcB1	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	2 Borewell	IIIs	TCB
Alavandi	616	8.27	BPRcB1	LMU-4	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton+Maize (Cf+Ct+Mz)	1 Borewell	IIIs	TCB
Alavandi	617	4.67	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	TCB
Alavandi	618	5.02	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	TCB
Alavandi	619	6.08	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	Not Available	IIs	TCB
Alavandi	620	5.63	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	TCB
Alavandi	621	8.81	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	1 Borewell	IIs	TCB
Alavandi	622	10.42	NGPiB1	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow+Cotton (Cf+Ct)	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
Alavandi	623	7.97	NGPiB1	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	624	6.11	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	TCB
Alavandi	625	6.54	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	626	4.03	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Sugarcane (Mz+Sc)	Not Available	IIIs	TCB
Alavandi	627	3.5	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Greengram+Maize (Gg+Mz)	Not Available	IIIs	TCB
Alavandi	628	0.57	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow (Bj+Cf)	Not Available	IIIs	TCB
Byrapura	123	1.45	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land+Current fallow (Fl+Cf)	Not Available	IIIs	TCB
Byrapura	124	1.82	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Byrapura	125	1.52	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Byrapura	128	0.99	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Byrapura	129	0.01	BDGhB1g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Halavagali	6	0.64	BPRhB2g2	LMU-4	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Maize (Ct+Mz)	Not Available	IIIes	TCB
Halavagali	7	0.13	BPRhB2g2	LMU-4	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Halavagali	8	2.81	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Cotton (Bj+Ct)	1 Borewell	IIIes	TCB
Halavagali	9	1.44	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	TCB
Halavagali	10	5.93	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIe	TCB
Halavagali	11	1.42	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane (Sc)	Not Available	IIe	TCB
Halavagali	12	0.4	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIe	TCB
Halavagali	13	6.78	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIe	TCB
Halavagali	14	5.27	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Bajra+Maize (Fl+Bj+Mz)	Not Available	IIe	TCB
Halavagali	15	6.35	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Current fallow (Mz+Bj+Cf)	2 Borewell	IIIes	TCB
Halavagali	16	1.61	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	TCB
Halavagali	17	1.54	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	1 Borewell	IIIes	TCB
Halavagali	18	3.68	BPRhB2g2	LMU-4	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	2 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
Halavagali	19	1.9	BPRhB2g2	LMU-4	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Cotton+Current fallow+Maize (Bj+Ct+Cf+Mz)	Not Available	IIIes	TCB
Halavagali	20	3.53	BPRhB2g2	LMU-4	Deep (100-150 cm)	Sandy clay loam	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIIes	TCB
Halavagali	21	5.08	LKRhB2g1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Bajra (Sc+Bj)	4 Borewell	IIIes	TCB
Halavagali	22	5.06	CKMiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane+Current fallow (Sc+Cf)	Not Available	IIs	TCB
Halavagali	23	4.92	CKMiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Pomegranate (Pg)	Not Available	IIs	TCB
Halavagali	24/1	4.7	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra (Mz+Bj)	Not Available	IIIs	TCB
Halavagali	24/2	1.69	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	TCB
Halavagali	25	5.85	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Sugarcane (Sc)	Not Available	IIIs	TCB
Halavagali	26	6.04	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Current fallow+Maize (Bj+Cf+Mz)	Not Available	IIIs	TCB
Halavagali	27	7.97	Habitation	Others	Others	Others	Others	Others	Others	Others	Sugarcane (Sc)	Not Available	Others	Others
Halavagali	28	2.32	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Halavagali	29	0	Habitation	Others	Others	Others	Others	Others	Others	Others	Maize (Mz)	Not Available	Others	Others
Halavagali	37	1.21	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Fallow land+Sugarcane (Bj+Fl+Sc)	Not Available	IIIs	TCB
Halavagali	53	21.09	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Waterbody	Not Available	IIe	TCB
Hyderanagara	14	0.01	GHThB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Hyderanagara	15	7.13	HDHhB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Fallowland+Maize+Bajra+Current fallow (Fl+Mz+Bj+Cf)	Not Available	IIes	TCB
Hyderanagara	16	5.33	GHThB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	1 Borewell	IIes	TCB
Hyderanagara	17	4.22	HDHhB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sugarcane (Mz+Sc)	1 Borewell	IIes	TCB
Hyderanagara	18	3.8	GHThB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Hyderanagara	19	2.99	GHThB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Hyderanagara	20	2.58	GHThB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current fallow (Mz+Cf)	Not Available	IIs	TCB
Hyderanagara	21	0	GHThB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Hyderanagara	22	8.09	GHThB1g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	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
Hyderanagara	23	11.13	HDHiB2g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize (Bj+Mz)	Not Available	IIes	TCB
Hyderanagara	24	4.66	HDHiB2g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	TCB
Hyderanagara	25	9.65	CKMiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Hyderanagara	26	6.89	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Cotton (Bj+Ct)	1Borewell, 1 Openwell	IIe	TCB
Hyderanagara	27	9.71	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Current fallow (Mz+Bj+Cf)	Not Available	IIe	TCB
Hyderanagara	28	5.05	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Cotton (Bj+Ct)	Not Available	IIe	TCB
Hyderanagara	29	7.86	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Fallow land (Mz+Bj+Fl)	Not Available	IIe	TCB
Hyderanagara	30	6.91	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIe	TCB
Hyderanagara	31	6.05	KMHiB2	LMU-3	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Vegetables+Bajra (Sc+Vg+Bj)	Not Available	IIe	TCB
Hyderanagara	32	4.33	HDHhB2g2	LMU-4	Moderately deep (75-100 cm)	Sandy clay loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sugarcane+Current fallow+Maize (Sc+Cf+Mz)	1 Borewell	IIes	TCB
Hyderanagara	33	9.13	BSRiB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Currentfallow+Groundnut (Mz+Cf+Gn)	Not Available	IIe	TCB
Hyderanagara	34	5.65	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Sugarcane (Mz+Sc)	Not Available	IIs	TCB
Hyderanagara	35	5.7	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Jowar (Mz+Jw)	Not Available	IIs	TCB
Hyderanagara	36	14.78	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Maize+Sugarcane (Bj+Mz+Sc)	1 Borewell	IIs	TCB
Hyderanagara	37	6.97	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Bajra+Current fallow (Mz+Bj+Cf)	Not Available	IIs	TCB
Hyderanagara	38	4.83	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Sugarcane (Bj+Sc)	Not Available	IIs	TCB
Hyderanagara	39	0.21	TGRiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Sugarcane (Mz+Sc)	Not Available	IIs	TCB
Hyderanagara	40	0.71	GHThB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	TCB
Hyderanagara	41	0.17	GHThB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra (Mz+Bj)	Not Available	IIes	TCB
Kallahalli	10	0.01	MKHhB1	LMU-5	Moderately shallow (50-75 cm)	Sandy clay loam	Non gravelly (<15%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Fallowland (Mz+Fl)	Not Available	IIIs	TCB
Kallahalli	11	4.24	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Kallahalli	12	5.01	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	TCB
Kallahalli	13	10.4	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	TCB
Kallahalli	14	5.13	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	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
Kallahalli	15	4.51	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land (Fl)	Not Available	IIes	TCB
Kallahalli	16	4.12	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIs	TCB
Kallahalli	17	5.03	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Kallahalli	18	9.59	HDHiB2g1	LMU-4	Moderately deep (75-100 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Fallow land (Bj+Fl)	Not Available	IIes	TCB
Kallahalli	19	4.06	KGPhB2g1	LMU-6	Shallow (25-50 cm)	Sandy clay loam	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIIes	TCB
Kallahalli	20	3.3	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Kallahalli	21	5.38	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Kallahalli	22	6.36	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Kallahalli	23	2.1	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Fallow land (Bj+Fl)	Not Available	IIs	TCB
Kallahalli	24	0.47	GHThB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra+Fallow land (Bj+Fl)	Not Available	IIs	TCB
Kallahalli	34	0	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Sunflower (Cf+Sf)	Not Available	IIes	TCB
Kallahalli	42	0.28	GHTiB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	TCB
Kallahalli	43	0.31	GHThB1	LMU-3	Moderately deep (75-100 cm)	Sandy clay loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bajra (Bj)	Not Available	IIs	TCB
Kallahalli	55	0.11	GHTcB2g1	LMU-3	Moderately deep (75-100 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Horsegram (Mz+Hg)	Not Available	IIes	TCB
Kasalapura	17	3.36	KLRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Currentfallow+Maize+Bajra (Cf+Mz+Bj)	Not Available	IIw	Graded bunding
Kasalapura	18	3.56	RTRiB2	LMU-2	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	High (151-200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIe	TCB

Appendix II

Halawadi (2Q2c) Microwatershed

Soil Fertility Information

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Alavandi	601	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	602	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	603	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	604	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	605	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	606	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	607	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	608	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	609	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	610	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	611	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	612	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	613	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	614	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	615	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	616	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	617	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	618	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	619	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	620	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	621	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	622	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Alavandi	623	Slightly alkaline (pH	Non saline	Low (< 0.5 %)	Medium (23 –	Medium (145 –	Low (<10	Low (< 0.5	Deficient (<	Sufficient (>	Sufficient (>	Sufficient (>

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		7.3 – 7.8)	(<2 dsm)		57 kg/ha)	337 kg/ha)	ppm)	ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Alavandi	624	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	625	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	626	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	627	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Alavandi	628	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Byrapura	123	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	124	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	125	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	128	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Byrapura	129	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	6	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	7	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	8	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	9	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	10	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	11	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	12	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	13	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Halavagali	14	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	16	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	17	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	18	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Halavagali	19	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	23	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	24/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	24/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	26	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	27	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Halavagali	28	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Halavagali	29	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Halavagali	37	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Halavagali	53	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	14	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	15	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	16	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	17	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	18	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	19	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	22	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	23	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	24	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Hyderanagara	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)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	26	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	27	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	28	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	29	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	30	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	31	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	32	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	33	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	34	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	35	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	36	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	37	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	38	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	39	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Hyderanagara	40	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Hyderanagara	41	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	10	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	11	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	12	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	13	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	14	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	15	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	16	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey Number	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kallahalli	17	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	18	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	19	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	20	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	21	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	22	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	23	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	24	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	34	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	43	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kallahalli	55	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kasalapura	17	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kasalapura	18	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Medium (23 – 57 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Appendix III

