ICAR-NBSS&LUP Sujala MWS Publ.545

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

VIRAPURA-2 (4D4A1Q1e) MICRO WATERSHED

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 Virapura-2 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:11-11-2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Virapura-2 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 581 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 96 per cent is covered by soils and 4 per cent is by habitation and settlements. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 11 soil series and 23 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.*
- *An area of about 96 per cent is suitable for agriculture.*
- *An area of about 18 per cent of the soils are very shallow to shallow (<25-50 cm), 38 per cent of the soils are moderately shallow to moderately deep (50-100 cm) and 40 per cent soils are deep to very deep (100->150 cm).*
- *Entire cultivated area of the microwatershed has clayey (sandy clay and clay) soils at the surface.*
- *An area of about 64 per cent area has non-gravelly (<15% gravel) soils and 32 per cent has gravelly to very gravelly (15-60% gravel) soils.*
- *An area of about 32 per cent area is very low to low (<50-100 mm/m), 23 per cent area is medium (101-150 mm/m) and 40 per cent area is very high (>200 mm/m) in available water capacity.*

- *An area of about 24 per cent area of the microwatershed has nearly level (0-1% slope) lands and 72 per cent area of the microwatershed has very gently sloping (1-3% slope) lands.*
- *An area of about 48 per cent area is moderately (e2) eroded and about 48 per cent area is slightly (e1) eroded.*
- *An entire cultivated area of the microwatershed falls under strongly alkaline to very strongly alkaline (pH 8.4->9.0) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils in the entire cultivated area of the microwatershed is <2 dsm^{-1} indicating that the soils are non-saline.*
- *Organic carbon is high (>0.75%) in 17 per cent area, medium (0.5-0.75%) in 67 per cent area and low (<0.5%) in 12 per cent area of the microwatershed.*
- *An area of about 56 per cent is medium (23-57 kg/ha) and 39 per cent is low (<23 kg/ha) in available phosphorus.*
- *An area of about 8 per cent is medium (145-337 kg/ha) and 88 per cent is high (>337 kg/ha) in available potassium.*
- *Available sulphur is medium (10 -20 ppm) in 29 per cent area and low (<10 ppm) in 67 per cent area of the microwatershed.*
- *An area of about 74 per cent is low (<0.5ppm) and 21 per cent is medium (0.5-1.0 ppm) in available boron content.*
- *An area of about 23 per cent is sufficient (>4.5 ppm) and 73 per cent is deficient (<4.5 ppm) in available iron content.*
- *Entire cultivated area of the microwatershed is sufficient (>1.0 ppm) in available manganese content.*
- *Entire cultivated area of the microwatershed is sufficient (>0.2 ppm) in available copper content.*
- *An area of about 95 per cent is deficient (<0.6 ppm) and <1 per cent is sufficient (>0.6 ppm) in available zinc content.*
- *The land suitability for 31 major crops grown in the microwatershed was assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, 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	*125(21)*	*325(56)*		*Sapota*	-	-
Maize	-	*450(78)*		*Pomegranate*	-	*366(63)*
Bajra	-	*450(78)*		*Guava*	-	-
Groundnut	-	-		*Jackfruit*	-	-
Sunflower	*77(13)*	*289(50)*		*Jamun*	-	*230(40)*
Cotton	*125(21)*	*325(56)*		*Musambi*	*77(13)*	*289(50)*
Red gram	-	*288(49)*		*Lime*	*77(13)*	*289(50)*
Bengalgram	*125(21)*	*326(56)*		*Cashew*	-	-
Chilli	-	*72(12)*		*Custard apple*	*125(21)*	*325(56)*
Tomato	-	*7(1)*		*Amla*	*7(1)*	*443(76)*
Brinjal	-	*449(78)*		*Tamarind*	-	*230(40)*
Onion	-	-		*Marigold*	-	*449(78)*
Bhendi	-	*449(78)*		*Chrysanthemum*	-	*449(78)*
Drumstick	-	*366(63)*		*Jasmine*	-	*83(14)*
Mulberry	-	*194(33)*		*Crossandra*	-	*150(26)*
Mango	-	-				

- *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 for these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. 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

Soil is a finite natural resource that is central to sustainable agriculture and food security. Over the years, this precious resource is faced with the problems of erosion, salinity, alkalinity, degradation, depletion of nutrients and even decline in availability of land for agriculture. It is a known fact, that it takes thousands of years to form a few centimetres of soil, thus, soil is a precious gift of nature. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agro-climatic setting, and use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. As much as 121 m ha of land is reportedly degraded which leads to impaired soil quality. It is imperative that steps are urgently taken to check and reverse land degradation without any further loss of time. The improvements in productivity will have to come from sustainable intensification measures that make the most effective use of land and water resources. 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.

Added to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Thus, developing strategies to slow down the degradation process or reclaim the soils to normal condition and ensure sustainability of production system are the major issues today. This demands a systematic appraisal of our soil and land resources with respect to their extent, geographic distribution, characteristics, behaviour and uses potential, which is very important for developing an effective land use and cropping systems for augmenting agricultural production on a sustainable basis. The soil and land resource inventories made so far in Karnataka had limited utility because the surveys were of different types, scales and intensities carried out at different times with specific objectives. Hence, there is an urgent need to generate

detailed site-specific farm level database on various land resources for all the villages/watersheds in a time bound manner that would help to protect the valuable soil and land resources and also to stabilize the farm production.

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

The Land Resource Inventory is basically done for identifying potential and problem areas, developing sustainable land use plans, estimation of surface run off and water harvesting potential, preparation of soil and water conservation plans, land degradation/desertification etc. The Bureau is presently engaged in developing an LRI methodology using high resolution satellite remote sensing data and Digital Elevation Model (DEM) data to prepare Landscape Ecological Units (LEU) map representing agro-ecosystem as a whole. The LEU is preferred over landform as the base map for LRI. LEU is the assemblage of landform, slope and land use. An attempt 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 Virapura-2 microwatershed in Koppal Taluk and 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 scales 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 Virapura-2 Microwatershed is located in the central part of northern Karnataka in Koppal Taluk, Koppal District, Karnataka State (Fig.2.1). It comprises parts of Kinnala, Mudhlapura & Madhinura villages. It lies between $15^0$25' – $15^0$26' North latitudes and $76^0$05'– $76^0$07' East longitudes and covers an area of 581 ha. It is about 13 km from Koppal town and is surrounded by Mudhlapura village on the north, Madhinura village on the west, southwest, south and southeast and Kinnala village on the eastern side of the microwatershed.

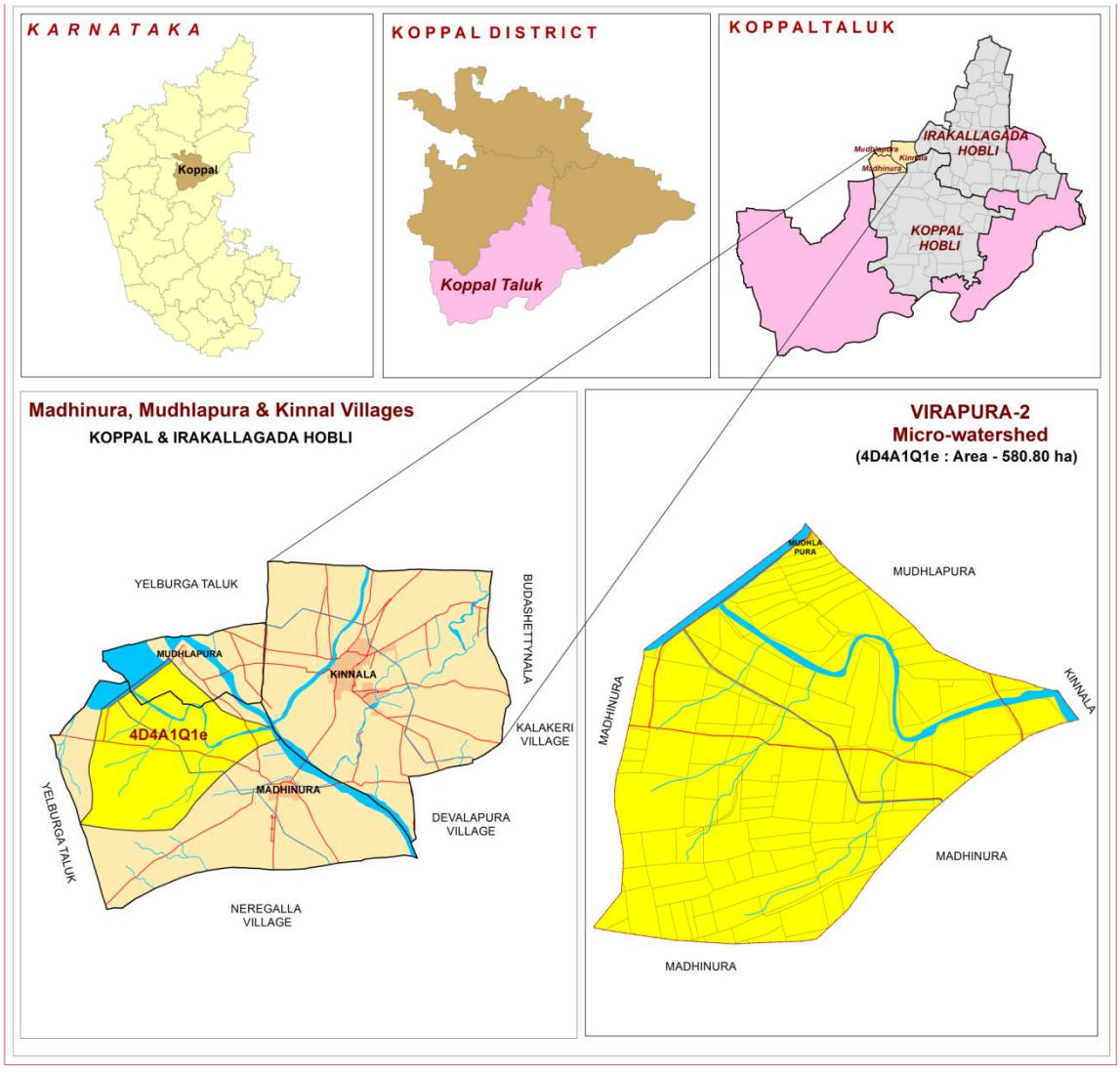


Fig.2.1 Location map of Virapura-2 Microwatershed

2.2 Geology

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

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

Fig.2.2a Granite and granite gneiss rocks

Fig.2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as Granite gneiss and Alluvial landscapes based on geology. The microwatershed area has been further divided into mounds/ridges, summits, side slopes and very gently sloping uplands and nearly level plains based on slope and its relief features. The elevation ranges from 530-562 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought - prone with total annual rainfall of 662 mm (Table 2.1) Of this, a maximum of 424 mm precipitation takes place 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 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 and 193 mm in the months 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**	

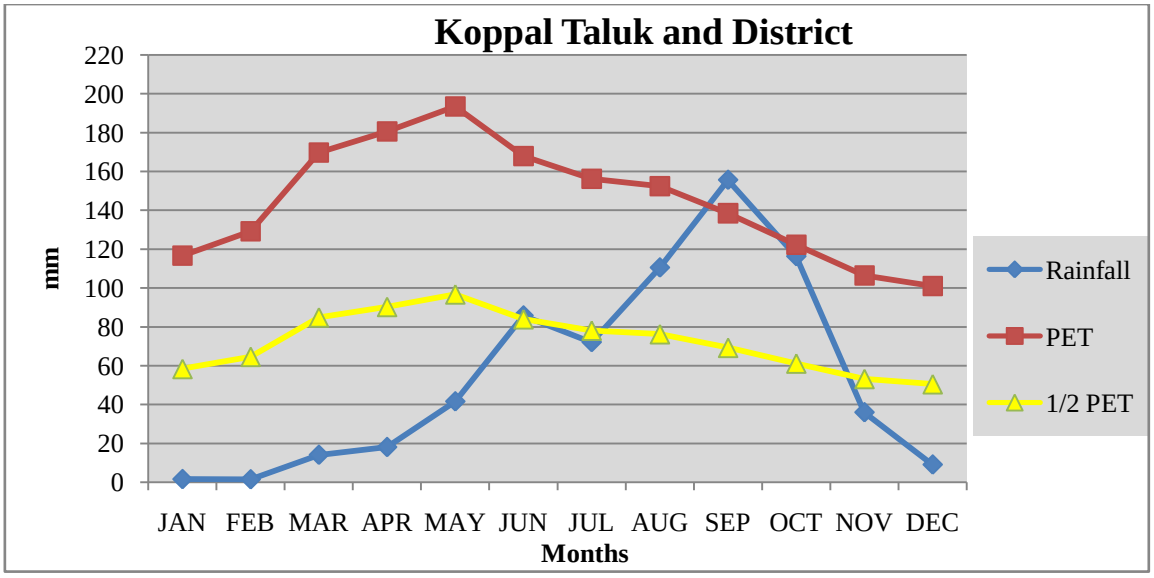


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

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 Virapura-2 microwatershed

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, Bengalgram, marigold 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 Virapura-2 Microwatershed is presented in Fig.2.6. Simultaneously, enumeration of existing wells (bore wells and open wells) and other soil and water conservation structures in the microwatershed is made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and conservation structures in Virapura-2 Microwatershed is given Fig.2.7.

Table 2.2 Land Utilization in Koppal District

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

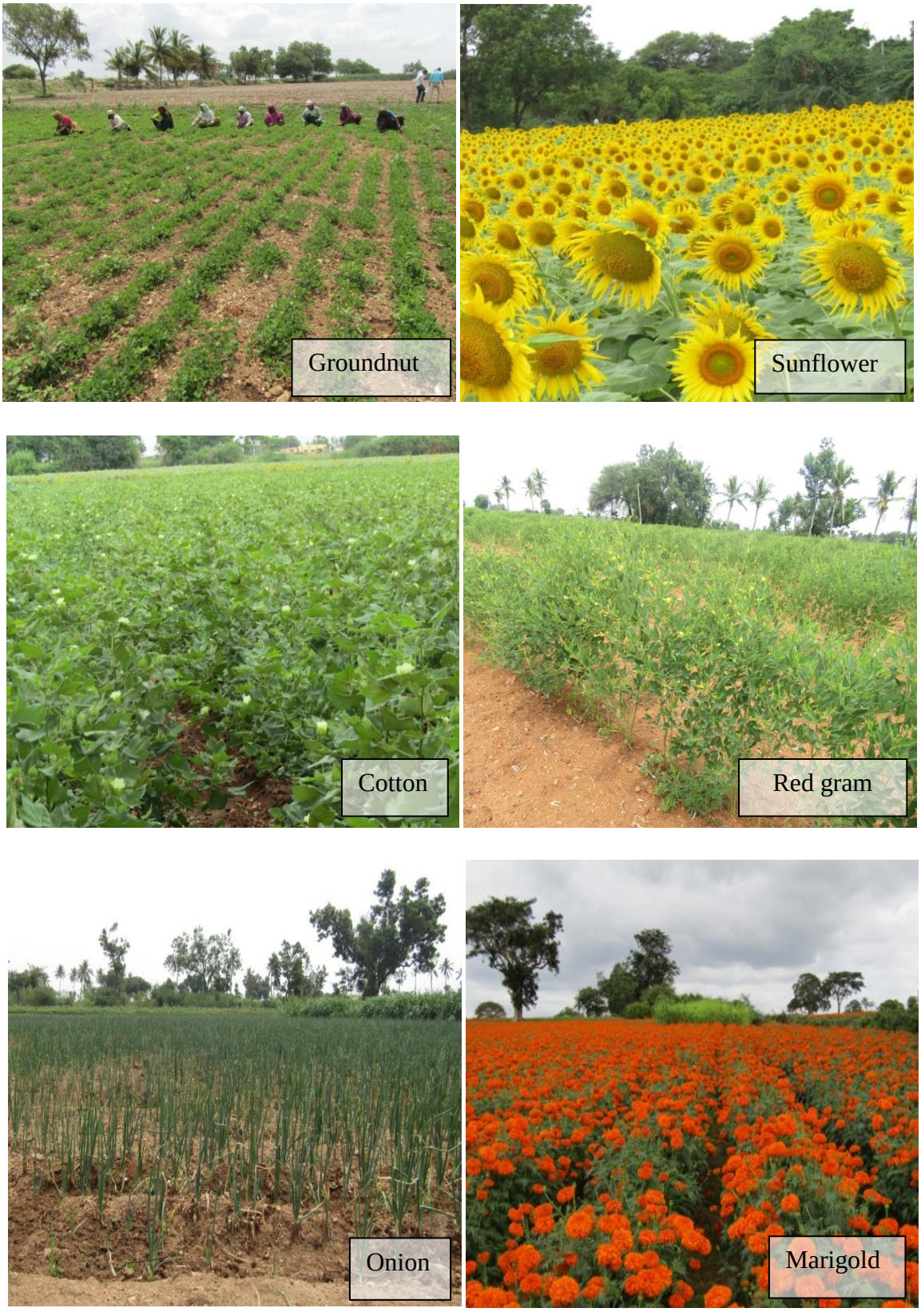


Fig.2.5 Different crops and cropping systems in Virapura-2 Microwatershed

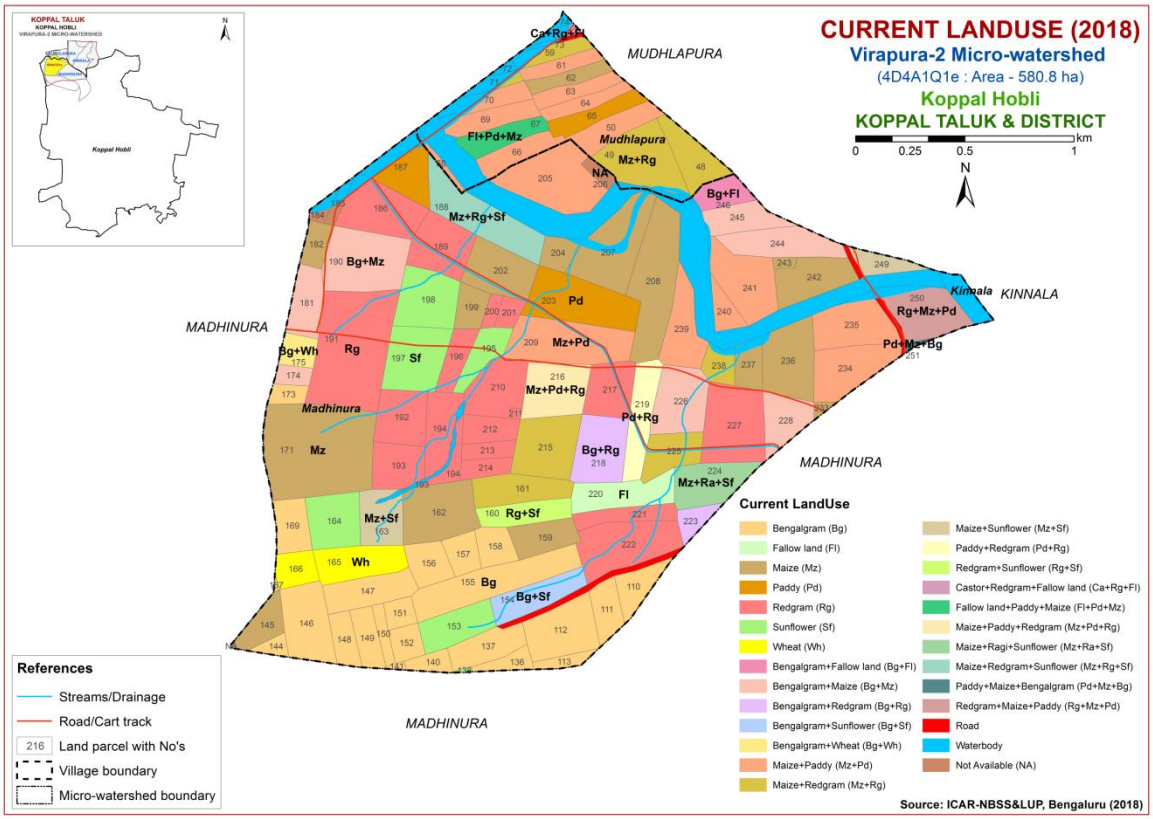


Fig.2.6 Current Land Use – Virapura-2 Microwatershed

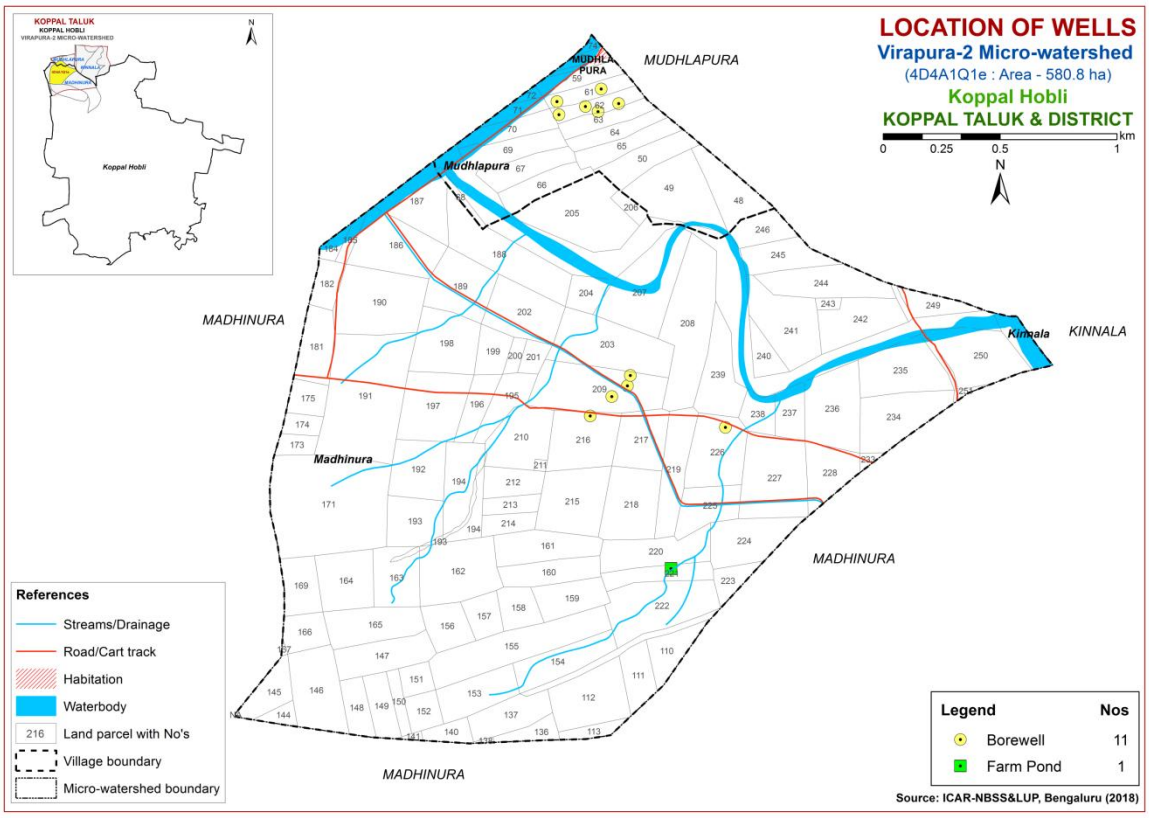


Fig.2.7 Location of wells and conservation structures - Virapura-2 Microwatershed

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 Virapura-2 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 581 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

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

interpretation units based on image characteristics. The image interpretation legend for physiography is given below.

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

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

DSe Alluvial landscape

DSe 1 Summit

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

DSe 2 Very gently sloping

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

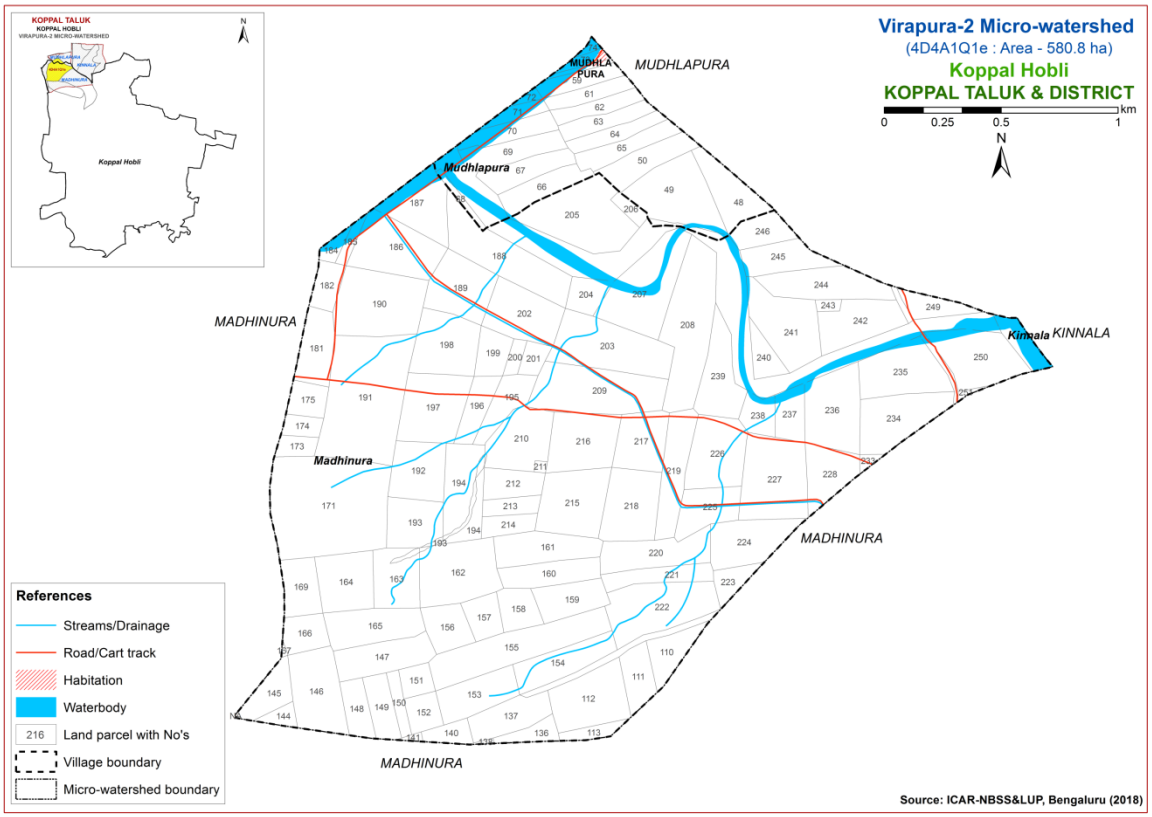


Fig 3.1 Scanned and Digitized Cadastral map of Virapura-2 Microwatershed

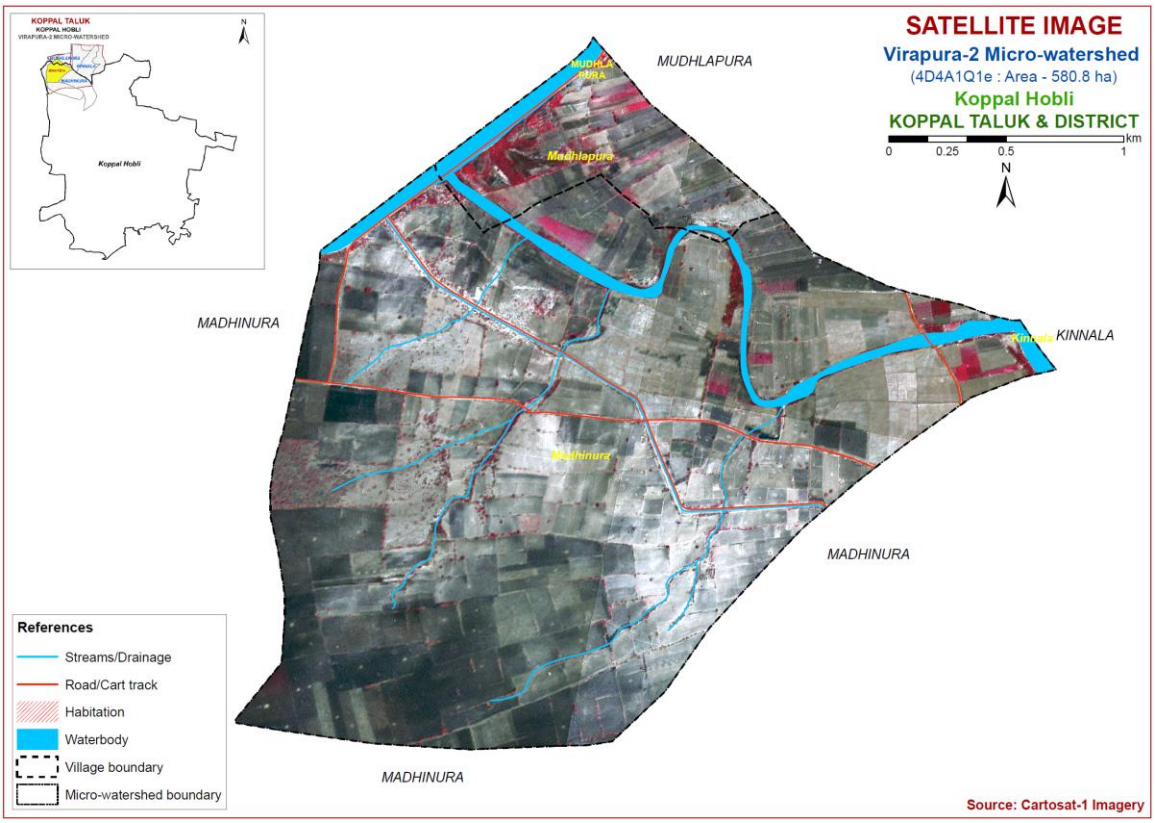


Fig.3.2 Satellite Image of Virapura-2 Microwatershed

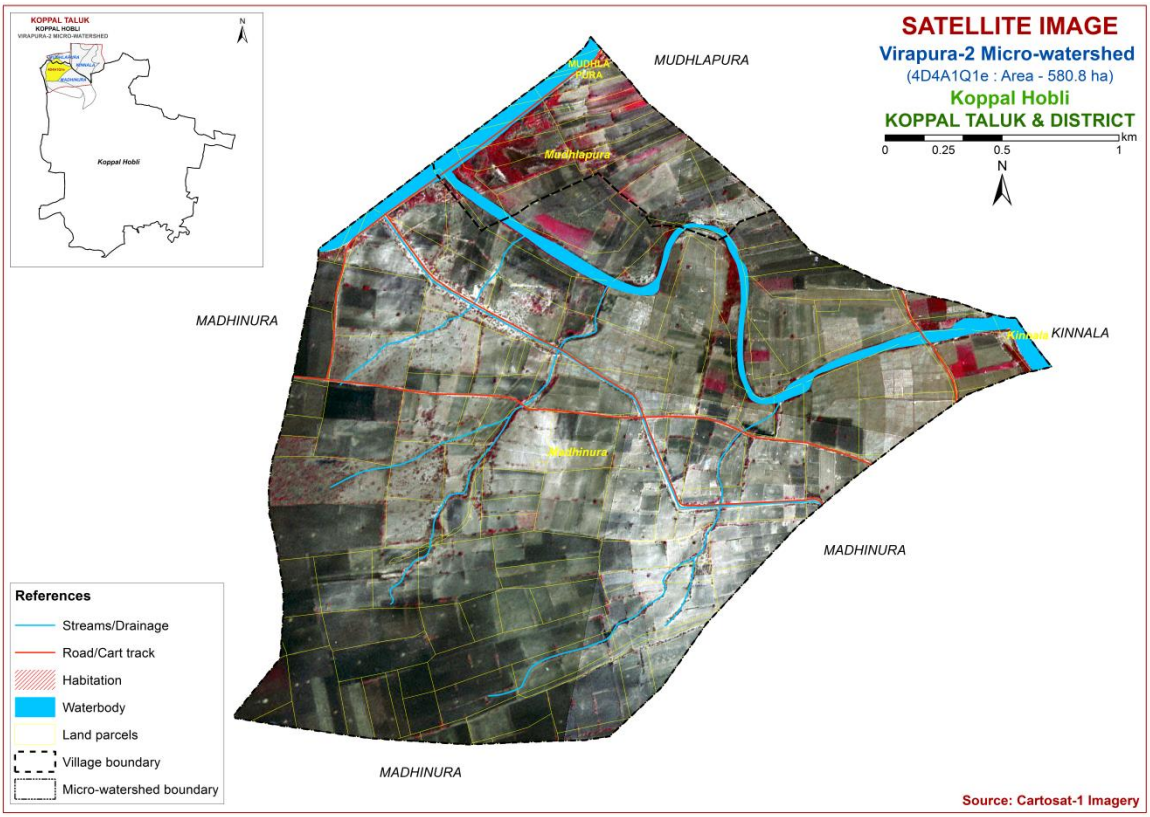


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Virapura-2 Microwatershed

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 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).

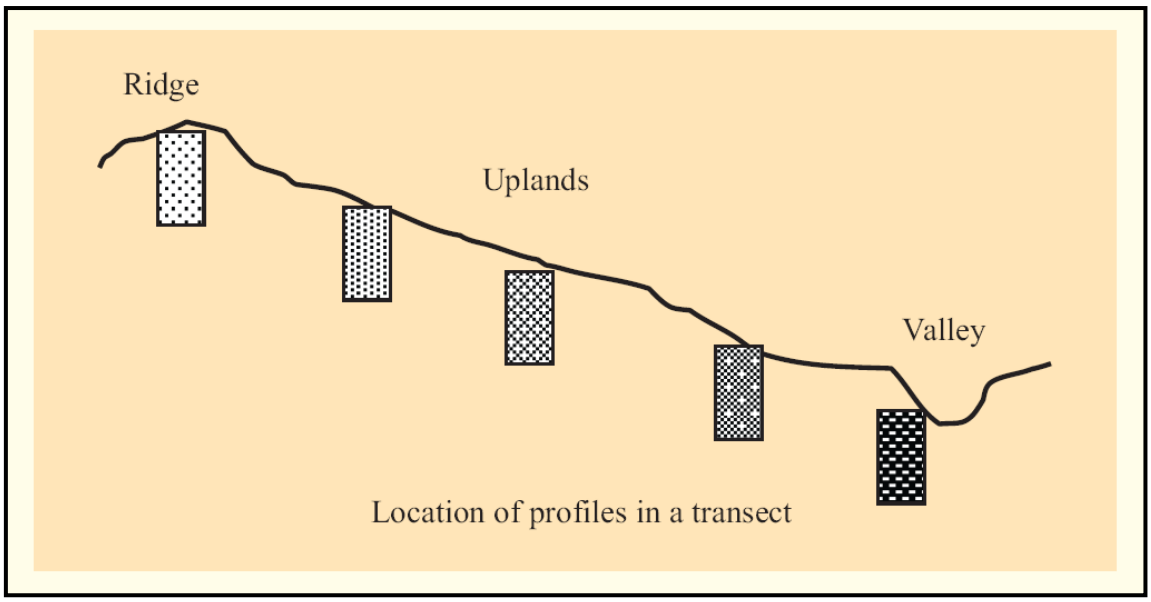


Fig: 3.4. Location of profiles in a transect

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 up to 200 cm or to the depth limited by rock or hard substratum and studied in detail for all their morphological and physical characteristics. The soil and site characteristics were recorded for all profile sites on a standard proforma as per the guidelines given in USDA Soil Survey Manual (Soil Survey Staff, 2012). Apart from the transect study, profiles were also studied at random, almost like in a grid pattern, outside the transect areas 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, 11 soil series were identified in Virapura-2 Microwatershed.

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

Sl. No.	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareou-sness
SOILS OF GRANITE GNEISS LANDSCAPE							
1	Belagatti (BGT)	<25	10 YR3/1, 3/2, 4/2	gc	>35	Ap-Crk	es
2	Sirur (SRR)	100-150	10YR3/2,3/1,3/3, 5/2	c	<15	Ap-Bw-BCk-Crk	es-ev
SOILS OF ALLUVIAL LANDSCAPE							
3	Muttal (MTL)	25-50	10YR3/2,3/3,4/2 7.5YR3/2,3/3,6/4	gc	15-35	Ap-Bw-Ck	e-ev
4	Ravanaki (RNK)	50-75	7.5YR3/2,3/3,5/2,5/3 10YR3/1,3/2,4/1,4/2, 5/1,6/1	c	<15	Ap-Bw-Cr	e-ev
5	Dambarahalli (DRL)	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bss	e-es
6	Narasapura (NSP)	75-100	10 YR 3/1, 3/2, 4/2,	c	<15	Ap-Bw-Cr	e-es
7	Handrala (HDL)	100-150	10 YR 2/1, 3/1,4/1,	c	<15	Ap-Bss-Ck	es
8	Lakshmangudda (LGD)	100-150	10YR3/1,3/2,4/1,4/2 7.5YR3/1,3/2,5/1 2.5Y5/2,5/3,6/3	c	<15	Ap-Bss-Ck	es
9	Alawandi (AWD)	>150	10 YR 2/1, 3/2,	c	<15	Ap-Bss	e-es
10	Bardur (BDR)	>150	10YR 2/1, 3/1, 3/2	c	<15	Ap-Bss	es
11	Murlapur (MLR)	>150	10YR 2/1, 2/2, 3/1, 3/2, 4/1	c	10-20	Ap-Bss	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 minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map. The soil map shows the geographic distribution and area extent of 23 mapping units representing 11 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 23 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has

similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples for each series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2018 from Virapura-2 farmer's fields (60 samples) for fertility status (major and micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

3.6 Land Management Units (LMUs)

The 23 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 choosen for identification and delineation of LMUs. For Virapura-2 Microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope erosion and gravel content have been considered for defining LMUs. The land management units are expected to behave similarly for a given level of management.

Table 3.2 Soil map unit description of Virapura-2 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
SOILS OF GRANITE GNEISS LANDSCAPE				
	BGT	Belagatti soils are very shallow (< 25 cm), well drained, have very dark gray to very dark grayish brown, calcareous, gravelly black clay soils occurring on very gently to gently sloping uplands under cultivation		**25(4.27)**
6		BGTiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	16(2.78)
11		BGTmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	9(1.49)
	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		**7(1.21)**
474		SRRmA1	Clay surface, slope 0-1%, slight erosion	7(1.21)
SOILS OF ALLUVIAL LANDSCAPE				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous, black gravelly		**80 (13.8)**

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
		clay soils occurring on nearly level to gently sloping plains under cultivation		
308		MTLmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	35(5.99)
309		MTLmB1g2	Clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	13(2.27)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	32(5.54)
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, calcareous, clay black soils occurring on nearly level to very gently sloping plains under cultivation		**83 (14.35)**
331		RNKiB2g1	Sandy clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	10(1.67)
332		RNKmA1g1	Clay surface, slope 0-1%, slight erosion, gravelly (15-35%)	10(1.81)
333		RNKmB1	Clay surface, slope 1-3%, slight erosion	12(2.1)
334		RNKmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	4(0.68)
336		RNKmB2	Clay surface, slope 1-3%, moderate erosion	29(4.93)
337		RNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	18(3.16)
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous, black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**88(15.29)**
344		DRLmA1	Clay surface, slope 0-1%, slight erosion	9 (1.59)
350		DRLmB2	Clay surface, slope 1-3%, moderate erosion	42(7.26)
351		DRLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	37(6.44)
	NSP	Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, sodic, calcareous, cracking black clay soils occurring on nearly level to very gently sloping plains under cultivation		**47(8.16)**
362		NSPmB2	Clay surface, slope 1-3%, moderate erosion	47(8.16)
	HDL	Handrala soils are deep (100-150 cm), moderately well drained, have dark gray to very dark gray, calcareous, black cracking clay soils occurring on very gently sloping plains under cultivation		**58(9.96)**
378		HDLmA1	Clay surface, slope 0-1%, slight erosion	21(3.57)
382		HDLmB2	Clay surface, slope 1-3%, moderate erosion	37(6.39)
	LGD	Lakshmangudda soils are deep (100-150 cm), well drained, have light olive brown to very dark gray, calcareous, clay		**62(10.74)**

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
		soils occurring on nearly level uplands under cultivation		
393		LGDmB1	Clay surface, slope 1-3%, slight erosion	62(10.74)
	AWD	Alawandi soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to black , calcareous, black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**65(11.08)**
421		AWDmA1	Clay surface, slope 0-1%, slight erosion	64(11.06)
422		AWDmB1	Clay surface, slope 1-3%, slight erosion	1(0.2)
	BDR	Bardur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous, black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**12(2.15)**
430		BDRmB1	Clay surface, slope 1-3%, slight erosion	12(2.15)
	MLR	Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous, black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**26(4.4)**
411		MLRmA1	Clay surface, slope 0-1%, slight erosion	26(4.4)
1000		Habitation & water body	Area under Habitation and Water body	**26(4.43)**

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

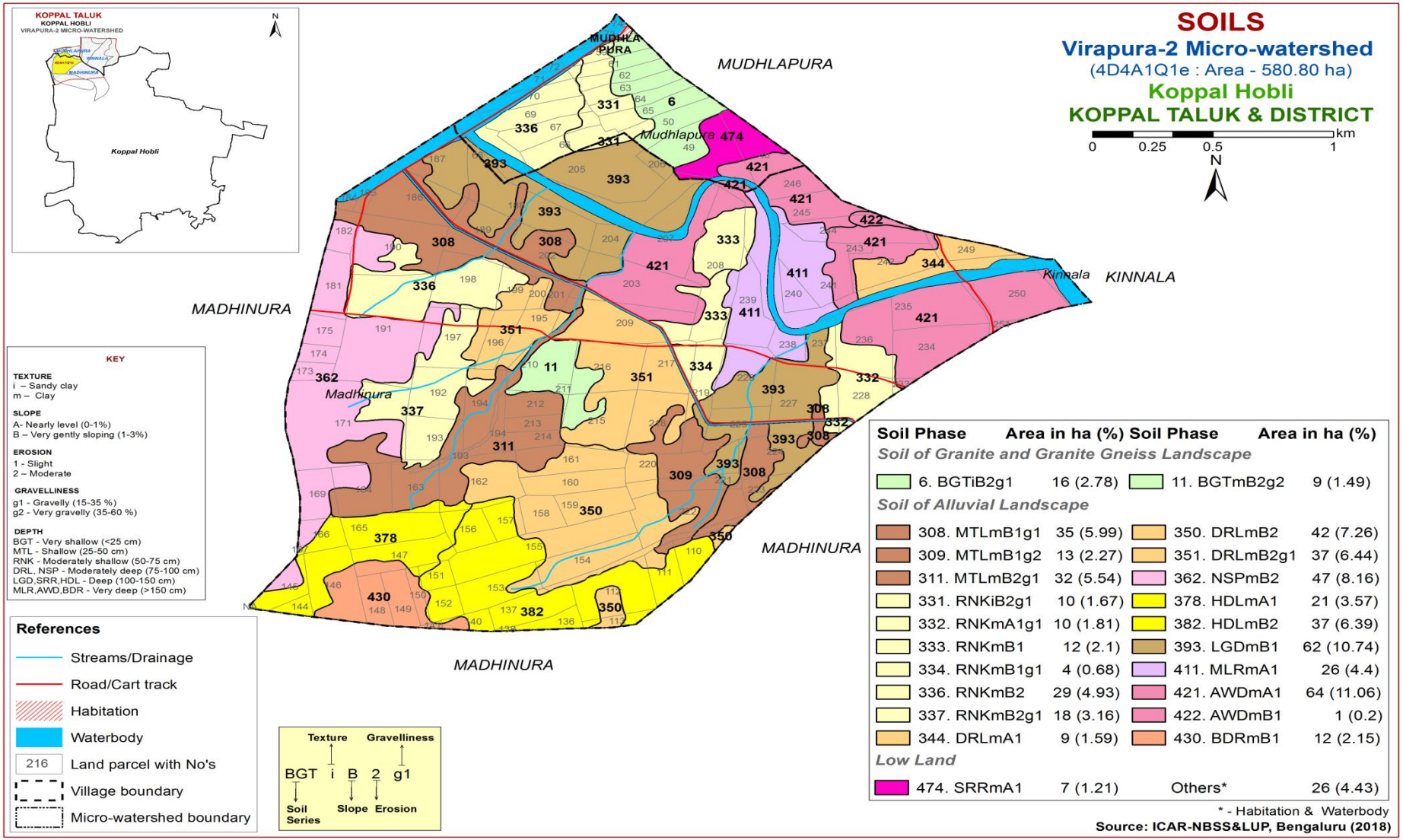


Fig 3.5 Soil Phase or Management Units- Virapura-2 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Virapura-2 Microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 11 soil series are identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 11 soil series identified followed by 23 soil phases (management units) mapped (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Virapura-2 microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite gneiss landscape

In this landscape, 2 soil series are identified and mapped. Of these, Belagatti (BGT) series occupies major area of 25 ha (4%) followed by Sirur (SRR) 7 ha (1%). The brief description of each soil series along with the soil phases identified and mapped is given below.

4.1.1 Belagatti (BGT) Series: Belagatti soils are very shallow (< 25 cm), well drained, have dark gray to dark grayish brown, calcareous, gravelly clay soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands. The Belagatti series has been classified as a member of the clayey-skeletal, mixed, isohyperthermic family of Lithic Ustorthents.

The thickness of the soil is less than 25 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay with more than 35 per cent gravel, and the available water capacity is very low (<50 mm/m). Two soil phases were identified and mapped.

Landscape and soil profile characteristics of Belagatti (BGT) Series

4.1.2 Sirur (SRR) Series: Sirur soils are deep (100-150cm), moderately well drained, very dark grayish brown to grayish brown, calcareous, cracking clay soils. They have developed from weathered granite gneiss 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 is 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

4.2 Soils of Alluvial landscape

In this landscape, 9 soil series were identified and mapped. Of these, Dambarahalli (DRL) series occupies major area of 88 ha (15%) followed by Ravanaki (RNK) 83 ha (14%), Muttal (MTL) 80 ha (14%), Alawandi (AWD) 65 ha (11%), Lakshmangudda (LGD) 62 ha (11%), Handrala (HDL) 58 ha (10%), Narasapura (NSP) 47 ha (8%), Murlapur (MLR) 26 ha (4%) and Bardur (BDR) 12 ha (2%)**.** The brief description along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 30 to 50 cm. The thickness of A-horizon ranges from 15 to 18 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 18 to 32 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay. The available water capacity is low (51-100 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Muttal (MTL) Series

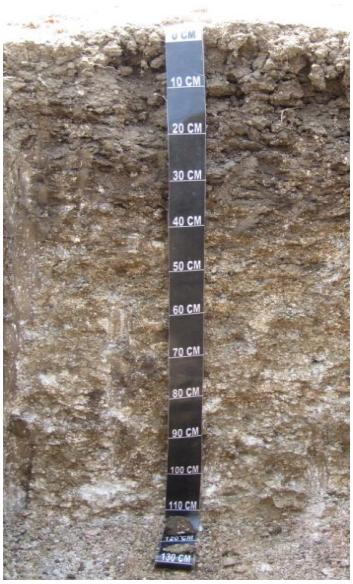
4.2.2 Ravanaki (RNK) Series: Ravanaki soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, calcareous, clay soils. They have developed from alluvium and occur on nearly level to very gently sloping plains. The Ravanaki series has been classified as a member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

The thickness of the solum ranges from 50 to 75 cm. The thickness of A-horizon ranges from 15 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 35 to 60 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 6 and chroma 2 to 4. Its texture is sandy clay to clay with gravel content of 10 to 20 per cent. The available water capacity is low (51-100 mm/m). Six soil phases were identified and mapped.

Landscape and Soil Profile Characteristics of Ravanaki (RNK) Series

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

The thickness of the solum ranges from 75 to 99 cm. The thickness of A-horizon ranges from 13 to 24 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay. The thickness of B horizon ranges from 54 to 85 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is high (151-200 mm/m). Three soil phases were identified and mapped.

Landscape and soil profile characteristics of Dambarahalli (DRL) Series

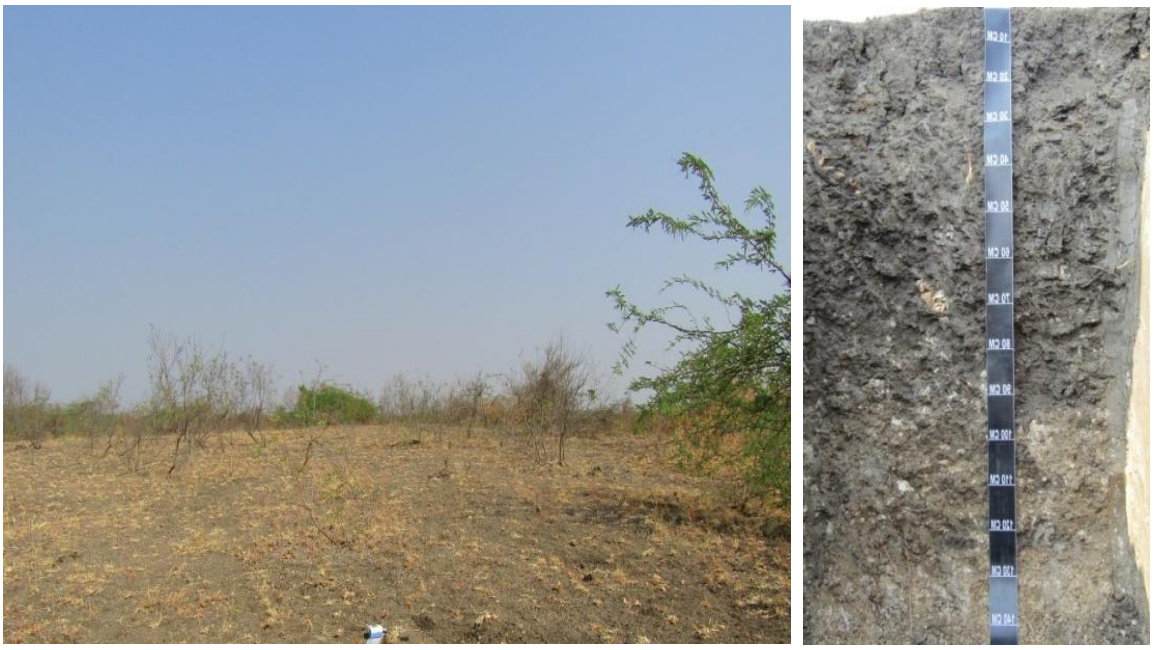
4.2.4 Narsapura (NSP) Series: Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, sodic, calcareous, black cracking clay soils. They have developed from alluvium and occur on very gently sloping plains. The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

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


Landscape and soil profile characteristics of Narsapura (NSP) Series

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

The thickness of the solum ranges from 102 to 149 cm. The thickness of A-horizon ranges from 14 to 26 cm. Its colour is in 10 YR hue with value 3 and chroma 1. The texture is clay. The thickness of B horizon ranges from 103 to 127 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 2. Texture is dominantly clay. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.



Landscape and Soil Profile Characteristics of Handrala (HDL) Series

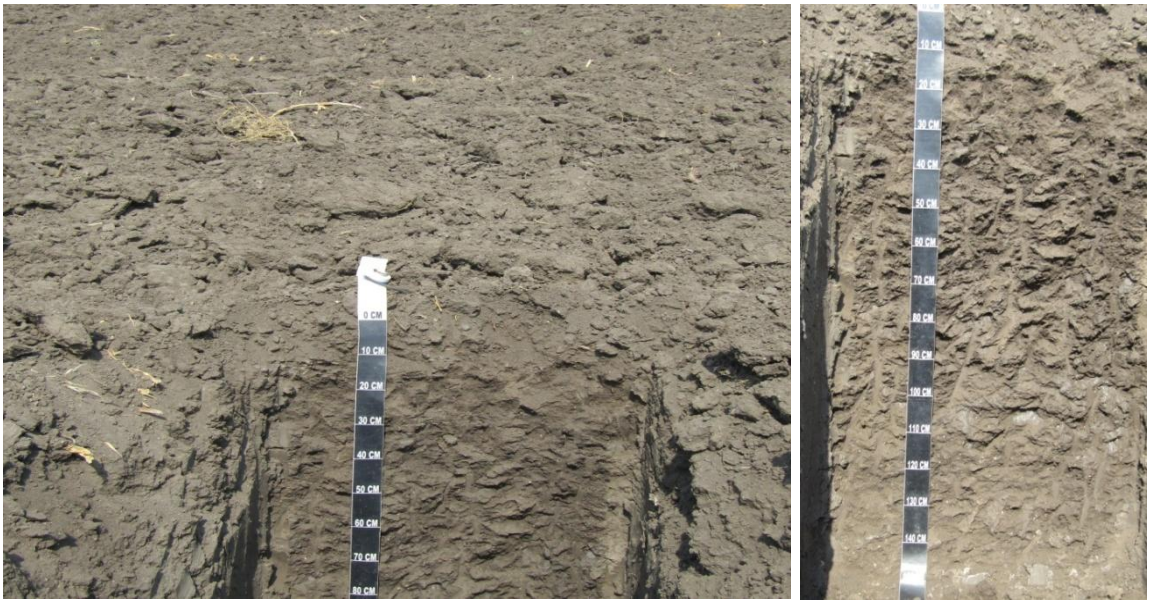
4.2.6 Lakshmangudda (LGD) Series: Lakshmangudda soils are deep (100-150 cm), moderately well drained, have light olive brown to very dark gray, calcareous, cracking clay soils. They have developed from alluvium and occur on nearly level plains. The Lakshmangudda series has been classified as a member of the fine, smectitic (calc), isohyperthermic family of Typic Haplusterts.

The thickness of the solum ranges from 108 to 149 cm. The thickness of A-horizon ranges from 16 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value and chroma 3 to 4. The texture varies from sandy clay to clay with 5 to 10 per cent gravel. The thickness of B horizon ranges from 90 to 132 cm. Its colour is in 2.5 Y, 10 YR and 7.5 YR hue with value 3 to 6 and chroma 1 to 3. Its texture is clay. The available water capacity is high (150-200 mm/m). Only one soil phase was identified and mapped.

Landscape and Soil Profile Characteristics of Lakshmangudda (LGD) Series

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

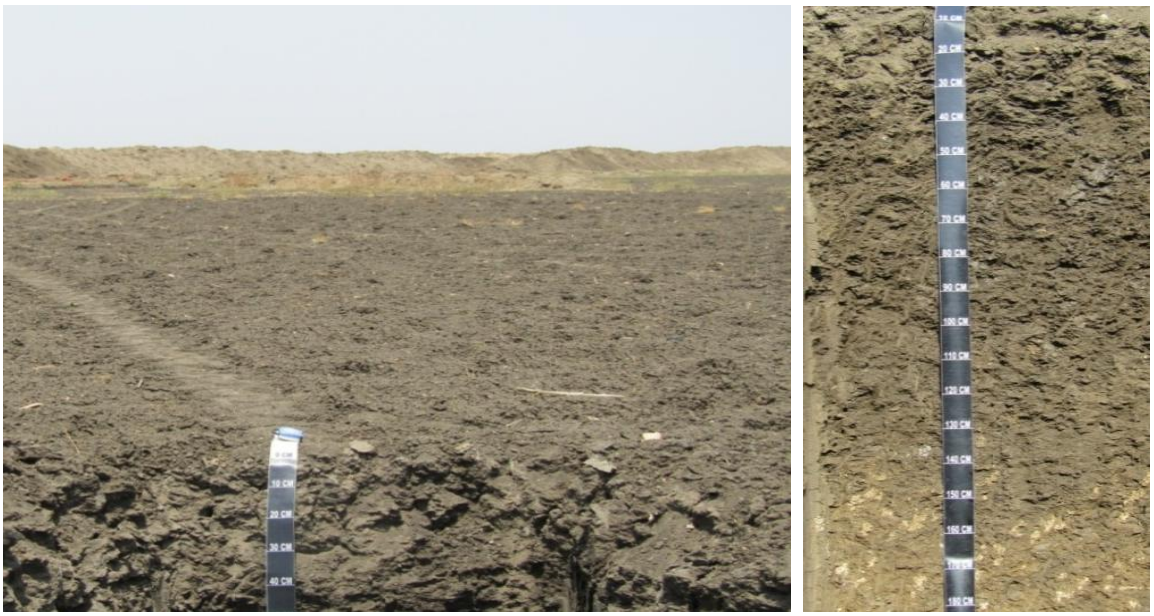
The thickness of the solum is more than 150 cm. The thickness of A-horizon ranges from 16 to 26 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. The texture varies from sandy clay to clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.



Landscape and soil Profile Characteristics of Alawandi (AWD) Series

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

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



Landscape and soil profile characteristics of Bardur (BDR) Series

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

The thickness of the solum is >150 cm. The thickness of A-horizon ranges from 20 to 25 cm. Its colour is in 10 YR hue with value 3 and chroma 1.The texture is clay with no gravel. The thickness of B horizon ranges from 150 to 190 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. Its texture is clay. The available water capacity is very high (>200 mm/m). Only one soil phase was identified and mapped.

Landscape and soil profile characteristics of Murlapur (MLR) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Virapura-2 Microwatershed

Series Name: Belagatti (BGT), **Pedon:** A2/RM-5
Location: $15^0$19'10.8"N, $75^0$57'48.1"E, Kavalura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey-skeletal, mixed (calc), isohyperthermic Lithic Ustorthents

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
0-23	Ap	36.14	20.34	43.52	10.87	6.93	5.97	8.42	3.94	40	c	29.53	17.97

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}							%	%
0-23	8.4			0.157	0.12	18.24			0.73	0.50		44.84	1.03		1.11

Contd....

Series Name: Muttal (MTL), **Pedon:** RM-13
Location: $15^0$14'30.8"N, $75^0$56'50.6"E, Gatareddihalla village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Clayey, mixed (calc), isohyperthermic (Paralithic) Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-20	Ap	39.05	13.74	47.21	3.05	5.05	8.21	14.63	8.11	15-30	c	29.95	17.94
20-34	Bwk	28.77	19.57	51.66	4.81	4.71	4.92	9.09	5.24	10	c	33.44	21.56

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-20	8.27	-	-	0.202	0.79	6.10	-	-	0.62	0.25	-	36.64	0.78	-	0.69
20-34	8.36	-	-	0.177	0.99	23.04	-	-	0.29	0.38	-	39.60	0.77	-	0.96

Contd....

Series Name: Ravanaki (RNK), **Pedon:** RM-20
Location: $15^0$14'22.7"N, $75^0$57'45.8"E, Gatareddihalla village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very-fine, smectitic (calc), isohyperthermic Typic Haplustepts

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-28	8.86	-	-	0.483	0.63	15.48	-	-	0.86	6.27	-	37.00	0.64	-	6.78
28-55	8.61	-	-	1.4	0.23	13.68	-	-	0.68	12.27	-	53.20	0.81	-	9.22

Contd....

Series Name: Dombarahalli (DRL),**Pedon:** R-8
Location: $15^0$13'96.2"N, $75^0$57'48.6" E Ragunathanahalli village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very-fine, smectitic (calc), isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-15	Ap	28.25	19.48	52.27	4.76	4.44	4.87	8.23	5.95	-	c	39.86	27.20
15-27	BA1	21.55	20.00	58.45	3.76	2.76	3.43	6.30	5.30	-	c	46.35	34.84
27-45	Bss1	14.86	20.89	64.25	2.46	2.23	2.23	3.91	4.02	-	c	57.99	41.06
45-80	Bss2	10.42	19.04	70.54	1.74	1.97	1.27	2.78	2.66	-	c	66.36	36.24

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}							%	%
0-15	8.78	-	-	0.42	0.32	12.35	-	-	0.59	4.25	-	49.70	0.95	100.00	5.62
15-27	9.03	-	-	0.61	0.30	12.48	-	-	0.30	8.96	-	57.23	0.98	100.00	10.07
27-45	9.10	-	-	0.67	0.34	11.70	-	-	0.25	11.85	-	60.71	0.95	100.00	14.05
45-80	9.18	-	-	0.86	0.32	13.39	-	-	0.27	15.40	-	63.33	0.90	100.00	18.45

Contd....

Series Name: Narsapura (NSP), **Pedon:** A2/RM-2
Location: $15^0$19'86.9"N, $75^0$57'86.1"E, Kavalura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very-fine, smectitic (calc), isohyperthermic Vertic Haplustepts

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-29	9.16	-	-	0.615	0.23	9.36	-	-	0.72	10.98	-	51.09	0.98	-	8.60
29-52	8.69	-	-	2.01	0.5	8.64	-	-	0.55	24.42	-	60.63	0.94	-	16.11
52-77	8.52	-	-	2.68	0.46	7.68	-	-	0.50	25.65	-	60.74	0.88	-	16.90

Contd....

Series Name: Handrala (HDL), **Pedon:** A2/RM-1
Location: $15^0$19'69.8"N, $75^0$58'00"E, Kavalura village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Very-fine, smectitic (calc), isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-25	Ap	21.68	16.62	61.70	4.42	3.98	3.43	5.64	4.20	10	c	41.36	31.27
25-50	Bss1	14.93	15.76	69.32	2.64	2.53	2.99	3.33	3.44	05	c	48.92	39.19
50-82	Bss2	23.11	16.60	60.29	4.51	3.61	6.31	4.74	3.95	05	c	42.46	33.85
82-117	Bss3	10.50	18.38	71.12	1.98	1.98	1.63	2.57	2.33	05	c	52.95	42.82

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-25	9.06	-	-	0.371	0.16	4.80	-	-	0.80	7.93	-	62.33	1.01	-	5.09
25-50	9.09	-	-	0.719	0.2	7.20	-	-	0.42	14.94	-	67.10	0.97	-	8.90
50-82	9.28	-	-	0.47	0.19	9.36	-	-	0.47	11.59	-	60.21	1.00	-	7.70
82-117	8.76	-	-	1.55	0.36	8.64	-	-	0.11	2.28	-	25.33	0.36	-	3.61

Contd....

Series Name: Lakshmangudda (LGD) **Pedon:** R-2
Location: $15^0$13'08.2"N, $76^0$15'27.3" E Raghunathanahalli village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, smectitic (calc), isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	50.60	14.29	35.11	4.53	7.86	12.49	5.18	20.54	-	sc	28.99	18.05
17-40	Bss1	40.22	16.89	42.89	3.03	7.03	9.95	13.84	6.38	-	c	34.09	23.60
40-65	Bss2	37.58	17.32	45.10	2.94	6.86	10.24	11.55	5.99	-	c	35.23	24.68
65-92	Bss3	30.69	19.33	49.97	2.09	5.06	8.03	8.25	7.26	-	c	40.92	29.53
92-124	Bss4	29.82	21.09	49.09	2.99	5.76	7.65	3.33	10.09	-	c	44.40	31.52
124-145	Bss5	28.77	22.78	48.44	2.63	5.36	7.44	8.86	4.49	-	c	43.05	30.08

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	8.03	-	-	1.93	0.94	8.84	-	-	0.35	5.02	-	32.37	0.92	100.00	1.82
17-40	7.68	-	-	1.85	0.98	8.97	-	-	0.16	4.38	-	42.18	0.98	100.00	1.66
40-65	7.61	-	-	1.75	0.94	9.36	-	-	0.16	3.77	-	42.84	0.95	100.00	1.32
65-92	7.82	-	-	1.65	1.07	9.23	-	-	0.22	5.02	-	47.85	0.96	100.00	2.82
92-124	8.46	-	-	1.10	1.13	10.40	-	-	0.23	6.72	-	47.31	0.96	100.00	7.95
124-145	8.66	-	-	0.94	0.88	14.17	-	-	0.22	6.48	-	44.80	0.92	100.00	8.17

Contd....

Series Name: Alawandi (AWD),**Pedon:** R-16
Location: : $15^0$13'08.2"N, $76^0$15'27.3" E Neeralagi village, Koppal Taluk and District
Analysis at: NBSS&LUP, Regional Centre, Bangalore. **Classification:** Fine, smectitic (calc), isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	20.88	25.75	53.37	3.31	4.31	4.31	5.19	3.76	-	c	33.11	25.58
17-39	Bss1	25.99	19.79	54.22	5.04	5.48	5.04	5.92	4.50	-	c	33.11	26.23
39-70	Bss2	26.76	17.80	55.44	2.93	5.31	5.53	7.37	5.63	-	c	36.15	28.67
70-111	Bss3	23.83	20.25	55.93	4.15	4.81	4.92	6.01	3.93	-	c	43.60	33.71
111-139	Bss4	21.21	20.40	58.40	2.79	4.80	4.91	5.25	3.46	-	c	46.92	36.28
139-162	Bss5	13.15	20.96	65.90	1.69	2.47	2.36	3.37	3.26	-	c	54.96	41.81

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	8.10	-	-	0.37	0.52	9.48	-	-	0.40	1.56	-	51.30	0.96	100.00	1.22
17-39	8.60	-	-	0.24	0.52	9.60	-	-	0.14	4.60	-	52.60	0.97	100.00	3.50
39-70	8.89	-	-	0.27	0.52	9.48	-	-	0.16	2.41	-	53.90	0.97	100.00	1.78
70-111	9.10	-	-	0.35	0.54	11.28	-	-	0.15	8.95	-	54.10	0.97	100.00	6.61
111-139	9.15	-	-	0.41	0.58	10.80	-	-	0.15	7.36	-	56.10	0.96	100.00	5.24
139-162	9.16	-	-	0.50	0.50	15.48	-	-	0.19	10.19	-	61.66	0.94	100.00	6.61

Contd....

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

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

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

Contd....

Series Name: Murlapur (MLR), **Pedon:** R-A1/16

Location: $15^0$19'42.9"N, $75^0$55'84.7"E, Kavalura village, Koppal Taluk and District

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-30	Ap	27.97	13.96	58.07	4.22	4.77	6.66	8.10	4.22	10	c	36.24	25.90
30-53	BA	26.34	17.48	56.17	4.17	5.05	6.04	7.24	3.84	05	c	38.55	28.98
53-83	Bss1	19.35	19.55	61.10	3.13	3.91	4.03	5.48	2.80	05	c	44.48	33.69
83-105	Bss2	16.63	17.47	65.90	2.70	3.93	2.92	3.93	3.15	<5	c	50.55	38.11
105-160	Bss3	14.69	20.34	64.97	0.79	2.26	4.07	4.18	3.39	<5	c	51.54	40.19

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}							%	%
0-30	9.19	-	-	0.313	0.57	10.08	-	-	0.64	5.67	-	42.08	0.72	-	5.39
30-53	9.22	-	-	0.449	0.24	13.08	-	-	0.35	8.23	-	41.02	0.73	-	8.02
53-83	9.17	-	-	0.377	0.82	16.92	-	-	0.39	14.28	-	51.20	0.84	-	11.16
83-105	9.18	-	-	0.477	0.61	15.48	-	-	0.35	13.19	-	53.11	0.81	-	9.94
105-160	9.01	-	-	1.17	0.24	16.92	-	-	0.43	19.61	-	53.95	0.83	-	14.54

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 and 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 recognised based on the dominant limitations observed within a given land capability class. The subclasses are designated by adding a lower case letter like 'e', 'w', 's', or 'c' to the class numeral. The subclass "e" indicates that the main hazard is risk of erosion, "w" indicates drainage or wetness as a limitation for plant growth, "s" indicates shallow soil depth, coarse or heavy textures, calcareousness, salinity/alkali 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 identified 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 23 soil map units identified in the Virapura-2 microwatershed are grouped under 3 Land capability classes and 6 land capability subclasses (Fig. 5.1). Entire cultivated area of about 555 ha (96%) is suitable for agriculture. An area of about 26 ha (4%) is under habitation and settlements.

Maximum area of about 450 ha (78%) is good lands (Class II) and distributed in the major part of the microwatershed with minor problems of soil, drainage and erosion. An area about 80 ha (14%) is moderately good lands (Class III) with moderate limitations of soil and erosion and distributed in the northwestern, southwestern and southern part of the microwatershed. Fairly good lands (Class IV) cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of soil and erosion.

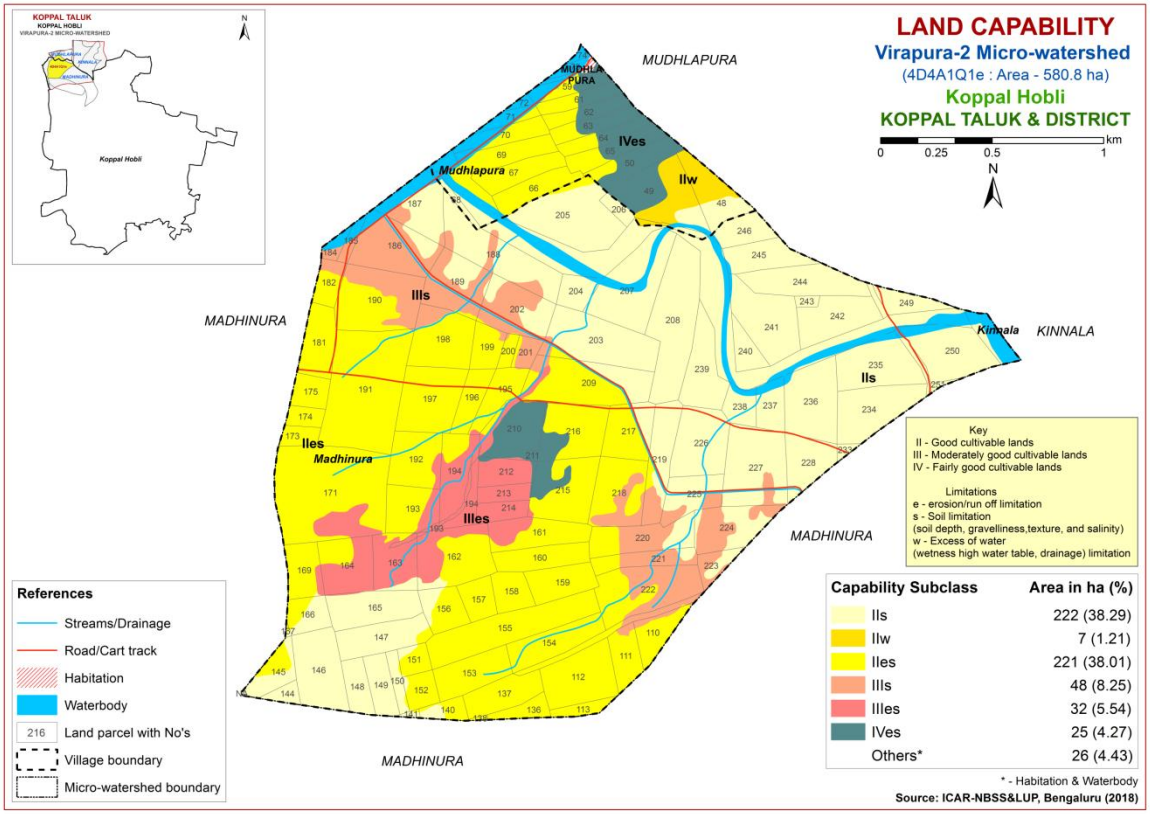


Fig. 5.1 Land Capability map of Virapura-2 Microwatershed

5.2 Soil Depth

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

Very shallow (<25 cm) soils cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed. An area of about 80 ha (14%) is under shallow (25-50 cm) soils and distributed in the southwestern, northwestern and southern part of the microwatershed. Moderately shallow (50-75 cm) soils cover an area of about 83 ha (14%) and occur in the southwestern, western, northern and eastern part of the microwatershed. Moderately deep (75-100 cm) soils cover a major area of about 136 ha (23%) and distributed in the central, western, southwestern, southern and eastern part of the microwatershed. An area of about 127 ha (22%) is under deep (100-150 cm) soils and occur in the southwestern, southern, eastern and northern part of the microwatershed. Very deep (>150 cm) soils occupy an area of 103 ha (18%) and occur in the northern, eastern and southwestern part of the microwatershed.

The most productive lands cover about 230 ha (40%) where all climatically adapted long duration crops can be grown. The problem soils cover about 105 ha (18%) area where only short duration crops can be grown and the probability of crop failure is high.

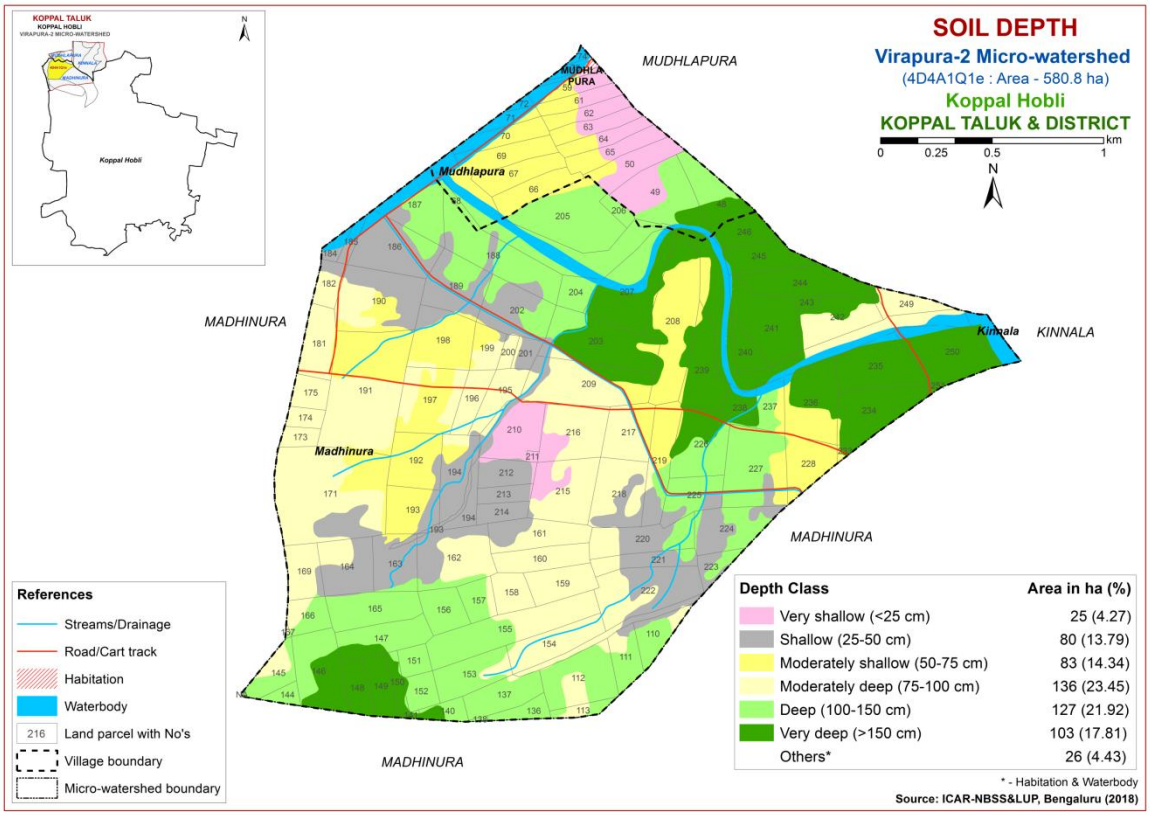


Fig. 5.2 Soil Depth map of Virapura-2 Microwatershed

5.3 Surface Soil Texture

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

Entire cultivated area of the microwatershed has soils that are clayey at the surface.