Halawadi (2Q2c) 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	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Alavandi	601	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Alavandi	602	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	603	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Alavandi	604	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Alavandi	605	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Alavandi	606	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Alavandi	607	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	608	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Alavandi	609	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Alavandi	610	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	611	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	612	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	613	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	614	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	615	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	616	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	617	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Alavandi	618	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Alavandi	619	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Alavandi	620	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Alavandi	621	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Alavandi	622	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	623	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Alavandi	624	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Alavandi	625	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Alavandi	626	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Alavandi	627	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Alavandi	628	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Byrapura	123	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Byrapura	124	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Byrapura	125	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Byrapura	128	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Byrapura	129	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S2rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2tg	S2tg	S3g	S3g	S2g	S2tg
Halavagali	6	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Halavagali	7	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Halavagali	8	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	9	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	10	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Halavagali	11	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Halavagali	12	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Halavagali	13	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halavagali	14	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Halavagali	15	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	16	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	17	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	18	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Halavagali	19	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	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	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Halavagali	20	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3g	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S3g	S2g	S2g	S2g
Halavagali	21	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3rg	S2rg	S3rg	S3g	S3g	S3rg	S3rg	S3rg	S3g
Halavagali	22	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Halavagali	23	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Halavagali	24/1	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Halavagali	24/2	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Halavagali	25	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Halavagali	26	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Halavagali	27	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
Halavagali	28	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
Halavagali	29	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
Halavagali	37	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g
Halavagali	53	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t
Hyderanagara	14	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderanagara	15	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Hyderanagara	16	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderanagara	17	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Hyderanagara	18	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderanagara	19	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderanagara	20	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderanagara	21	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Hyderan agara	22	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderan agara	23	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Hyderan agara	24	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Hyderan agara	25	S3r	S2t	S2rg	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2r	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Hyderan agara	26	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	27	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	28	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	29	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	30	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	31	S2r	S1	S1	S1	S1	S2t	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S2r	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Hyderan agara	32	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Hyderan agara	33	S3r	S2t	S2r	S1	S2rt	S2r	S3r	S2r	S2t	S2r	S2r	S1	S2rg	S1	S2rt	S2r	S2r	S2t	S1	S1	S2t	S2t	S2r	S1	S2t	S2t	S1	S2t	S2r	S2r	S2t
Hyderan agara	34	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	35	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	36	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	37	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	38	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	39	S3rz	S2z	S2rz	S2tz	S2rz	S2rz	S3rz	S2rz	S2z	S2rz	S2rz	S2z	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2z	S2z	S2z	S2rz	S2rz	S2z	S2z
Hyderan agara	40	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Hyderan agara	41	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	10	N1r	S2rg	S3rg	S2rg	S3rg	S2rg	N1r	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S2rg	S2rg	S2rg	S2rg	S2rg	S3rg	S2rg	S2rg	S3g	S3g	S2rg	S3rg	S3rg	S3g

Village	Survey Number	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Red gram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Bhendi	Brinjal	Crossandra	Drumstick	Mulberry	Onion
Kallahalli	11	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	12	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	13	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	14	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	15	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	16	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	17	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	18	S3rg	S3g	S2rg	S3g	S2rg	S3rg	S3rg	S2rg	S3g	S3rg	S3g	S2rg	S2rg	S2rg	S2rg	S2rg	S2rg	S2g	S3g	S3g	S3g	S3g	S2rg	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S3g
Kallahalli	19	N1rg	S3rg	N1rg	S3rg	N1rg	S3rt	N1rg	N1rg	S3rt	S3rg	N1rg	S3r	N1rg	S3r	N1r	N1rg	N1rg	S3rg	S3rg	S3rg	S3rg	S3rg	N1rg	S3r	S3rg	S3r	S3r	S3rg	N1r	N1r	S3r
Kallahalli	20	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	21	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	22	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	23	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	24	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	34	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	42	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	43	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kallahalli	55	S3r	S2g	S2r	S2g	S2r	S2rg	S3r	S2r	S2g	S2rg	S2rg	S1	S2r	S1	S2r	S2r	S2r	S1	S2g	S2g	S2g	S2g	S2r	S1	S2g	S1	S1	S2g	S2rg	S2r	S1
Kasalapura	17	S3tz	S2tz	S3tz	S1	S3tz	S1	S2tz	S1	S1	S1	S2tz	S1	S3tz	S1	N1t	S2tz	S1	S3t	S2tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Kasalapura	18	S1	S2t	S1	S1	S1	S1	S1	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S2t	S2t	S1	S1	S1	S2t

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

FINDINGS OF THE SOCIO-ECONOMIC SURVEY

- *The survey was conducted in Halawadi is located at North latitude 15^0 11' 54.604" and 15^0 9' 51.215" and East longitude 75^0 58' 33.457" and 75^0 56' 52.871" covering an area of about 524.88 ha coming under Halavagali, Kallahalli, Alavandi and Hyderanagar villages of Koppal taluk.*
- *Socio-economic analysis of Halawadi micro watersheds of Bettageri sub-watershed, Koppal taluk & District indicated that, out of the total sample of 42 total respondents, 16 (38.10 %) were marginal, 12 (28.57%) were small, 9 (21.43 %) were Semi medium and 1 (2.38 %) were medium farmers.*
- *The population characteristics of households indicated that, there were 111 (54.15%) men and 94 (45.85 %) were women. The average population of landless was 4, marginal farmers were 4.7, small farmers were 5, semi medium farmers were 5.4 and medium farmers were 5.*
- *Majority of the respondents (46.34%) were in the age group of 16-35 years.*
- *Education level of the sample households indicated that, there were 40.49 per cent illiterates, 59.01 percent pre university education and 4.88 per cent attained graduation.*
- *About, 92.86 per cent of household heads practicing agriculture and 7.14 per cent of the household heads were engaged as agricultural labourers.*
- *Agriculture was the major occupation for 64.39 per cent of the household members.*
- *In the study area, 78.57 per cent of the households possess katcha house and 9.52 per cent possess pucca house.*
- *The durable assets owned by the households showed that, 71.43 per cent possess TV, 28.57 per cent possess mixer grinder, 102.38 per cent possess mobile phones and 54.76 per cent possess motor cycles.*
- *Farm implements owned by the households indicated that, 9.52 per cent of the households possess plough, 14.29 per cent possess tractor, 9.52 per cent possess bullock cart and 11.90 per cent possess sprayer.*
- *Regarding livestock possession by the households, 4.76 per cent possess local cow and 9.52 per cent possess buffalo.*
- *The average labour availability in the study area showed that, own labour men available in the micro watershed was 1.89, women available in the micro watershed was 1.67, hired labour (men) available was 9.66 and hired labour (women) available was 9.*
- *Out of the total land holding of the sample respondents 83.04 per cent (51.66 ha) of the area is under dry condition and the remaining 15.78 per cent area is irrigated land.*
- *There were 6.00 live bore wells among the sampled households.*

- *Bore well was the major source of irrigation for 14.29 per cent of the households.*
- *The major crops grown by sample farmers are Maize, Bajra, Red gram, Groundnut and Sunflower and cropping intensity was recorded as 99.89 per cent.*
- *Out of the sample households 35.71 percent possessed bank account and 14.29 per cent of them have savings in the account.*
- *About 54.76 per cent of the respondents borrowed credit from various sources.*
- *Majority of the respondents (100.00%) have borrowed loan for agriculture purpose.*
- *Regarding the opinion on institutional sources of credit, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.*
- *Per hectare cost of cultivation for Maize, Bajra, Red gram, Groundnut and Sunflower was Rs.38281.00 , 20291.06, 23686.60, 40972.51, and 33117.67 with benefit cost ratio of 1:1.40, 1: 1.01, 1: 1.90, 1: 1.30 and 1:1.10 respectively.*
- *Further, 21.43 per cent of the households opined that dry fodder was adequate and 16.67 per cent of the households have opined that the green fodder was adequate.*
- *The average annual gross income of the farmers was Rs. 72246.43 in micro-watershed, of which Rs. 56722.62 comes from agriculture.*
- *Sampled households have grown 72 horticulture trees and 68 forestry trees together in the fields and back yards.*
- *Households have an average investment capacity of Rs. 928.57 for land development.*
- *Source of funds for additional investment is concerned, 2.33 per cent depends on own funds and 16.28 per cent depends on bank loan for land development activities.*
- *Regarding marketing channels, 69.05 per cent of the households have sold agricultural produce to the local/village merchants.*
- *Further, 78.57 per cent of the households have used tractor for the transport of agriculture commodity.*
- *Majority of the farmers (33.33%) have experienced soil and water erosion problems in the watershed and 61.90 per cent of the households were interested towards soil testing.*
- *Firewood was the major source of fuel for domestic use for 78.57 per cent of the households and 21.43 per cent households has LPG connection.*
- *Piped supply was the major source for drinking water for 38.10 per cent of the households.*
- *Electricity was the major source of light for 97.62 per cent of the households.*
- *In the study area, 45.24 per cent of the households possess toilet facility.*
- *Regarding possession of PDS card, 92.86 per cent of the households possessed BPL card and 4.76 per cent of the household's were not having ration cards.*

- *Households opined that, the requirement of cereals (66.67%), pulses (26.19%) and oilseeds (40.48%) are adequate for consumption.*
- *Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (64.29%) wild animal menace on farm field (57.14%), frequent incidence of pest and diseases (66.67%), inadequacy of irrigation water (61.90%), high cost of fertilizers and plant protection chemicals (73.81%), high rate of interest on credit (73.81%), low price for the agricultural commodities (61.90%), lack of marketing facilities in the area (66.67%), inadequate extension services (42.86%), lack of transport for safe transport of the agricultural produce to the market (61.90%), Less rainfall (33.33%) and Source of Agri-technology information (Newspaper/ TV/Mobile) (23.81%).*

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.

1. Description of the study area

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

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

2. Locale of the survey and description of the micro-watershed and

The study was conducted in Halawadi micro-watershed (Bettageri sub-watershed, Koppal taluk & District) is located at North latitude 15^0 11’ 54.604” and 15^0 9’ 51.215” and East longitude 75^0 58’ 33.457" and 75^0 56’ 52.871”covering an area of about 524.88 ha bounded by under Halavagali, Kallahalli, Alavandi and Hyderanagar Villages.

3. Selection of the respondents for the study

The micro-watershed is marked with 320 square meters grids. One farmer from every alternate grid in the micro-watershed was selected for the study and interviewed for socio-economic data. Totally 42 households were interviewed for the survey.

4. The parameters considered for socio-economic survey of households

Two forms of data were collected from the micro-watershed which includes primary data from the farm households and secondary data about the villages under the micro-watershed jurisdiction.

The following parameters were considered for the primary data collection about the socio-economic data of the households, (1) Demographic information, (2) Farm and durable assets owned by households, (3) Livestock possession, (4) Labour availability, (5) Level of migration in the village, Land holding, (7) Cropping pattern, (8) Source of irrigation, (9) Borrowing status, (10) Cost of cultivation of major crops, (11) Economics of subsidiary activities, (12) Fodder availability, (13) Family annual income from different sources, (14) Horticulture and forestry species grown, (15) Additional investment capacity, (16) Marketing practices, (17) Status of soil and water conservation structure, (18) Access to basic needs and (19) Constraints and suggestion.