Entire cultivated area of the microwatershed falls under clayey (clay and sandy clay) soils 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.

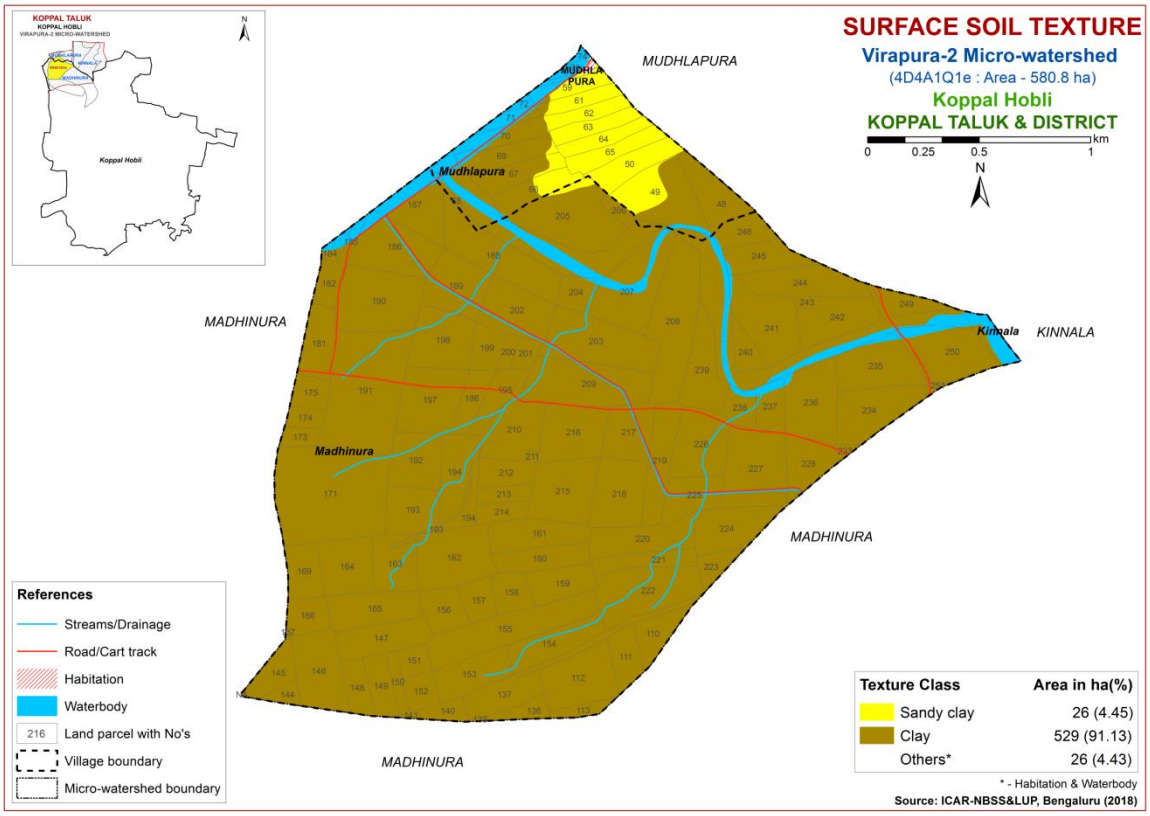


Fig. 5.3 Surface Soil Texture map of Virapura-2 Microwatershed

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 spatial distribution in the microwatershed is shown in Fig.5.4.

Maximum area of about 370 ha (64%) has non gravelly (<15%) soils and occur in the major part of the microwatershed. An area of about 163 ha (28%) has gravelly (15-35%) soils and distributed in the central, northwestern, northern, eastern, southern, western and southwestern part of the microwatershed. An area of about 22 ha (4%) has very gravelly (35-60%) soils and occur in the central and southern part of the microwatershed.

Maximum area of about 370 ha (64%) are most productive lands with respect to gravelliness. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem lands cover about 185 ha

(32%) that are gravelly to very gravelly where only medium or short duration crops can be grown.

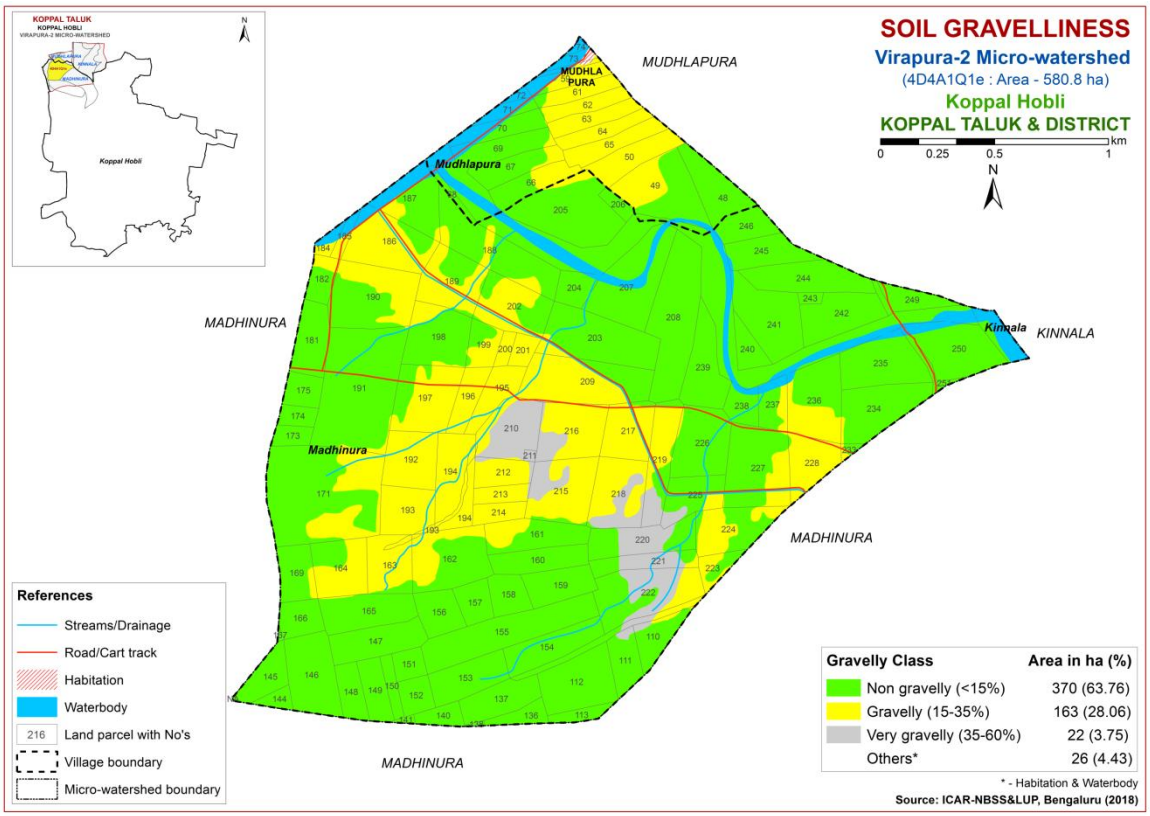


Fig. 5.4 Soil Gravelliness map of Virapura-2 Microwatershed

5.5 Available Water Capacity

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

An area of about 25 ha (4%) has soils that are very low (<50 mm/m) in available water capacity and distributed in the central and northern part of the microwatershed. Low (51-100 mm/m) in available water capacity cover an area of about 163 ha (28%) and occur in the southwestern, western, northwestern, northern, eastern and southern part of the microwatershed. An area of about 136 ha (23%) is medium (101-150 mm/m) in available water capacity and occur in the central, western, southwestern, southern and eastern part of the microwatershed. Maximum area of about 231 ha (40%) is very high (>200 mm/m) in available water capacity and occur in the southwestern, southern, eastern, northern and northwestern part of the microwatershed.

An area of about 188 ha (32%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 231 ha (40%) has soils that have very high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

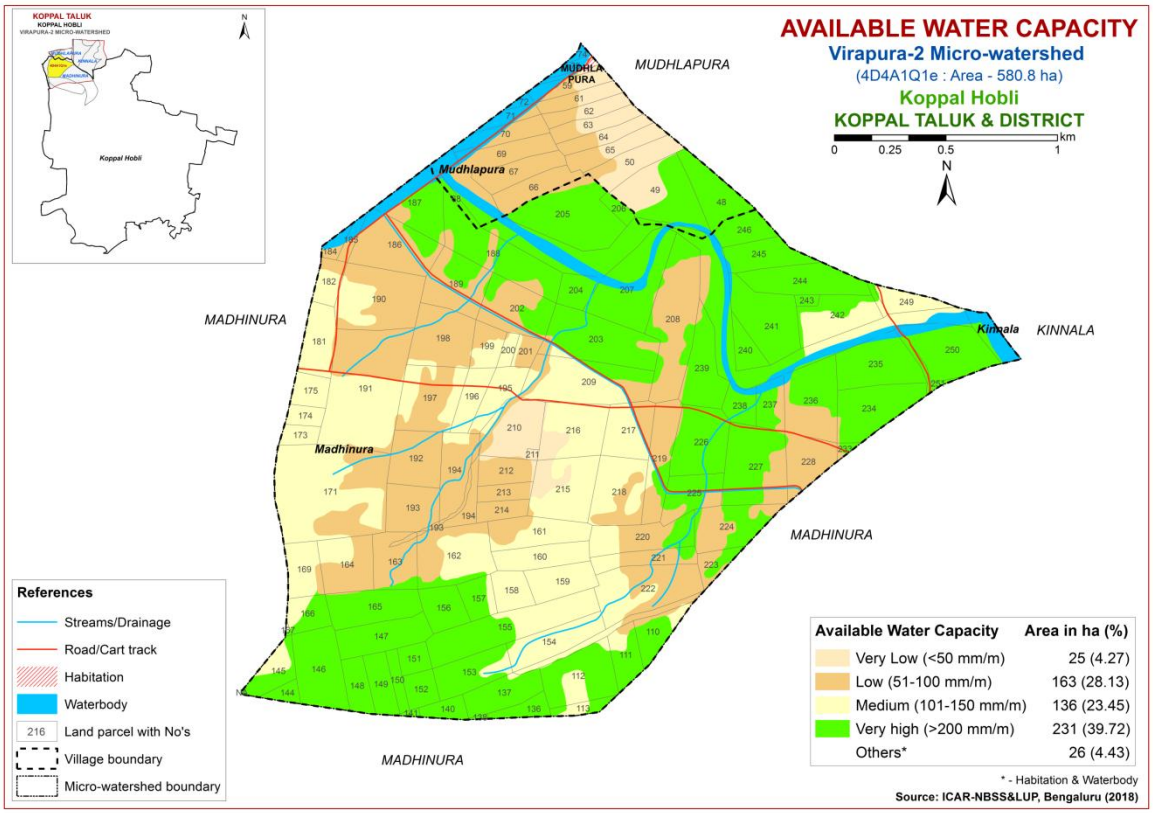


Fig. 5.5 Soil Available Water Capacity map of Virapura-2 Microwatershed

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 different 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 137 ha (24%) falls under nearly level (0-1% slope) lands and distributed in the northern, eastern and southwestern part of the microwatershed. Maximum area of about 418 ha (72%) falls under very gently sloping (1-3% slope) lands and distributed in the major part of the microwatershed.

Entire cultivated area of the microwatershed has soils that have high potential in respect of soil slopes. In these areas, all climatically adapted annual and perennial crops

can be grown without much soil and water conservation and other land development measures.

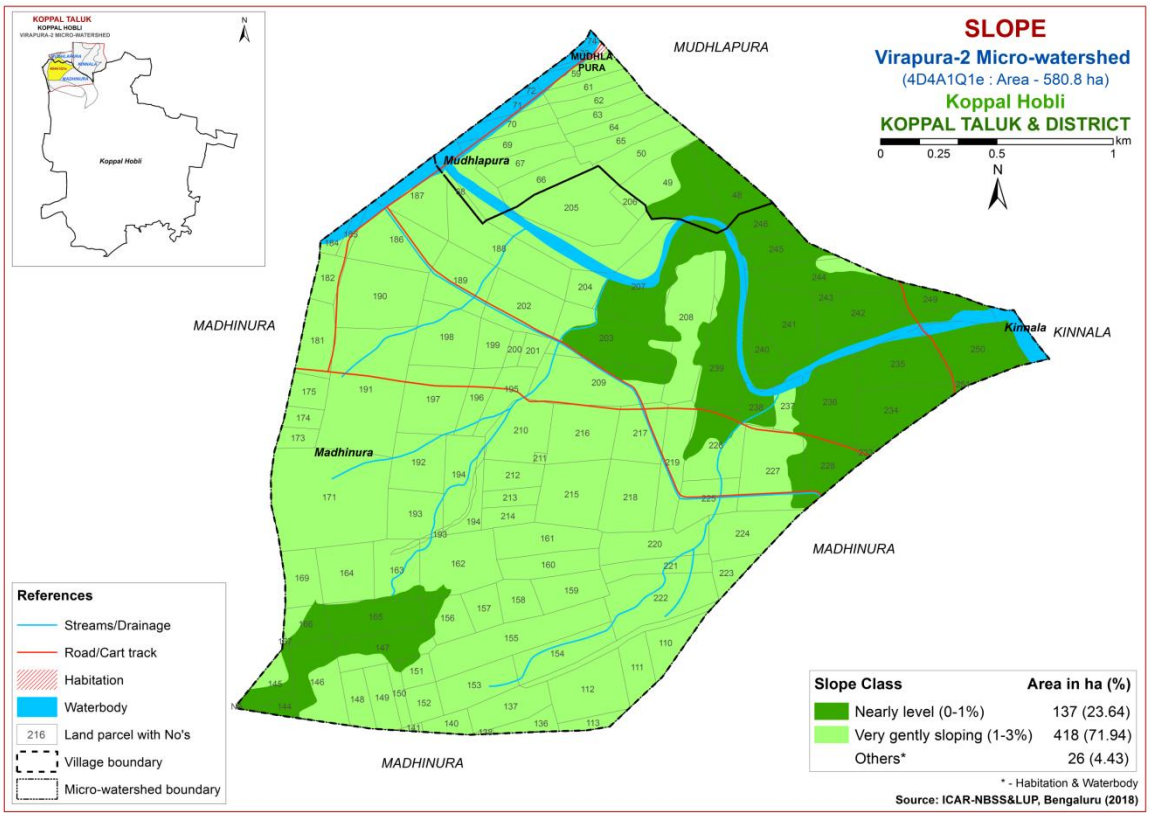


Fig. 5.6 Soil Slope map of Virapura-2 Microwatershed

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.

Soils that are slightly eroded (e1 class) cover an area of 277 ha (48%) and distributed in the northwestern, northern, eastern, southern and southwestern part of the microwatershed. Soils that are eroded (e2 class) cover a major area of 278 ha (48%) and distributed in the central, northern, southern, southwestern, western and northwestern part of the microwatershed.

Maximum area of about 278 ha (48%) in the microwatershed is problematic because of moderate erosion. For these areas, taking up soil and water conservation and other land development measures are needed.

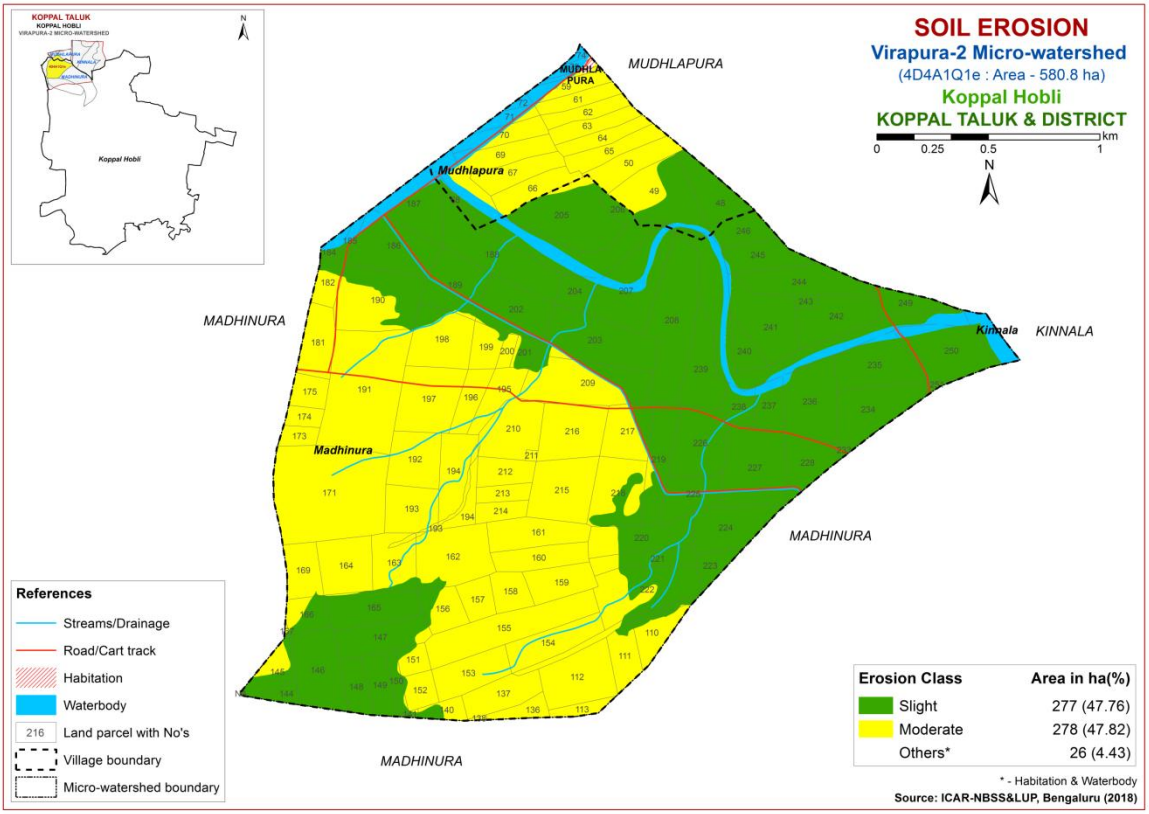


Fig. 5.7 Soil Erosion map of Virapura-2 Microwatershed

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 characterised 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 2018 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

Soil fertility data generated has been assessed and individual maps for all the nutrients for the microwatershed have been generated 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 Virapura-2 microwatershed for soil reaction (pH) showed that an entire cultivated area of the microwatershed falls under strongly alkaline to very strongly alkaline (pH 8.4->9.0) in soil reaction (Fig.6.1). Thus, entire cultivated area falls under alkaline condition.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon (OC)

The soil organic carbon content (an index of available Nitrogen) of the microwatershed is medium (0.5-0.75%) in major area of about 387 ha (67%) and occur in the major part of the microwatershed. Low (<0.5%) in organic carbon cover an area of about 67 ha (12%) and distributed in the southern and southwestern part of the microwatershed. An area of about 101 ha (17%) is high (>0.75%) in organic carbon and distributed in the northern, eastern and southern part of the microwatershed (Fig.6.3).

6.4 Available Phosphorus

Major area of about 327 ha (56%) is medium (23-57 kg/ha) in available phosphorus and distributed in the major part of the microwatershed. Low (<23 kg/ha) in available phosphorus cover an area of about 228 ha (39%) and distributed in the northwestern, northern, southwestern and southern part of the microwatershed (Fig 6.4).

6.5 Available Potassium

An area of about 47 ha (8%) is medium (145-337 kg/ha) in available potassium and distributed in the southern part of the microwatershed. Maximum area of about 508 ha (88%) is high (>337 kg/ha) in available potassium and distributed in the major part of the microwatershed (Fig.6.5).

6.6 Available Sulphur

An area of about 388 ha (67%) is low (<10 ppm) in available sulpur and distributed in the major part of the microwatershed. An area of about 167 ha (29%) is medium (10-20 ppm) in available sulpur and occur in the northern and eastern part of the microwatershed (Fig.6.6).

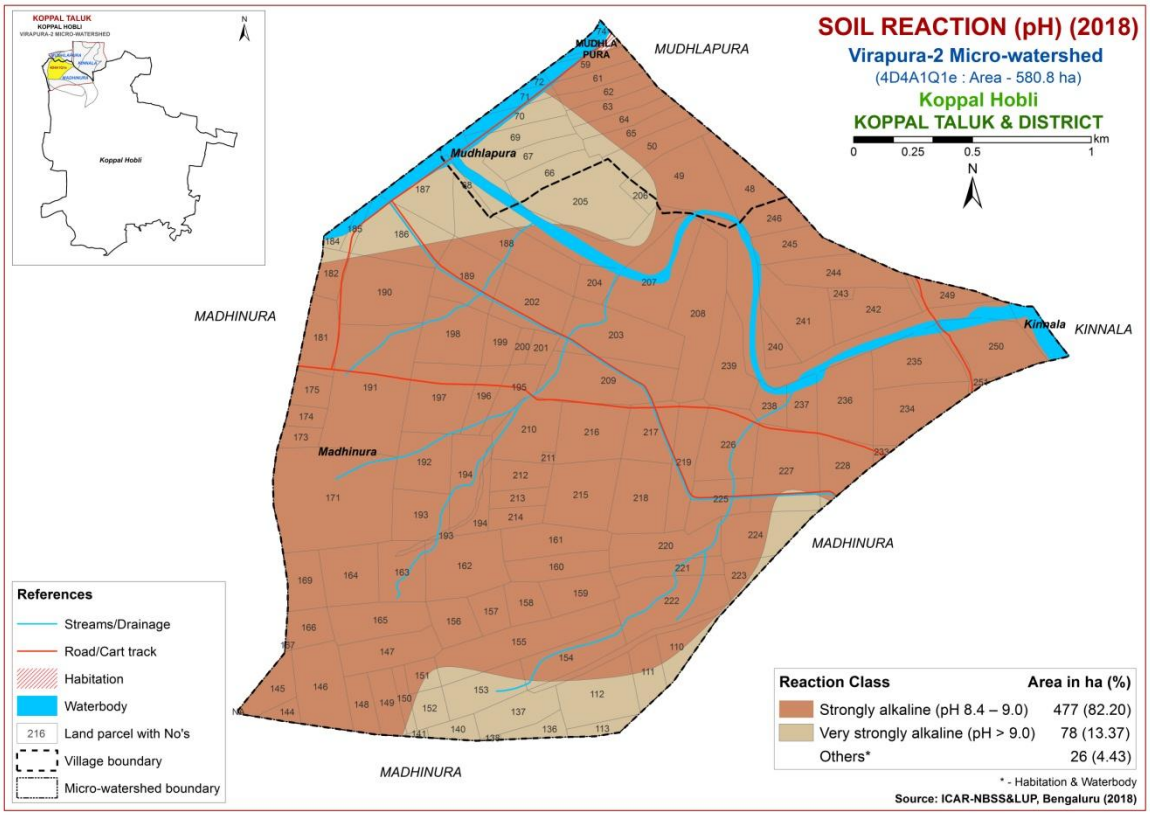


Fig.6.1 Soil Reaction (pH) map of Virapura-2 Microwatershed

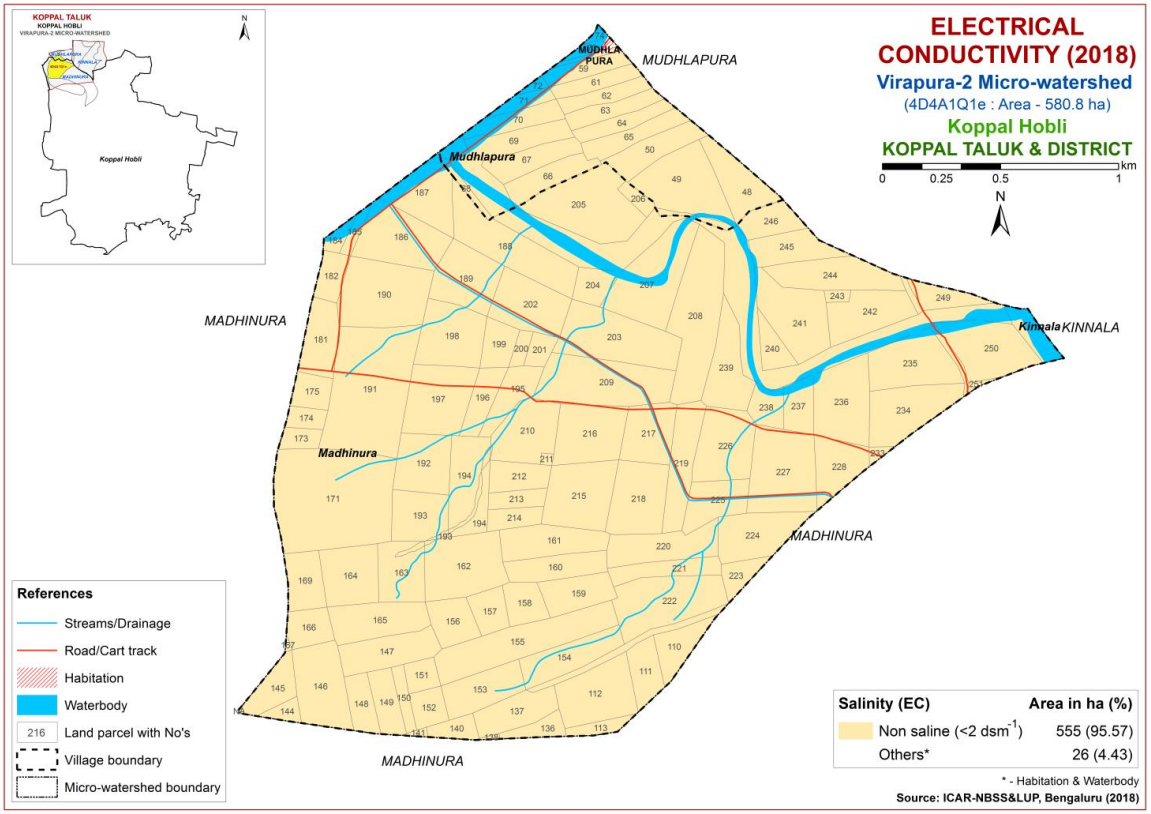


Fig.6.2 Electrical Conductivity (EC) map of Virapura-2 Microwatershed

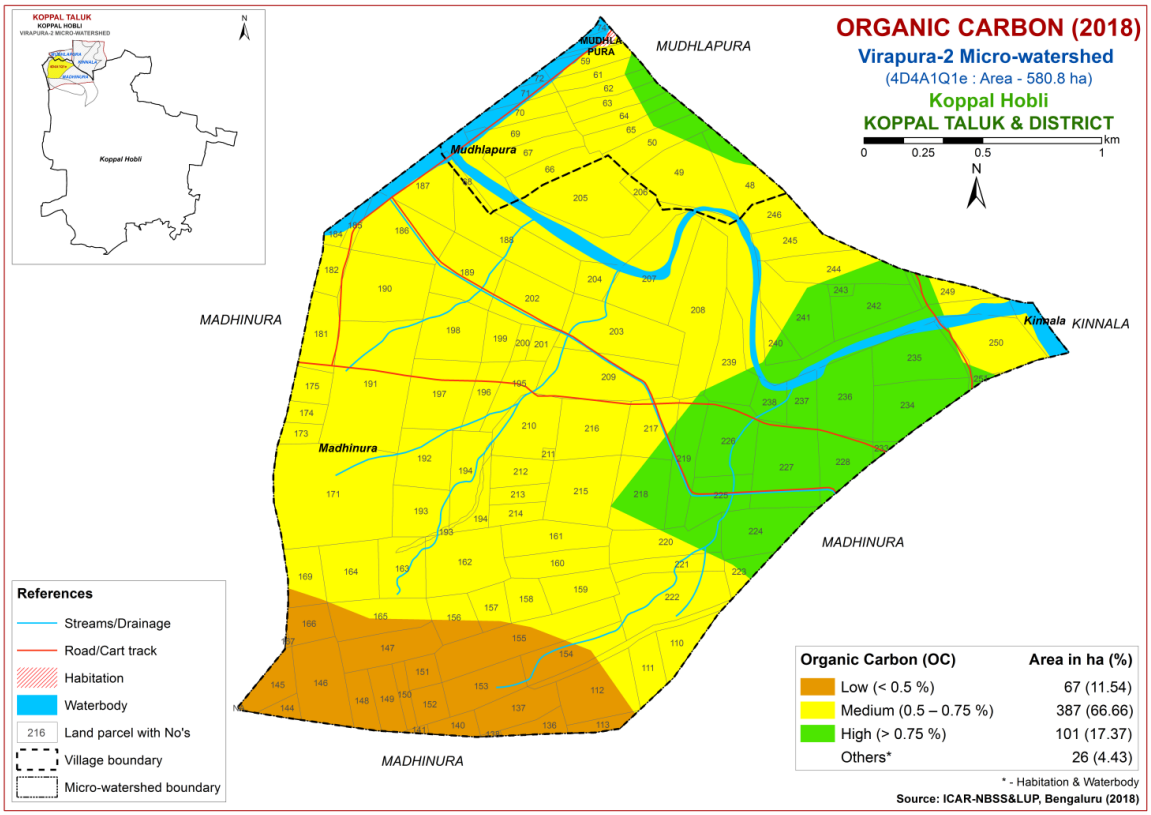


Fig.6.3 Soil Organic Carbon (OC) map of Virapura-2 Microwatershed

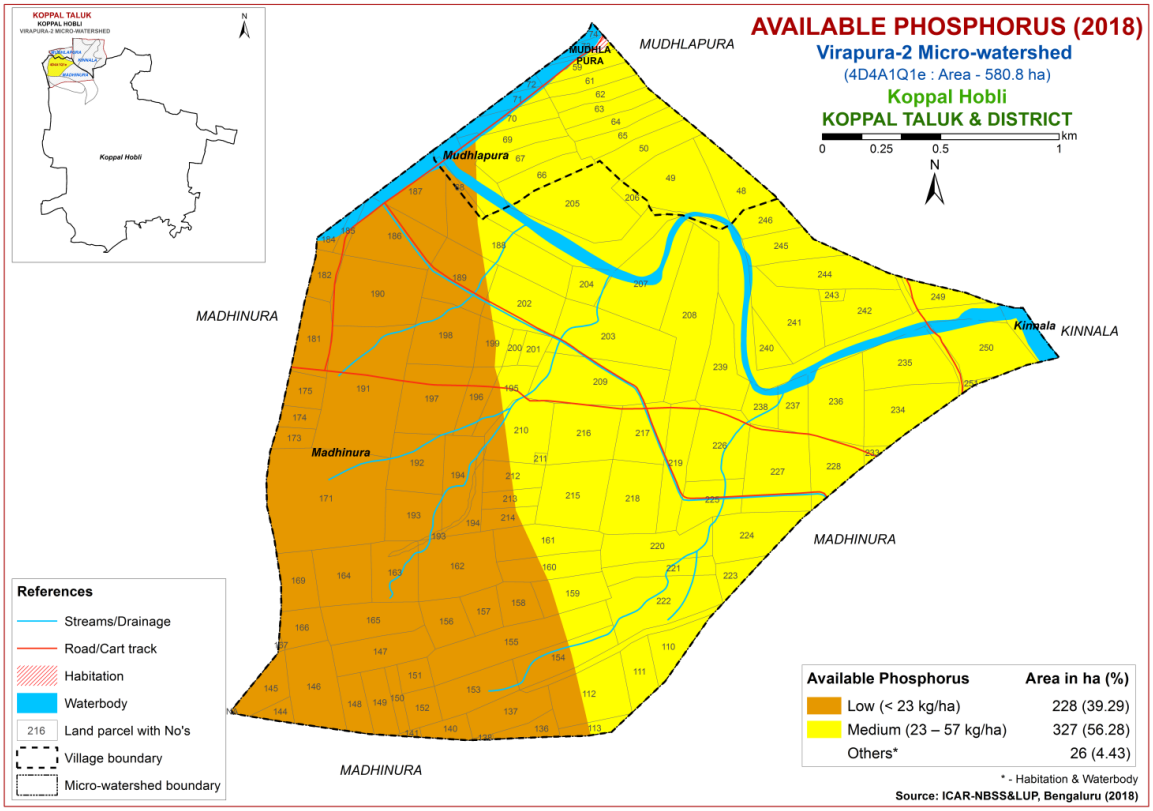


Fig.6.4 Soil Available Phosphorus map of Virapura-2 Microwatershed

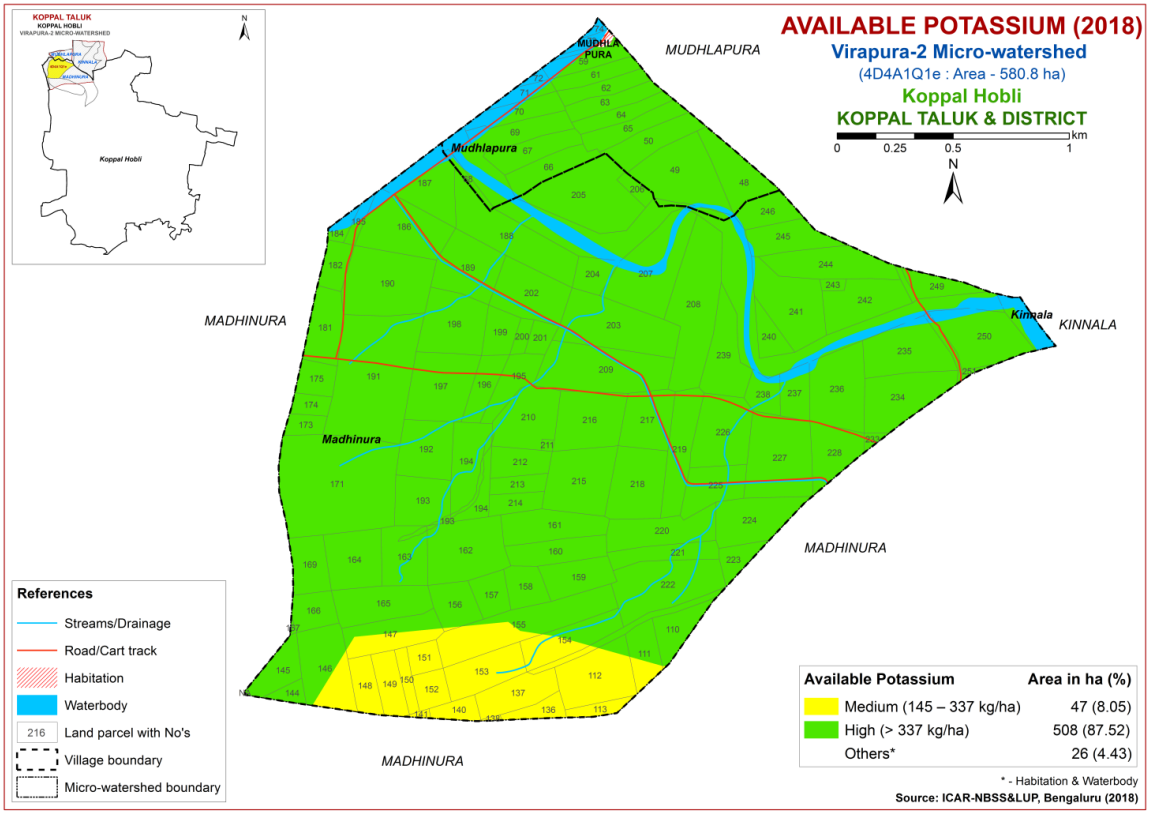


Fig.6.5 Soil Available Potassium map of Virapura-2 Microwatershed

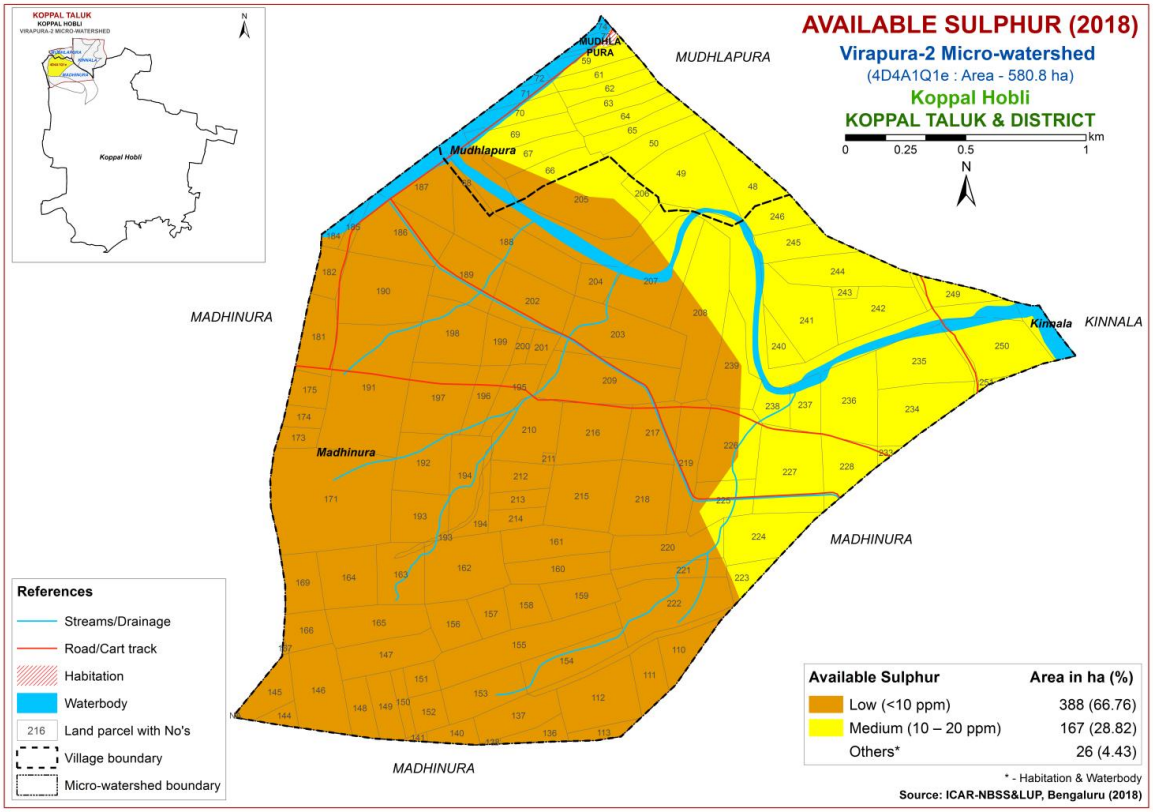


Fig.6.6 Soil Available Sulphur map of Virapura-2 Microwatershed

6.7 Available Boron

Available boron is low (<0.5 ppm) in a major area of about 433 ha (74%) and distributed in the major part of the microwatershed. An area of about 123 ha (21%) is medium (0.5-1.0 ppm) in available boron and occur in the northern and eastern part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in an area of about 131 ha (23%) and distributed in the northern, southern and eastern part of the microwatershed. Maximum area of about 424 ha (73%) is deficient (<4.5 ppm) in available iron and distributed in the major part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

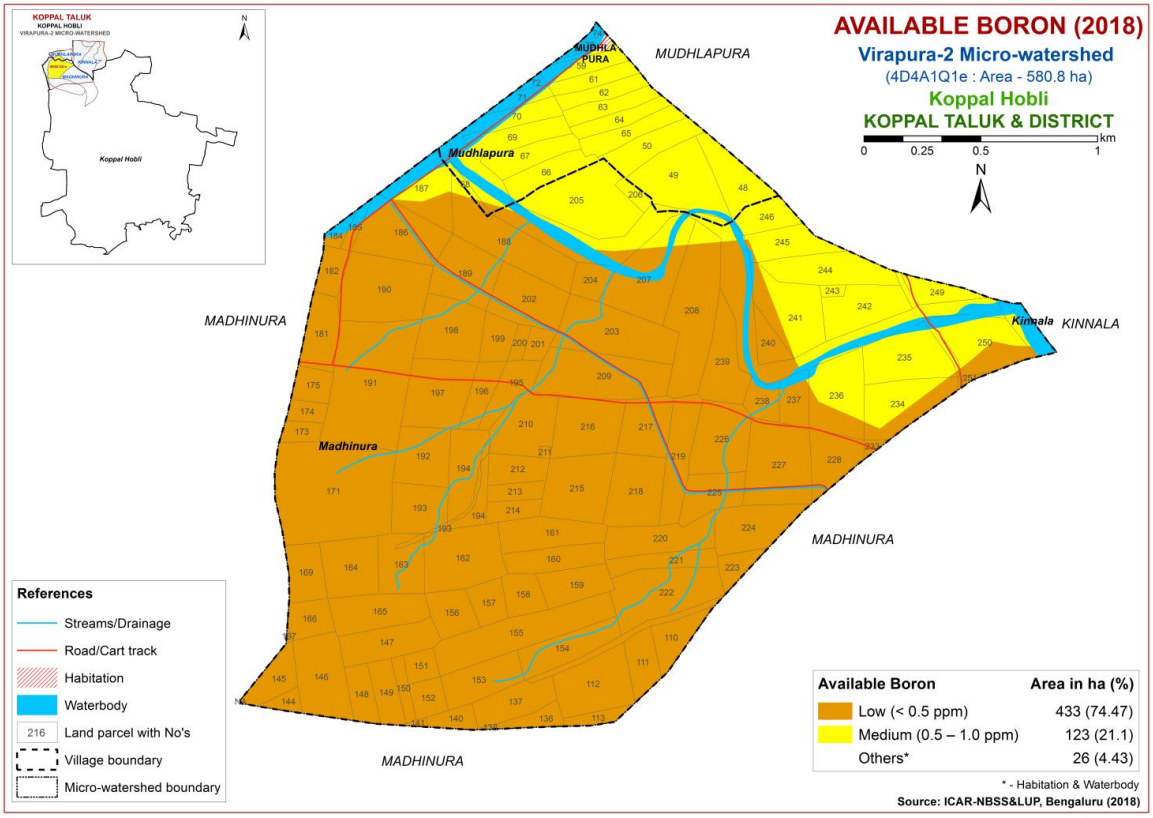


Fig.6.7 Soil Available Boron map of Virapura-2 Microwatershed

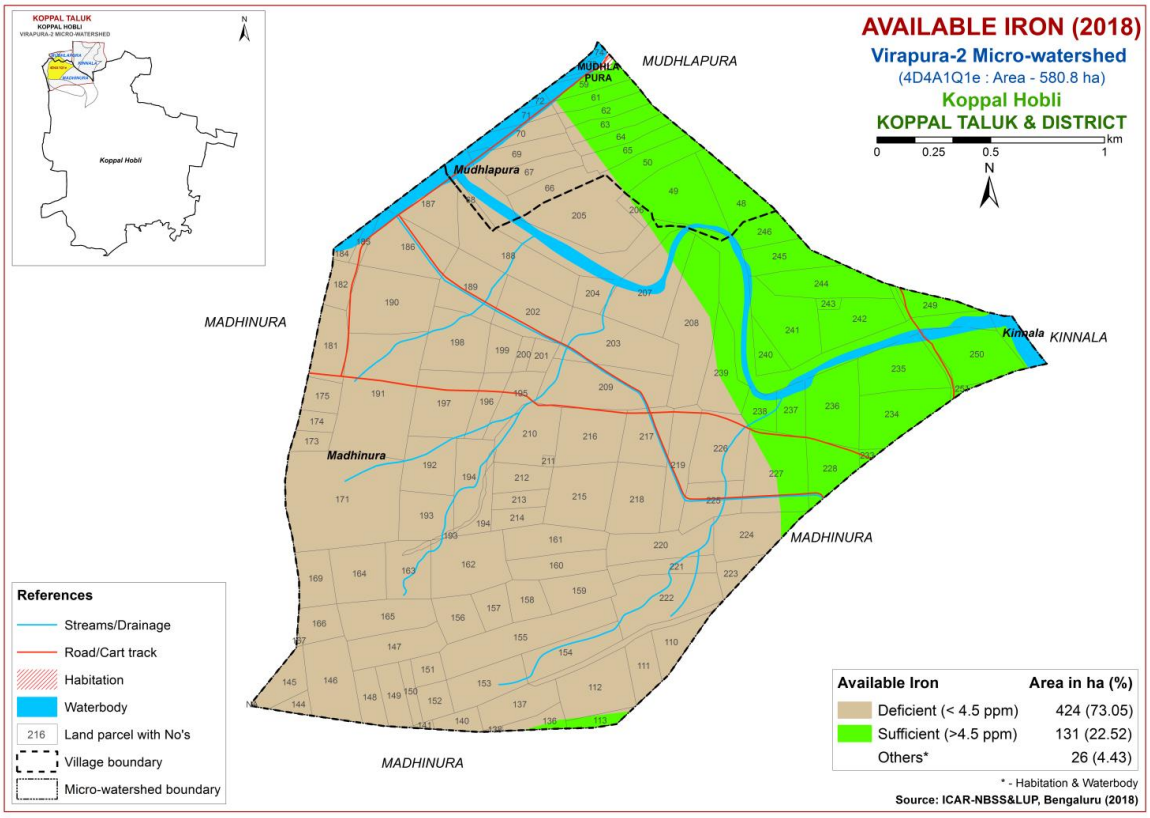


Fig.6.8 Soil Available Iron map of Virapura-2 Microwatershed

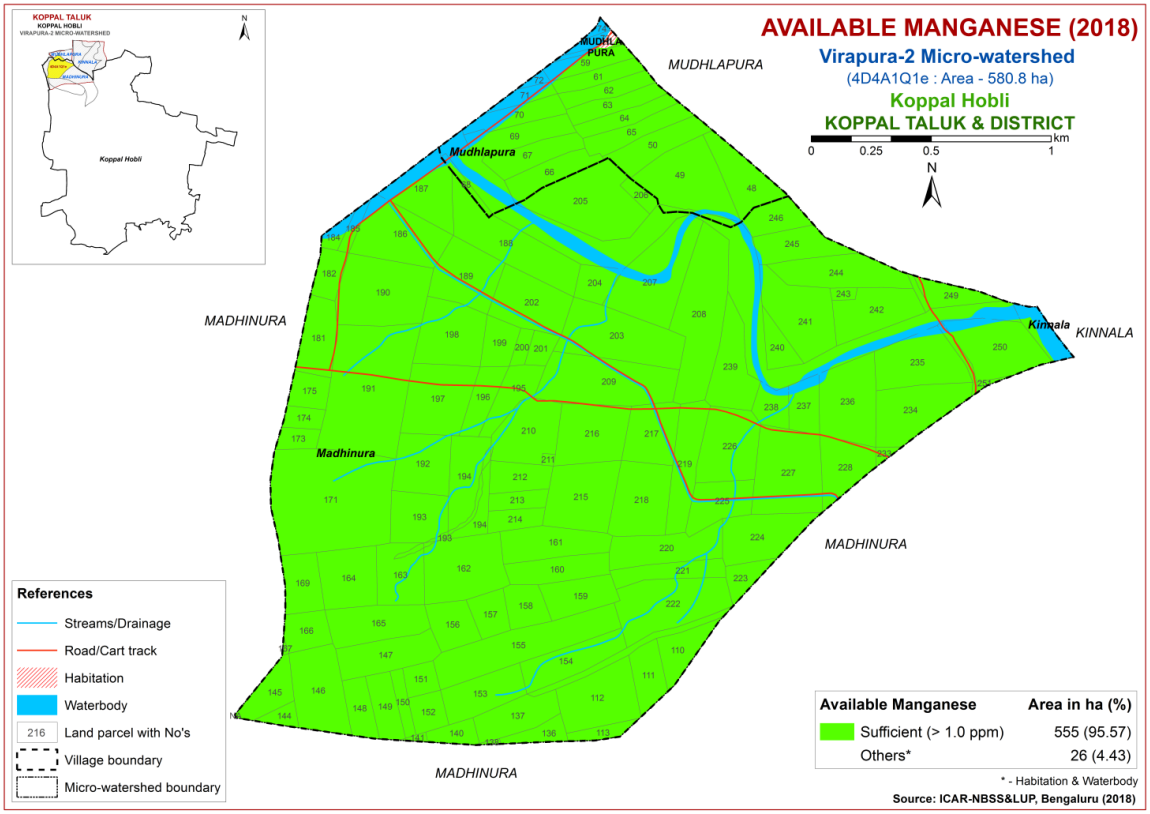


Fig.6.9 Soil Available Manganese map of Virapura-2 Microwatershed

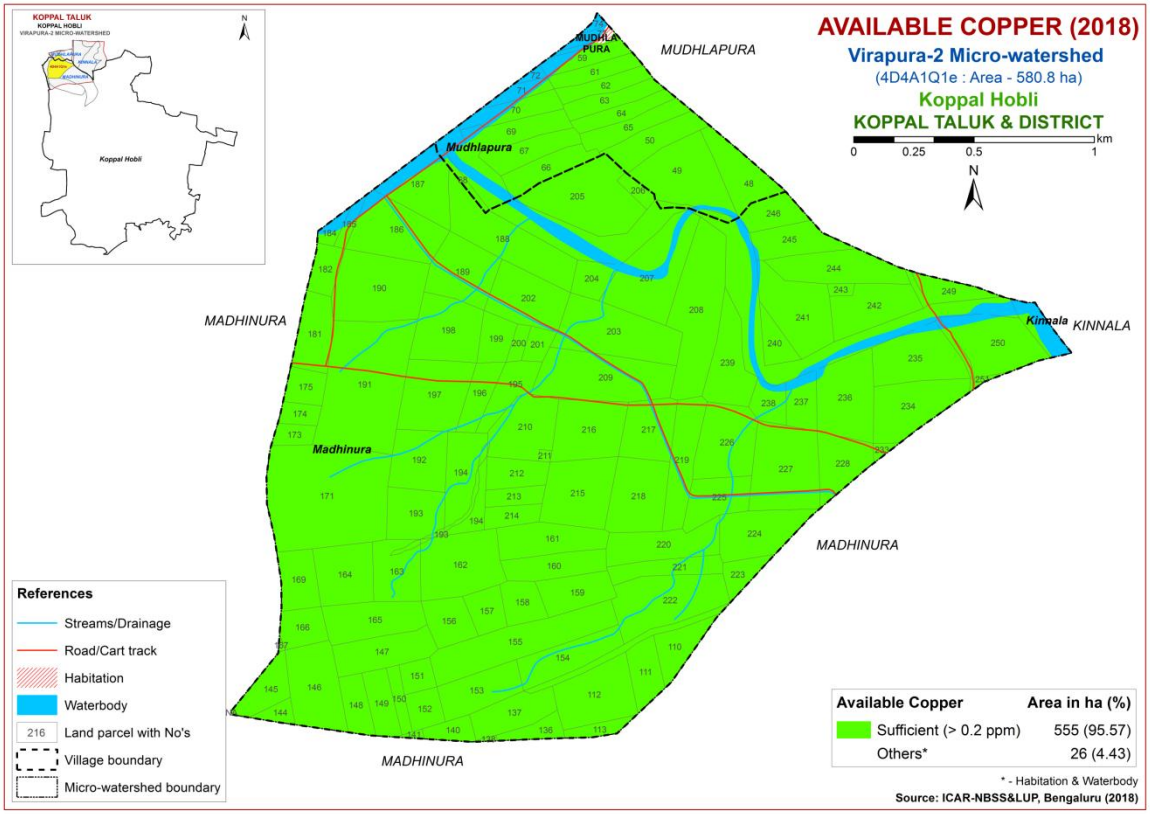


Fig.6.10 Soil Available Copper map of Virapura-2 Microwatershed

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in a major area of about 554 ha (95%) and distributed in the major part of the microwatershed. An area of about 1 ha (<1%) is sufficient (>0.6 ppm) and distributed in the eastern part of the microwatershed (Fig 6.11).

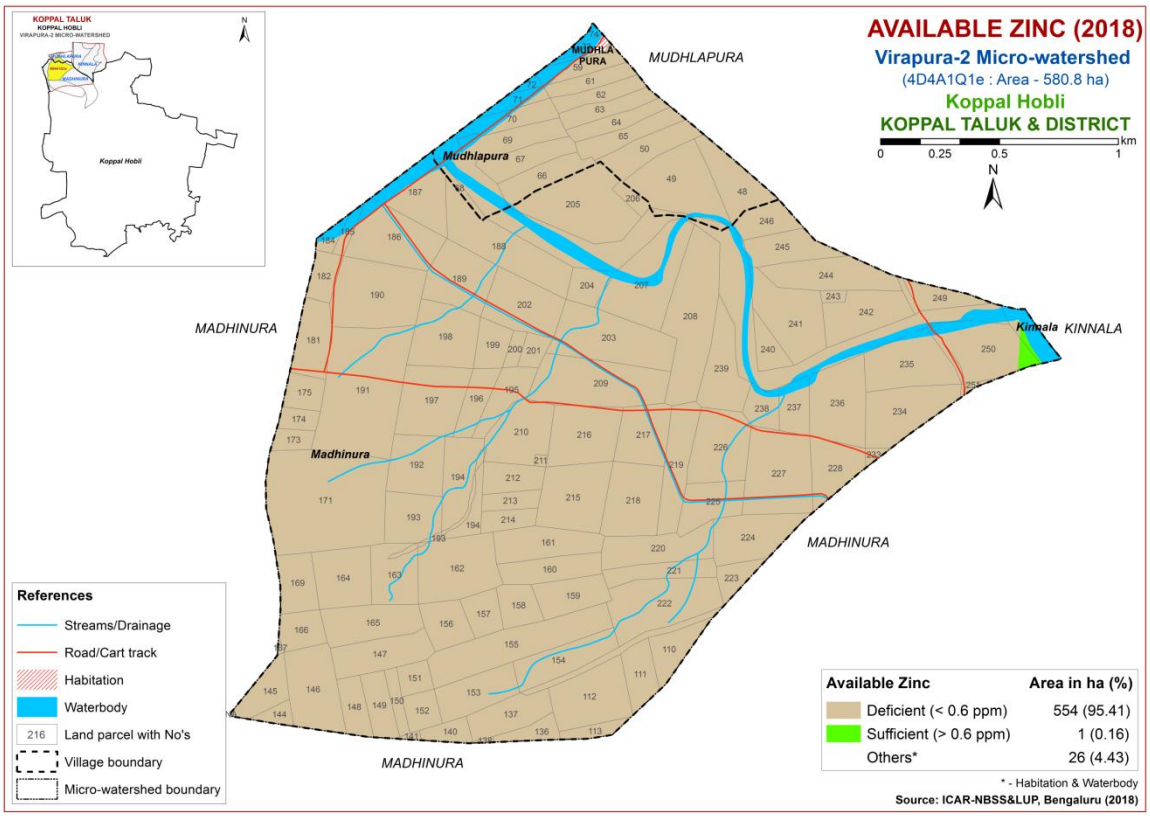


Fig.6.11 Soil Available Zinc map of Virapura-2 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Virapura-2 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 (Table 7.1) were matched with the crop requirements (Tables 7.2 to 7.32) to arrive at the crop suitability. The soil and land characteristics table and crop requirements tables are given at the end of the chapter. In FAO land suitability classification, two orders are recognized. Order S-Suitable and Order N- Not suitable. The orders have Classes, subclasses and units. Order-S has three classes, Class S1-Highly Suitable, Class S2-Moderately Suitable and Class S3-Marginally Suitable. Order N has two classes, N1-Currently not Suitable and N2-Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3, N1 and N2 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable 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 land a 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.

An area of about 125 ha (21%) is highly suitable (Class S1) for growing sorghum and occur in the northern, western, southwestern and southern part of the microwatershed. Maximum area of about 325 ha (56%) is moderately suitable (Class S2) for growing

sorghum and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, nutrient availability and calcareousness. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing sorghum and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands for growing sorghum cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

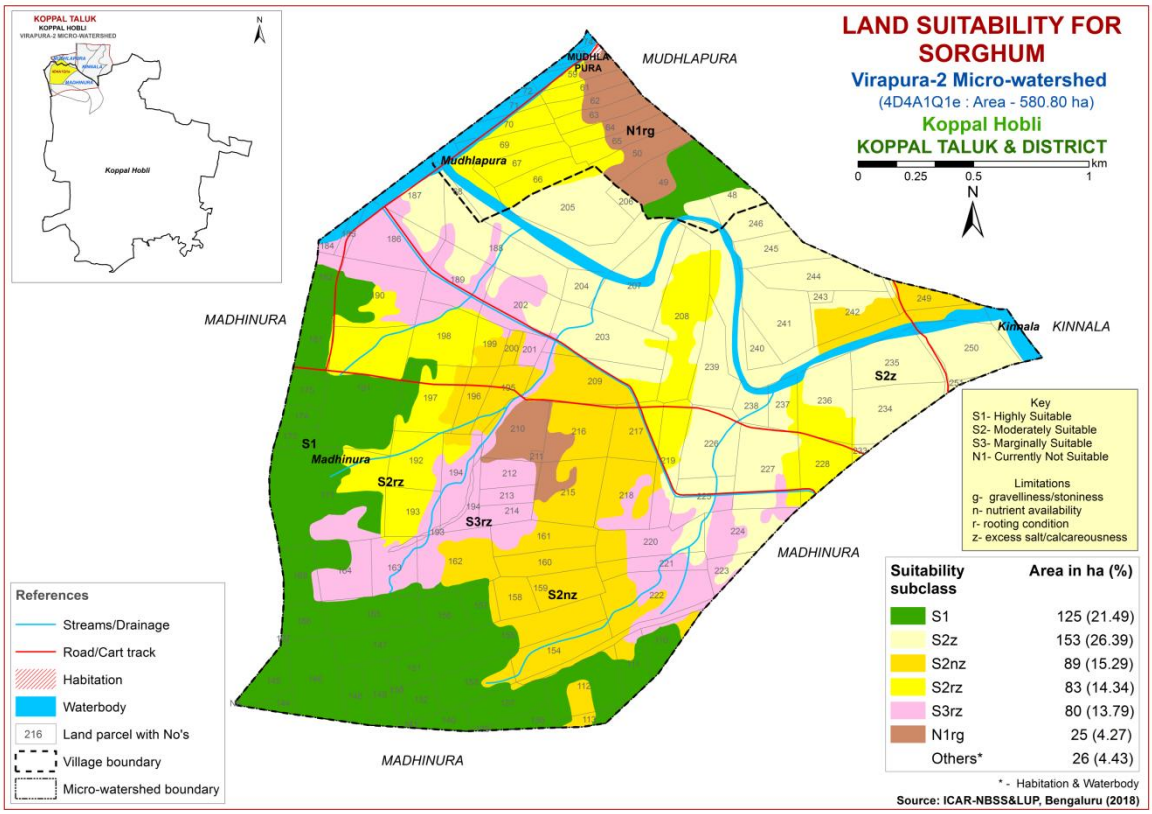


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Highly suitable (Class S1) lands for growing maize is not available in this microwatershed. Maximum area of about 450 ha (78%) is moderately suitable (Class S2) for growing maize and distributed in the major part of the microwatershed with minor limitations of texture and calcareousness. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing maize and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of texture and

calcareousness. Currently not suitable (Class N1) lands for growing maize cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

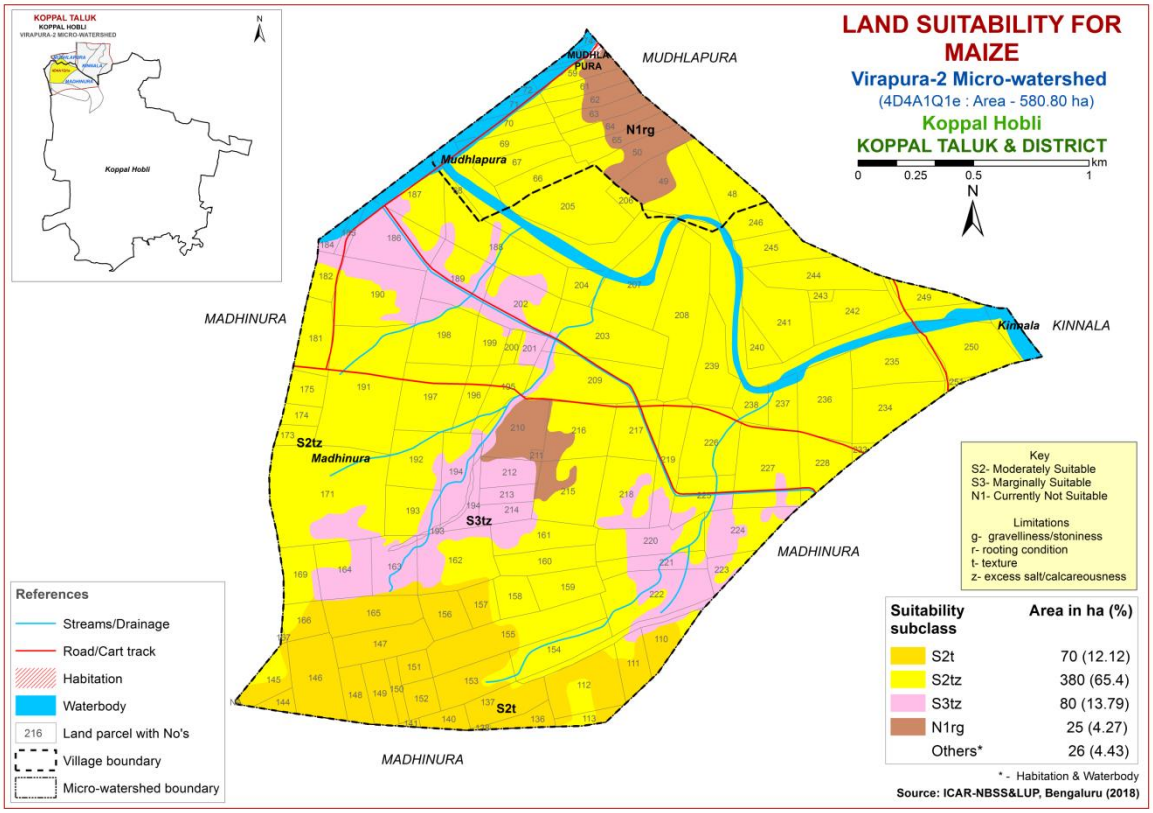


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the major food crop grown in an area of 2.34 lakh ha in Karnataka in the northern districts. The crop requirements (Table 7.4) for growing bajra were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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.

Maximum area of about 450 ha (78%) is moderately suitable (Class S2) for growing bajra and distributed in the major part of the microwatershed with minor limitations of texture and calcareousness. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing bajra and distributed in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands for growing bajra cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

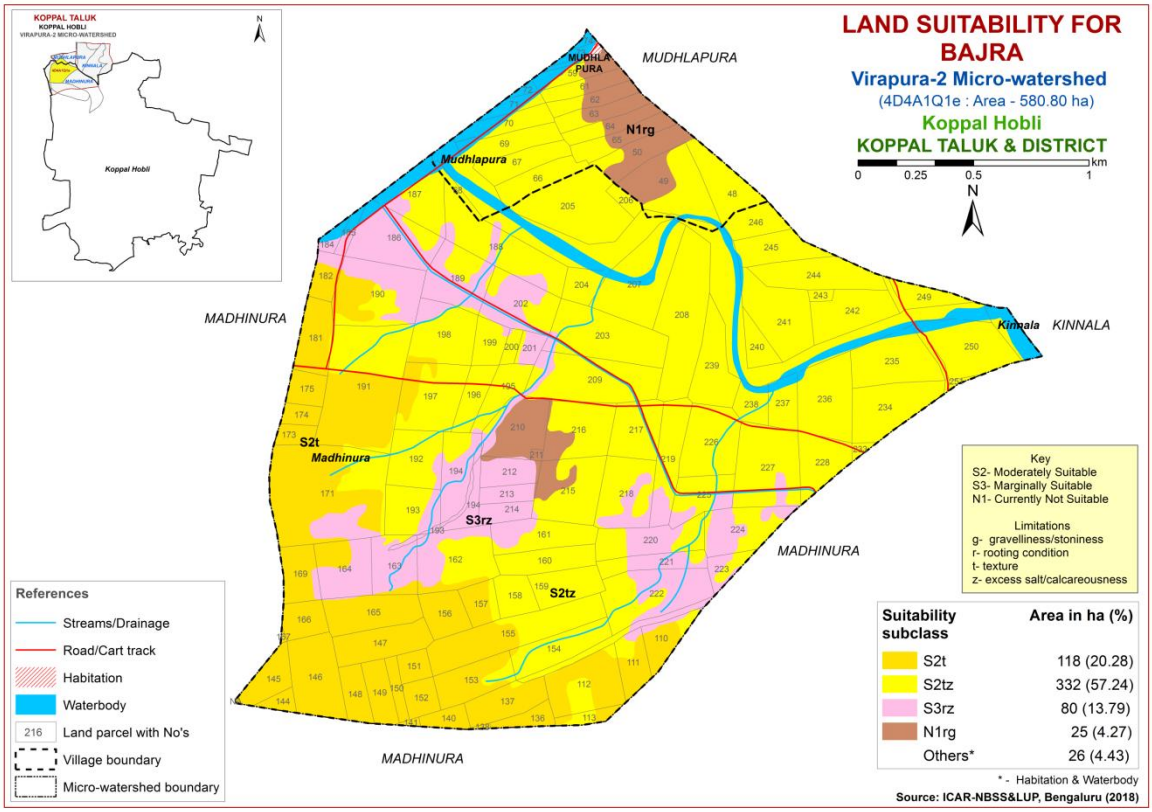


Fig. 7.3 Land Suitability map of Bajra

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

Maximum area of about 530 ha (91%) is marginally suitable (Class S3) for growing groundnut and distributed in the major part of the microwatershed with moderate limitations of calcareousness and texture. Currently not suitable (Class N1) lands for growing groundnut cover an area of about 25 ha (4%) and distributed in the central and southern part of the microwatershed with severe limitations of gravelliness and rooting depth.

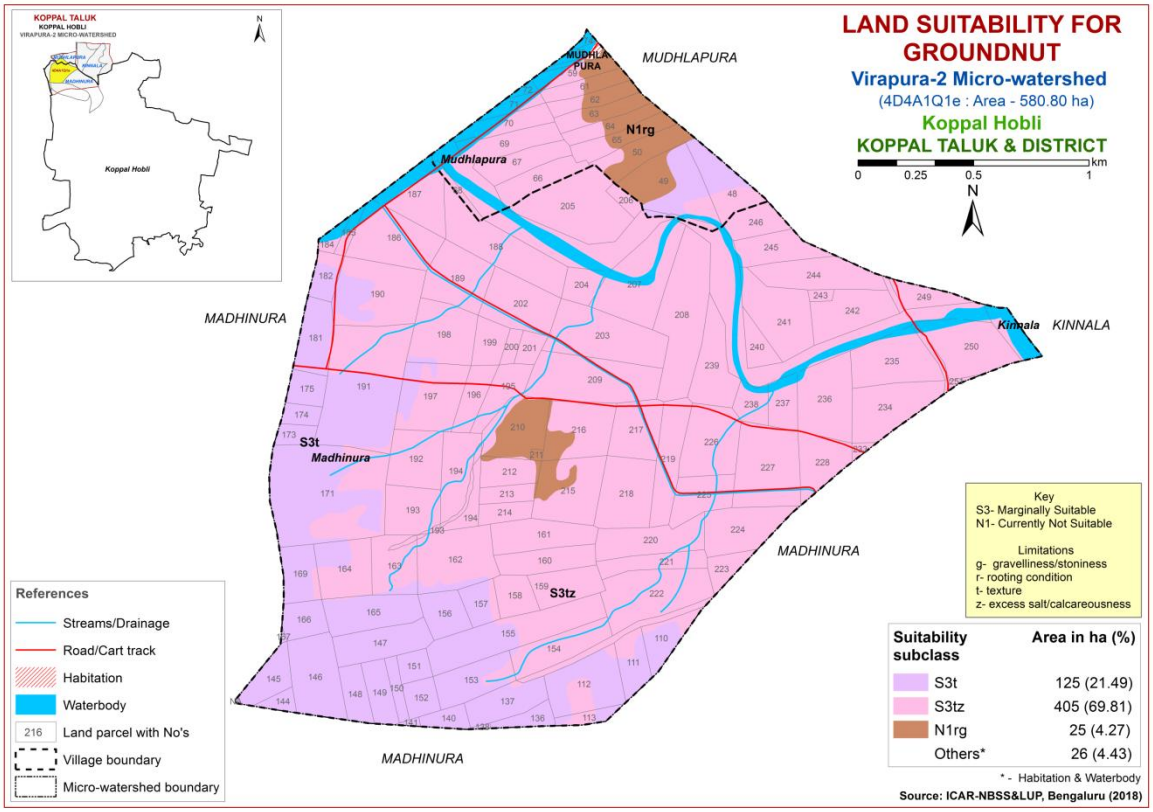


Fig. 7.4 Land Suitability map of Groundnut

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 77 ha (13%) is highly suitable (Class S1) for growing sunflower and distributed in the northern, southern and southwestern part of the microwatershed. Maximum area of about 289 ha (50%) is moderately suitable (Class S2) for growing sunflower and distributed in the major part of the microwatershed with minor limitations of rooting depth and calcareousness. An area of about 83 ha (14%) is marginally suitable (Class S3) for growing sunflower and occur in the northern, western, southwestern and eastern part of the microwatershed with moderate limitations of calcareousness and rooting depth. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing sunflower and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

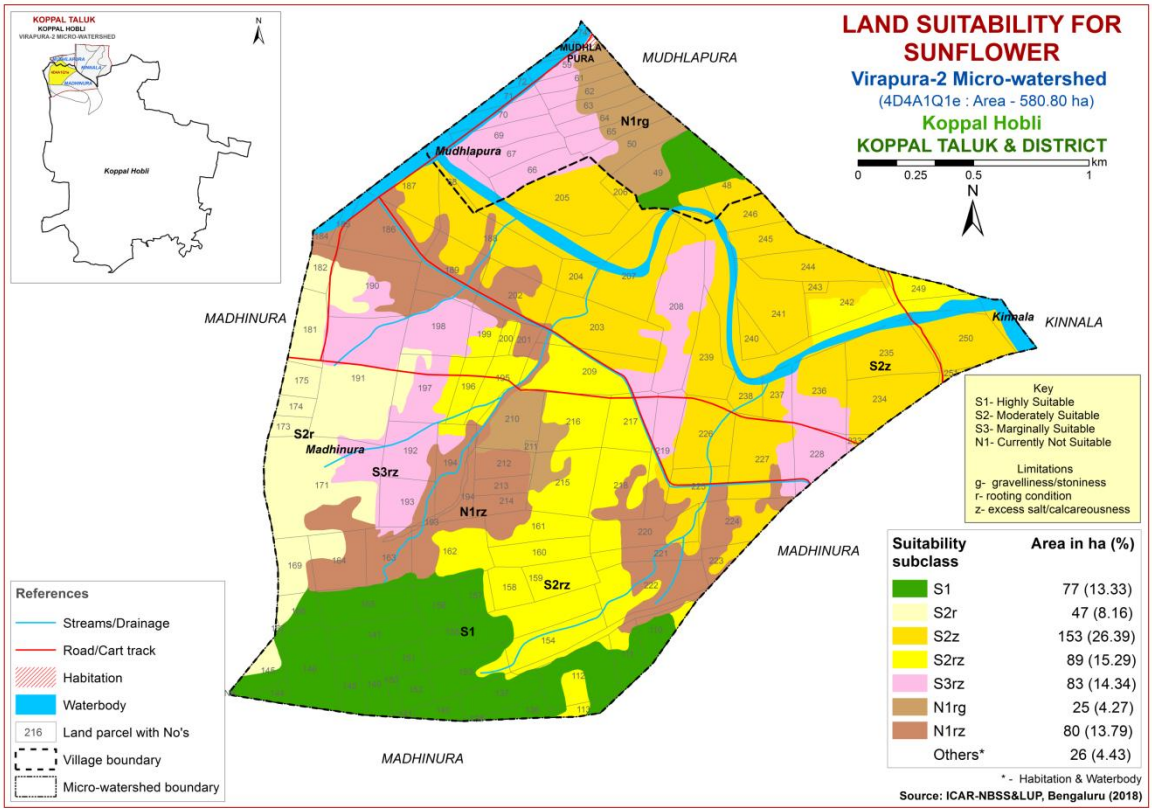


Fig. 7.5 Land Suitability map of Sunflower

7.6 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, Kalaburagi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.7) 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 7.6.