The following parameters were considered for the secondary data regarding the villages under the micro-watershed jurisdiction, (1) Number of villages in each micro-watershed jurisdiction, (2) Village wise number of households, (3) Geographical area of the villages, (4) Cultivable are a including rainfed and irrigated, (5) Number and type of house in each village, (6) Human and livestock population, (7) Facilities in the village such as roads, transport facility for conveyance, drinking water supply, street light and (8) Community based organizations in the villages.

5. Development of interview schedule and data collection

Taking into the consideration the objectives of the survey, an interview schedule was prepared after thorough consultation with the experts in the field of social sciences. A comprehensive interview schedule covering all the major parameters for measuring the socio-economic situation was developed.

6. Tools used to analyze the data

The statistical components such as frequency and percentage were used to analyze the data.

Abbreviations used in the report

LL=Landless
MF=Marginal Farmers
SF=Small farmers
SMF=Semi medium farmers
MDF=Medium farmers
LF=Large Farmers

Chapter 4

FINDINGS OF THE SURVEY

This chapter deals with systematic presentation of results of the survey. Keeping in view the objectives, the salient features of the survey are presented under the following headings.

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Halawadi Micro watershed is presented in Table 1 and it indicated that 42 farmers were sampled in Halawadi micro-watershed among households surveyed 16 (38.10%) were marginal, 12(28.57%) were small, 9 (21.43 %) were semi medium and 1 (2.38 %) were medium farmers. 4 landless farmers were also interviewed for the survey.

Table 1. Households sampled for socio economic survey in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	4	9.52	16	38.1	12	28.6	9	21.4	1	2.38	42	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Halawadi Micro watershed is presented in Table 2. The data indicated that, there were 111 (54.15%) men and 94 (45.85%) were women. The average population of landless was 4, marginal farmers were 4.7, small farmers were 5, semi medium farmers were 5.4 and medium farmers were 5.

Table 2. Population characteristics in Halawadi micro-watershed

Sl. No.	Particulars	LL (16)		MF (75)		SF (60)		SMF (49)		MDF (5)		All (205)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	8	50	46	61	30	50	25	51	2	40	111	54.2
2	Women	8	50	29	39	30	50	24	49	3	60	94	45.9
Total		16	100	75	100	60	100	49	100	5	100	205	100
Average		4.0		4.7		5.0		5.4		5.0		4.9	

Age wise classification of population: The age wise classification of household members in Halawadi Micro watershed is presented in Table 3. The indicated that, 35 (17.07%) of population were 0-15 years of age, 95 (46.34%) were 16-35 years of age, 56 (27.32%) were 36-60 years of age and 19 (9.27 %) were above 61 years of age.

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

Sl.No.	Particulars	LL (16)		MF (75)		SF (60)		SMF (49)		MDF (5)		All (205)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	4	25	11	14.7	11	18.3	8	16.33	1	20	35	17.07
2	16-35 years of age	7	43.8	36	48	26	43.3	25	51.02	1	20	95	46.34
3	36-60 years of age	4	25	21	28	18	30	10	20.41	3	60	56	27.32
4	> 61 years	1	6.25	7	9.33	5	8.33	6	12.24	0	0	19	9.27
Total		16	100	75	100	60	100	49	100	5	100	205	100

Education level of household members: Education level of household members in Halawadi Micro watershed is presented in Table 4. The results indicated that, there were 40.49 per cent of illiterates, 23.90 per cent of them had primary school education, 5.85 per cent middle school education, 13.66 per cent high school education, 7.80 per cent of them had PUC education, 0.98 per cent of them had Diploma, 4.88 per cent attained graduation and 1.95 them had other education.

Table 4. Education level of members of the household in Halawadi micro-watershed

Sl.No.	Particulars	LL (16)		MF (75)		SF (60)		SMF (49)		MDF (5)		All (205)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	5	31.3	34	45.3	25	41.7	17	34.7	2	40	83	40.5
2	Primary School	2	12.5	19	25.3	16	26.7	12	24.5	0	0	49	23.9
3	Middle School	2	12.5	6	8	1	1.67	2	4.08	1	20	12	5.85
4	High School	1	6.25	10	13.3	12	20	3	6.12	2	40	28	13.7
5	PUC	4	25	2	2.67	4	6.67	6	12.2	0	0	16	7.8
6	Diploma	0	0	1	1.33	0	0	1	2.04	0	0	2	0.98
7	ITI	0	0	1	1.33	0	0	0	0	0	0	1	0.49
8	Degree	1	6.25	2	2.67	2	3.33	5	10.2	0	0	10	4.88
9	Others	1	6.25	0	0	0	0	3	6.12	0	0	4	1.95
Total		16	100	75	100	60	100	49	100	5	100	205	100

Occupation of head of households: The data regarding the occupation of the household heads in Halawadi Micro watershed is presented in Table 5. The results indicate that, 92.86 per cent of households heads were practicing agriculture, 7.14 per cent of the household heads were agricultural Labour and private service (2.38%).

Table 5: Occupation of heads of households in Halawadi micro-watershed

Sl. No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	1	25	16	100	12	100	9	100	1	100	39	92.86
2	Agricultural Labour	3	75	0	0	0	0	0	0	0	0	3	7.14
3	Private Service	0	0	1	6.3	0	0	0	0	0	0	1	2.38
4	Others	0	0	0	0	1	8.33	0	0	0	0	1	2.38
Total		4	100	17	100	13	100	9	100	1	100	44	100

Table 6: Occupation of members of the household in Halawadi micro-watershed

Sl. No.	Particulars	LL (16)		MF (75)		SF (60)		SMF (49)		MDF (5)		All (205)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	3	18.8	57	76	37	61.67	31	63.27	4	80	132	64.4
2	Agricultural Labour	7	43.8	1	1.33	6	10	0	0	0	0	14	6.83
3	Government Service	0	0	0	0	1	1.67	0	0	0	0	1	0.49
4	Private Service	0	0	2	2.67	0	0	2	4.08	0	0	4	1.95
5	Trade & Business	0	0	0	0	1	1.67	0	0	0	0	1	0.49
6	Student	5	31.3	13	17.3	13	21.67	10	20.41	1	20	42	20.5
7	Others	0	0	0	0	2	3.33	0	0	0	0	2	0.98
8	Housewife	0	0	2	2.67	0	0	4	8.16	0	0	6	2.93
9	Children	1	6.25	0	0	0	0	2	4.08	0	0	3	1.46
Total		16	100	75	100	60	100	49	100	5	100	205	100

Occupation of the members of the household: The data regarding the occupation of the household members in Halawadi Micro watershed is presented in Table 6. The results indicate that, agriculture was the major occupation for 64.39 per cent of the household members, 6.83 per cent were agricultural labour, 1.95 per cent were private service, 0.49 per cent were working in government sector, 20.49 per cent were working in pursuing education, 2.93 per cent were involved as housewife, and 1.46 per cent were children.

Institutional Participation of household members: The data regarding the institutional participation of the household members in Halawadi Micro watershed is presented in Table 7. The results show that, households were not participating in any of the institutions.

Table 7: Institutional Participation of household member in Halawadi micro-watershed

Sl.No.	Particulars	LL (16)		MF (75)		SF (60)		SMF (49)		MDF (5)		All (205)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	16	100	75	100	60	100	49	100	5	100	205	100
Total		16	100	75	100	60	100	49	100	5	100	205	100

Type of house owned: The data regarding the type of house owned by the households in Halawadi Micro watershed is presented in Table 8. The results indicate that, 9.52 percent possess thatched house, 78.57 per cent of the households possess katcha house, 9.52 per cent possess pacca house and 2.38 percent possess semi pacca house.

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

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	1	25	3	19	0	0	0	0	0	0	4	9.52
2	Katcha	2	50	12	75	12	100	6	66.7	1	100	33	78.57
3	Pucca/RCC	1	25	1	6.3	0	0	2	22.2	0	0	4	9.52
4	Semi pacca	0	0	0	0	0	0	1	11.1	0	0	1	2.38
Total		4	100	16	100	12	100	9	100	1	100	42	100

Table 9. Durable assets owned by households in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	4	100	9	56	10	83.3	7	78	0	0	30	71.43
2	DVD/VCD Player	0	0	0	0	1	8.33	1	11	0	0	2	4.76
3	Mixer/Grinder	1	25	4	25	4	33.3	3	33	0	0	12	28.57
4	Refrigerator	0	0	0	0	0	0	1	11	0	0	1	2.38
5	Bicycle	0	0	0	0	1	8.33	0	0	0	0	1	2.38
6	Motor Cycle	2	50	7	44	5	41.7	9	100	0	0	23	54.76
7	Auto	0	0	1	6.3	0	0	0	0	0	0	1	2.38
8	Mobile Phone	4	100	16	100	13	108	9	100	1	100	43	102.38

Durable assets owned by the households: The data regarding the Durable Assets owned by the households in Halawadi Micro watershed is presented in Table 9. The results shows that, 71.43 per cent possess TV, 28.57 per cent possess mixer grinder, 2.38

per cent possess refrigerator, 2.38 per cent possess Bicycle, 54.76 per cent possess motor cycle and 102.38 per cent possess mobile phones.

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Halawadi Micro watershed is presented in Table 10. The result shows that, the average value of television was Rs.3633.00, DVD/VCD was Rs. 5000, Player mixer grinder was Rs.1000.00, refrigerator was 1000.00, bicycle was Rs.15000.00, Auto was Rs. 40000, motor cycle was Rs. 34043.00 and mobile phone was Rs.1559.00.

Table 10. Average value of durable assets owned in Halawadi micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
1	Television	4750	3888	3000	3571	0	3633
2	DVD/VCD Player	0	0	9000	1000	0	5000
3	Mixer/Grinder	1000	1050	1000	933	0	1000
4	Refrigerator	0	0	0	1000	0	1000
5	Bicycle	0	0	15000	0	0	15000
6	Motor Cycle	10000	39000	36000	34444	0	34043
7	Auto	0	40000	0	0	0	40000
8	Mobile Phone	1625	1990	1231	1183	2000	1559

Farm implements owned: The data regarding the farm implements owned by the households in Halawadi Micro watershed is presented in Table 11. About 9.52 per cent of the households possess Bullock Cart, Plough and Chaff cutter, 9.52 per cent possess plough and 11.90 per cent possess Sprayer, 33.33 per cent possess Weeder and 14.29 per cent possess tractor.