An area of about 125 ha (21%) is highly suitable (Class S1) for growing cotton and occur in the northern, western, southwestern and southern part of the microwatershed. Maximum area of about 325 ha (56%) is moderately suitable (Class S2) for growing cotton and distributed in the major part of the microwatershed with minor limitations of calcareousness and rooting depth. Major area of about 80 ha (14%) is marginally suitable (Class S3) for growing cotton and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands for growing cotton cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

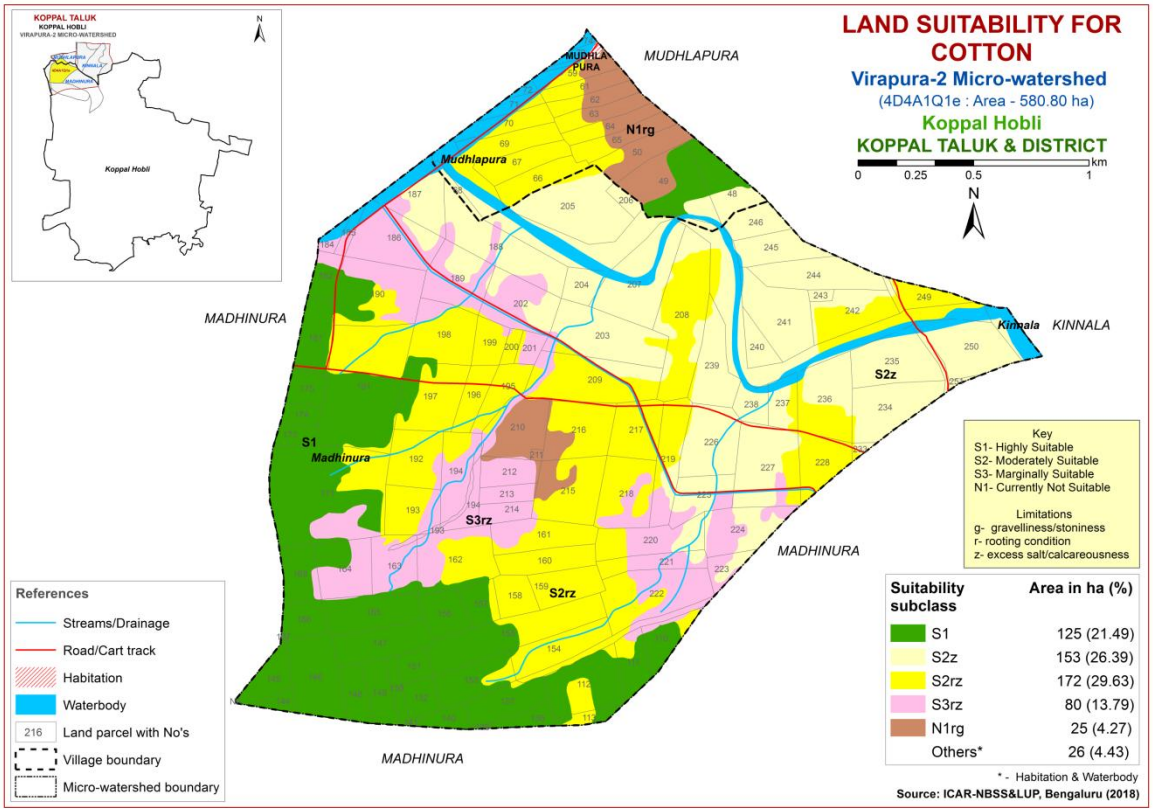


Fig. 7.6 Land Suitability map of Cotton

7.7 Land Suitability for Red gram (*Cajanus cajana*)

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburagi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red 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 red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

Maximum area of about 288 ha (49%) is moderately suitable (Class S2) for growing red gram and occur in the northwestern, northern, eastern, southern, southwestern, and western part of the microwatershed. They have minor limitations of texture and calcareousness. An area of about 163 ha (28%) is marginally suitable (Class S3) for growing red gram and distributed in the central, northern, western, southern and eastern part of the microwatershed with moderate limitations of rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing red gram and occur in the central, northern, southwestern, northwestern and southern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

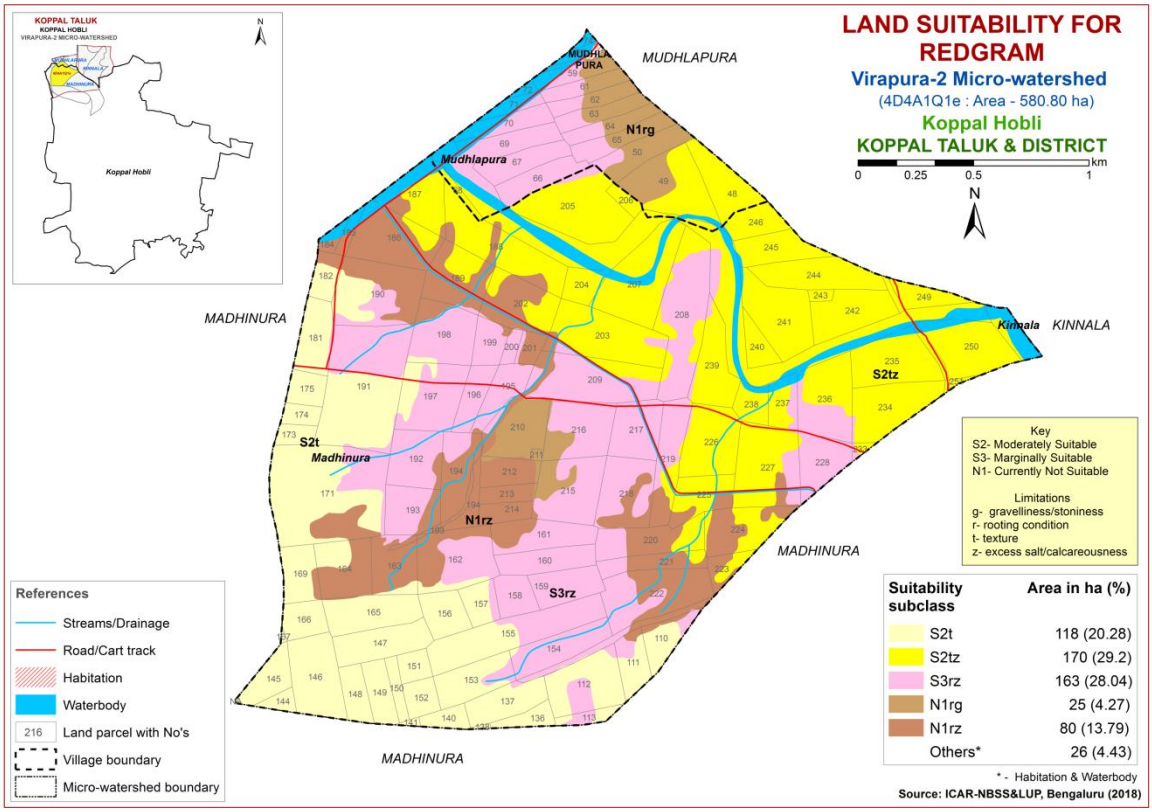


Fig. 7.7 Land Suitability map of Red gram

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

Bengal gram is one of the most important pulse crop grown in about 9.39 lakh ha area in Bijapur, Raichur, Kalaburagi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram (Table 7.9) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Bengal gram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.8.

Highly suitable (Class S1) lands for growing bengal gram occur in an area of 125 ha (21%) and distributed in the northern, western, southwestern and southern part of the microwatershed. Maximum area of about 326 ha (56%) is moderately suitable (Class S2) for growing bengal gram and distributed in the major part of the microwatershed. They have minor limitations of rooting depth and calcareousness. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing bengal gram and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands for growing bengal gram cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

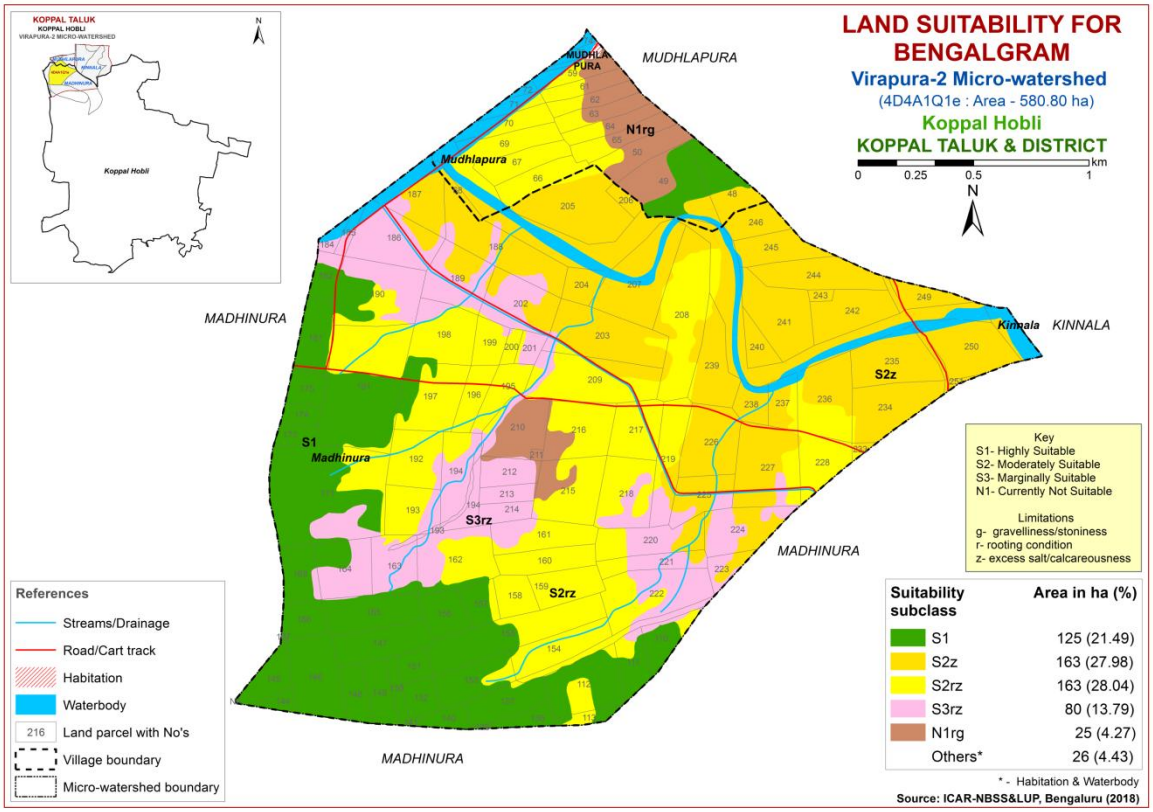


Fig. 7.8 Land Suitability map of Bengal gram

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

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

An area of about 72 ha (12%) is moderately suitable (Class S2) for growing chilli and distributed in the northern and eastern part of the microwatershed with minor limitations of texture and calcareousness. Major area of about 458 ha (79%) is marginally suitable (Class S3) for growing chilli and occur in the major part of the microwatershed with moderate limitations of texture, rooting depth and calcareousness. Currently not suitable (Class N1) lands for growing chilli cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

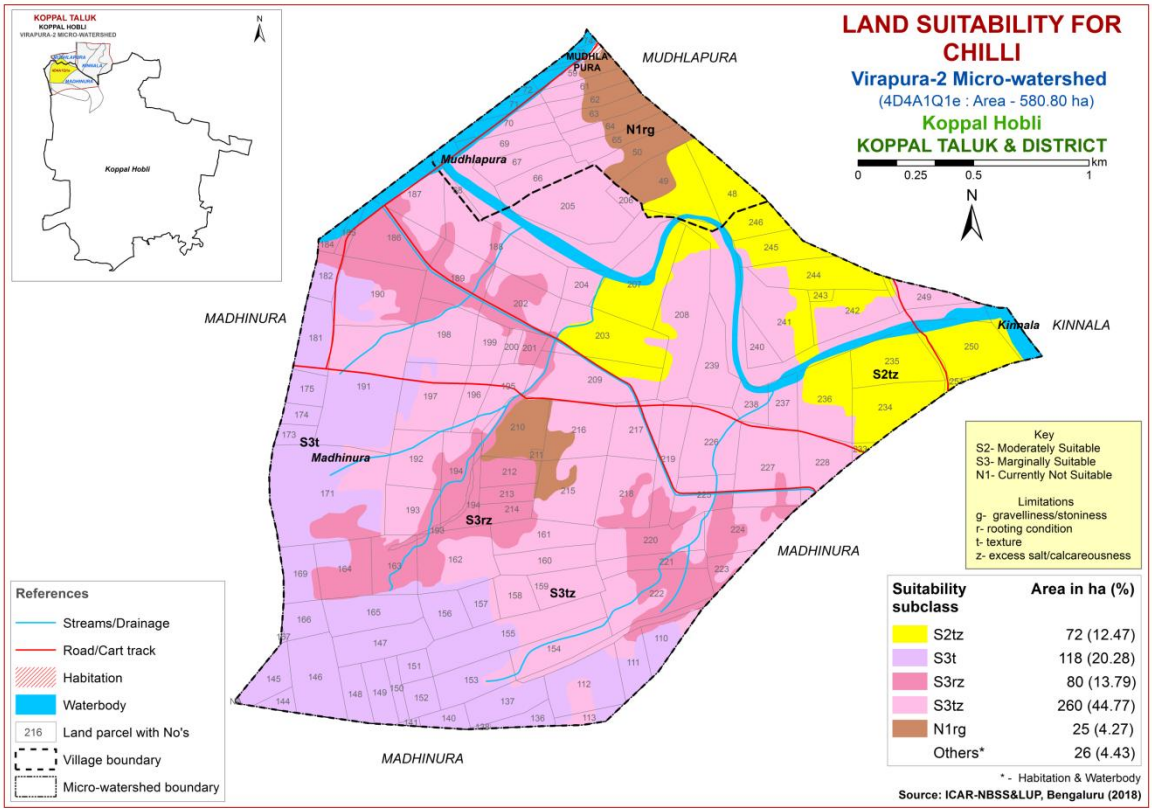


Fig. 7.9 Land Suitability map of Chilli

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 7 ha (1%) is moderately suitable (Class S2) for growing tomato and distributed in the northern part of the microwatershed with minor limitations of texture and calcareousness. Major area of about 522 ha (90%) is marginally suitable (Class S3) for growing tomato and occur in the major part of the microwatershed with moderate limitations of texture, drainage and calcareousness. Currently not suitable (Class N1) lands for growing tomato cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of gravelliness and rooting depth.

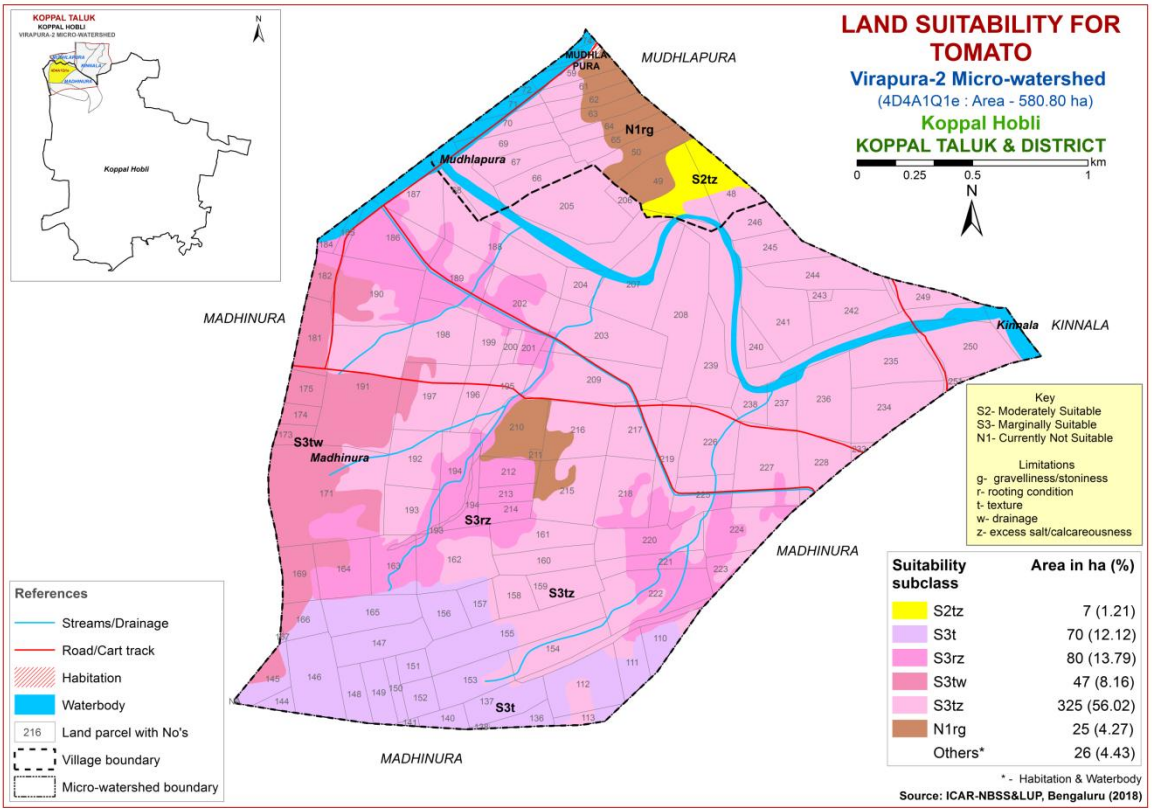


Fig. 7.10 Land Suitability map of Tomato

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.

Maximum area of about 449 ha (78%) is moderately suitable (Class S2) for growing brinjal and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness and texture. An area about of 80 ha (14%) is marginally suitable (Class S3) for growing brinjal and distributed in the northwestern, southwestern and southern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands for growing brinjal cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitation of rooting depth.

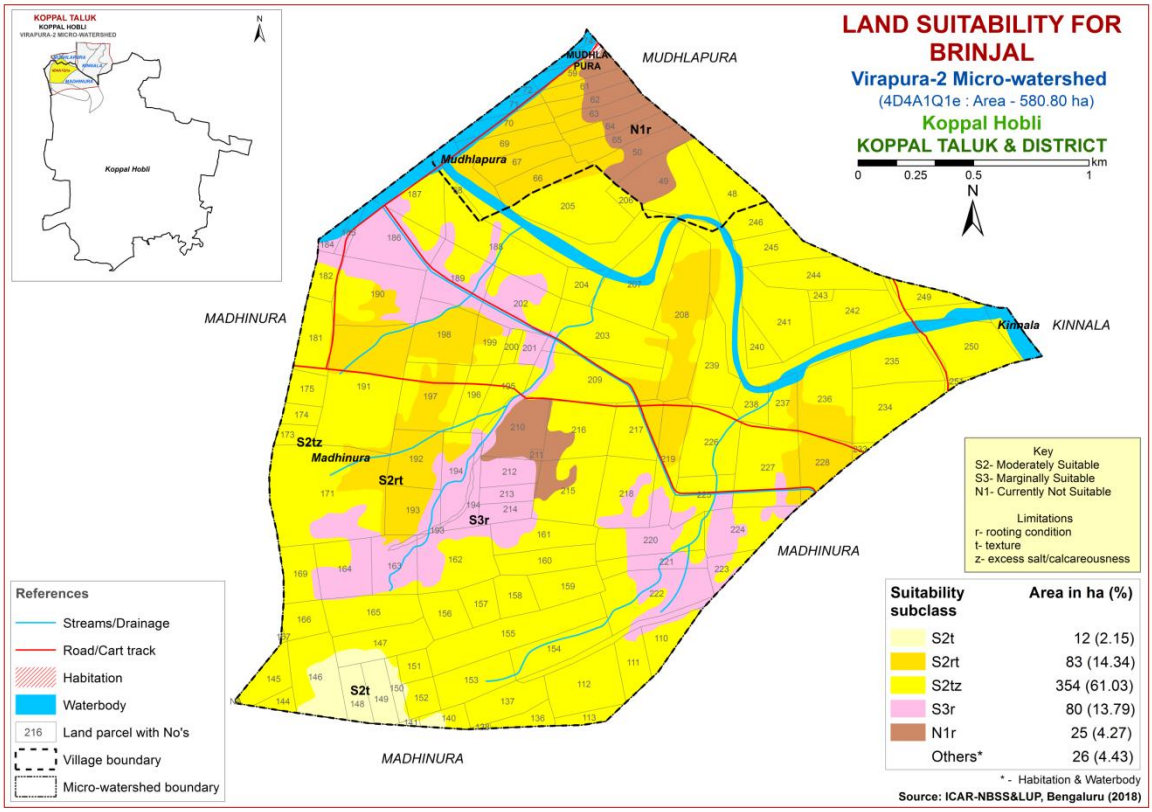


Fig 7.11 Land Suitability map of Brinjal

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

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

Major area of about 530 ha (91%) is marginally suitable (Class S3) for growing onion and distributed in the major part of the microwatershed with moderate limitations of rooting depth, calcareousness and texture. Currently not suitable (Class N1) lands for growing onion cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitation of rooting depth.

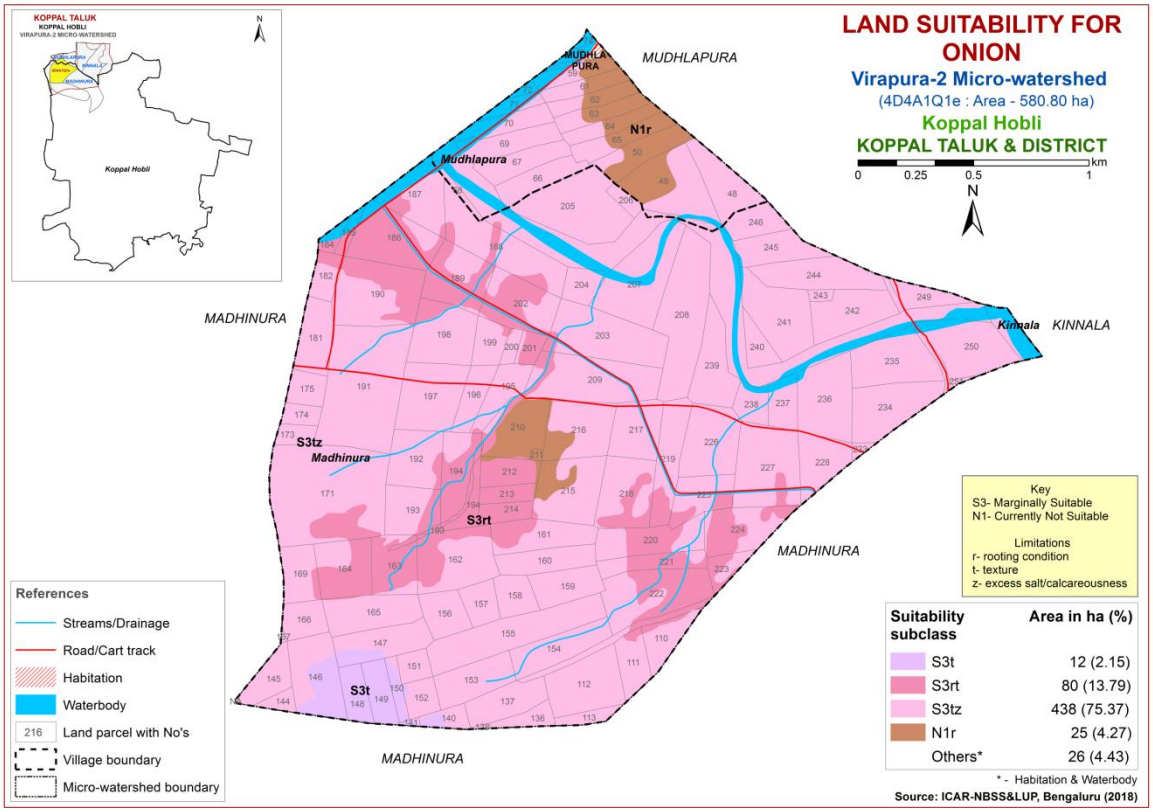


Fig 7.12 Land Suitability map of Onion

7.13 Land Suitability for Bhendi (*Abelmoschus esculentus*)

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

Maximum area of about 449 ha (78%) is moderately suitable (Class S2) for growing bhendi and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness and texture. An area about of 80 ha (14%) is marginally suitable (Class S3) for growing bhendi and distributed in the northwestern, southwestern and southern part of the microwatershed with moderate limitation of rooting depth. Currently not suitable (Class N1) lands for growing bhendi cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitation of rooting depth.

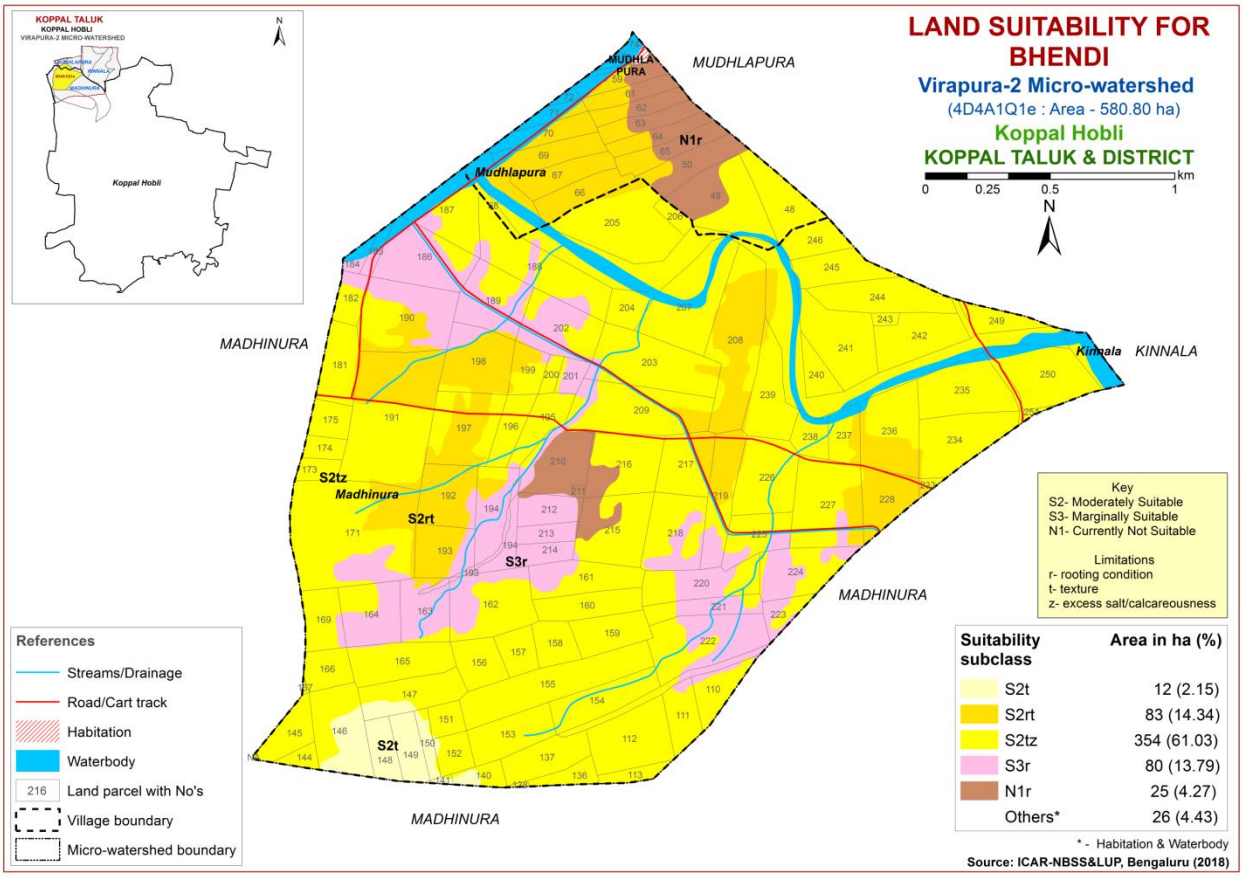


Fig 7.13 Land Suitability map of Bhendi

7.14 Land Suitability for Drumstick (*Moringa oleifera)*

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

Maximum area of about 366 ha (63%) is moderately suitable (Class S2) for growing drumstick and distributed in the major part of the microwatershed with minor limitations of texture, rooting depth and calcareousness. An area of about 83 ha (14%) is marginally suitable (Class S3) for growing drumstick and occur in the northern, northwestern, southwestern and eastern part of the microwatershed with moderate limitations of rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing drumstick and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

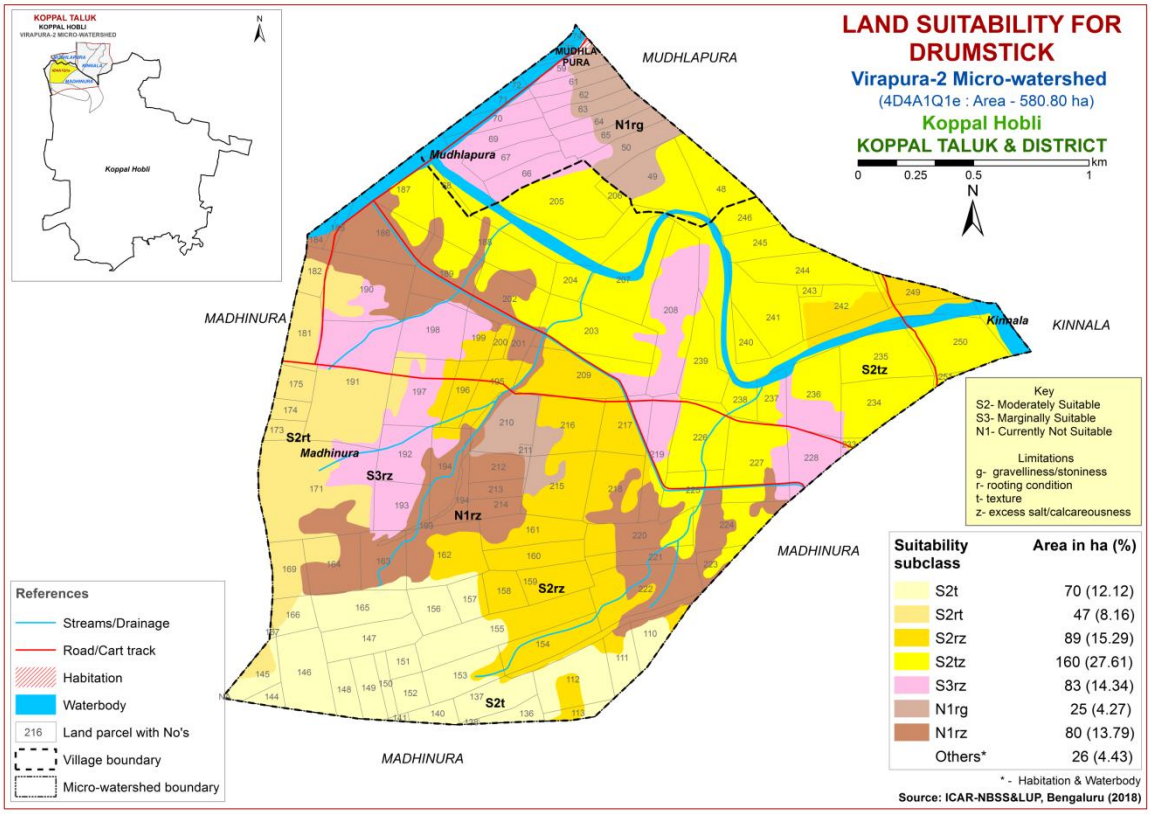


Fig. 7.14 Land Suitability map of Drumstick

7.15 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 7.16) 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 7.15.

An area of about 194 ha (33%) is moderately suitable (Class S2) for growing mulberry and distributed in the central, eastern, western, southwestern and southern part of the microwatershed with minor limitations of texture, drainage and calcareousness. Marginally suitable (Class S3) lands cover a major area of about 255 ha (44%) and occur in the western, southwestern, eastern, northern and northwestern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and texture. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing mulberry and occur in the central, northwestern, southwestern, southern and northern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

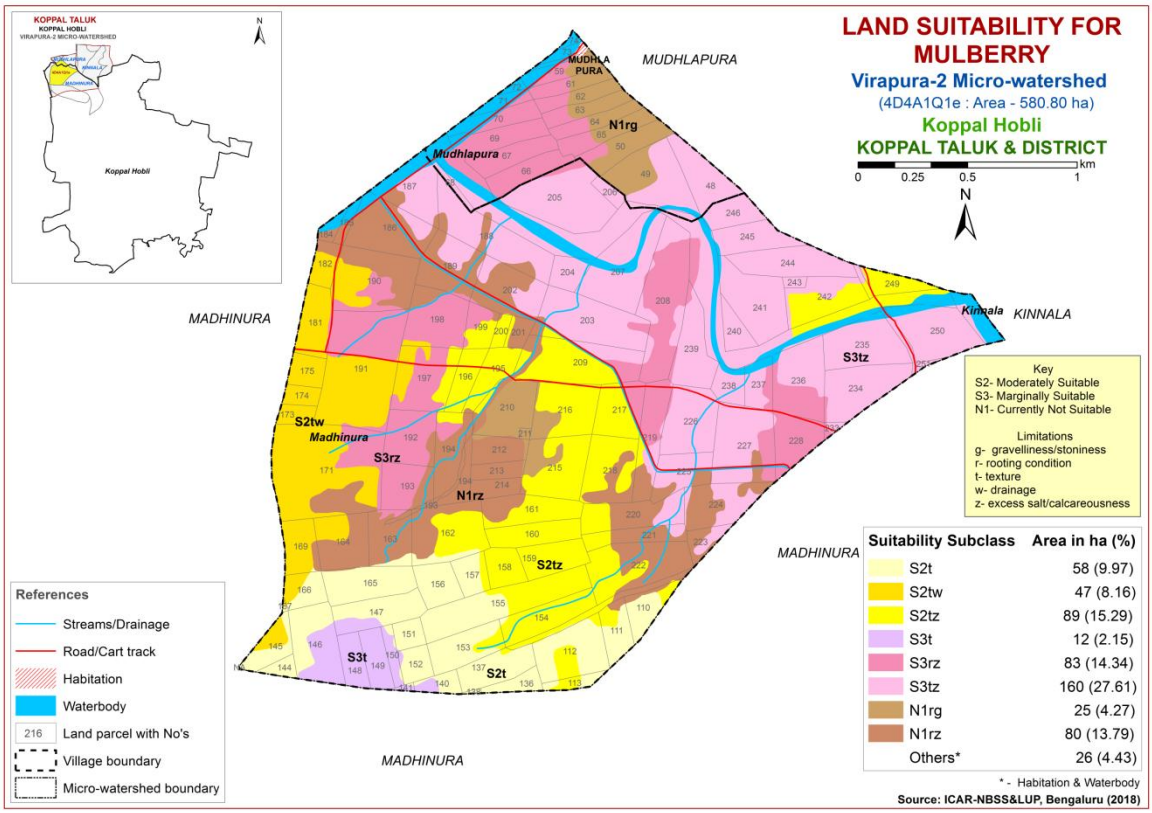


Fig. 7.15 Land Suitability map of Mulberry

7.16 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 7.17) 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 7.16.

Marginally suitable (Class S3) lands cover a major area of about 336 ha (63%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and gravelliness. An area of about 188 ha (32%) is currently not suitable (Class N1) for growing mango and occur in the central, northern, northwestern, western, southwestern, southern and eastern part of the microwatershed with severe limitations of rooting depth, calcareousness, texture and gravelliness.

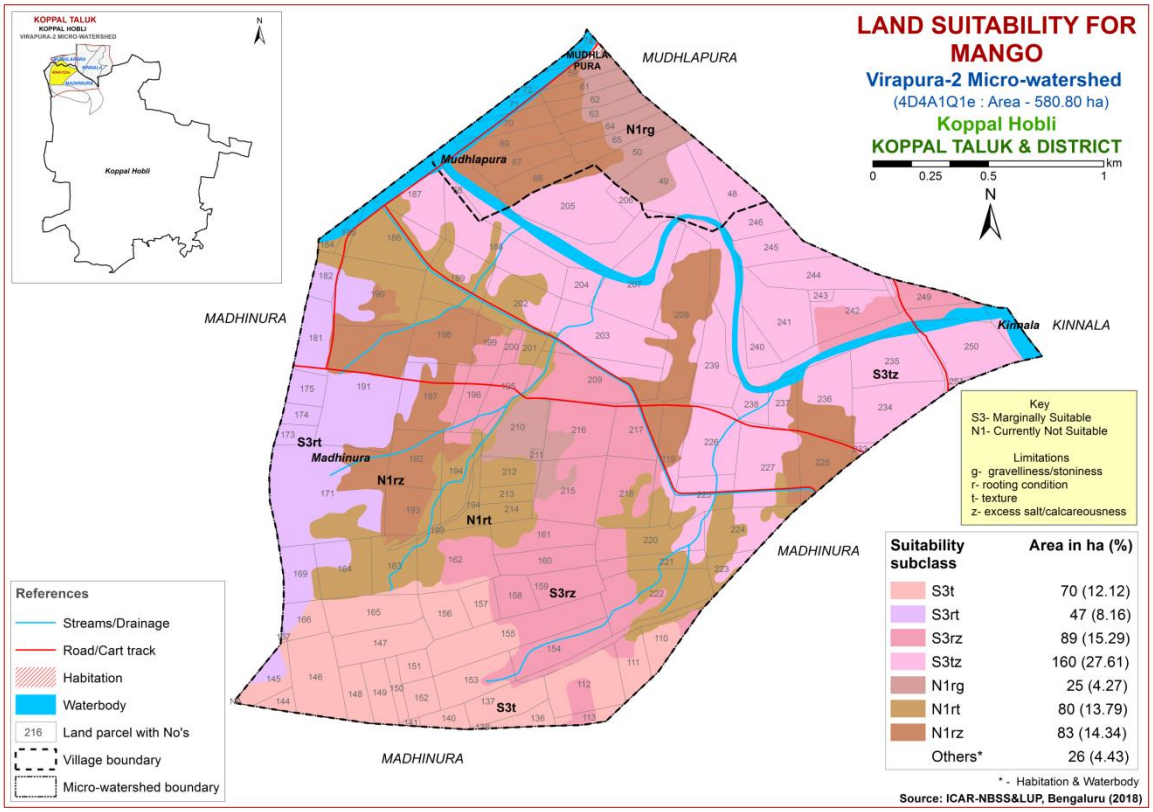


Fig. 7.16 Land Suitability map of Mango

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.

Major area of about 449 ha (78%) is marginally (Class S3) suitable for growing sapota and occur in the major part of the microwatershed with moderate limitations of texture, rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing sapota and occur in the central, northwestern, southwestern, southern and northern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

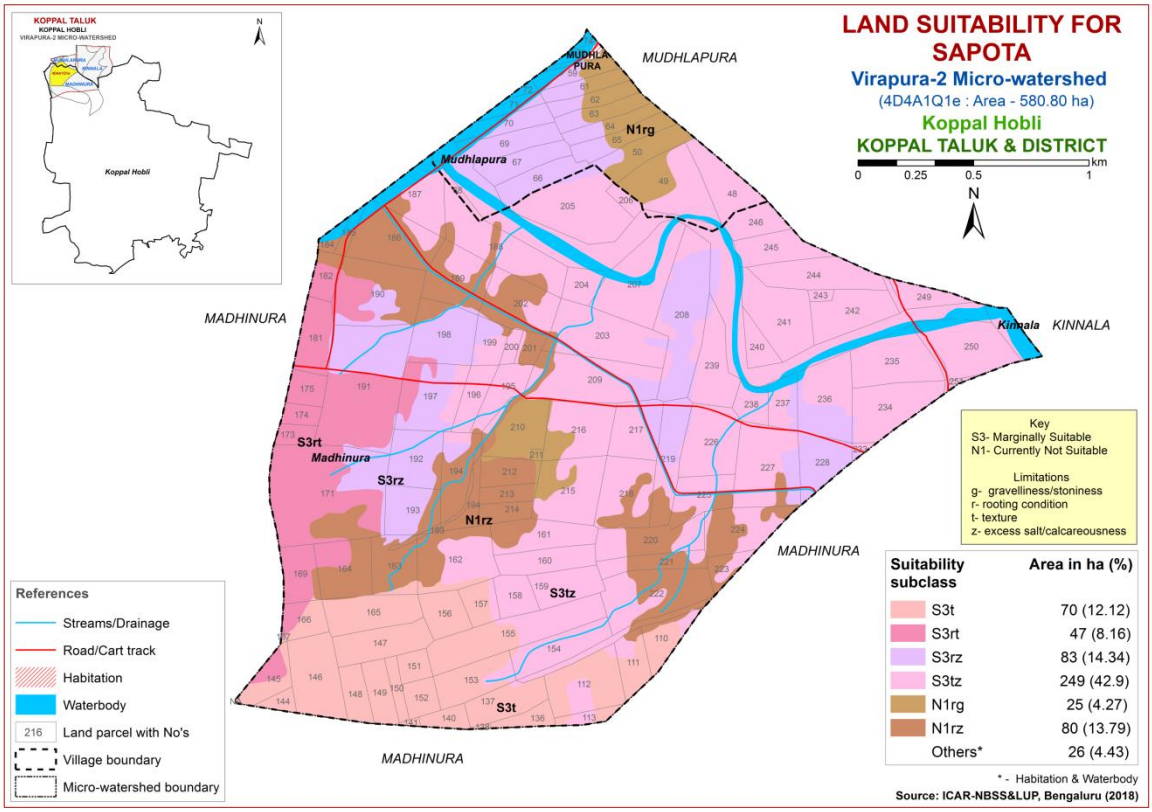


Fig. 7.17 Land Suitability map of Sapota

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.

Maximum area of about 366 ha (63%) is moderately suitable (Class S2) for growing pomegranate and occur in the major part of the microwatershed with minor limitations of texture, rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 83 ha (14%) and occur in the western, northwestern, southwestern, eastern and northern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing pomegranate and occur in the central, northwestern, southwestern, southern and northern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

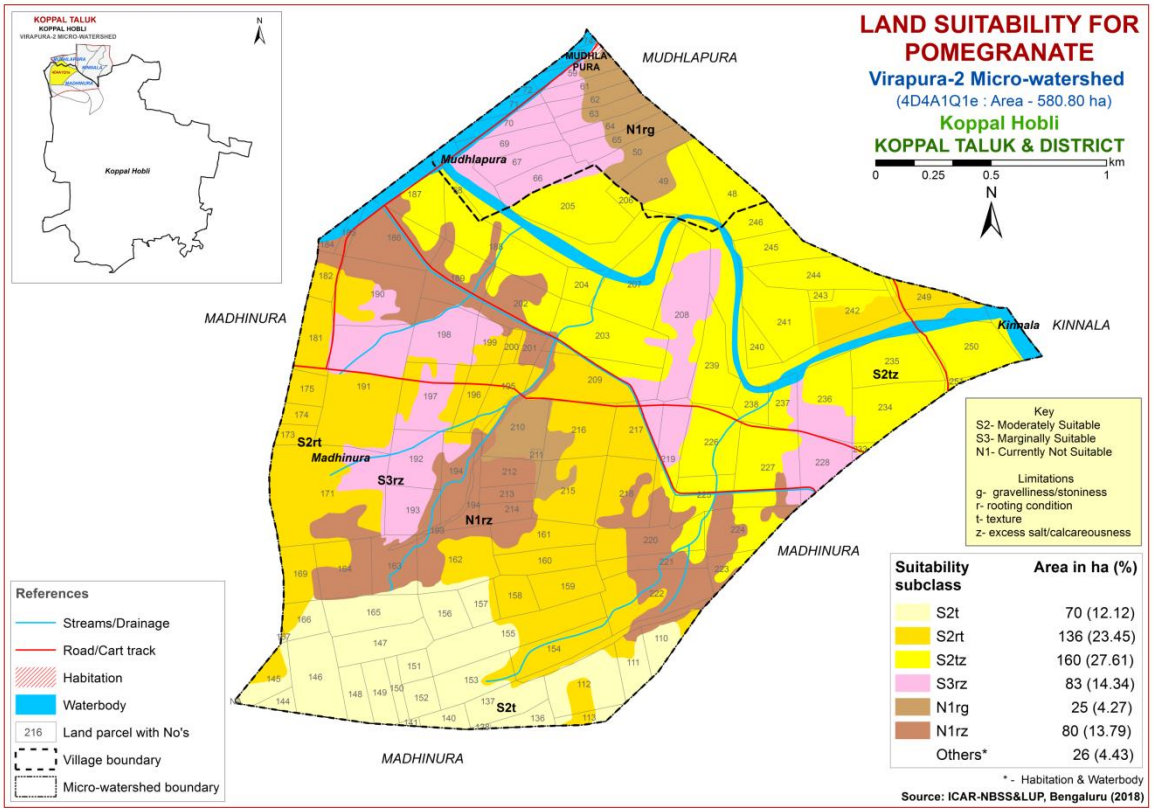


Fig. 7.18 Land Suitability map of Pomegranate

7.19 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 7.20) 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 7.19.

An area of 450 ha (78%) is marginally (Class S3) suitable for growing guava and occur in the major part of the microwatershed with moderate limitations of texture and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing guava and occur in the central, northwestern, southwestern, southern and northern part of the microwatershed with severe limitations of rooting depth, topography and gravelliness.

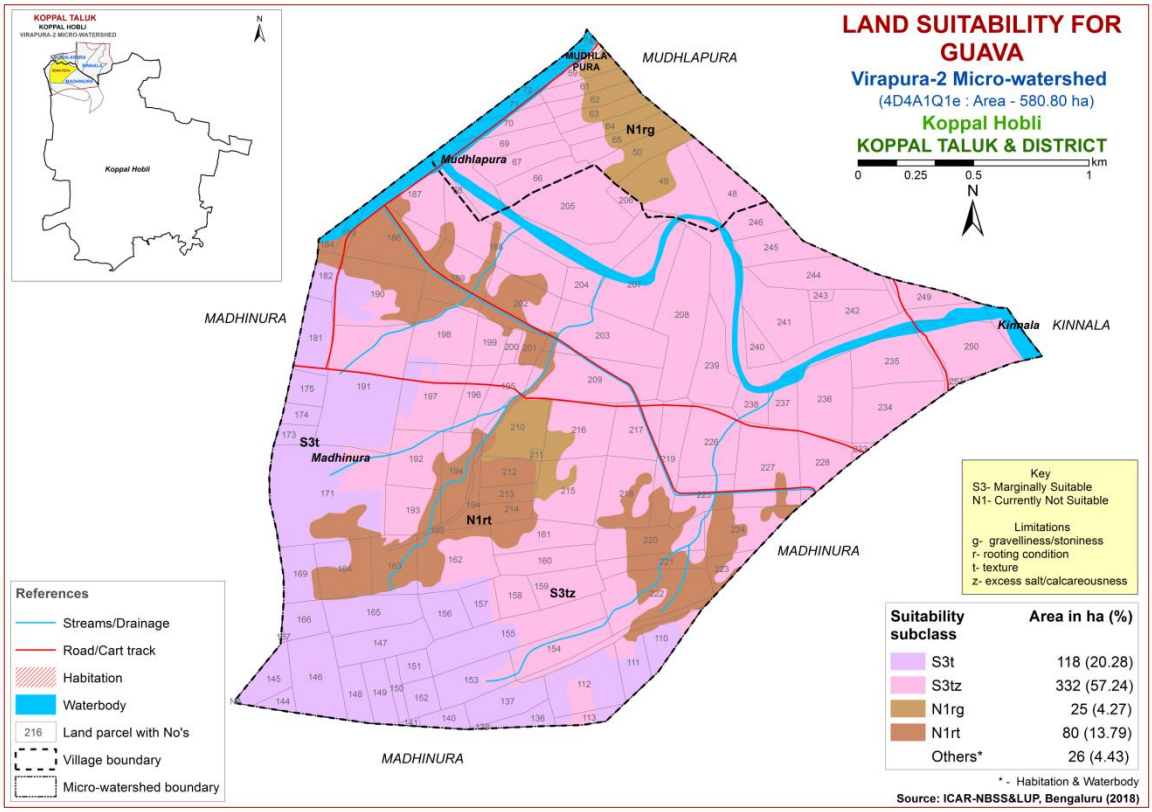


Fig. 7.19 Land Suitability map of Guava

7.20 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 7.21) 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 7.20.

Major area of about 450 ha (78%) is marginally (Class S3) suitable for growing jackfruit and occur in the major part of the microwatershed with moderate limitations of texture and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing jackfruit and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, texture and gravelliness.

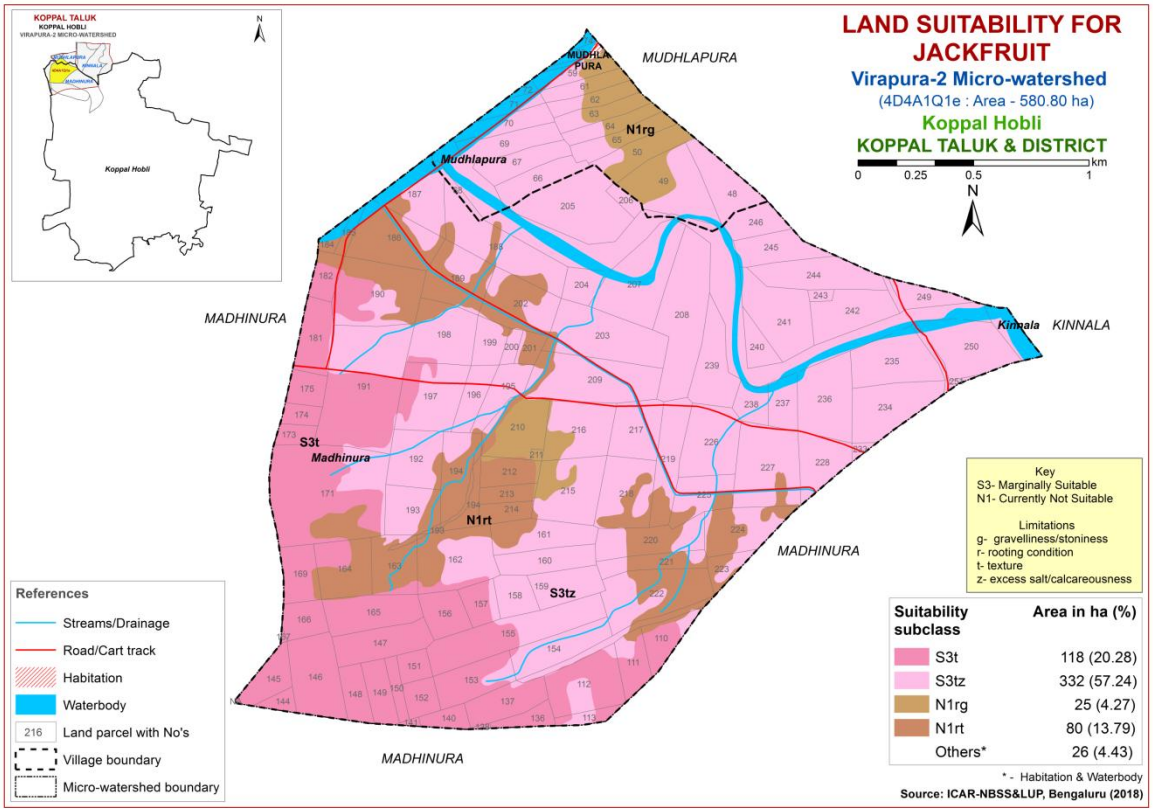


Fig. 7.20 Land Suitability map of Jackfruit

7.21 Land Suitability for Jamun (*Syzygium cumini*)

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

Maximum area of 230 ha (40%) is moderately suitable (Class S2) for growing jamun and occur in the northwestern, northern, eastern, southern and southwestern part of the microwatershed with minor limitations of texture, rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 219 ha (38%) and occur in the central, northern, northwestern, western, southwestern, southern and eastern part of the microwatershed. They have moderate limitations of rooting depth, texture and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing jamun and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, texture and gravelliness.

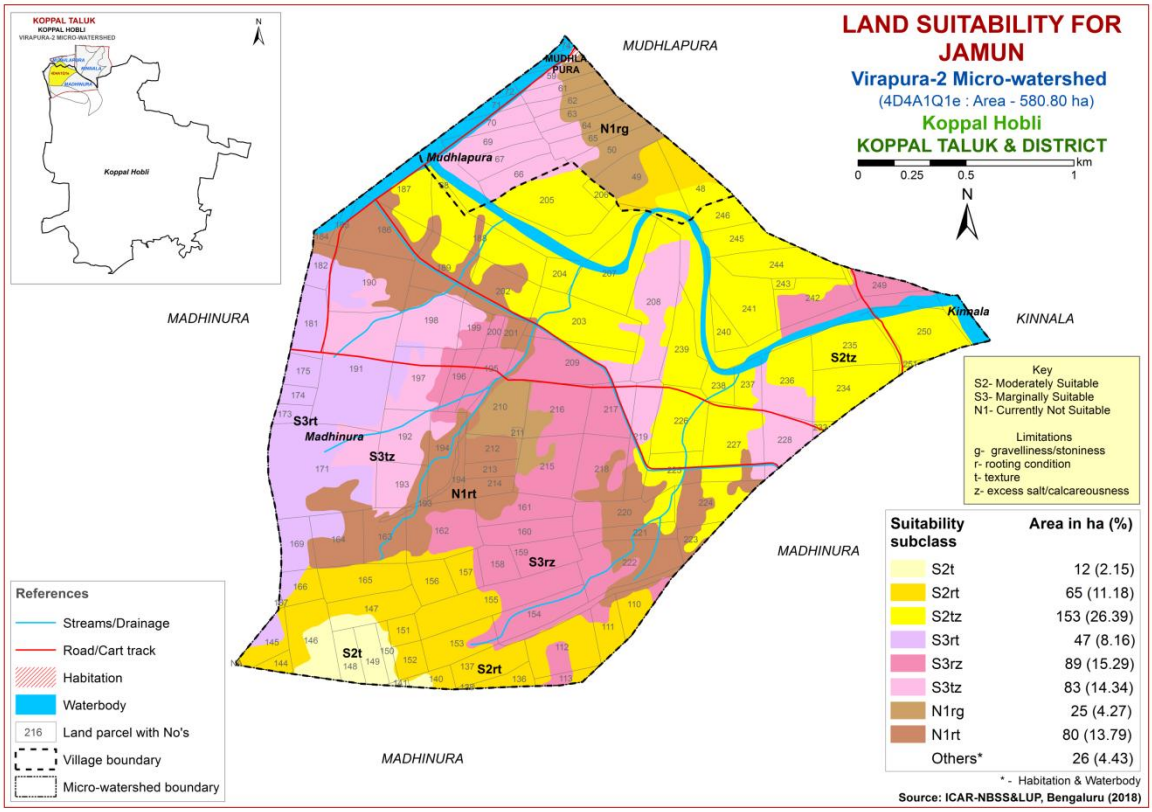


Fig. 7.21 Land Suitability map of Jamun

7.22 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 7.23) 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 7.22.

Highly suitable (Class S1) lands for growing musambi cover an area of about 77 ha (13%) and occur in the northern, southern and southwestern part of the microwatershed. Maximum area of about 289 ha (50%) is moderately suitable (Class S2) for growing musambi and occur in the major part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 83 ha (14%) and occur in the northern, northwestern, western, southwestern and eastern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing musambi and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

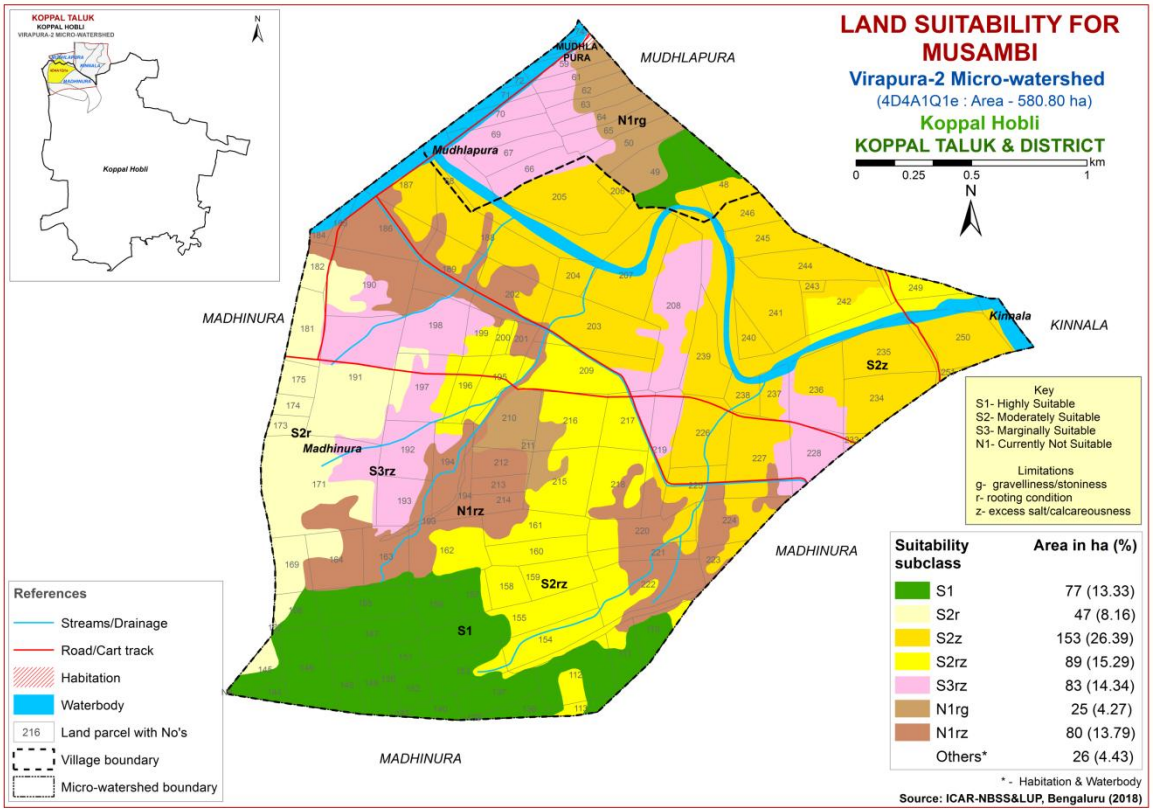


Fig. 7.22 Land Suitability map of Musambi

7.23 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 (Table 7.24) for growing lime (Table 7.15) 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 7.23.

An area of about 77 ha (13%) is highly suitable (Class S1) for growing lime and occur in the northern, southern and southwestern part of the microwatershed. An area of about 289 ha (50%) is moderately suitable (Class S2) for growing lime and occur in the major part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 83 ha (14%) and occur in the northern, northwestern, western, southwestern and eastern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 105 ha (18%) is currently not suitable (Class N1) for growing lime and occur in the central, northern, northwestern, southwestern and southern part of the microwatershed with severe limitations of rooting depth, calcareousness and gravelliness.

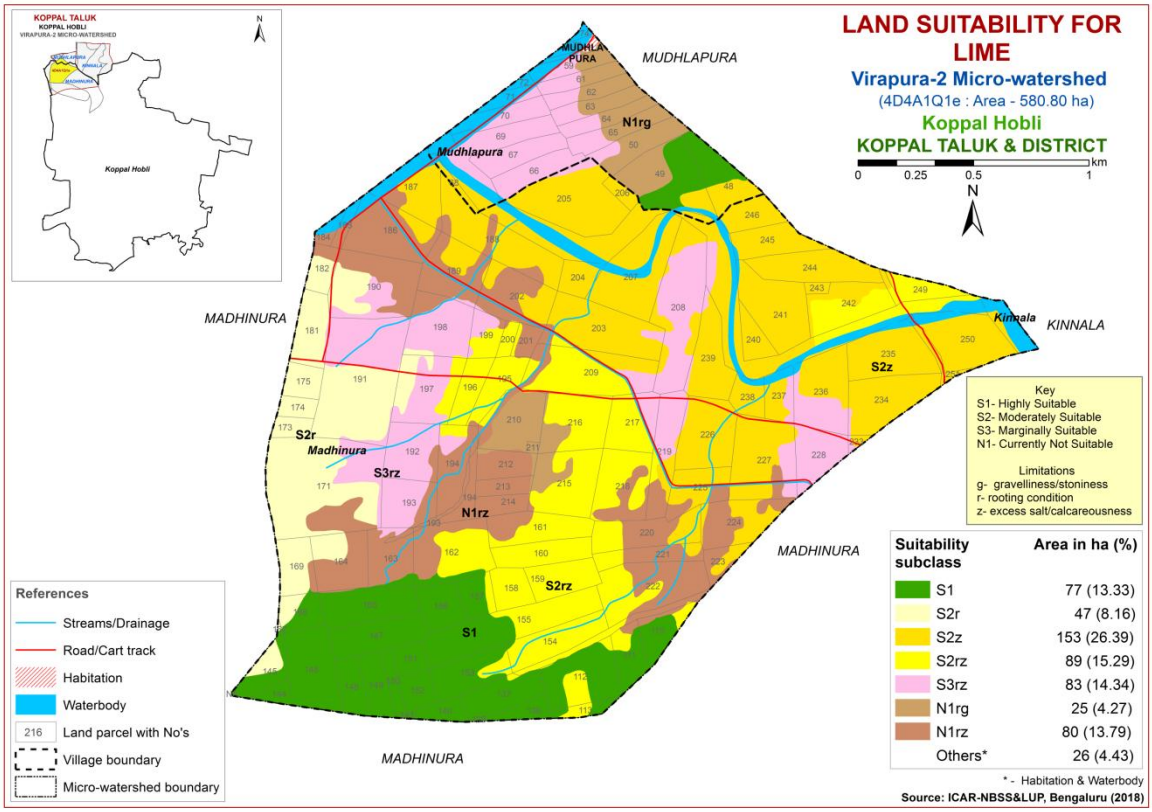


Fig. 7.23 Land Suitability map of Lime

7.24 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements (Table 7.25) for growing cashew were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.24.

Currently not suitable (Class N1) lands cover a entire cultivated area of the microwatershed with severe limitations of texture, rooting depth, calcareousness and gravelliness.

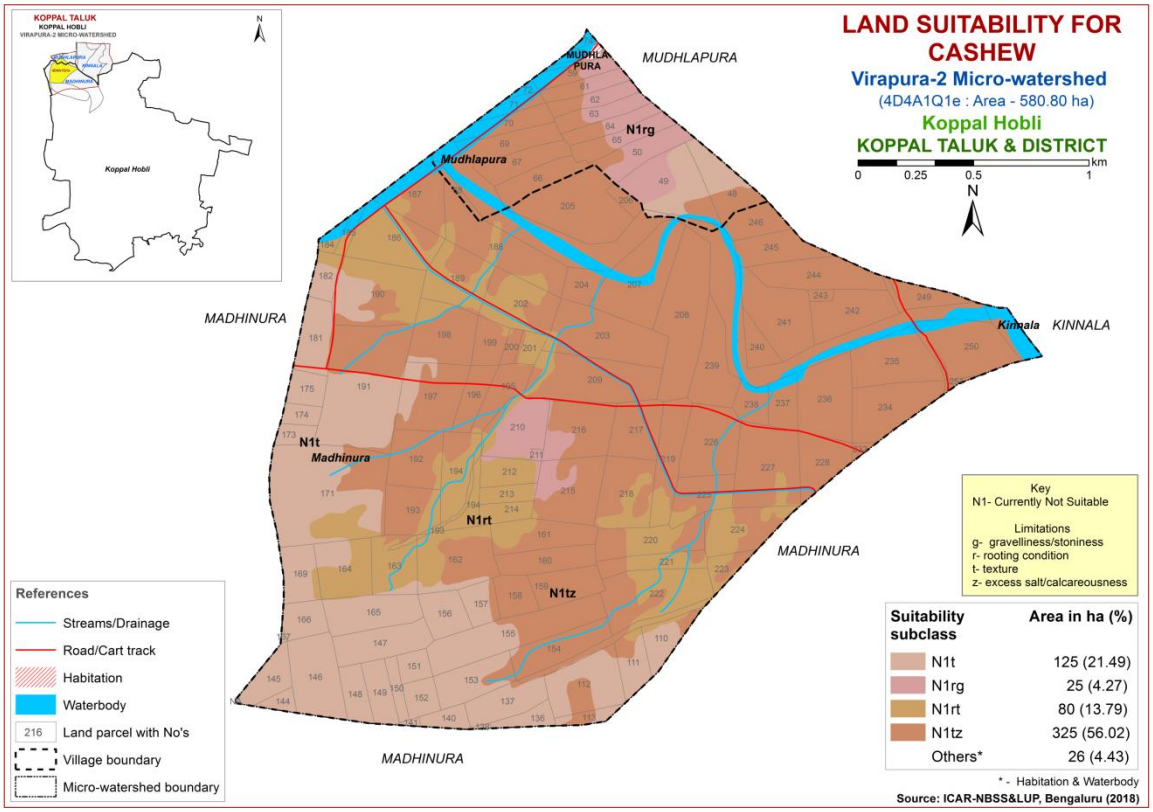


Fig. 7.24 Land Suitability map of Cashew

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 125 ha (21%) is highly suitable (Class S1) for growing custard apple and occur in the northern, western, southwestern and southern part of the microwatershed. Major area of about 325 ha (56%) is moderately suitable (Class S2) for growing custard apple and occur in the major part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover an area of about 80 ha (14%) for growing custard apple and occur in the northwestern, southwestern and southern part of the microwatershed. They have moderate limitations of calcareousness and gravelliness. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

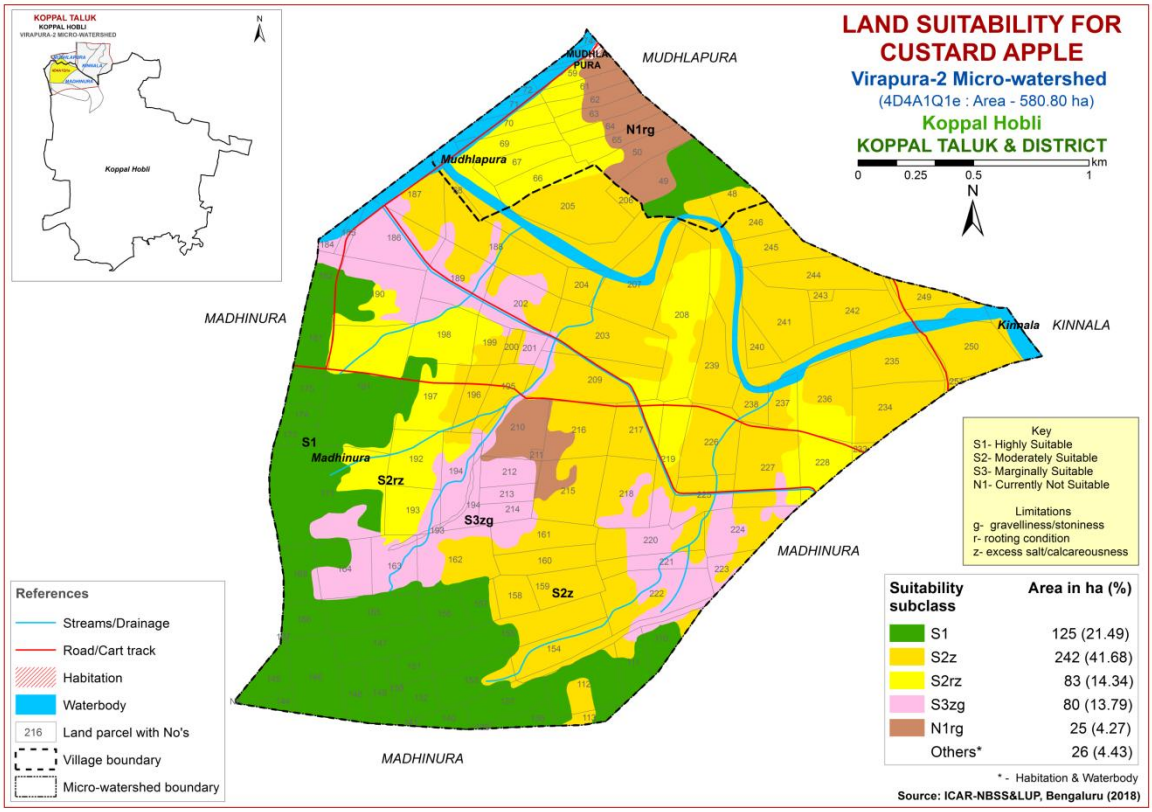


Fig. 7.25 Land Suitability map of Custard Apple

7.26 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 for (Table 7.27) 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 7.26.

Highly suitable (Class S1) lands for growing amla cover an area of about 7 ha (1%) and occur in the northern part of the microwatershed. Major area of about 443 ha (76%) is moderately suitable (Class S2) for growing amla and occur in the major part of the microwatershed with minor limitations of rooting depth, calcareousness and texture. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing amla and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of calcareousness and texture. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

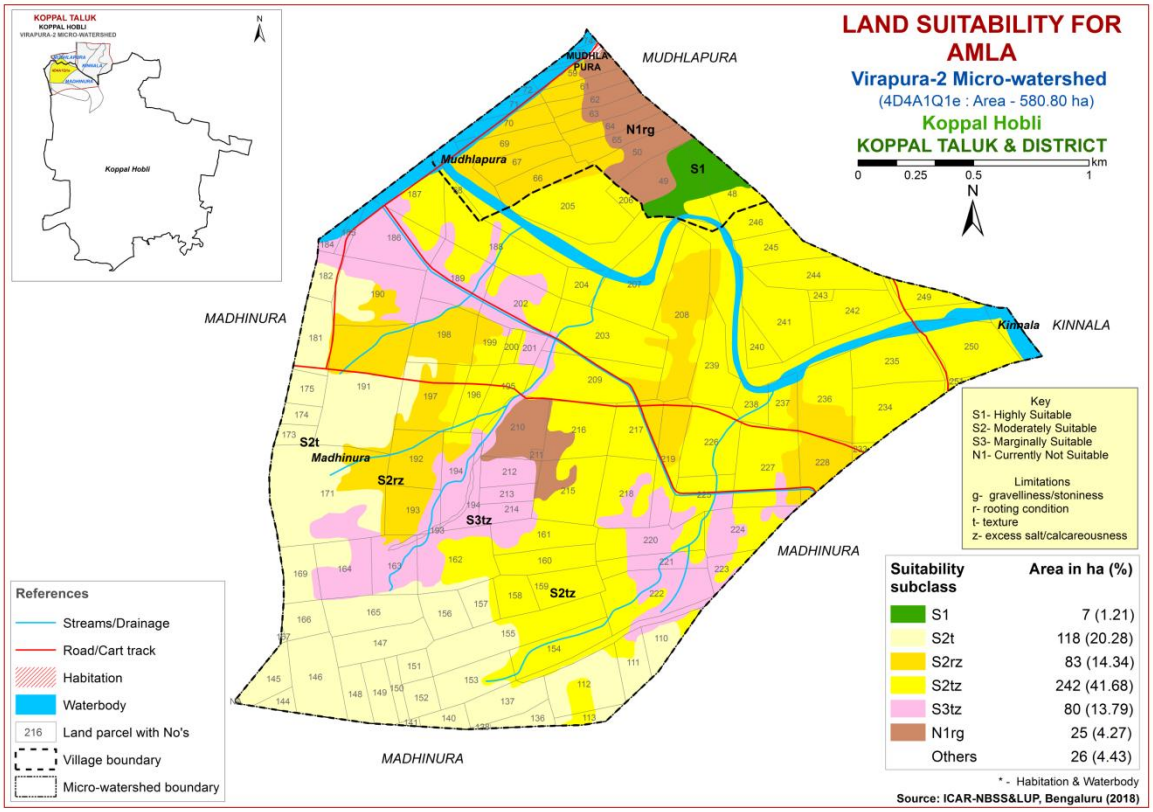


Fig. 7.26 Land Suitability map of Amla

7.27 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 7.28) 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 is given in Figure 7.27.

Maximum area of about 230 ha (40%) is moderately suitable (Class S2) for growing tamarind and occur in the northern, eastern, southern and southwestern part of the microwatershed with minor limitations of rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of 136 ha (23%) for growing tamarind and occur in the central, eastern, western, southwestern and southern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. An area of about 188 ha (32%) is currently not suitable (Class N1) for growing tamarind and distributed in the central, northern, eastern, northwestern, southwestern and southern part of the microwatershed. They have severe limitations of rooting depth, calcareousness and gravelliness.

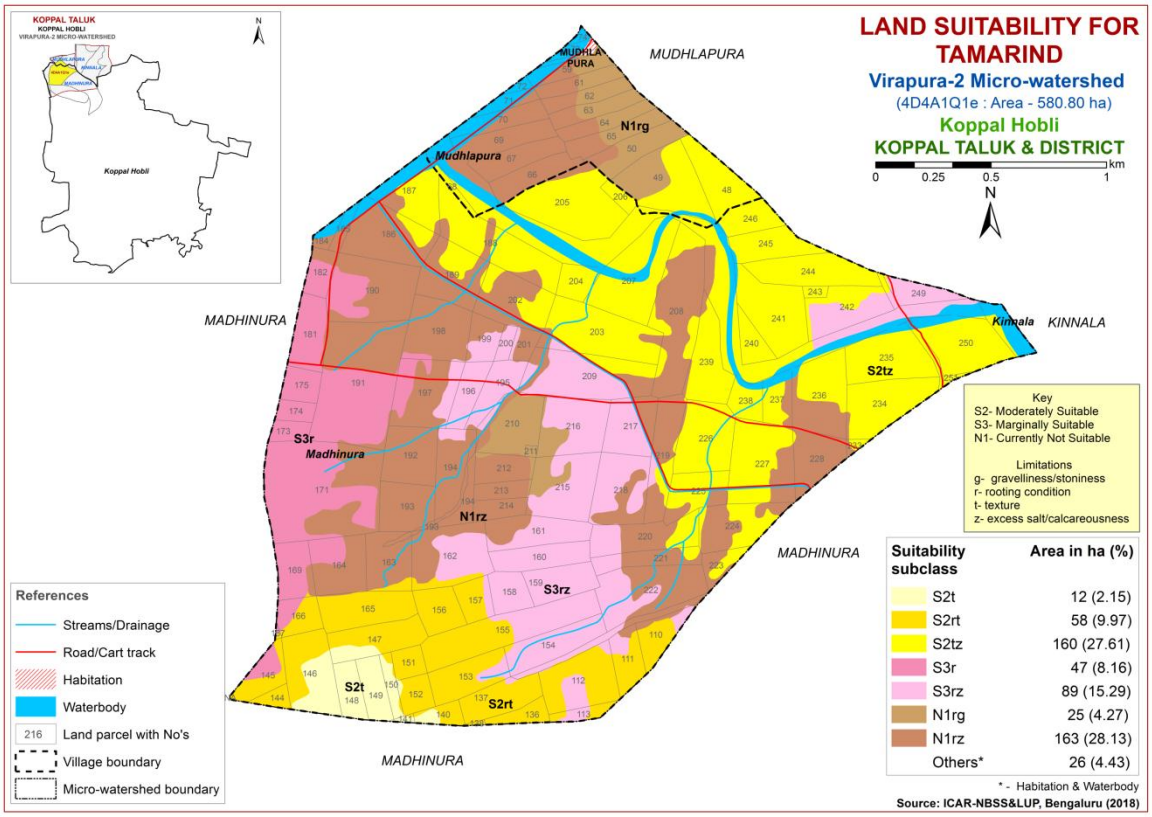


Fig. 7.27 Land Suitability map of Tamarind

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 (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.28.

Maximum area of about 449 ha (78%) is moderately suitable (Class S2) for growing marigold and distributed in the major part of the microwatershed with minor limitations of texture, rooting depth, calcareousness and drainage. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing marigold and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and southern part of the microwatershed with severe limitations of rooting depth and gravelliness.

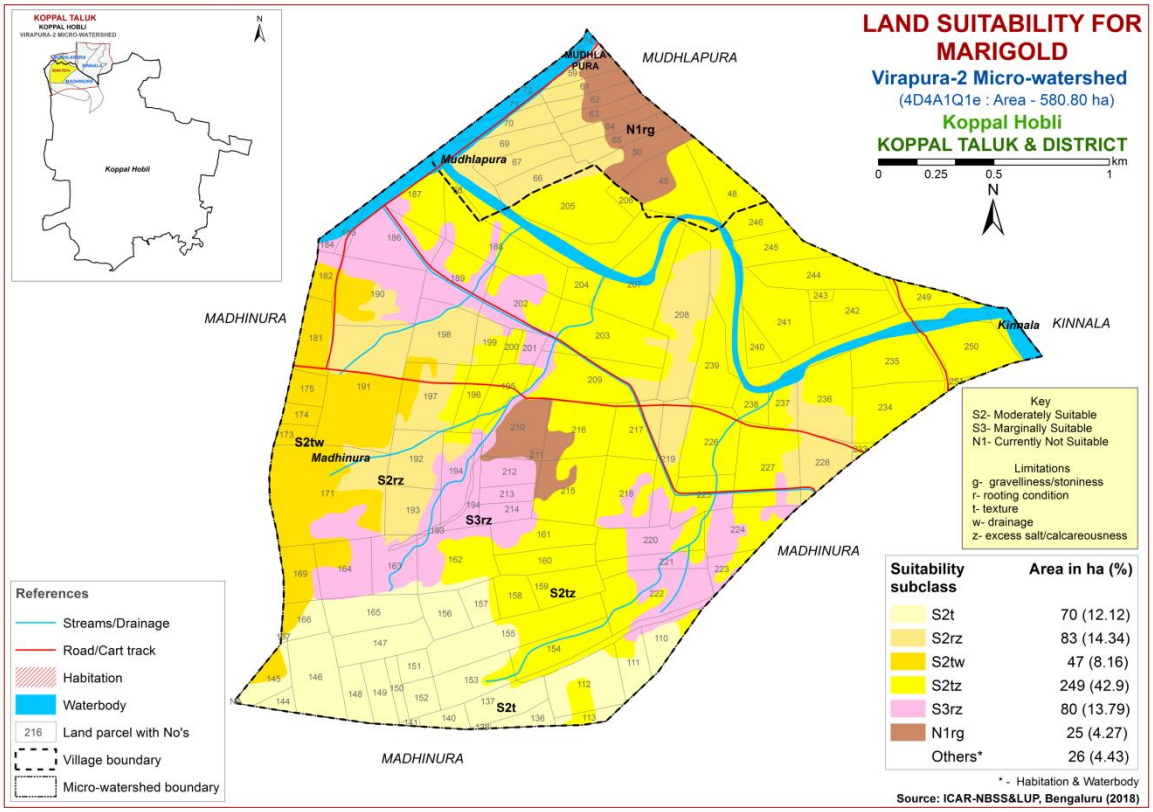


Fig. 7.28 Land Suitability map of Marigold

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.