Table 11. Farm implements owned in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	2	16.67	2	22.2	0	0	4	9.52
2	Plough	0	0	1	6.25	1	8.33	2	22.2	0	0	4	9.52
3	Irrigation Pump	0	0	1	6.25	0	0	0	0	0	0	1	2.38
4	Power Tiller	0	0	1	6.25	0	0	0	0	0	0	1	2.38
5	Tractor	0	0	2	12.5	3	25	1	11.1	0	0	6	14.29
6	Sprayer	0	0	2	12.5	1	8.33	1	11.1	1	100	5	11.9
7	Weeder	0	0	6	37.5	5	41.67	3	33.3	0	0	14	33.33
8	Maize Huller	0	0	0	0	1	8.33	0	0	0	0	1	2.38
9	Chaff Cutter	0	0	1	6.25	1	8.33	2	22.2	0	0	4	9.52
10	Blank	4	100	10	62.5	5	41.67	5	55.6	0	0	24	57.14

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Halawadi Micro watershed is presented in Table 12. The results show that the average value of plough was Rs.2600.00, bullock Cart was Rs.3000.00, seed/fertilizer drill was Rs.10000.00, sprayer was Rs 10000, weeder was Rs.56.00 and tractor Rs. 433333.

Table 12. Average value of farm implements in Halawadi micro-watershed

Average Value (Rs.)

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
1	Bullock Cart	0	0	2500	3500	0	3000
2	Plough	0	20000	500	800	0	2600
3	Irrigation Pump	0	25000	0	0	0	25000
4	Transplanter/Grinder	0	0	0	0	0	0
5	Power Tiller	0	25000	0	0	0	25000
6	Tractor	0	450000	433333	400000	0	433333
7	Sprayer	0	2000	2000	2000	50000	10000
8	Weeder	0	72	47	44	0	56
9	Maize Huller	0	0	1000	0	0	1000
10	Chaff Cutter	0	2000	500	500	0	875

Livestock possession by the households: The data regarding the Livestock possession by the households in Halawadi Micro watershed is presented in Table 13. The indicate that, 7.14 per cent of the households possess bullocks, 4.76 per cent possess local cow, 9.52 per cent possess buffalo, 9.52 per cent possess sheep and 2.38 per cent possess goat.

Table 13. Livestock possession by households in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	1	6.3	0	0	2	22	0	0	3	7.14
2	Local cow	0	0	1	6.3	0	0	1	11	0	0	2	4.76
3	Buffalo	0	0	1	6.3	1	8.33	1	11	1	100	4	9.52
4	Sheep	0	0	1	6.3	1	8.33	2	22	0	0	4	9.52
5	Goat	0	0	1	6.3	0	0	0	0	0	0	1	2.38
6	blank	4	100	13	81	10	83.33	3	33	0	0	30	71.43

Average Labour availability: The data regarding the average labour availability in Halawadi Micro watershed is presented in Table 14. The indicated that, own labour men available in the micro watershed was 1.89, women available in the micro watershed was 1.67, hired labour (men) available was 9.66 and hired labour (women) available was 9.

Table 14. Average labour availability in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		N	N	N	N	N	N
1	Hired labour Female	0	8.93	9.09	8.89	10	9
2	Own Labour Female	0	1.64	1.58	1.67	3	1.67
3	Own labour Male	0	2.07	1.5	2	3	1.89
4	Hired labour Male	0	9.5	9.55	10	10	9.66

Adequacy of hired labour: The data regarding the adequacy of hired labour in Halawadi Micro watershed is presented in Table 15. The results indicate that, 85.71 per cent of the household opined that hired labour was adequate.

Table 15. Adequacy of hired labour in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	14	87.5	12	100	9	100	1	100	36	85.7

Distribution of land (ha): The data regarding the distribution of land (ha) in Halawadi Micro watershed is presented in Table 16. The results indicate that, 42.90 ha (83.04%) of dry land and 8.15 ha (15.78 %) of irrigated land.

Table 16. Distribution of land (ha) in Halawadi micro-watershed

Sl.No.	Particulars	MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%
1	Dry	9.98	94.27	13.32	82.44	14.74	73.49	4.86	100	42.9	83.04
2	Irrigated	0	0	2.84	17.56	5.32	26.51	0	0	8.15	15.78
3	Permanent Fallow	0.61	5.73	0	0	0	0	0	0	0.61	1.17
Total		10.6	100	16.16	100	20.06	100	4.86	100	51.66	100

Average value of land (ha): The data regarding the average land value (Rs./ha) in Halawadi Micro watershed is presented in Table 17. The results show that the average value of dry land was Rs.319205.74, the average value of irrigated land was Rs.453548.38 and the average value of permanent fallow land was Rs. 494000.

Table 17. Average value of land (ha) in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		N	N	N	N	N	N
1	Dry	0	510827.3	255103.3	183063.4	514583.3	319205.7
2	Irrigated	0	0	634236.8	357153.7	0	453548.4
3	Permanent Fallow	0	494000	0	0	0	494000

Status of bore wells: The data regarding the status of bore wells in Halawadi Micro watershed is presented in Table 18. The results indicate that, there were 6 functioning bore wells among the sampled households in micro watershed.

Table 18. Status of bore wells in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		N	N	N	N	N	N
1	De-functioning	0	0	0	0	0	0
2	Functioning	0	0	3	3	0	6

Source of irrigation: The data regarding the source of irrigation in Halawadi Micro watershed is presented in Table 19. The results that, bore well were major source of irrigation for 14.29 per cent of the households.

Table 19. Source of irrigation in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0	0	0	3	25	3	33.3	0	0	6	14.29

Table 20. Depth of water (Avg. In meters) in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		N	N	N	N	N	N
1	Bore Well	0	0	29.21	38.95	0	16.69

Depth of water (Avg. In meters): The data regarding the depth of water in Halawadi Micro watershed is presented in Table 20. The results revealed that, the depth of bore well was 16.69 meter.

Irrigated Area (ha): The results (Table 21) indicate that, the availability of irrigation water was used for kharif crops was 8.10 ha, and 4.61 ha for rabi crop.

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

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
1	Kharif	0	0	2.84	5.26	0	8.1
2	Rabi	0	0	0.97	3.64	0	4.61
Total		0	0	3.81	8.91	0	12.71

Cropping pattern: The data regarding the cropping pattern in Halawadi Micro watershed is presented in Table 22. The results indicate that, farmers have grown Maize (13.16 ha), Bajra (13.20 ha), Sunflower (9.96 ha), Jowar (7.04 ha), Groundnut (4.21 ha), Sugarcane (2.16 ha), Water melon (1.7 ha), Red gram (togari) (1.4 ha), and Chick pea (0.81 ha).

Table 22. Cropping pattern in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
1	Kharif - Maize	0	1.21	4.26	7.69	0	13.16
2	Kharif - Bajra	0	0.89	4.41	7.69	1.21	13.20
3	Kharif - Sunflower	0	2.02	4.29	2.02	1.62	9.96
4	Kharif - Jowar	0	3.4	1.62	0	2.02	7.04
5	Kharif - Groundnut	0	0	0.81	2.43	0	3.24
6	Kharif - Sugarcane	0	0.81	1.35	0	0	2.16
7	Rabi - Water melon	0	0	0	1.7	0	1.7
8	Kharif - Red gram (togari)	0	1.4	0	0	0	1.4
9	Rabi - Groundnut	0	0	0.97	0	0	0.97
10	Kharif - Chick pea	0	0.81	0	0	0	0.81
Total		0	10.55	16.7	21.54	4.86	53.64

Cropping intensity: The data regarding the cropping intensity in Halawadi Micro watershed is presented in Table 23. The results indicate that, the cropping intensity was 99.89 per cent.

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

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
1	Cropping Intensity	0	100	100	99.74	100	99.89

Possession of bank account and savings: The data regarding the possession of bank account and saving in Halawadi micro-watershed is presented in Table 24. The results indicate that, 35.71 cent of the households posses bank account and 14.29 per cent of them have savings.

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

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0	8	50	2	16.67	4	44.44	1	100	15	35.71
2	Savings	0	0	3	18.75	1	8.33	2	22.22	0	0	6	14.29

Borrowing status: The data regarding the borrowing status in Halawadi micro-watershed is presented in Table 25. The results indicate that, 54.76 percent of the sample farmers have borrowed credit from different sources.

Table 25. Borrowing status in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	10	62.5	6	50	6	66.7	1	100	23	54.76

Source of credit: The results (Table 26) show that, 100.00 per cent have borrowed loan from Grameena Bank.

Table 26. Source of credit borrowed by households in Halawadi micro-watershed

Sl.No.	Particulars	MF (5)		SF (1)		SMF (1)		MDF (1)		All (8)	
		N	%	N	%	N	%	N	%	N	%
1	Grameena Bank	5	100	1	100	1	100	1	100	8	100

Avg. Credit amount: The data regarding the avg. Credit amount in Halawadi micro-watershed is presented in Table 27. The results show that, farmers have borrowed Avg. Credit of Rs.115000.00 from different sources.

Table 27. Avg. Credit amount in Halawadi micro-watershed

Sl.No.	Particulars	LL (0)	MF (5)	SF (1)	SMF (1)	MDF (1)	All (8)
		N	N	N	N	N	N
1	Average Credit	0	115000	115000	115000	115000	115000

Purpose of credit borrowed (institutional Source): The data regarding the purpose of credit borrowed - Institutional Credit in Halawadi micro-watershed is presented in Table 28. The results indicate that, 100.00 per cent of the households have borrowed loan for agriculture.

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

SN	Particulars	LL (0)		MF (5)		SF (1)		SMF (1)		MDF (1)		All (8)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture production	0	0	5	100	1	100	1	100	1	100	8	100

Repayment status of household (institutional Source): The results (Table 29) indicate that, 100.00 per cent have unpaid.

Table 29. Repayment status of household (institutional Source) in Halawadi micro-watershed

Sl.No.	Particulars	LL (0)		MF (5)		SF (1)		SMF (1)		MDF (1)		All (8)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Un paid	0	0	5	100	1	100	1	100	1	100	8	100

Opinion regarding institutional sources of credit: The results (Table 30) indicate that, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.

Table 30. Opinion regarding institutional sources of credit in Halawadi micro-watershed

Sl.No.	Particulars	LL (0)		MF (5)		SF (1)		SMF (1)		MDF (1)		All (8)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Helped to perform timely agricultural operations	0	0	5	100	1	100	1	100	1	100	8	100

Cost of Cultivation of Maize: The data regarding the cost of cultivation (Rs/ha) of Maize in Halawadi micro watershed is presented in Table 31.a. The results indicate that, the total cost of cultivation (Rs/ha) for Maize was Rs. 38281.00. The gross income realized by the farmers was Rs. 51975.10. The net income from Maize cultivation was Rs.13694.10, thus the benefit cost ratio was found to be 1:1.40.