Maximum area of about 449 ha (78%) is moderately suitable (Class S2) for growing chrysanthemum and distributed in the major part of the microwatershed with minor limitations of texture, rooting depth, calcareousness and drainage. An area of about 80 ha (14%) is marginally suitable (Class S3) for growing chrysanthemum and occur in the northwestern, southwestern and southern part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

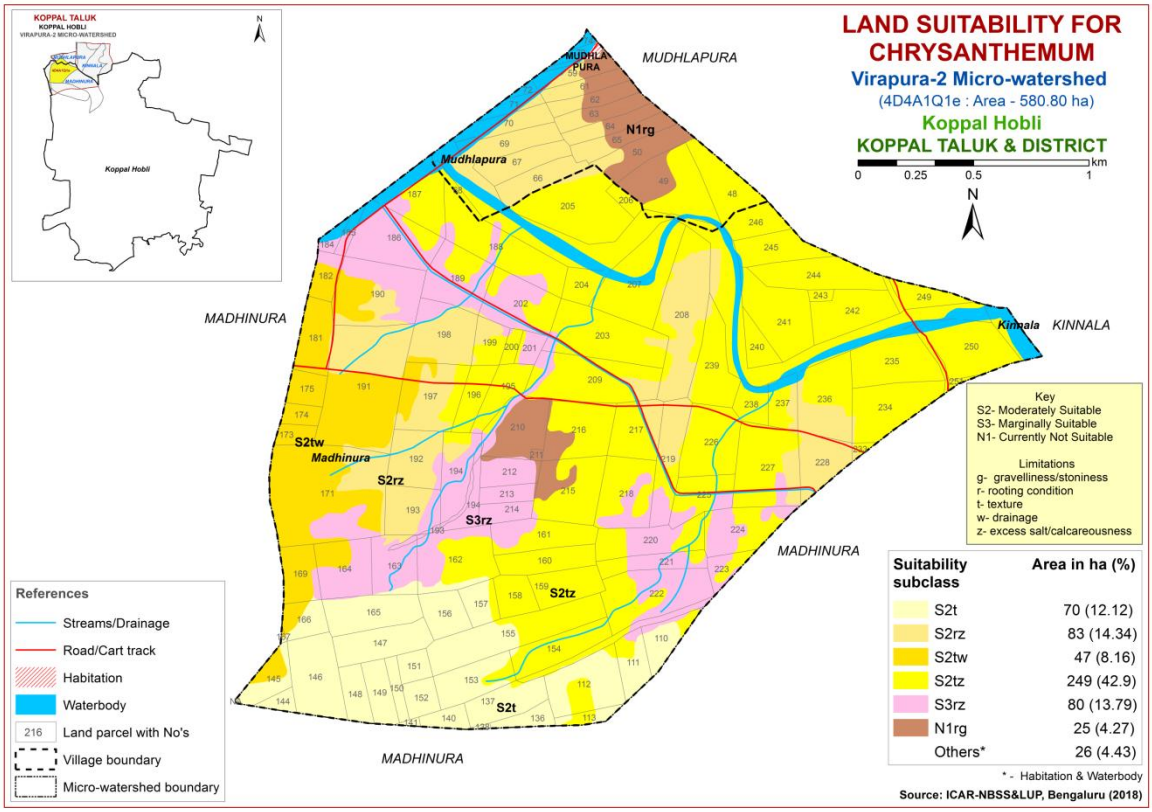


Fig. 7.29 Land Suitability map of Chrysanthemum

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 83 ha (14%) is moderately suitable (Class S2) for growing jasmine and occur in the northern, western, southwestern and eastern part of the microwatershed. They have minor limitations of calcareousness and rooting depth. Major area of about 446 ha (77%) is marginally suitable (Class S3) for growing jasmine and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and drainage. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

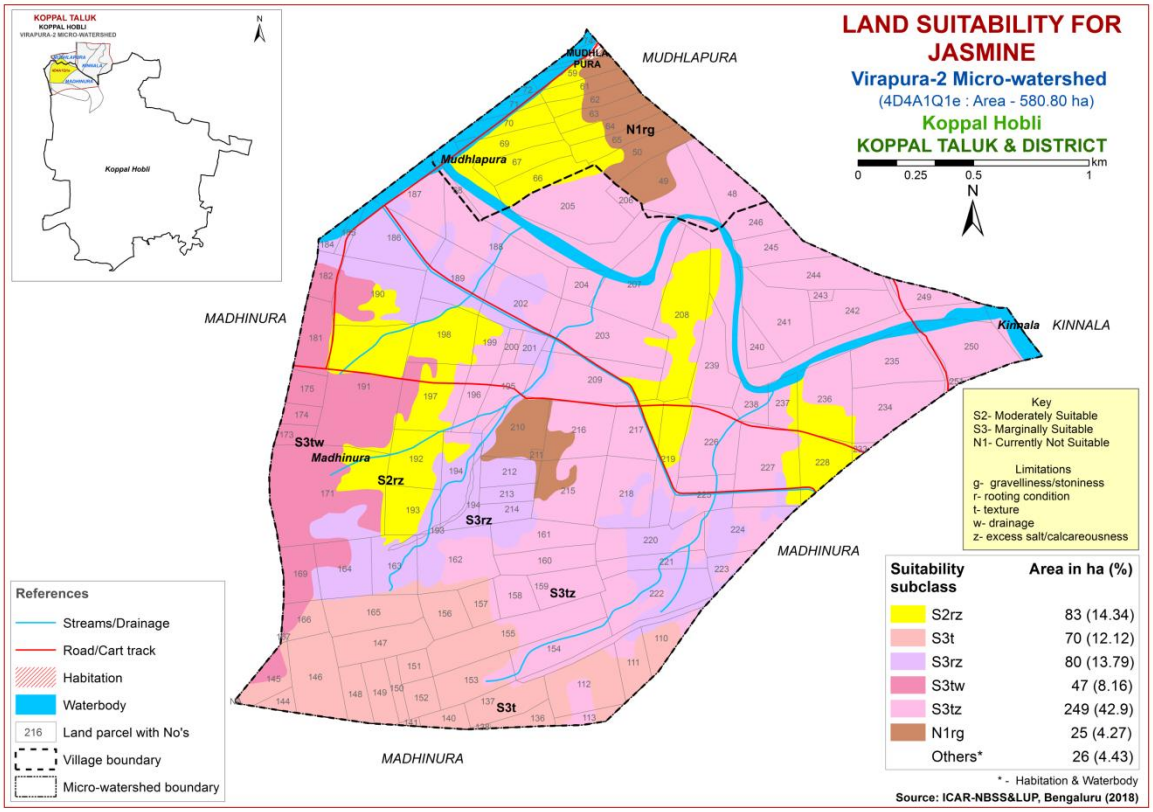


Fig. 7.30 Land Suitability map of Jasmine

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

Crossandra is one of the most important flower crop grown in all the districts of the state. The crop requirements (Table 7.32) for growing crossandra were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.31.

An area of about 150 ha (26%) is moderately suitable (Class S2) for growing crossandra and occur in the central, southern and southwestern part of the microwatershed. They have minor limitations of texture and calcareousness. Major area of about 380 ha (65%) is marginally suitable (Class S3) for growing crossandra and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and rooting depth. Currently not suitable (Class N1) lands cover an area of about 25 ha (4%) and distributed in the central and northern part of the microwatershed with severe limitations of rooting depth and gravelliness.

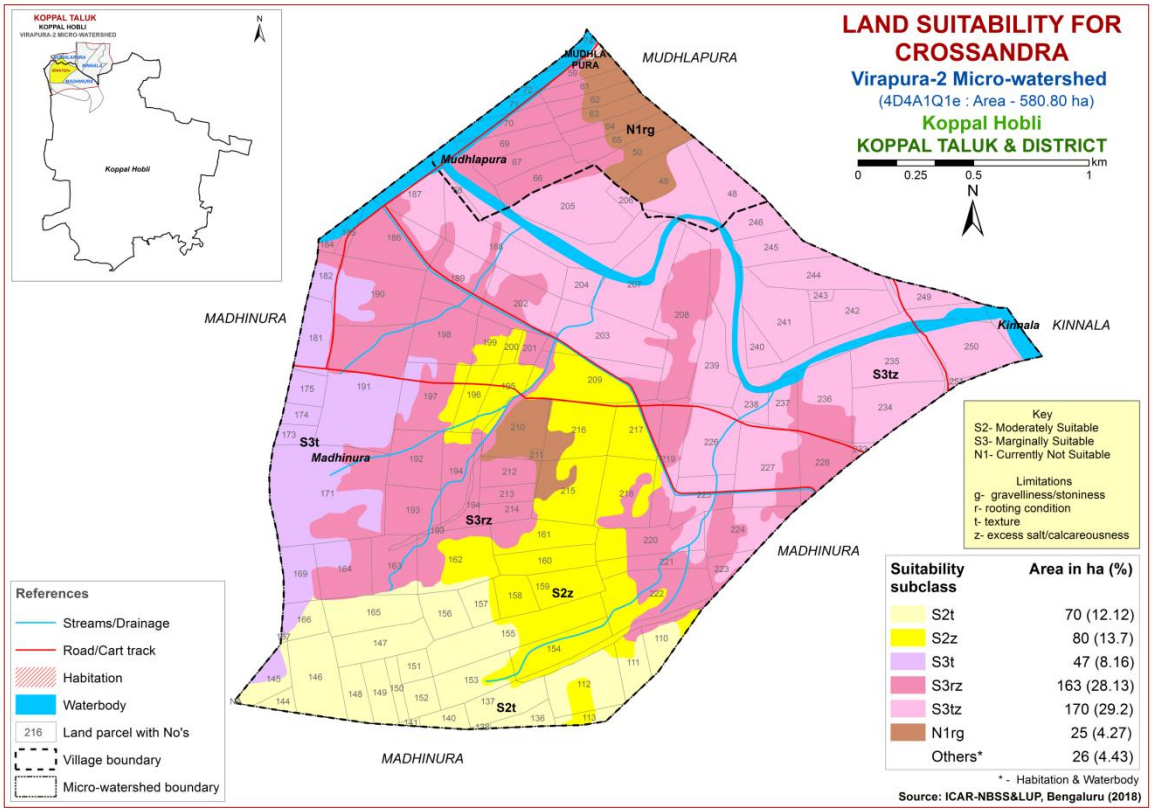


Fig. 7.31 Land Suitability map of Crossandra

Table 7.1 Soil-Site Characteristics of Virapura-2 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p+)kg-1]	BS (%)
					Surf-ace	Sub-surface	Sur-face	Sub-surface								
BGTiB2g1	662	<90	WD	<25	sc	gc	15-35	>35	<50	1-3	Moderate	8.4	0.157	1.11	44.84	-
BGTmB2g2	662	<90	WD	<25	c	gc	35-60	>35	<50	1-3	Moderate	8.4	0.157	1.11	44.84	-
SRRmA1	662	<90		100-150	c	c	<15	<15	151-200	0-1	Slight	-	-	-	-	-
MTLmB1g1	662	<90	WD	25-50	c	gc	15-35	15-35	51-100	1-3	Slight	8.27	0.202	0.69	36.64	-
MTLmB1g2	662	<90	WD	25-50	c	gc	35-60	15-35	51-100	1-3	Slight	8.27	0.202	0.69	36.64	-
MTLmB2g1	662	<90	WD	25-50	c	gc	15-35	15-35	51-100	1-3	Moderate	8.27	0.202	0.69	36.64	-
RNKiB2g1	662	<90	MWD	50-75	sc	c	15-35	<15	51-100	1-3	Moderate	8.86	0.483	6.78	37.00	-
RNKmA1g1	662	<90	MWD	50-75	c	c	15-35	<15	51-100	0-1	Slight	8.86	0.483	6.78	37.00	-
RNKmB1	662	<90	MWD	50-75	c	c	<15	<15	51-100	1-3	Slight	8.86	0.483	6.78	37.00	-
RNKmB1g1	662	<90	MWD	50-75	c	c	15-35	<15	51-100	1-3	Slight	8.86	0.483	6.78	37.00	-
RNKmB2	662	<90	MWD	50-75	c	c	<15	<15	51-100	1-3	Moderate	8.86	0.483	6.78	37.00	-
RNKmB2g1	662	<90	MWD	50-75	c	c	15-35	<15	51-100	1-3	Moderate	8.86	0.483	6.78	37.00	-
DRLmA1	662	<90	MWD	75-100	c	c	<15	<15	151-200	0-1	Slight	8.78	0.42	5.62	49.70	100
DRLmB2	662	<90	MWD	75-100	c	c	<15	<15	151-200	1-3	Moderate	8.78	0.42	5.62	49.70	100
DRLmB2g1	662	<90	MWD	75-100	c	c	15-35	<15	151-200	1-3	Moderate	8.78	0.42	5.62	49.70	100
NSPmB2	662	<90	MWD	75-100	c	c	<15	<15	101-150	1-3	Moderate	9.16	0.615	8.60	51.09	-
HDLmA1	662	<90	MWD	100-150	c	c	<15	<15	>200	0-1	Slight	9.06	0.371	5.09	62.33	-
HDLmB2	662	<90	MWD	100-150	c	c	<15	<15	>200	1-3	Moderate	9.06	0.371	5.09	62.33	-
LGDmB1	662	<90	MWD	100-150	c	c	<15	<15	151-200	1-3	Slight	8.03	1.93	1.82	32.37	100
AWDmA1	662	<90	MWD	>150	c	c	<15	<15	>200	0-1	Slight	8.10	0.37	1.22	51.30	100
AWDmB1	662	<90	MWD	>150	c	c	<15	<15	>200	1-3	Slight	8.10	0.37	1.22	51.30	100
BDRmB1	662	<90	MWD	>150	c	c	<15	<15	>200	1-3	Slight	8.73	0.203	4.37	40.56	-
MLRmA1	662	<90	MWD	>150	c	c	<15	10-20	>200	0-1	Slight	9.19	0.313	5.39	42.08	-

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

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 characteristics					
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 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/Somewhat 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 7.8 Land suitability criteria for Red 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	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 7.9 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 7.10 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 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

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

Table 7.17 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 7.18 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 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 7.21 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 7.22 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 7.23 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 7.24 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 7.25 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 7.26 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 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 7.28 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 7.29 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

Table 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 23 soil map units identified in Virapura-2 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 Unit map (Fig.7.32) 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.

LMUs	Mapping unit	Soil and site characteristics
1	421.AWDmA1 422.AWDmB1 430.BDRmB1 411.MLRmA1 378.HDLmA1 382.HDLmB2 393.LGDmB1	Deep to very deep, black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly (<15%).
2	474.SRRmA1	Deep, lowland calcareous clay soils, 0-1% slope, slight erosion, non-gravelly (<15%).
3	344.DRLmA1 350.DRLmB2 351.DRLmB2g1 362.NSPmB2	Moderately deep black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).
4	331.RNKiB2g1 332.RNKmA1g1 333.RNKmB1 334.RNKmB1g1 336.RNKmB2 337.RNKmB2g1	Moderately shallow, black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).
5	308.MTLmB1g1 309.MTLmB1g2 311.MTLmB2g1	Shallow, black calcareous clay soils, 1-3% slope, slight to moderate erosion, gravelly to very gravelly (15-60%).
6	6.BGTiB2g1 11.BGTmB2g2	Very shallow, black calcareous gravelly clay soils, 1-3% slope, moderate erosion, gravelly to very gravelly (15-60%).

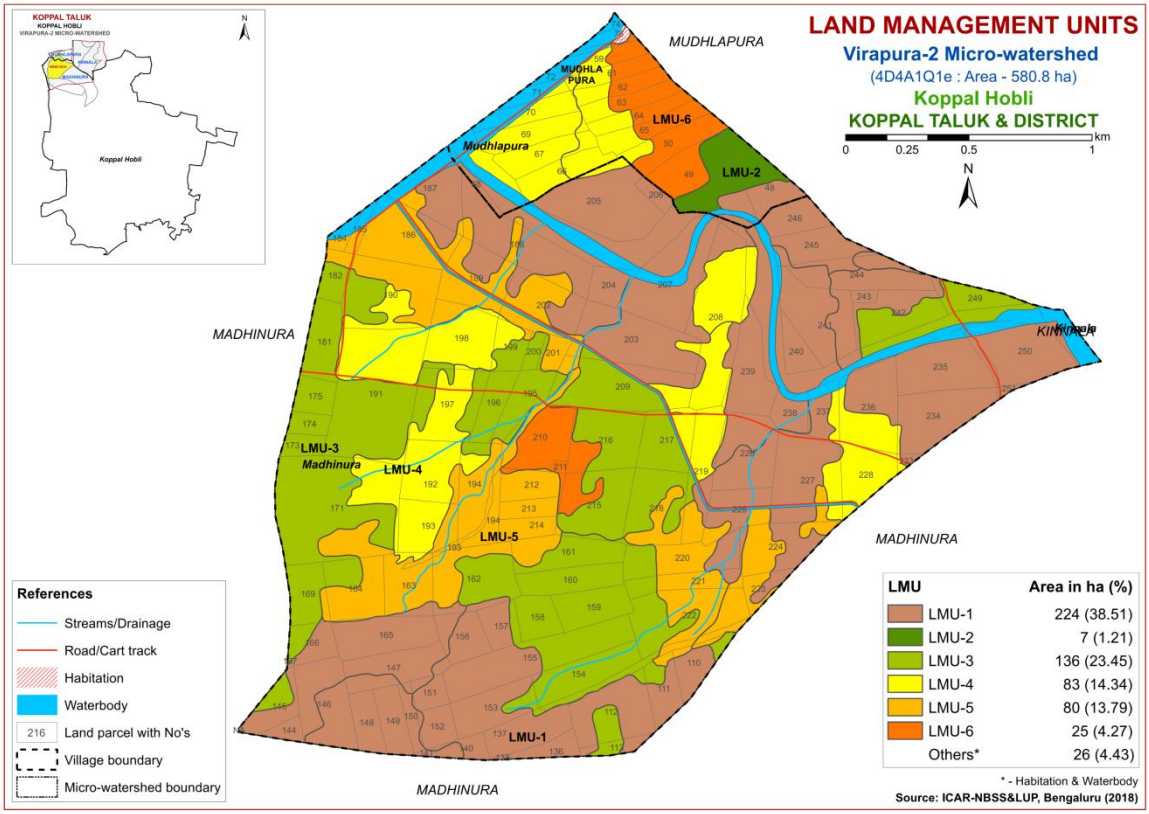


Fig 7.32 Land Management Units map of Virapura-2 microwatershed

7.33 Proposed Crop Plan for Virapura-2 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 Virapura-2 Microwatershed

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
1	421.AWDmA1 422.AWDmB1 430.BDRmB1 411.MLRmA1 378.HDLmA1 382.HDLmB2 393.LGDmB1	**Madhinura**:110,111, 112,113,136,137,138, 140,141,144,145,146, 147,148,149,150,151, 152,153,155,156,157, 165,166,187,188,203, 204,205,206,207,225, 226,227,233,234,235, 236,237,238,239,240, 241,243,244,245,246, 250,251 **Mudhlapura** : 68	Deep to very deep, black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly (<15%).	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra , Soybean	**Fruit crops**: Sapota, Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables**: Drumstick, Chilli, Coriander, Tomato, Bhendi **Flowers**: Marigold, Jasmine, Chrysanthemum, Crossandra	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	474.SRRmA1	**Mudhlapura** : 48,49	Deep, lowland calcareous clay soils, 0-1% slope, slight erosion, non-gravelly (<15%).	Lowland Paddy, Maize, cotton	**Fruit crops**: Custard Apple, Amla **Vegetable crops**: Brinjal, Tomato, Chillies, Drumstick, Coriander **Flower crops**: Marigold, Chrysanthemum, Jasmine	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practices
3	344.DRLmA1 350.DRLmB2 351.DRLmB2g1 362.NSPmB2	**Madhinura**:154,158, 159,160,161,162,167, 169,171,173,174,175, 181,182,191,195,196, 199,200,209,215,216, 217,218,222,242,249	Moderately deep black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).	Maize, Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra , Soybean	**Fruit crops**: Mango, Sapota, Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple **Vegetables**: Drumstick, Chilli, Coriander, Tomato, Bhendi **Flowers**: Marigold, Jasmine, Chrysanthemum, Crossandra	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices

LMU	Soil Map Units	Survey Number	Soil and site characteristics	Field Crops	Horticulture Crops	Suitable Interventions
4	331.RNKiB2g1 332.RNKmA1g1 333.RNKmB1 334.RNKmB1g1 336.RNKmB2 337.RNKmB2g1	**Madhinura**:192,193,197,198,208,219,228 **Mudhlapura**:66,67,69,70	Moderately shallow, black calcareous clay soils, 0-3% slope, slight to moderate erosion, non-gravelly to gravelly (<15-35%).	Sorghum, Bajra, Bengal gram, Linseed, Safflower, Coriander	**Fruit crops**: Amla, Custard apple **Flower crops**: Marigold, Jasmine, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
5	308.MTLmB1g1 309.MTLmB1g2 311.MTLmB2g1	**Madhinura**:163,164,185,186,189,190,194,201,202,212,213,214,220,221,223,224	Shallow, black calcareous clay soils, 1-3% slope, slight to moderate erosion, gravelly to very gravelly (15-60%).	Bengal gram	**Agri-Silvi-Pasture**: Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope
6	6.BGTiB2g1 11.BGTmB2g2	**Madhinura**: 210,211 **Mudhlapura**:50,59,61,62,63,64,65	Very shallow, black calcareous gravelly clay soils, 1-3% slope, moderate erosion, gravelly to very gravelly (15-60%).	-	**Agri-Silvi-Pasture**:*Styloxanthes hamata, Styloxanthes scabra*	Suitable soil and water conservation practices

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 unfavorable conditions occur

Characteristics of Virapura-2 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Dambarahalli (DRL) series occupies major area of 88 ha (15%) followed by Ravanaki (RNK) 83 ha (14%), Muttal (MTL) 80 ha (14%), Alawandi (AWD) 65 ha (11%), Lakshmangudda (LGD) 62 ha (11%), Handrala (HDL) 58 ha (10%), Narasapura (NSP) 47 ha (8%), Murlapur (MLR) 26 ha (4%), Belagatti (BGT) 25 ha (4%), Bardur (BDR) 12 ha (2%) and Sirur (SRR) 7 ha (1%).
- As per land capability classification, maximum area of about 450 ha (78%) in the microwatershed falls under good lands (Class II) with minor limitations of soil,

drainage and erosion. An area of about 80 ha (14%) is under moderately good lands (Class III) with severe limitations of soil and erosion. Fairly good lands (Class IV) cover an area of about 25 ha (4%) with very severe limitations of soil and erosion.

- On the basis of soil reaction, an entire cultivated area of microwatershed falls under strongly alkaline to very strongly alkaline (pH 8.4->9.0) in soil reaction.

Soil Health Management

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

Alkaline soils

Strongly alkaline to very strongly alkaline soils cover an entire cultivated area of the microwatershed.

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 25% extra N and P (125 % RDN&P).
4. Application of ZnSO4 – 12.5 kg/ha (once in three years).
5. Application of Boron – 5 kg/ha (once in three years).

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area of about 278 ha (48%) is suffering from moderate erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

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

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

- **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- **Surface Soil Texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, radish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-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 Virapura-2 Microwatershed.
- **Organic Carbon:** The OC content is medium (0.5-0.75%) in an area of about 387 ha (67%) and low (<0.5%) in 67 ha (12%) area of the microwatershed. These areas needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping and high (>0.75%) in 101 ha (17%) area.
- **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 454 ha (78%) area where OC is low and medium (<0.5-0.75%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.

- **Available Phosphorus**: An area of about 228 ha (39%) is low (<23 kg/ha) and 327 ha (56%) is medium (23-57 kg/ha) in available phosphorus content. Hence all the plots, where available phosphorus is low and medium, for all the crops, 25% additional P-needs to be applied
- **Available Potassium:** Available potassium content is medium (145-337 kg/ha) in 47 ha (8%) and high (>337 kg/ha) in 508 ha (88%) of the microwatershed. All the plots, where available potassium is medium, for all the crops, additional 25% of potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops, Available sulphur content is medium (10-20ppm) in 167 ha (29%) and low (<10 ppm) in 388 ha (67%) area of the microwatershed. Low and medium areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% of sulphur) for 2-3 years for the deficiency to be corrected.
- **Available Boron:** An area of about 433 ha (74%) is low (<0.5 ppm) and 123 ha (21%) is medium (0.5-1.0 ppm) in available boron content. Low and medium (<0.5-1.0 ppm) areas need to be applied with sodium borate @ 10kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency.
- **Available Iron:** Available iron content is deficient (<4.5 ppm) in an area of about 424 ha (73%) and sufficient (>4.5 ppm) in 131 ha (23%) area of the microwatershed. For deficient areas, iron sulphate @ 25 kg/ha needs to be applied for 2-3 years to correct the deficiency.
- **Available Manganese:** Entire cultivated area of the microwatershed is sufficient (>1.0 ppm) in the available manganese content.
- **Available Copper:** Entire cultivated area of the microwatershed is sufficient (>0.2 ppm) in the available copper content.
- **Available Zinc:** Available zinc content is deficient (<0.6 ppm) in an area of about 554 ha (95%) and sufficient (>0.6 ppm) in 1 ha (<1%) area of the microwatershed. For deficient areas, application of zinc sulphate @ 25kg/ha is recommended.
- **Soil Alkalinity:** An entire cultivated area of the microwatershed has soils that are strongly alkaline 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

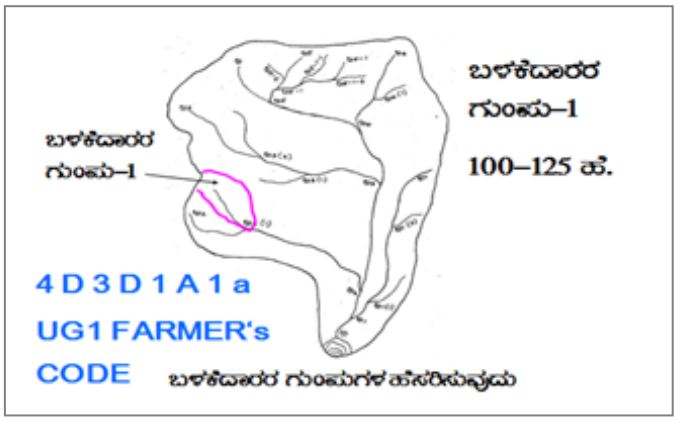
with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. 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 Virapura-2 Microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

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



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

Steps for Survey and Preparation of Treatment Plan

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

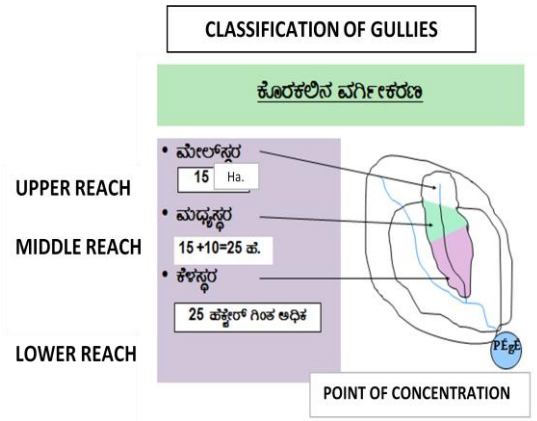
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

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

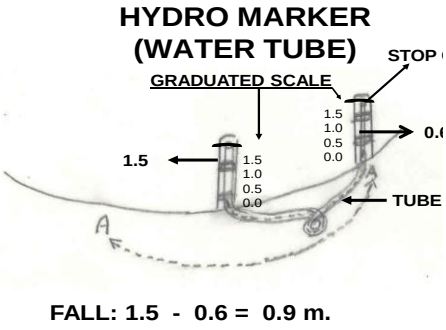
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class (bg0 .....b= loamy sand, g0 = <15% gravel). The recommended sections for different soils are given below.

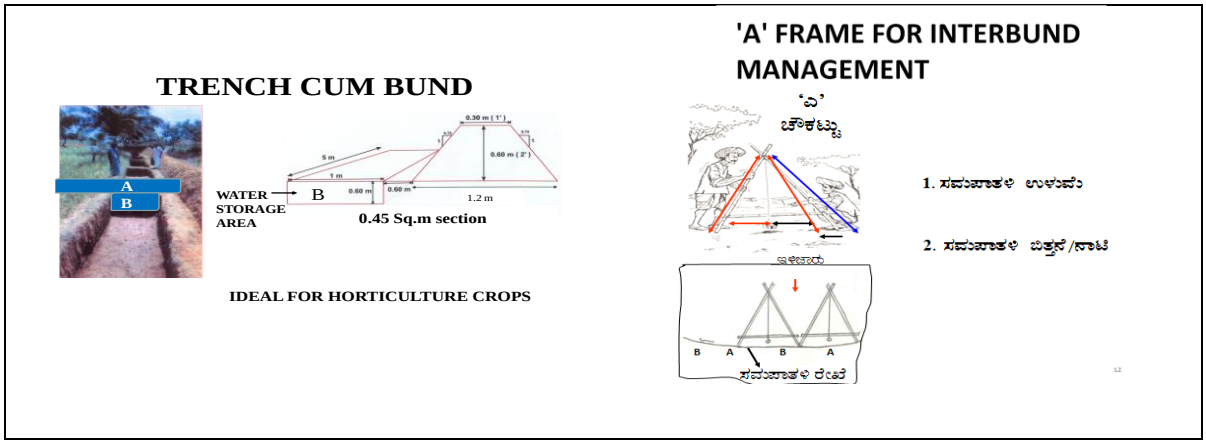
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soils	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow black clayey soils	
0.45	2	0.75	01:01	0.92		
0.45	2.4	0.75	1.3:1	1.07	Shallow black clayey soils	
0.6	3.1	0.7	1.78:1	1.29	Medium black clayey 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
m2	m	m3	L(m)	W(m)	D(m)	Quantity (m3)	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 drainage lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff in water budgeting and quality of water in the wells and site suitability.
e) Detailed Leveling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthern checks in the natural water course. Location and design details are given in the Manual.

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. An area of about 418 ha (72%) needs Graded Bunding and 137 ha (24%) needs strengthening of existing bunds.

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

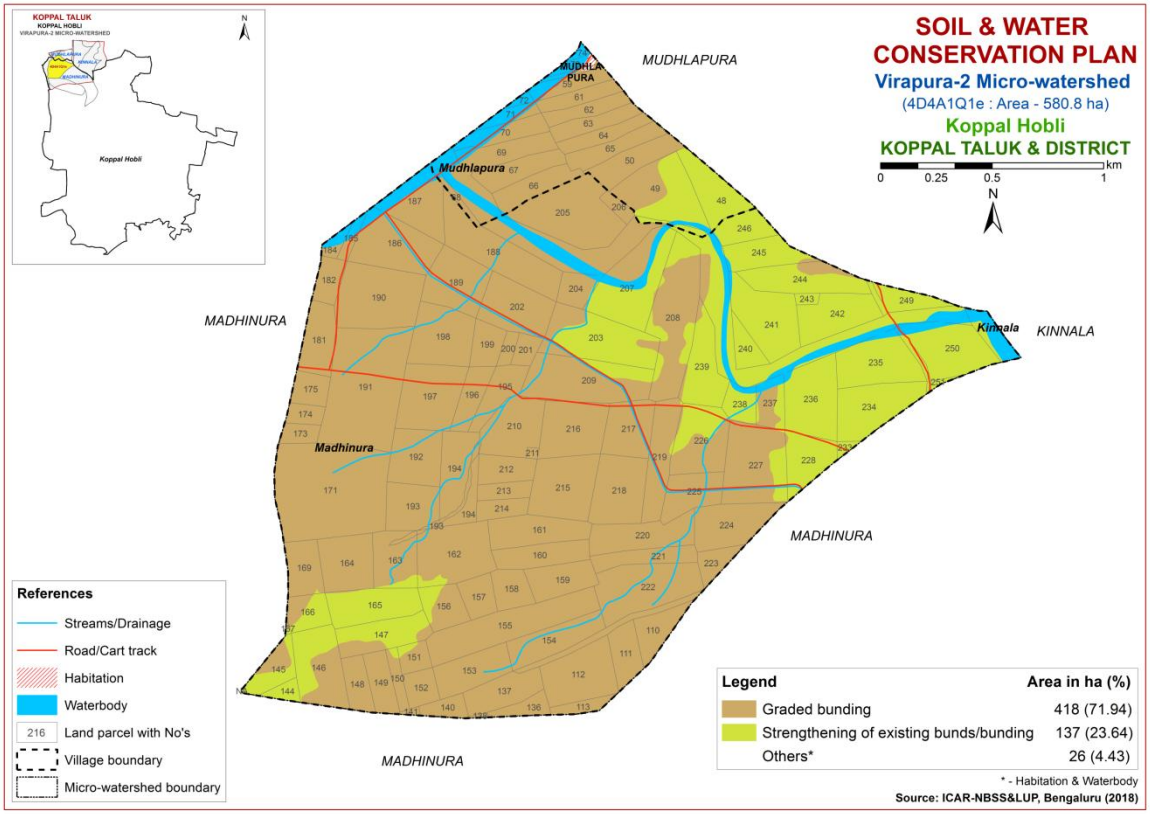


Fig. 9.1 Soil and Water Conservation Plan map of Virapura-2 Microwatershed

9.3 Greening of Microwatershed

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

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

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

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

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Appendix I

Virapura-2 (1Q2e) Microwatershed

Soil Phase Information

Village	Survey Number	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
Madhinura	110	3.24	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	111	3.21	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	112	7.31	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	113	1.35	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	136	1.75	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	137	4.49	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	138	0.13	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIes	Graded bunding
Madhinura	140	1.66	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	141	0.24	BDRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	144	1.07	HDLmA1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	145	3.29	HDLmA1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	146	7.25	BDRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	147	5.46	HDLmA1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	148	2.63	BDRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	149	2.95	BDRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	150	1.39	BDRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram (Bg)	Not Available	IIs	Graded bunding
Madhinura	151	1.73	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	152	2.17	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	153	5.06	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIes	Graded bunding
Madhinura	154	5.21	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram+Sunflower (Bg+Sf)	Not Available	IIes	Graded bunding
Madhinura	155	10.39	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	156	3.47	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhin	157	2.55	HDLmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly	Very high (>200	Very gently sloping	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded

Village	Survey Number	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
ura							(<15%)	mm/m)	(1-3%)					bunding
Madhinura	158	2.82	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	159	4.17	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Madhinura	160	4.19	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Sunflower (Rg+Sf)	Not Available	IIes	Graded bunding
Madhinura	161	5.45	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	Graded bunding
Madhinura	162	8.42	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Madhinura	163	4.84	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Sunflower (Mz+Sf)	Not Available	IIIes	Graded bunding
Madhinura	164	5.78	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIIes	Graded bunding
Madhinura	165	5.94	HDLmA1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Wheat (Wh)	Not Available	IIs	Graded bunding
Madhinura	166	2.82	HDLmA1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Wheat (Wh)	Not Available	IIs	Graded bunding
Madhinura	167	0.11	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	169	3.74	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	171	20.34	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Madhinura	173	1.46	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram (Bg)	Not Available	IIes	Graded bunding
Madhinura	174	1.43	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram+Maize (Bg+Mz)	Not Available	IIes	Graded bunding
Madhinura	175	2.26	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram+Wheat (Bg+Wh)	Not Available	IIes	Graded bunding
Madhinura	181	4.39	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram+Maize (Bg+Mz)	Not Available	IIes	Graded bunding
Madhinura	182	2.25	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Madhinura	184	0.95	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Madhinura	185	0.95	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIIs	Graded bunding
Madhinura	186	7.82	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Graded bunding
Madhinura	187	5.96	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Madhinura	188	9.16	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram+Sunflower (Mz+Rg+Sf)	Not Available	IIs	Graded bunding
Madhinura	189	6.47	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Graded bunding