Table 31(a). Cost of Cultivation of Maize in Halawadi micro-watershed

S.N	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	40.42	7920.17	20.69
2	Bullock		Pairs/day	0.81	461.36	1.21
3	Tractor		Hours	5.16	3712.68	9.7
4	Machinery		Hours	0.47	499.06	1.3
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	20.53	3780.22	9.87
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	3.17	2734.36	7.14
8	Fertilizer + micronutrients		Quintal	4.94	4130.58	10.79
9	Pesticides (PPC)		Kgs/liters	0.92	762.14	1.99
10	Irrigation		Number	2.6	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	3443.84	9
14	Land revenue and Taxes			0	2.32	0.01
II	**Cost B1**					
16	Interest on working capital				1369.02	3.58
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				28815.74	75.27
III	**Cost B2**					
18	Rental Value of Land				386.36	1.01
19	**Cost B2 = (Cost B1 + Rental value)**				29202.11	76.28
IV	**Cost C1**					
20	Family Human Labour			25.81	5597.62	14.62
21	**Cost C1 = (Cost B2 + Family Labour)**				34799.73	90.91
V	**Cost C2**					
22	Risk Premium				1.18	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				34800.91	90.91
VI	**Cost C3**					
24	Managerial Cost				3480.09	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				38281	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		23.4	51587.23	
		b) Main Crop Sales Price (Rs.)			2204.55	
	By Product	e) Main Product (q)		1.25	387.87	
		f) Main Crop Sales Price (Rs.)			309.09	
b.	Gross Income (Rs.)				51975.1	
c.	Net Income (Rs.)				13694.1	
d.	Cost per Quintal (Rs./q.)				1635.91	
e.	Benefit Cost Ratio (BC Ratio)				1:1.4	

Cost of Cultivation of Bajra: The data regarding the cost of cultivation (Rs/ha) of Bajra in Halawadi micro watershed is presented in Table 31.b. The results indicate that, the total cost of cultivation (Rs/ha) for Bajra was Rs. 20291.06. The gross income realized by the farmers was Rs. 19635.92. The net income from Bajra cultivation was Rs.-655.14, thus the benefit cost ratio was found to be 1:1.01.

Table 31(b). Cost of Cultivation of Bajra in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	25.12	4815.85	23.73
2	Bullock		Pairs/day	0.27	201.39	0.99
3	Tractor		Hours	4.23	3475.87	17.13
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.21	962.42	4.74
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	4.48	4182.02	20.61
9	Pesticides (PPC)		Kgs / liters	0.95	704.75	3.47
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	109.39	0.54
14	Land revenue and Taxes			0	0.31	0
II	**Cost B1**					
16	Interest on working capital				701.93	3.46
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15153.92	74.68
III	**Cost B2**					
18	Rental Value of Land				289.58	1.43
19	**Cost B2 = (Cost B1 + Rental value)**				15443.5	76.11
IV	**Cost C1**					
20	Family Human Labour			13	3002.66	14.8
21	**Cost C1 = (Cost B2 + Family Labour)**				18446.16	90.91
V	**Cost C2**					
22	Risk Premium				0.25	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				18446.41	90.91
VI	**Cost C3**					
24	Managerial Cost				1844.64	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				20291.06	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		16.47	18446.1	
		b) Main Crop Sales Price (Rs.)			1120	
	By Product	e) Main Product (q)		2.8	1189.82	
		f) Main Crop Sales Price (Rs.)			425	
b.	Gross Income (Rs.)				19635.92	
c.	Net Income (Rs.)				-655.14	
d.	Cost per Quintal (Rs./q.)				1232.02	
e.	Benefit Cost Ratio (BC Ratio)				1:1.01	

Cost of Cultivation of Red gram: The data regarding the cost of cultivation (Rs/ha) of Red gram in Halawadi micro watershed is presented in Table 31.c. The results indicate, the total cost of cultivation (Rs/ha) for Red gram was Rs.23686.60. The gross income realized by the farmers was Rs. 45972.51. The net income from Red gram cultivation was Rs. 22285.91, thus the benefit cost ratio was found to be 1:1.90.

Table 31(c). Cost of Cultivation of Red gram in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	13.62	3405.33	14.38
2	Bullock		Pairs/day	0	0	0
3	Tractor		Hours	4.16	3741.67	15.8
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.05	966.27	4.08
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	5.65	3657.55	15.44
9	Pesticides (PPC)		Kgs / liters	0	0	0
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	0.03	0
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				554.86	2.34
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				12325.71	52.04
III	**Cost B2**					
18	Rental Value of Land				283.33	1.2
19	**Cost B2 = (Cost B1 + Rental value)**				12609.04	53.23
IV	**Cost C1**					
20	Family Human Labour			35.34	8924.23	37.68
21	**Cost C1 = (Cost B2 + Family Labour)**				21533.27	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				21533.27	90.91
VI	**Cost C3**					
24	Managerial Cost				2153.33	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				23686.6	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		11.95	44801.89	
		b) Main Crop Sales Price (Rs.)			3750	
	By Product	e) Main Product (q)		2.34	1170.62	
		f) Main Crop Sales Price (Rs.)			500	
b.	Gross Income (Rs.)				45972.51	
c.	Net Income (Rs.)				22285.91	
d.	Cost per Quintal (Rs./q.)				1982.61	
e.	Benefit Cost Ratio (BC Ratio)				1:1.9	

Cost of Cultivation of Groundnut: The data regarding the cost of cultivation (Rs/ha) of Groundnut in Halawadi micro watershed is presented in Table 31.d. The results indicate that, the total cost of cultivation (Rs/ha) for Groundnut was Rs. 40972.51. The gross income realized by the farmers was Rs.53056.20. The net income from Groundnut cultivation was Rs. 12083.69, thus the benefit cost ratio was found to be 1:1.30.

Table 31(d). Cost of Cultivation of Groundnut in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	29.9	5598.49	13.66
2	Bullock		Pairs/day	0.89	515.44	1.26
3	Tractor		Hours	4.33	3170.01	7.74
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	69.33	8642.31	21.09
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	12.35	1482	3.62
8	Fertilizer + micronutrients		Quintal	5.09	5403.02	13.19
9	Pesticides (PPC)		Kgs/liters	1.44	1478.01	3.61
10	Irrigation		Number	4.13	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	2122.76	5.18
14	Land revenue and Taxes			0	2.74	0.01
II	**Cost B1**					
16	Interest on working capital				2040.72	4.98
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				30455.52	74.33
III	**Cost B2**					
18	Rental Value of Land				338.89	0.83
19	**Cost B2 = (Cost B1 + Rental value)**				30794.41	75.16
IV	**Cost C1**					
20	Family Human Labour			30.55	6452.66	15.75
21	**Cost C1 = (Cost B2 + Family Labour)**				37247.07	90.91
V	**Cost C2**					
22	Risk Premium				0.67	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				37247.74	90.91
VI	**Cost C3**					
24	Managerial Cost				3724.77	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				40972.51	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		13.75	49482.68	
		b) Main Crop Sales Price (Rs.)			3600	
	By Product	e) Main Product (q)		1.79	3573.52	
		f) Main Crop Sales Price (Rs.)			2000	
b.	Gross Income (Rs.)				53056.2	
c.	Net Income (Rs.)				12083.69	
d.	Cost per Quintal (Rs./q.)				2980.86	
e.	Benefit Cost Ratio (BC Ratio)				1:1.3	

Cost of Cultivation of Sunflower: The data regarding the cost of cultivation (Rs/ha) of Sunflower in Halawadi micro watershed is presented in Table 31.e. The results indicate that, the total cost of cultivation (Rs/ha) for Sunflower was Rs.33117.67. The gross income realized by the farmers was Rs. 35040.81. The net income from Sunflower cultivation was Rs. 1923.14, thus the benefit cost ratio was found to be 1:1.10.

Table 31(e). Cost of Cultivation of Sunflower in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	33.94	6289.02	18.99
2	Bullock		Pairs/day	0.98	610.64	1.84
3	Tractor		Hours	3.42	2662.53	8.04
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	5.81	1333.71	4.03
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	2.08	6225.26	18.8
8	Fertilizer + micronutrients		Quintal	4.35	4039.49	12.2
9	Pesticides (PPC)		Kgs/liters	1.71	1756.27	5.3
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	708.97	2.14
14	Land revenue and Taxes			0	0.31	0
II	**Cost B1**					
16	Interest on working capital				1602.6	4.84
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				25228.79	76.18
III	**Cost B2**					
18	Rental Value of Land				289.58	0.87
19	**Cost B2 = (Cost B1 + Rental value)**				25518.38	77.05
IV	**Cost C1**					
20	Family Human Labour			19.36	4588.34	13.85
21	**Cost C1 = (Cost B2 + Family Labour)**				30106.72	90.91
V	**Cost C2**					
22	Risk Premium				0.25	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				30106.97	90.91
VI	**Cost C3**					
24	Managerial Cost				3010.7	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				33117.67	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.84	35040.81	
		b) Main Crop Sales Price (Rs.)			3233.33	
b.	Gross Income (Rs.)				35040.81	
c.	Net Income (Rs.)				1923.14	
d.	Cost per Quintal (Rs./q.)				3055.88	
e.	Benefit Cost Ratio (BC Ratio)				1:1.1	

Cost of Cultivation of Bengal gram: The data regarding the cost of cultivation (Rs/ha) of Bengal gram in Halawadi micro watershed is presented in Table 31.f. The results indicate that, the total cost of cultivation (Rs/ha) for Bengal gram was Rs. 16529.47. The gross income realized by the farmers was Rs. 12350. The net income from Bengal gram cultivation was Rs. -4179.47 thus the benefit cost ratio was found to be 1:0.7.

Table 31(f). Cost of Cultivation of Bengal gram in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	22.23	4816.5	29.14
2	Bullock		Pairs/day	0	0	0
3	Tractor		Hours	2.47	2223	13.45
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	6.18	555.75	3.36
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	2.47	864.5	5.23
9	Pesticides (PPC)		Kgs / liters	0	0	0
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	0.02	0
14	Land revenue and Taxes			0	0	0
II	**Cost B1**					
16	Interest on working capital				170.43	1.03
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				8630.2	52.21
III	**Cost B2**					
18	Rental Value of Land				283.33	1.71
19	**Cost B2 = (Cost B1 + Rental value)**				8913.54	53.93
IV	**Cost C1**					
20	Family Human Labour			22.23	6113.25	36.98
21	**Cost C1 = (Cost B2 + Family Labour)**				15026.79	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				15026.79	90.91
VI	**Cost C3**					
24	Managerial Cost				1502.68	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				16529.47	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.35	12350	
		b) Main Crop Sales Price (Rs.)			1000	
b.	Gross Income (Rs.)				12350	
c.	Net Income (Rs.)				-4179.47	
d.	Cost per Quintal (Rs./q.)				1338.42	
e.	Benefit Cost Ratio (BC Ratio)				1:0.7	

Cost of Cultivation of Sugarcane: The data regarding the cost of cultivation (Rs/ha) of Sugarcane in Halawadi micro watershed is presented in Table 31.g. The results indicate that, the total cost of cultivation (Rs/ha) for Sugarcane was Rs. 70939.93. The gross income realized by the farmers was Rs. 178018.02. The net income from Sugarcane cultivation was Rs. 107078.09 thus the benefit cost ratio was found to be 1:2.5.

Table 31(g). Cost of Cultivation of Sugarcane in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	80.11	15428.23	21.75
2	Bullock		Pairs/day	1.48	890.09	1.25
3	Tractor		Hours	5.19	3634.53	5.12
4	Machinery		Hours	0.74	815.92	1.15
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	1112.6	27815.32	39.21
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	1.48	1483.48	2.09
8	Fertilizer + micronutrients		Quintal	2.97	1958.2	2.76
9	Pesticides (PPC)		Kgs/liters	1.48	1483.48	2.09
10	Irrigation		Number	14.83	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	1.48	0
14	Land revenue and Taxes			0	2.47	0
II	**Cost B1**					
16	Interest on working capital				3929.1	5.54
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				57442.3	80.97
III	**Cost B2**					
18	Rental Value of Land				0	0
19	**Cost B2 = (Cost B1 + Rental value)**				57442.3	80.97
IV	**Cost C1**					
20	Family Human Labour			28.19	7046.55	9.93
21	**Cost C1 = (Cost B2 + Family Labour)**				64488.85	90.91
V	**Cost C2**					
22	Risk Premium				2	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				64490.85	90.91
VI	**Cost C3**					
24	Managerial Cost				6449.08	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				70939.93	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		1780.2	178018.02	
		b) Main Crop Sales Price (Rs.)			100	
b.	Gross Income (Rs.)				178018.02	
c.	Net Income (Rs.)				107078.09	
d.	Cost per Quintal (Rs./q.)				39.85	
e.	Benefit Cost Ratio (BC Ratio)				1:2.5	

Cost of Cultivation of Water melon: The data regarding the cost of cultivation (Rs/ha) of Water melon in Halawadi micro watershed is presented in Table 31.h. The results indicate that, the total cost of cultivation (Rs/ha) for Water melon was Rs. 38536.93. The gross income realized by the farmers was Rs. 99241.07. The net income from Water melon cultivation was Rs. 60704.14 thus the benefit cost ratio was found to be 1: 2.6.

Table 31(h). Cost of Cultivation of Water melon in Halawadi micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**				
1	Hired Human Labour	Man days	53.92	13167.82	34.17
2	Bullock	Pairs/day	0	0	0
3	Tractor	Hours	6.06	4245.31	11.02
4	Machinery	Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	1.65	4135.04	10.73
6	Seed Inter Crop	Kgs.	0	0	0
7	FYM	Quintal	0	0	0
8	Fertilizer + micronutrients	Quintal	4.56	3787.7	9.83
9	Pesticides (PPC)	Kgs / liters	0.55	275.67	0.72
10	Irrigation	Number	3.05	0	0
11	Repairs		0	0	0
12	Msc. Charges (Marketing costs etc)		0	0	0
13	Depreciation charges		0	2367.67	6.14
14	Land revenue and Taxes		0	2.88	0.01
II	**Cost B1**				
16	Interest on working capital			984.05	2.55
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**			28966.15	75.16
III	**Cost B2**				
18	Rental Value of Land			333.33	0.86
19	**Cost B2 = (Cost B1 + Rental value)**			29299.48	76.03
IV	**Cost C1**				
20	Family Human Labour		19.74	5732.09	14.87
21	**Cost C1 = (Cost B2 + Family Labour)**			35031.57	90.9
V	**Cost C2**				
22	Risk Premium			2	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**			35033.57	90.91
VI	**Cost C3**				
24	Managerial Cost			3503.36	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**			38536.93	100
VII	**Economics of the Crop**				
a.	Main Product	a) Main Product (q)	330.8	99241.07	
		b) Main Crop Sales Price (Rs.)		300	
b.	Gross Income (Rs.)			99241.07	
c.	Net Income (Rs.)			60704.14	
d.	Cost per Quintal (Rs./q.)			116.49	
e.	Benefit Cost Ratio (BC Ratio)			1:2.6	

Cost of Cultivation of Jowar: The data regarding the cost of cultivation (Rs/ha) of Jowar in Halawadi micro watershed is presented in Table 31.i. The results indicate that, the total cost of cultivation (Rs/ha) for Jowar was Rs. 33314.63. The gross income realized by the farmers was Rs. 20481.84. The net income from Jowar cultivation was Rs. -12832.79 thus the benefit cost ratio was found to be 1:0.6.

Table 31(i). Cost of Cultivation of Jowar in Halawadi micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	43.07	7583.8	22.76
2	Bullock		Pairs/day	0.75	404.03	1.21
3	Tractor		Hours	3.25	2240.14	6.72
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	7.46	672.87	2.02
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	1.48	4446	13.35
8	Fertilizer + micronutrients		Quintal	5.89	5577.39	16.74
9	Pesticides (PPC)		Kgs/liters	1.66	915.26	2.75
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	2010.19	6.03
14	Land revenue and Taxes			0	0.55	0
II	**Cost B1**					
16	Interest on working capital				1393.42	4.18
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				25243.65	75.77
III	**Cost B2**					
18	Rental Value of Land				291.67	0.88
19	**Cost B2 = (Cost B1 + Rental value)**				25535.32	76.65
IV	**Cost C1**					
20	Family Human Labour			19.66	4750.38	14.26
21	**Cost C1 = (Cost B2 + Family Labour)**				30285.7	90.91
V	**Cost C2**					
22	Risk Premium				0.33	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				30286.03	90.91
VI	**Cost C3**					
24	Managerial Cost				3028.6	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				33314.63	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		13.56	19173.49	
		b) Main Crop Sales Price (Rs.)			1414.29	
	By Product	e) Main Product (q)		3.16	1308.34	
		f) Main Crop Sales Price (Rs.)			414.29	
b.	Gross Income (Rs.)				20481.84	
c.	Net Income (Rs.)				-12832.79	
d.	Cost per Quintal (Rs./q.)				2457.37	
e.	Benefit Cost Ratio (BC Ratio)				1:0.6	

Adequacy of fodder: The data regarding the adequacy of fodder in Halawadi Micro watershed is presented in Table 32. The results indicate that, 21.43 per cent of the households opined that dry fodder was adequate and 16.67 percent of them opined it was sufficient.

Table 32. Adequacy of fodder in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	2	12.5	3	25	3	33.3	1	100	9	21.43
2	Adequate-Green Fodder	0	0	2	12.5	3	25	2	22.2	0	0	7	16.67

Average annual gross income: The data regarding the annual gross income in Halawadi Micro watershed is presented in Table 33. The results indicate that, the farmers have annual gross income of Rs. 72246.43 in micro-watershed, of which Rs. 56722.62 is from agriculture itself.

Table 33. Average annual gross income in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	3125	20000	0	0	6904.76
2	Wage	43750	1562.5	3333.33	1111.11	0	5952.38
3	Agriculture	0	39646.9	66500	96666.7	80000	56722.6
4	Dairy Farm	0	1375	0	2222.22	20000	1476.19
8	Goat Farming	0	3125	0	0	0	1190.48
	Income(Rs.)	43750	48834.4	89833.3	100000	100000	72246.4

Average annual Expenditure: The data regarding the average annual expenditure in Halawadi Micro watershed is presented in Table 34. The results indicate that, the farmers have annual gross expenditure of Rs. 543427.78 in micro-watershed, of which Rs. 42642.86 is from agriculture itself.

Table 34. Average annual Expenditure in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Service/salary	0	25000	200000	0	0	5357.14
2	Wage	33750	10000	9333.33	7000	0	4285.71
3	Agriculture	0	26066.7	55833.3	74444.4	60000	42642.9
4	Dairy Farm	0	15000	0	12000	5000	761.9
8	Goat Farming	0	10000	0	0	0	238.1
	Total	33750	86066.7	265167	93444.4	65000	543428

Horticulture species grown: The data regarding horticulture species grown in Halawadi Micro watershed is presented in Table 35. The results indicate that, the total number of horticultural trees grown (both field and backyard) by the sampled households were coconut (66) Pomogranate (2) and Sapota (4).

Table 35. Horticulture species grown in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	1	4	5	0	56	0	0	0	62	4
2	Pomegranate	0	0	0	0	2	0	0	0	0	0	2	0
3	Sapota	0	0	0	0	4	0	0	0	0	0	4	0

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

Forest species grown: The data regarding forest species grown in Halawadi Micro watershed is presented in Table 36. The results indicate that, households have planted 13 teak trees, 50 neem trees, 3 acacia trees and 2 banyan trees together in both field and backyard.

Table 36. Forest species grown in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	0	10	0	3	0	0	0	13	0
2	Neem	0	0	23	3	15	0	9	0	0	0	47	3
3	Acacia	0	0	0	0	0	0	3	0	0	0	3	0
4	Banyan	0	0	1	0	1	0	0	0	0	0	2	0

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

Average additional investment capacity: The data regarding average additional investment capacity in Halawadi Micro watershed is presented in Table 37. The results indicate that, households have an average investment capacity of Rs. 928.57 for land development and Rs.71.43 for adoption of improved crop production activities.

Table 37. Average additional investment capacity of households in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)	MF (16)	SF (12)	SMF (9)	MDF (1)	All (42)
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Land development	0	875	1500	777.78	0	928.57
2	Improved crop production	0	187.5	0	0	0	71.43

Source of funds for additional investment: The data regarding source of funds for additional investment in Halawadi Micro watershed is presented in Table 38. The results indicate that, the sources of finance raised from Own funds for land development was 16.28 per cent and 2.33 per cent and soft loan was for 2.33 per cent for improved livestock management.

Table 38. Source of funds for additional investment in Halawadi micro-watershed

Sl.No	Item	Irrigation facility		Improved livestock management	
		N	%	N	%
1	Own funds	7	16.28	0	0
2	Soft loan	1	2.33	1	2.33

Marketing of agricultural produce: The data regarding marketing of the agricultural produce in Halawadi Micro watershed is presented in Table 39. The results indicated that,

92.86 per cent of output of bajra was sold in the market with average price of Rs. 1120.00; 70.00 per cent of output of Bengal gram was sold in the market with average price of Rs. 1000.00; 85.29 per cent of output of groundnut was sold in the market with average price of Rs. 3600.00; 75.90 per cent of output of Jowar was sold in the market with average price of Rs. 1414.29; 96.92 per cent of output of Maize was sold in the market with average price of Rs. 2204.55; 50.0 per cent of output of red gram was sold in the market with average price of Rs.7500; 100 per cent of output of sugarcane was sold in the market with average price of Rs. 100; 100 per cent of output of sunflower was sold in the market with average price of Rs. 3233 and100 per cent of output of water melon was sold in the market with average price of Rs. 100.

Table 39. Marketing of agricultural produce in Halawadi micro-watershed

Sl. No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	210	15	195	93	1120
2	Bengal gram	10	3	7	70	1000
3	Groundnut	68	10	58	85	3600
4	Jowar	83	20	63	76	1414
5	Maize	325	10	315	97	2205
6	Red gram	16	8	8	50	7500
7	Sugarcane	2400	0	2400	100	100
8	Sunflower	107	0	107	100	3233
9	Water Melon	1200	0	1200	100	300

Marketing channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Halawadi Micro watershed is presented in Table 40. The results indicated that, 69.05 cent of the households have sold agricultural produce to the local/village merchants and 33.33 per per cent have sold to Agent/Traders.

Table 40. Marketing channels used for sale of agricultural produce in Halawadi micro-watershed

Sl. No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0	3	19	6	50	5	55.6	0	0	14	33.33
2	Local/village Merchant	0	0	11	69	9	75	6	66.7	3	300	29	69.05

Table 41. Mode of transport of agricultural produce in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	0	0	3	19	4	33.3	0	0	0	0	7	16.67
2	Tractor	0	0	10	63	9	75	11	122	3	300	33	78.57
3	Truck	0	0	1	6.3	2	16.7	0	0	0	0	3	7.14

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Halawadi Micro watershed is presented in Table 41. The results indicated that, 78.57 cent of the households have used tractor, 16.67 per cent have used

Cart for the transport of agriculture commodity and 7.14 per cent have used Truck for the transport of agriculture commodity.

Incidence of soil and water erosion problems: The data regarding incidence of incidence of soil and water erosion problems in Halawadi Micro watershed is presented in Table 42. The results indicate that, 33.33 per cent of the households have experienced soil and water erosion problems.

Table 42. Incidence of soil and water erosion problems in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	6	38	1	8.33	6	67	1	100	14	33.33

Interest towards soil testing: The data regarding Interest shown towards soil testing in Halawadi Micro watershed is presented in Table 43. The results indicated that, 61.90 per cent of the households were interested towards soil testing.

Table 43. Interest regarding soil testing in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	12	75	7	58.3	6	67	1	100	26	61.9

Soil and water conservation practices and structures adopted: The data regarding soil and water conservation practices and structures adopted in Halawadi Micro watershed is presented in Table 44. The results indicated that 23.81 per cent of farmers practicing summer ploughing as soil and water conservation practice.

Table 44. Soil and water conservation practices and structures adopted in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Field Bunding	0	0	5	31	2	17	2	22.2	1	100	10	23.81

Status of soil and water conservation structures: The data regarding status soil and water conservation structures adopted in Halawadi Micro watershed is presented in Table 45. The results indicated that, the households have adopted field bunding as a soil and water conservation structures out of which 100.00 per cent was slightly damaged.

Table 45. Status of soil and water conservation structures in Halawadi micro-watershed

Sl.No	Item	Good		Slightly Damaged	
		N	%	N	%
1	Field Bunding	0	0	9	100

Agencies involved in the soil and water conservation structures: The data regarding Agencies involved in the soil and water conservation structures adopted in Halawadi Micro watershed is presented in Table 46. The results indicated that, 11.90 per cent of the households have adopted by their own.

Table 46. Agencies involved in the soil and water conservation structures in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Own	0	0	2	13	2	16.67	1	11	0	0	5	11.9
2	Govt.	0	0	2	13	0	0	0	0	0	0	2	4.76
3	Other	0	0	1	6.3	0	0	1	11	1	100	3	7.14

Usage pattern of fuel for domestic use: The data on usage pattern of fuel for domestic use in Halawadi Micro watershed is presented in Table 47. The results indicated that, LPG was the major source of fuel for domestic use for 21.43 per cent of the households followed by firewood (78.57 %), Kerosene (2.38 %).

Table 47. Usage pattern of fuel for domestic use in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	3	75	12	75	9	75	8	88.9	1	100	33	78.57
2	Kerosene	0	0	1	6.25	0	0	0	0	0	0	1	2.38
3	LPG	1	25	4	25	3	25	1	11.1	0	0	9	21.43

Source of drinking water: The data on source of drinking water in Halawadi Micro watershed is presented in Table 48. The results indicated that, tank supply of water was the major source for drinking water for 7.14 per cent of the households followed by piped waters supply (38.10 %), bore well water (57.14%) and lake/tank water for (7.14%).

Table 48. Source of drinking water in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	2	50	8	50	5	41.67	1	11.1	0	0	16	38.1
2	Bore Well	2	50	6	37.5	7	58.33	8	88.9	1	100	24	57.14
3	Lake/ Tank	0	0	2	12.5	1	8.33	0	0	0	0	3	7.14

Source of light: The data on source of light in Halawadi Micro watershed is presented in Table 49. The results indicated that, electricity was the major source of light for 97.62 per cent of the households.

Table 49. Source of light in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	4	100	16	100	12	100	8	89	1	100	41	97.6

Existence of sanitary toilet facility: The data on availability of toilet facility in Halawadi Micro watershed is presented in Table 50. The results indicated that, 45.24 per cent of the households possess toilets.

Table 50. Existence of sanitary toilet facility in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	4	100	8	50	5	41.67	1	11	1	100	19	45.2

Possession of PDS card: The data regarding possession of PDS card in Halawadi Micro watershed is presented in Table 51. The results indicated that, 92.86 per cent possessed BPL card and 4.76 per cent do not possess PDS card.

Table 51. Possession of PDS card in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	4	100	16	100	12	100	6	67	1	100	39	92.86
2	Not Possessed	0	0	0	0	0	0	2	22	0	0	2	4.76

Participation in NREGA programme: The data regarding Participation in NREGA programme in Halawadi Micro watershed is presented in Table 52. The results indicated that, only 42.86 percent of the households have participated in NREGA programme.

Table 52. Participation in NREGA programme in Halawadi micro-watershed

Sl. No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	2	50	7	43.8	6	50	3	33.3	0	0	18	42.9

Adequacy of food items: The data regarding adequacy of food items in Halawadi Micro watershed is presented in Table 53. The results indicated that, the extent of adequacy of food items for cereals, pulses, Oilseeds and vegetables were 66.67, 26.19, 40.48, 57.14 per cent respectively, similarly for Fruits (7.14%), milk (59.52%), Egg (28.57%) and Meat (19.05%).

Table 53. Adequacy of food items in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	0	0	10	62.5	10	83.33	8	88.9	0	0	28	66.67
2	Pulses	0	0	5	31.3	4	33.33	2	22.2	0	0	11	26.19
3	Oilseed	0	0	7	43.8	6	50	4	44.4	0	0	17	40.48
4	Vegetables	1	25	7	43.8	9	75	6	66.7	1	100	24	57.14
5	Fruits	0	0	1	6.25	1	8.33	1	11.1	0	0	3	7.14
6	Milk	0	0	8	50	8	66.67	8	88.9	1	100	25	59.52
7	Egg	0	0	4	25	4	33.33	3	33.3	1	100	12	28.57
8	Meat	0	0	3	18.8	4	33.33	1	11.1	0	0	8	19.05

Table 54. Inadequacy of food items in Halawadi micro-watershed

Sl.No.	Particulars	LL (4)		MF (16)		SF (12)		SMF (9)		MDF (1)		All (42)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	4	100	5	31.3	1	8.33	1	11.1	1	100	12	28.57
2	Pulses	4	100	8	50	7	58.33	7	77.8	1	100	27	64.29
3	Oilseed	4	100	5	31.3	6	50	5	55.6	1	100	21	50
4	Vegetables	3	75	6	37.5	1	8.33	2	22.2	0	0	12	28.57
5	Fruits	4	100	8	50	5	41.67	4	44.4	1	100	22	52.38
6	Milk	4	100	5	31.3	3	25	1	11.1	0	0	13	30.95
7	Egg	2	50	6	37.5	3	25	1	11.1	0	0	12	28.57
8	Meat	4	100	10	62.5	6	50	5	55.6	1	100	26	61.9

Inadequacy of food items: The data regarding in adequacy of food items in Halawadi Micro watershed is presented in Table 54. The results indicated that, the extent of in adequacy of food items for cereals, pulses, Oilseeds and vegetables were 28.57, 64.29, 50.00, 28.57, 61.90 per cent respectively, similarly for fruits (52.38%), milk (30.95%), egg (28.57%) and meat (61.90%).

Response on market surplus of food items: The data regarding adequacy of food items in Halawadi Micro watershed is presented in Table 55. The results indicated that, the extent of adequacy of food items for cereals, pulses, Oilseeds and vegetables were 4.76, 7.14, 9.52, 9.52 per cent respectively, similarly for fruits (11.90%), milk (4.76%), egg (30.95%) and meat (4.76%).

Table 55. Response on market surplus of food items in Halawadi micro-watershed

Sl. No.	**Particulars**	**LL** (4)		**MF** (16)		**SF** (12)		**SMF** (9)		**MDF** (1)		**All (42)**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	Cereals	0	0	2	12.5	0	0	0	0	0	0	2	4.76
2	Pulses	0	0	3	18.8	0	0	0	0	0	0	3	7.14
3	Oilseed	0	0	4	25	0	0	0	0	0	0	4	9.52
4	Vegetables	0	0	3	18.8	0	0	1	11.1	0	0	4	9.52
5	Fruits	0	0	4	25	0	0	1	11.1	0	0	5	11.9
6	Milk	0	0	2	12.5	0	0	0	0	0	0	2	4.76
7	Egg	2	50	5	31.3	3	25	3	33.3	0	0	13	30.95
8	Meat	0	0	2	12.5	0	0	0	0	0	0	2	4.76

Table 56. Farming constraints experienced in Halawadi micro-watershed

SN	**Particulars**	**MF** (16)		**SF** (12)		**SMF** (9)		**MDF** (1)		**All (42)**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	Lower fertility status of the soil	12	75	7	58.33	7	77.78	1	100	27	64.29
2	Wild animal menace on farm field	11	68.75	6	50	6	66.67	1	100	24	57.14
3	Frequent incidence of pest and diseases	13	81.25	7	58.33	7	77.78	1	100	28	66.67
4	Inadequacy of irrigation water	12	75	7	58.33	6	66.67	1	100	26	61.9
5	High cost of Fertilizers and plant protection chemicals	16	100	8	66.67	6	66.67	1	100	31	73.81
6	High rate of interest on credit	15	93.75	8	66.67	7	77.78	1	100	31	73.81
7	Low price for the agricultural commodities	12	75	7	58.33	6	66.67	1	100	26	61.9
8	Lack of marketing facilities in the area	13	81.25	8	66.67	6	66.67	1	100	28	66.67
9	Inadequate extension services	9	56.25	5	41.67	3	33.33	1	100	18	42.86
10	Lack of transport for safe transport of the Agril produce to the market.	11	68.75	7	58.33	7	77.78	1	100	26	61.9
11	Less rainfall	3	18.75	8	66.67	3	33.33	0	0	14	33.33
12	Source of Agri-technology information	3	18.75	4	33.33	3	33.33	0	0	10	23.81

Farming constraints: The data regarding farming constraints experienced by households in Halawadi Micro watershed is presented in Table 56. The results indicated that, lower fertility status of the soil was the constraint experienced by (64.29 %) per cent of the households, wild animal menace on farm field (57.14%), frequent incidence of pest and diseases (66.67%), inadequacy of irrigation water (61.90%), high cost of fertilizers and plant protection chemicals (73.81%), high rate of interest on credit (73.81%), low price for the agricultural commodities (61.90 %), lack of marketing facilities in the area (66.67%), inadequate extension services (42.86 %), lack of transport for safe transport of the agricultural produce to the market (61.90%), less rainfall (33.33%), source of agri-technology information (Newspaper/TV/Mobile) (23.81%).

Chapter 5

SUMMARY AND IMPLICATIONS

In order to assess the socio-economic condition of the farmers in the watershed 42 households located in the micro watershed were interviewed for the survey. The study was conducted in Halawadi micro-watershed (Bettageri sub-watershed, Koppal taluk & District) is located at North latitude 15^0 11' 54.604" and 15^0 9' 51.215" and East longitude 75^0 58' 33.457" and 75^0 56' 52.871"covering an area of about 524.88 ha bounded by under Halavagali, Kallahalli, Alavandi and Hyderanagar Villages.

Socio-economic analysis of Halawadi micro watersheds of Bettageri sub-watershed, Koppal taluk & District indicated that, out of the total sample of 42 total respondents, 16 (38.10 %) were marginal, 12 (28.57%) were small, 9 (21.43 %) were Semi medium and 1 (2.38 %) were medium farmers.

The population characteristics of households indicated that, there were 111 (54.15%) men and 94 (45.85 %) were women. The average population of landless was 4, marginal farmers were 4.7, small farmers were 5, semi medium farmers were 5.4 and medium farmers were 5. Majority of the respondents (46.34%) were in the age group of 16-35 years.

Education level of the sample households indicated that, there were 40.49 per cent illiterates, 59.01 percent pre university education and 4.88 per cent attained graduation. About, 92.86 per cent of household heads practicing agriculture and 7.14 per cent of the household heads were engaged as agricultural labourers.

Agriculture was the major occupation for 64.39 per cent of the household members. In the study area, 78.57 per cent of the households possess katcha house and 9.52 per cent possess pucca house. The durable assets owned by the households showed that, 71.43 per cent possess TV, 28.57 per cent possess mixer grinder, 102.38 per cent possess mobile phones and 54.76 per cent possess motor cycles.

Farm implements owned by the households indicated that, 9.52 per cent of the households possess plough, 14.29 per cent possess tractor, 9.52 per cent possess bullock cart and 11.90 per cent possess sprayer. Regarding livestock possession by the households, 4.76 per cent possess local cow and 9.52 per cent possess buffalo.

The average labour availability in the study area showed that**,** own labour men available in the micro watershed was 1.89, women available in the micro watershed was 1.67, hired labour (men) available was 9.66 and hired labour (women) available was 9.

Out of the total land holding of the sample respondents 83.04 per cent (51.66 ha) of the area is under dry condition and the remaining 15.78 per cent area is irrigated land. There were 6.00 live bore wells among the sampled households. Bore well was the major source of irrigation for 14.29 per cent of the households. The major crops grown by

sample farmers are Maize, Bajra, Red gram, Groundnut and Sunflower and cropping intensity was recorded as 99.89 per cent.

Out of the sample households 35.71 percent possessed bank account and 14.29 per cent of them have savings in the account. About 54.76 per cent of the respondents borrowed credit from various sources. Majority of the respondents (100.00%) have borrowed loan for agriculture purpose. Regarding the opinion on institutional sources of credit, 100.00 per cent of the households opined that credit helped to perform timely agricultural operations.

Per hectare cost of cultivation for Maize, Bajra, Red gram, Groundnut and Sunflower was Rs.38281.00 , 20291.06, 23686.60, 40972.51, and 33117.67 with benefit cost ratio of 1:1.40, 1: 1.01, 1: 1.90, 1: 1.30, and 1:1.10 , respectively. Further, 21.43 per cent of the households opined that dry fodder was adequate and 16.67 per cent of the households have opined that the green fodder was adequate.

The average annual gross income of the farmers was Rs. 72246.43 in micro-watershed, of which Rs. 56722.62 comes from agriculture. Sampled households have grown 72 horticulture trees and 68 forestry trees together in the fields and back yards. Households have an average investment capacity of Rs. 928.57 for land development. Source of funds for additional investment is concerned, 2.33 per cent depends on own funds and 16.28 per cent depends on bank loan for land development activities.

Regarding marketing channels, 69.05 per cent of the households have sold agricultural produce to the local/village merchants. Further, 78.57 per cent of the households have used tractor for the transport of agriculture commodity. Majority of the farmers (33.33%) have experienced soil and water erosion problems in the watershed and 61.90 per cent of the households were interested towards soil testing.

Firewood was the major source of fuel for domestic use for 78.57 per cent of the households and 21.43 per cent households has LPG connection. Piped supply was the major source for drinking water for 38.10 per cent of the households. Electricity was the major source of light for 97.62 per cent of the households. In the study area, 45.24 per cent of the households possess toilet facility.

Regarding possession of PDS card, 92.86 per cent of the households possessed BPL card and 4.76 per cent of the household's were not having ration cards. Households opined that, the requirement of cereals (66.67%), pulses (26.19%) and oilseeds (40.48%) are adequate for consumption.

Farming constraints experienced by households in the micro watersheds were lower fertility status of the soil (64.29%) wild animal menace on farm field (57.14%), frequent incidence of pest and diseases (66.67%), inadequacy of irrigation water (61.90%), high cost of fertilizers and plant protection chemicals (73.81%), high rate of interest on credit (73.81%), low price for the agricultural commodities (61.90%), lack of

marketing facilities in the area (66.67%), inadequate extension services (42.86%), lack of transport for safe transport of the agricultural produce to the market (61.90%), Less rainfall (33.33%) and Source of Agri-technology information (Newspaper/ TV/Mobile) (23.81%).

Implications of the survey

- ✓ Result indicated that, there were 40.49 per cent were illiterate hence; extension methodologies such as demonstration, street play, drama, video shows will be effective in dissemination of the technologies in the micro watershed.
- ✓ The data indicate that, 78.57 per cent of the households possess katcha house. Hence, the development department while implementing the watershed plan should focus on agriculture to enhance the productivity of major crops in the area to increase the income of the farmers.
- ✓ Results indicated that the local institutional participation of the household members in the micro watershed is minimal hence, activities like membership campaign, awareness creation about the benefits of membership in local institutions and strengths of organized groups must be conveyed.
- ✓ Majority of the households in the watershed have experience in use of mobile phones, and television hence, these mass media can be effectively utilized for transfer of technology as well as for information dissemination.
- ✓ The farm machinery/implement possession in the micro watershed was found to be minimum the reasons may lack of knowledge or lack of financial ability which can be addressed through training on use of different farm implements, providing information on different sources of finance for purchase of farm implements.
- ✓ The possession of livestock such as crossbred cow found is less hence, farmers must be made aware of the benefits of crossbred cow in increased milk production.
- ✓ The possession of livestock such as sheep, goat and poultry was found to be low hence, farmers may be informed the role of subsidiary enterprises in enhancing the income and information on financial support for subsidiary activities.
- ✓ The data indicate that, job/work was the reason for all the migrants hence, farmers may be trained on profitable agriculture or self employment such has animal husbandry, plate making, sheep rearing, goat rearing, rabbit rearing with suitable information on sources of financial support.
- ✓ The results indicate that there was a change in quality of life due to migration hence, the developmental departments should take actions to arrest migration and to improve the quality of the life in rural areas.
- ✓ Households possess 42.90 (83.04 %) of dry land and 8.15ha (15.78 %) of irrigated land hence, the availability of the dry land agricultural technologies such as short duration crops, high yielding drought resistance crop varieties, drip irrigation technology and subsidy information will be helpful for the farmers to enhance the productivity of land and as well as farmers income.

- ✓ Few of the bore well in micro watershed found non functional hence, farmers may be trained on possibility of bore well rejuvenation.
- ✓ Open well was major source of irrigation for 0.00 per cent of the households. Hence, in order to increase the area under irrigation as well as to increase the water use efficiency farmers may trained on drip irrigation and provide the information on subsidy for drip irrigation equipment's along with the information on different agencies which provides the financial assistance for drip irrigation.
- ✓ The cropping intensity in the micro watershed was found to be (99.89 %) hence, care must be taken by the implementing agency to bring uncultivated land into cultivation through suitable measures.
- ✓ Many of the household members have borrowed loan from cooperative banks which has higher rate of interest hence, farmers may be sensitized on the different sources of credit with lesser interest rate such SHGs etc.
- ✓ The results indicated the non availability of both green and dry fodder throughout the year hence, fodder development activities can be taken up in the micro watershed.
- ✓ The average annual gross income of the households Rs.56722.62 from agriculture, and Rs. 5952.38 from wages. Agriculture was found to be the major source of income for households hence; the development activities should focus on productivity enhancement, marketing arrangements and agricultural technology dissemination to have a direct impact on the farmers.
- ✓ The cultivation of forest species is found minimal hence; information and production technology related to agro-forestry and integrated farming system.
- ✓ The data indicated that, 33.33 per cent of the households have experienced soil and water erosion problems. Hence, those farmers who reported the soil and water erosion problems may be given attention while implementation of the watershed development plan.
- ✓ The data indicated that, 61.90 per cent of the households have interest in soil testing hence, farmers must be provided with the information on various institutions which are involved in soil testing for the benefit of the farmers.
- ✓ Except summer ploughing the adoption of other soil and water conservation structures is minimum hence, the farmers in the micro watershed should be sensitized on the use of different conservation structures for soil water conservation.
- ✓ Cereals and pulses found be adequate for per cent of the households respectively hence, farm households and the farm women must be trained on importance of balanced nutrition and role of vegetable, milk, egg, meat in balanced diet.
- ✓ Lower fertility status of the soil (64.29%), wild animal menace on farm field (57.14%), frequent incidence of pest and diseases (66.67%), high cost of fertilizers and plant protection chemicals (73.81%), high rate of interest on credit (73.81%), low price for the agricultural commodities (61.90%), lack of marketing facilities in the area (66.67%), inadequate extension services (42.86%), lack of transport for safe

transport of the agricultural produce to the market (61.90%) were the major farming constraints experienced hence, these constraints must be addressed immediately for the welfare of the farmers. Awareness to be created among the farmers to approach nearest KVKs/RSKs and other developmental departments for technical and for subsidized inputs and utilize the well established regulated markets, approaching the contract firms, direct markets to avoid the involvement of middlemen.