Village	Survey Number	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
Madhinura	190	9.98	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram+Maize (Bg+Mz)	Not Available	IIIs	Graded bunding
Madhinura	191	17.76	NSPmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	192	5.62	RNKmB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	193	4.76	RNKmB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	194	6.35	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Madhinura	195	3.45	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIes	Graded bunding
Madhinura	196	2.94	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	197	7.76	RNKmB2g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIes	Graded bunding
Madhinura	198	6.94	RNKmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sunflower (Sf)	Not Available	IIes	Graded bunding
Madhinura	199	2.57	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	Graded bunding
Madhinura	200	0.91	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	201	1.39	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIIs	Graded bunding
Madhinura	202	6.53	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIIs	Graded bunding
Madhinura	203	9.78	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy (Pd)	Not Available	IIs	Graded bunding
Madhinura	204	2.28	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	205	10.33	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	206	1	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Not Available (NA)	Not Available	IIs	Graded bunding
Madhinura	207	9.84	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	208	11.81	RNKmB1	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	209	10.37	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	3 Borewell	IIes	Graded bunding
Madhinura	210	6.2	BGTmB2g2	LMU-6	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Graded bunding
Madhinura	211	0.25	BGTmB2g2	LMU-6	Very shallow (<25 cm)	Clay	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IVes	Graded bunding
Madhinura	212	3	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Madhinura	213	1.8	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding

Village	Survey Number	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
Madhinura	214	1.95	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Madhinura	215	7.7	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IIes	Graded bunding
Madhinura	216	6.94	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy+Redgram (Mz+Pd+Rg)	1 Borewell	IIes	Graded bunding
Madhinura	217	5.18	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	218	6.96	DRLmB2g1	LMU-3	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bengalgram+Redgram (Bg+Rg)	Not Available	IIes	Graded bunding
Madhinura	219	5.67	RNKmB1g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Paddy+Redgram (Pd+Rg)	Not Available	IIs	Graded bunding
Madhinura	220	5.96	MTLmB1g2	LMU-5	Shallow (25-50 cm)	Clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Fallow land (Fl)	Not Available	IIIs	Graded bunding
Madhinura	221	3.33	MTLmB1g2	LMU-5	Shallow (25-50 cm)	Clay	Very gravelly (35-60%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	1 Farm Pond	IIIs	Graded bunding
Madhinura	222	9.12	DRLmB2	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Madhinura	223	1.92	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram+Redgram (Bg+Rg)	Not Available	IIIs	Graded bunding
Madhinura	224	6.12	MTLmB1g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Ragi+Sunflower (Mz+Ra+Sf)	Not Available	IIIs	Graded bunding
Madhinura	225	4.42	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIs	Graded bunding
Madhinura	226	7.04	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Bengalgram+Maize (Bg+Mz)	1 Borewell	IIs	Graded bunding
Madhinura	227	9.6	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Redgram (Rg)	Not Available	IIs	Graded bunding
Madhinura	228	4.58	RNKmA1g1	LMU-4	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Nearly level (0-1%)	Slight	Bengalgram+Maize (Bg+Mz)	Not Available	IIs	Graded bunding
Madhinura	233	0.46	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	234	7.11	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	235	7.25	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	236	7.75	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	237	2.79	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	238	2.29	MLRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIs	Graded bunding
Madhinura	239	5.8	MLRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	240	2.1	MLRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	241	7.71	MLRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding

Village	Survey Number	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
Madhinura	242	5.92	DRLmA1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	243	0.53	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Madhinura	244	6.33	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bengalgram+Maize (Bg+Mz)	Not Available	IIs	Graded bunding
Madhinura	245	4.21	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bengalgram+Maize (Bg+Mz)	Not Available	IIs	Graded bunding
Madhinura	246	2.98	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Bengalgram+Fallow land (Bg+Fl)	Not Available	IIs	Graded bunding
Madhinura	249	2.41	DRLmA1	LMU-3	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Nearly level (0-1%)	Slight	Maize+Sunflower (Mz+Sf)	Not Available	IIs	Graded bunding
Madhinura	250	7.48	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Redgram+Maize+Paddy (Rg+Mz+Pd)	Not Available	IIs	Graded bunding
Madhinura	251	0.26	AWDmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Paddy+Maize+Bengalgram (Pd+Mz+Bg)	Not Available	IIs	Graded bunding
Mudhlapura	48	4.96	SRRmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIw	Graded bunding
Mudhlapura	49	8.61	SRRmA1	LMU-2	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Redgram (Mz+Rg)	Not Available	IIw	Graded bunding
Mudhlapura	50	4.22	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IVes	Graded bunding
Mudhlapura	59	2.54	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Redgram (Mz+Rg)	Not Available	IVes	Graded bunding
Mudhlapura	61	2.41	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	2 Borewell	IVes	Graded bunding
Mudhlapura	62	2.46	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	4 Borewell	IVes	Graded bunding
Mudhlapura	63	2.78	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IVes	Graded bunding
Mudhlapura	64	2.61	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IVes	Graded bunding
Mudhlapura	65	3.4	BGTiB2g1	LMU-6	Very shallow (<25 cm)	Sandy clay	Gravelly (15-35%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVes	Graded bunding
Mudhlapura	66	3.63	RNKmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IIes	Graded bunding
Mudhlapura	67	3.73	RNKmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Fallow land+Paddy+Maize (Fl+Pd+Mz)	Not Available	IIes	Graded bunding
Mudhlapura	68	0.75	LGDmB1	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Paddy (Mz+Pd)	Not Available	IIs	Graded bunding
Mudhlapura	69	4.01	RNKmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IIes	Graded bunding
Mudhlapura	70	3.14	RNKmB2	LMU-4	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Paddy (Mz+Pd)	Not Available	IIes	Graded bunding
Mudhlapura	71	1.46	Waterbody	Others	Others	Others	Others	Others	Others	Others	Maize+Redgram (Mz+Rg)	Not Available	Others	Others

Village	Survey Number	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
Mudhlapura	72	0.41	Waterbody	Others	Others	Others	Others	Others	Others	Others	Maize+Redgram (Mz+Rg)	Not Available	Others	Others
Mudhlapura	73	0.92	Waterbody	Others	Others	Others	Others	Others	Others	Others	Castor+Redgram+Fallow land (Ca+Rg+Fl)	Not Available	Others	Others
Mudhlapura	74	0.33	Waterbody	Others	Others	Others	Others	Others	Others	Others	Fallow land (Fl)	Not Available	Others	Others
Kinnala	RIVER	0.002	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others

Appendix II

Virapura-2 (1Q2e) Microwatershed

Soil Fertility Information

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhinura	110	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	111	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	112	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)	Deficient (< 0.6 ppm)
Madhinura	113	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)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	136	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	137	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	138	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	140	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	141	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	144	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	145	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	146	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	147	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	148	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	149	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	150	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	151	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	152	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	153	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	154	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 – 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	155	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	156	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Madhinura	157	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	158	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	159	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	160	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	161	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	162	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	163	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	164	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	165	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	166	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	167	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Madhinura	169	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	171	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	173	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	174	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	175	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	181	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	182	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	184	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Madhinura	185	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	186	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	187	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	188	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	189	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	190	Strongly alkaline	Non saline	Medium (0.5	Low (< 23	High (> 337	Low (<10	Low (< 0.5	Deficient (<	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 8.4 – 9.0)	(<2 dsm)	– 0.75 %)	kg/ha)	kg/ha)	ppm)	ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Madhinura	191	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	192	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	193	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	194	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	195	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	196	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	197	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	198	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	199	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	200	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	201	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	202	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	203	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	204	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	205	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)
Madhinura	206	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	207	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	208	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	209	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	210	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	211	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	212	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	213	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Madhinura	214	Strongly alkaline	Non saline	Medium (0.5	Low (< 23	High (> 337	Low (<10	Low (< 0.5	Deficient (<	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 8.4 – 9.0)	(<2 dsm)	– 0.75 %)	kg/ha)	kg/ha)	ppm)	ppm)	4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Madhinura	215	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	216	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	217	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	218	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	219	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	220	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	221	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	222	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)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	223	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	224	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	225	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	226	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Low (<10 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	227	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	228	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	233	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	234	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	235	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	236	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	237	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	238	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	239	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)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	240	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	241	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	242	Strongly alkaline	Non saline	High (> 0.75	Medium (23 –	High (> 337	Medium (10	Medium (0.5 –	Sufficient	Sufficient (>	Sufficient (>	Deficient (<

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
		(pH 8.4 – 9.0)	(<2 dsm)	%)	57 kg/ha)	kg/ha)	– 20 ppm)	1.0 ppm)	(>4.5 ppm)	1.0 ppm)	0.2 ppm)	0.6 ppm)
Madhinura	243	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	244	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	245	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	246	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	249	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	250	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Madhinura	251	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	Medium (10 – 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	48	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	49	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	50	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	59	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	61	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	62	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	63	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	64	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	65	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	66	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	67	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	68	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Mudhlapura	69	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	70	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)	Medium (10 – 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Mudhlapura	71	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhlapura	72	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Mudhlapura	73	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	Survey No	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Mudhlapura	74	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kinnala	RIVER	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Appendix III

Virapura-2 (1Q2e) 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
Madhinura	110	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	111	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	112	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	113	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	136	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	137	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	138	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	140	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	141	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S3t
Madhinura	144	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	145	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	146	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S3t
Madhinura	147	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	148	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S3t
Madhinura	149	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S3t
Madhinura	150	S3t	S2t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2t	S2t	S2t	S2t	S3t	S3t
Madhinura	151	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	152	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	153	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	154	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	155	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	156	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	157	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	158	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz

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
Madhinura	159	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	160	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	161	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	162	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	163	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	164	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	165	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	166	S3t	S2t	S3t	S1	S3t	S1	S2rt	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2rt	S1	S3t	S3t	S3t	S2t	S2t	S2t	S2t	S3t	S2tz	S2tz	S2t	S2t	S2t	S3tz
Madhinura	167	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	169	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	171	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	173	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	174	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	175	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	181	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	182	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	184	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
Madhinura	185	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	186	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	187	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	188	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	189	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	190	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	191	S3rt	S2tz	S3rt	S1	S3t	S1	S3r	S2r	S1	S2r	S2t	S2t	S3t	S1	N1t	S3rt	S2r	S3t	S3t	S3tw	S2tw	S2tw	S2rt	S2t	S3tw	S2tz	S2tz	S3t	S2rt	S2tw	S3tz
Madhinura	192	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Madhinura	193	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz

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
Madhinura	194	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	195	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	196	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	197	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Madhinura	198	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Madhinura	199	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	200	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	201	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	202	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	203	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	204	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	205	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	206	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	207	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	208	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Madhinura	209	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	210	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Madhinura	211	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Madhinura	212	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	213	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	214	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	215	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	216	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	217	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	218	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	219	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz

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
Madhinura	220	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	221	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	222	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S2z	S2rz	S2tz	S3tz
Madhinura	223	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	224	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3r	S3r	S3rz	N1rz	N1rz	S3rt
Madhinura	225	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	226	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	227	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	228	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Madhinura	233	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	234	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	235	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	236	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	237	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	238	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	239	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	240	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	241	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	242	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S3tz	S2rz	S2tz	S3tz
Madhinura	243	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	244	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	245	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	246	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	249	S3rz	S2tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2z	S2rz	S2tz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S2tz	S3tz	S2tz	S2tz	S3tz	S2rz	S2tz	S3tz
Madhinura	250	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Madhinura	251	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S2tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz

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
Mudhlapura	48	S3tz	S2tz	S3tz	S1	S3tz	S1	S2tz	S1	S1	S1	S2tz	S1	S3tz	S1	N1t	S2rt	S1	S3t	S2tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Mudhlapura	49	S3tz	S2tz	S3tz	S1	S3tz	S1	S2tz	S1	S1	S1	S2tz	S1	S3tz	S1	N1t	S2rt	S1	S3t	S2tz	S2tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Mudhlapura	50	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	59	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	61	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	62	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	63	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	64	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	65	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1rg	N1r	N1r	N1rg	N1rg	N1rg	N1r
Mudhlapura	66	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Mudhlapura	67	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Mudhlapura	68	S3tz	S2tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S2tz	S3tz	S2tz	S2tz	S3tz	S2tz	S3tz	S3tz
Mudhlapura	69	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Mudhlapura	70	N1rz	S2tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S2tz	S2rz	S2rt	S2rt	S3rz	S3rz	S3rz	S3tz
Mudhlapura	71	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
Mudhlapura	72	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
Mudhlapura	73	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
Mudhlapura	74	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
Kinnala	RIVER	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

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data indicated that there were 111 (54.95%) men and 91 (45.05%) women among the sampled households.*
- *The average family size of landless farmers' was 4.4, marginal farmers' and small farmers' was 4.5, semi medium farmers' was 4.75 and medium farmers' was 6.*
- *The data indicated that, 40 (20.79%) people were in 0-15 years of age, 78 (38.61%) were in 16-35 years of age, 63 (31.19%) were in 36-60 years of age and 19 (9.41%) were above 61 years of age.*
- *The results indicated that Virapura-2 had 17.82 per cent illiterates, 26.73 per cent of them had primary school education, 1.49 per cent of them had middle school education, 28.22 per cent of them had high school education, 10.89 per cent of them had PUC education, 0.99 per cent had diploma education, 0.50 per cent of them did ITI and 10.40 per cent of them had degree level education.*
- *The results indicate that, 76.74 per cent of household heads were practicing agriculture and 23.26 per cent of the household heads were agricultural labour.*
- *The results indicate that agriculture was the major occupation for 33.66 per cent of the household members, 39.11 per cent were agricultural labourers, 20.79 per cent were students, 2.48 per cent were housewives and 2.97 per cent were children.*
- *The results show that, 0.50 per cent were in cooperative bank and 99.50 per cent of the population in the micro watershed has not participated in any local institutions.*
- *The results indicate that 95.35 per cent of the households possess katcha house and 4.65 per cent of the households possess semi pacca house.*
- *The results show that 79.07 per cent of the households possess TV, 55.81 per cent of them possess mixer/grinder, 2.33 per cent of them possess refrigerator and computer/laptop, 32.56 per cent of them possess bicycle, 51.16 per cent of them possess motor cycle and 93.02 per cent of them possess mobile phones.*
- *The results show that the average value of television was Rs. 5,600, mixer grinder was Rs. 1,231, refrigerator was Rs. 13,000, bicycle was 764, motor cycle was Rs. 31,043, mobile phones was 31,043 and computer/laptop was Rs. 32,000.*
- *About 16.28 per cent of the households possess bullock cart, 41.86 per cent of them possess plough, 11.63 per cent of them possess seed/fertilizer drill and tractor, 2.33 per cent of them possess irrigation pump and harvester, 4.65 per cent of them possess power tiller, 13.95 per cent of them possess sprayer, 69.77 per cent of them possess weeder, 18.60 per cent of them possess chaff cutter and 9.30 of them possess earth remover.*
- *The results show that the average value of bullock cart was Rs. 13,428, plough was Rs. 4,338, seed/fertilizer drill was Rs. 2,900, irrigation pump was Rs. 15,000, power tiller was Rs.75,000, tractor was Rs. 280,000, sprayer was Rs. 2,283, weeder was*

Rs.41, harvester was Rs.100, chaff cutter was Rs. 2,012 and earth remover/ duster was Rs. 11,000.

- *The results indicate that, 16.28 per cent of the households possess bullocks, 13.95 per cent of the households possess local cow, 9.30 per cent possess crossbreed cow and 2.33 per cent of them possess buffalo.*
- *The results indicate that, average own labour men available in the micro watershed was 1.63, average own labour (women) available was 1.18, average hired labour (men) available was 21.18 and average hired labour (women) available was 21.32.*
- *The results indicate that 44.19 per cent of the households opined that the hired labour was adequate and hired labour was inadequate.*
- *The results indicate that, households of the Virapura-2 micro-watershed possess 50.03 ha (79.67 %) of dry land and 12.77 ha (20.33 %) of irrigated land. Marginal farmers possess 5.51 ha (100%) of dry land. Small farmers possess 28.13 ha (97.20%) of dry land and 0.81 ha (2.80%) of irrigated land. Semi medium farmers possess 10.71 ha (72.28%) of dry land and 4.11 (27.72%) for irrigated land. Medium farmers possess 5.68 ha (41.97%) for dry land and 7.85 ha (58.03 %) for irrigated land.*
- *The results indicate that, the average value of dry land was Rs. 311,697.20 and the average value of irrigated land was Rs. 328,811.42. In case of marginal famers, the average land value was Rs. 852,975.77 for dry land. In case of small famers, the average land value was Rs. 266,470.19 for dry land and Rs. 1,235,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 289,380.20 for dry land and Rs. 413,694.59 for irrigated land. In case of medium farmers, the average land value was Rs. 52,815.40 for dry land and Rs. 190,979.39 for irrigated land.*
- *The results indicate that, there were 3 functioning and 1 de-functioning bore wells in the micro watershed.*
- *The results indicate that, bore well was the major irrigation source in the micro watershed for 6.98 per cent of the farmers and canal was the irrigation source for 2.333 per cent of the farmers.*
- *The results indicate that, the depth of bore well was found to be 6.75 meters.*
- *The results indicate that small, semi medium and medium farmers had an irrigated area of 0.81 ha, 5 ha, 6.60 ha and 7.85 ha respectively.*
- *The results indicate that, farmers have grown bajra (4.19 ha), bengal gram (11.72 ha), green gram (9.13 ha), sorghum (5.7 ha), maize (25.15 ha), paddy (5.44 ha), red gram (2.18 ha), sunflower (14.92ha) and onion (0.89ha). Marginal farmers had grown Bengal gram, green gram, maize, and sunflower. Small farmers had bajra, Bengal gram, green gram, sorghum, maize, red gram and sunflower. Semi medium farmers had grown Bengal gram, green gram, sorghum, maize and paddy; Medium farmers had grown bajra, Bengal gram, maize, paddy, red gram and sunflower.*

- *The results indicate that, the cropping intensity in Virapura-2 micro-watershed was found to be 76.55 per cent.*
- *The results indicate that, the total cost of cultivation for bajra was Rs. 16061.72. The gross income realized by the farmers was Rs. 16880.12. The net income from bajra cultivation was Rs. 818.40. Thus the benefit cost ratio was found to be 1:1.05.*
- *The total cost of cultivation for Bengal gram was Rs. 36704.16. The gross income realized by the farmers was Rs. 47286.72. The net income from Bengal gram cultivation was Rs. 10582.56. Thus the benefit cost ratio was found to be 1:1.29.*
- *The total cost of cultivation for green gram was Rs. 25898.32. The gross income realized by the farmers was Rs. 46103.12. The net income from green gram cultivation was Rs. 20204.80. Thus the benefit cost ratio was found to be 1:1.78.*
- *The total cost of cultivation for sorghum was Rs. 54260.50. The gross income realized by the farmers was Rs. 31863.00. The net income from sorghum cultivation was Rs. -22397.50. Thus the benefit cost ratio was found to be 1:0.59.*
- *The total cost of cultivation for Maize was Rs. 27769.24. The gross income realized by the farmers was Rs. 46789.16. The net income from Maize cultivation was Rs. 19019.92. Thus the benefit cost ratio was found to be 1:1.68.*
- *The total cost of cultivation for Paddy was Rs. 50929.31. The gross income realized by the farmers was Rs. 89645.05. The net income from Paddy cultivation was Rs. 38715.74. Thus the benefit cost ratio was found to be 1:1.76.*
- *The total cost of cultivation for red gram was Rs. 25709.83. The gross income realized by the farmers was Rs. 32750.60. The net income from red gram cultivation was Rs. 7040.77. Thus the benefit cost ratio was found to be 1:1.27.*
- *The total cost of cultivation for sunflower was Rs. 22835.52. The gross income realized by the farmers was Rs. 55494.51. The net income from sunflower cultivation was Rs. 32658.99. Thus the benefit cost ratio was found to be 1:2.43.*
- *The total cost of cultivation for onion was Rs. 45678.79. The gross income realized by the farmers was Rs. 85327.27. The net income from onion cultivation was Rs. 39648.49. Thus the benefit cost ratio was found to be 1:1.87.*
- *The results indicate that, 9.30 per cent of the households opined that dry fodder was adequate, 30.23 green fodders was adequate and 20.93 per cent was inadequate of the households.*
- *The results indicate that the annual gross income was Rs. 49,600 for landless farmers, for marginal farmers it was Rs. 72,985.71, for small farmers it was Rs. 109,237.37, for semi medium farmers it was Rs. 123,500 and for medium farmers it was Rs. 355,462.50.*
- *The results indicate that the average annual expenditure is Rs. 10,583.65. For landless households it was Rs. 3,760, for marginal farmers it was Rs. 9,061.22, for small farmers it was Rs. 4,861.50, for semi medium farmers it was Rs. 11,812.50 and for medium farmers it was Rs. 46,500.*

- *The results indicate that, households have planted 5 tamarind and banyan 35 neem trees in their field.*
- *The results indicated that, households have an average investment capacity of Rs. 2,209.3 for land development and Rs. 1,046.51 for improved crop production.*
- *The results indicated that loan from bank was the source of additional investment for 20 per cent for land development and improved crop production.*
- *The results indicated that, bajra, Bengal gram, green gram, sorghum, maize, onion, paddy, red gram and sunflower were sold to the extent of 100 per cent. The results indicated that, about 6.98 per cent of the farmers sold their produce to agent/ traders and contract marketing arrangement and 39.53 per cent of the farmers sold their produce to local/village merchants, regulated market and cooperative marketing society.*
- *The results indicated that, 127.91 per cent of the households used tractor and 4.65 per cent of them used truck as a mode of transportation for their agricultural produce.*
- *The results indicated that, 32.56 per cent of the households have experienced soil and water erosion problems in the farm.*
- *The results indicated that, 39.53 per cent have shown interest in soil test.*
- *The results indicated that, 90.7 per cent of the households used firewood, 2.33 per cent of the households used kerosene and 6.98 per cent of the households used LPG as a source of fuel.*
- *The results indicated that, piped supply was the major source of drinking water for 51.16 per cent of the households and bore well was the source of drinking water for 48.84 per cent of the households in micro watershed.*
- *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 44.19 per cent of the households possess sanitary toilet facility.*
- *The results indicated that, 6.98 per cent of the sampled households possessed APL and 76.74 per cent of the sample households possessed BPL card and 16.28 per cent of the households did not possess any PDS card.*
- *The results indicated that, 37.21 per cent of the households participated in NREGA programme.*
- *The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 58.14 per cent, oilseeds were adequate for 4.65 per cent, vegetables were adequate for 11.63 per cent, milk and egg were adequate for 53.49 per cent and meat were adequate for 51.16 per cent.*
- *The results indicated that, pulses and milk were inadequate for 41.86 per cent, oilseeds and fruits were inadequate for 62.79 per cent, vegetables were inadequate*

for 51.16 per cent, fruits were inadequate for 69.77 per cent, milk were inadequate for 41.86 per cent and egg were inadequate were 44.19 per cent of the households.

- *The results indicated that, oilseeds were market surplus for 30.23 per cent; vegetables were market surplus for 37.21 per cent and meat were market surplus for 18.60 per cent of the households.*
- *The results indicated that, lower fertility status of the soil and high rate of interest on credit was the constraint experienced by 46.51 per cent of the households, wild animal menace on farm field (55.81%),inadequacy of irrigation water (41.86%), high cost of fertilizers and plant protection chemicals and less rainfall (48.84%), lack of marketing facilities in the area (4.65%), low price for the agricultural commodities(2.33%), lack of transport for safe transport of the agricultural produce to the market and Source of Agri-technology information (44.19%).*

Chapter 2

INTRODUCTION

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

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

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

Scope and importance of survey

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

Chapter 3

METHODOLOGY

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

Description of the study area

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

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

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

Description of the micro watershed

Virapura-2 micro-watershed in Chenduru sub-watershed (Koppal taluk and district) is located in between $15^0$21'12.54'' to 15^0 20'2.666" North latitudes and 76^0 6'10.62'' to $76^0$4'50.378'' East longitudes, covering an area of about 581.05 ha, bounded by Mudhlapura, Madhinura and veerapura villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 43 households located in the micro-watershed were interviewed for the survey.

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Virapura-2 micro-watershed is presented in Table 1 and it indicated that 43 farmers were sampled in Virapura-2 micro-watershed among them 5 (11.63%) were landless, 7 (16.28%) were marginal farmers, 19(44.19%) were small farmers, 8 (18.60%) were semi medium farmers and 4 (9.30%) were medium farmers.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	5	11.63	7	16.28	19	44.19	8	18.60	4	9.30	43	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Virapura-2 micro-watershed is presented in Table 2. The data indicated that there were 111 (54.95%) men and 91 (45.05%) women among the sampled households. The average family size of landless farmers' was 4.4, marginal farmers' and small farmers' was 4.5, semi medium farmers' was 4.75 and medium farmers' was 6.

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

Sl.No.	Particulars	LL (22)		MF (32)		SF (86)		SMF (38)		MDF (24)		All (202)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	13	59.09	15	46.88	51	59.30	21	55.26	11	45.83	111	54.95
2	Women	9	40.91	17	53.13	35	40.70	17	44.74	13	54.17	91	45.05
Total		22	100.00	32	100.00	86	100.00	38	100.00	24	100.00	202	100.00
Average		4.4		4.5		4.5		4.75		6		4.6	

Age wise classification of family members: The age wise classification of household members in Virapura-2 micro-watershed is presented in Table 3. The data indicated that, 40 (20.79%) people were in 0-15 years of age, 78 (38.61%) were in 16-35 years of age, 63 (31.19%) were in 36-60 years of age and 19 (9.41%) were above 61 years of age.

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

Sl. No.	Particulars	LL (22)		MF (32)		SF (86)		SMF (38)		MDF (24)		All (202)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	5	22.73	7	21.88	15	17.44	7	18.42	8	33.33	42	20.79
2	16-35 years of age	8	36.36	15	46.88	34	39.53	14	36.84	7	29.17	78	38.61
3	36-60 years of age	7	31.82	10	31.25	26	30.23	14	36.84	6	25	63	31.19
4	> 61 years	2	9.09	0	0	11	12.79	3	7.89	3	12.50	19	9.41
Total		22	100	32	100	86	100	38	100	24	100	202	100

Education level of household members: Education level of household members in Virapura-2 micro-watershed is presented in Table 4. The results indicated that Virapura-2 had 17.82 per cent illiterates, 26.73 per cent of them had primary school education, 1.49 per cent of them had middle school education, 28.22 per cent of them had high school

education, 10.89 per cent of them had PUC education, 0.99 per cent had diploma education, 0.50 per cent of them did ITI and 10.40 per cent of them had degree level education.

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

Sl.No.	Particulars	LL (22)		MF (32)		SF (86)		SMF (38)		MDF (24)		All (202)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	4	18.18	5	15.63	17	19.77	7	18.42	3	12.50	36	17.82
2	Primary School	9	40.91	7	21.88	18	20.93	7	18.42	13	54.17	54	26.73
3	Middle School	0	0.00	0	0.00	2	2.33	1	2.63	0	0.00	3	1.49
4	High School	6	27.27	14	43.75	19	22.09	15	39.47	3	12.50	57	28.22
5	PUC	2	9.09	3	9.38	13	15.12	2	5.26	2	8.33	22	10.89
6	Diploma	0	0.00	2	6.25	0	0.00	0	0.00	0	0.00	2	0.99
7	ITI	0	0.00	0	0.00	1	1.16	0	0.00	0	0.00	1	0.50
8	Degree	1	4.55	1	3.13	12	13.95	4	10.53	3	12.50	21	10.40
9	Others	0	0.00	0	0.00	4	4.65	2	5.26	0	0.00	6	2.97
Total		22	100.00	32	100.00	86	100.00	38	100.00	24	100.00	202	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Virapura-2 micro-watershed is presented in Table 5. The results indicate that, 76.74 per cent of household heads were practicing agriculture and 23.26 per cent of the household heads were agricultural labour.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	7	100.00	15	78.95	7	87.50	4	100.00	33	76.74
2	Agricultural Labour	5	100.00	0	0.00	4	21.05	1	12.50	0	0.00	10	23.26
Total		5	100.00	7	100.00	19	100.00	8	100.00	4	100.00	43	100.00

Occupation of the household members: The data regarding the occupation of the household members in Virapura-2 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 33.66 per cent of the household members, 39.11 per cent were agricultural labourers, 20.79 per cent were students, 2.48 per cent were housewives and 2.97 per cent were children.

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

Sl. No.	Particulars	LL (22)		MF (32)		SF (86)		SMF (38)		MDF (24)		All (202)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0.00	22	68.75	30	34.88	12	31.58	4	16.67	68	33.66
2	Agricultural Labour	14	63.64	1	3.13	37	43.02	15	39.47	12	50.00	79	39.11
3	Student	5	22.73	7	21.88	14	16.28	8	21.05	8	33.33	42	20.79
4	Others	1	4.55	0	0.00	0	0.00	0	0.00	0	0.00	1	0.50
5	Housewife	1	4.55	2	6.25	1	1.16	1	2.63	0	0.00	5	2.48
6	Children	0	0.00	0	0.00	4	4.65	2	5.26	0	0.00	6	2.97
Total		22	100.00	32	100.00	86	100.00	38	100.00	24	100.00	202	100.00

Institutional participation of the household members: The data regarding the institutional participation of the household members in Virapura-2 micro-watershed is presented in Table 7. The results show that, 0.50 per cent were in cooperative bank and 99.50 per cent of the population in the micro watershed has not participated in any local institutions.

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

Sl.No.	Particulars	LL (22)		MF (32)		SF (86)		SMF (38)		MDF (24)		All (202)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	No Participation	22	100	32	100	86	100	37	97.37	24	100	201	99.50
2	Cooperative bank	0	0	0	0	0	0	1	2.63	0	0	1	0.50
Total		22	100	32	100	86	100	38	100	24	100	202	100

Type of house owned: The data regarding the type of house owned by the households in Virapura-2 micro-watershed is presented in Table 8. The results indicate that 95.35 per cent of the households possess katcha house and 4.65 per cent of the households possess semi pacca house.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Katcha	5	100.00	7	100.00	19	100.00	6	75.00	4	100.00	41	95.35
2	Semi pacca	0	0.00	0	0.00	0	0.00	2	25.00	0	0.00	2	4.65
Total		5	100.00	7	100.00	19	100.00	8	100.00	4	100.00	43	100.00

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Virapura-2 micro-watershed is presented in Table 9. The results show that 79.07 per cent of the households possess TV, 55.81 per cent of them possess mixer/grinder, 2.33 per cent of them possess refrigerator and computer/laptop, 32.56 per cent of them possess bicycle, 51.16 per cent of them possess motor cycle and 93.02 per cent of them possess mobile phones.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	3	60.00	5	71.43	17	89.47	5	62.50	4	100.00	34	79.07
2	Mixer/Grinder	2	40.00	3	42.86	10	52.63	5	62.50	4	100.00	24	55.81
3	Refrigerator	0	0.00	0	0.00	0	0.00	1	12.50	0	0.00	1	2.33
4	Bicycle	0	0.00	0	0.00	9	47.37	1	12.50	4	100.00	14	32.56
5	Motor Cycle	2	40.00	2	28.57	10	52.63	4	50.00	4	100.00	22	51.16
6	Mobile Phone	5	100.00	7	100.00	17	89.47	7	87.50	4	100.00	40	93.02
7	Computer/Laptop	0	0.00	0	0.00	0	0.00	1	12.50	0	0.00	1	2.33
8	Blank	0	0.00	0	0.00	1	5.26	1	12.50	0	0.00	2	4.65

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Virapura-2 micro-watershed is presented in Table 10. The results show that the average value of television was Rs. 5,600, mixer grinder was Rs.

1,231, refrigerator was Rs. 13,000, bicycle was 764, motor cycle was Rs. 31,043, mobile phones was 31,043 and computer/laptop was Rs. 32,000.

Table 10. Average value of durable assets owned by households in Virapura-2 micro-watershed **Average value (Rs.)**

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Television	9,000	8,000	5,182	5,360	2,125	5,600
2	Mixer/Grinder	2,000	1,666	1,180	1,220	662	1,231
3	Refrigerator	0	0	0	13,000	0	13,000
4	Bicycle	0	0	833	800	600	764
5	Motor Cycle	52,500	44,500	26,727	34,500	22,000	31,043
6	Mobile Phone	2,666	1,800	1,036	722	577	1,124
7	Computer/Laptop	0	0	0	32,000	0	32,000

Farm Implements owned: The data regarding the farm implements owned by the households in Virapura-2 micro-watershed is presented in Table 11. About 16.28 per cent of the households possess bullock cart, 41.86 per cent of them possess plough, 11.63 per cent of them possess seed/fertilizer drill and tractor, 2.33 per cent of them possess irrigation pump and harvester, 4.65 per cent of them possess power tiller, 13.95 per cent of them possess sprayer, 69.77 per cent of them possess weeder, 18.60 per cent of them possess chaff cutter and 9.30 of them possess earth remover.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0.00	0	0.00	6	31.58	1	12.50	0	0.00	7	16.28
2	Plough	1	20.00	3	42.86	11	57.89	2	25.00	1	25.00	18	41.86
3	Seed/Fertilizer Drill	0	0.00	0	0.00	3	15.79	2	25.00	0	0.00	5	11.63
4	Irrigation Pump	0	0.00	0	0.00	0	0.00	1	12.50	0	0.00	1	2.33
5	Power Tiller	0	0.00	1	14.29	1	5.26	0	0.00	0	0.00	2	4.65
6	Tractor	0	0.00	1	14.29	3	15.79	1	12.50	0	0.00	5	11.63
7	Sprayer	0	0.00	1	14.29	3	15.79	2	25.00	0	0.00	6	13.95
8	Weeder	1	20.00	4	57.14	16	84.21	5	62.50	4	100.00	30	69.77
9	Harvester	0	0.00	0	0.00	0	0.00	1	12.50	0	0.00	1	2.33
10	Chaff Cutter	0	0.00	0	0.00	6	31.58	1	12.50	1	25.00	8	18.60
11	Blank	4	80.00	2	28.57	3	15.79	3	37.50	0	0.00	12	27.91
12	Earth remover/Duster	0	0.00	1	14.29	2	10.53	1	12.50	0	0.00	4	9.30

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Virapura-2 micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 13,428, plough was Rs. 4,338, seed/fertilizer drill was Rs. 2,900, irrigation pump was Rs. 15,000, power tiller was Rs.75,000, tractor was Rs. 280,000, sprayer was Rs. 2,283, weeder was Rs.41, harvester was Rs.100, chaff cutter was Rs. 2,012 and earth remover/ duster was Rs. 11,000.

Table 12. Average value of farm implements owned by households in Virapura-2 micro-watershed **Average Value (Rs.)**

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Bullock Cart	0	0	14,166	9,000	0	13,428
2	Plough	1,500	1,500	3,463	16,000	2,000	4,338
3	Seed/Fertilizer Drill	0	0	3,666	1,750	0	2,900
4	Irrigation Pump	0	0	0	15,000	0	15,000
5	Power Tiller	0	100,000	50,000	0	0	75,000
6	Tractor	0	300,000	283,333	250,000	0	280,000
7	Sprayer	0	3,000	2,233	2,000	0	2,283
8	Weeder	50	45	29	77	25	41
9	Harvester	0	0	0	100	0	100
10	Chaff Cutter	0	0	2,033	2,000	1,900	2,012
11	Earth remover/Duster	0	25,000	8,000	3,000	0	11,000

Livestock possession by the households: The data regarding the Livestock possession by the households in Virapura-2 micro-watershed is presented in Table 13. The results indicate that, 16.28 per cent of the households possess bullocks, 13.95 per cent of the households possess local cow, 9.30 per cent possess crossbreed cow and 2.33 per cent of them possess buffalo.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	0	0.00	6	31.58	1	12.50	0	0.00	7	16.28
2	Local cow	0	0.00	1	14.29	4	21.05	1	12.50	0	0.00	6	13.95
3	Crossbred cow	0	0.00	1	14.29	3	15.79	0	0.00	0	0.00	4	9.30
4	Buffalo	0	0.00	0	0.00	1	5.26	0	0.00	0	0.00	1	2.33
9	blank	5	100.00	6	85.71	11	57.89	6	75.00	4	100.00	32	74.42

Average Labour availability: The data regarding the average labour availability in Virapura-2 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.63, average own labour (women) available was 1.18, average hired labour (men) available was 21.18 and average hired labour (women) available was 21.32.

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

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Hired labour Female	0.00	24.29	21.32	15.63	27.50	21.32
2	Own Labour Female	0.00	1.29	1.11	1.00	1.75	1.18
3	Own labour Male	0.00	1.14	1.74	1.63	2.00	1.63
4	Hired labour Male	0.00	25.00	20.53	17.50	25.00	21.18

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Virapura-2 micro-watershed is presented in Table 15. The results indicate that 44.19 per cent of the households opined that the hired labour was adequate and hired labour was inadequate.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0.00	6	85.71	9	47.37	4	50.00	0	0.00	19	44.19
2	Inadequate	0	0.00	1	14.29	10	52.63	4	50.00	4	100.00	19	44.19

Distribution of land (ha): The data regarding the distribution of land (ha) in Virapura-2 micro-watershed is presented in Table 16. The results indicate that, households of the Virapura-2 micro-watershed possess 50.03 ha (79.67 %) of dry land and 12.77 ha (20.33 %) of irrigated land.

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

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	0	0	5.51	100	28.13	97.20	10.71	72.28	5.68	41.97	50.03	79.67
2	Irrigated	0	0	0	0	0.81	2.80	4.11	27.72	7.85	58.03	12.77	20.33
Total		0	100	5.51	100	28.94	100	14.82	100	13.53	100	62.80	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Virapura-2 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 311,697.20 and the average value of irrigated land was Rs. 328,811.42.

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

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Dry	0.00	852,975.77	266,470.19	289,380.20	52,815.40	311,697.20
2	Irrigated	0.00	0.00	1,235,000.00	413,694.59	190,979.39	328,811.42

Status of bore wells: The data regarding the status of bore wells in Virapura-2 micro-watershed is presented in Table 18. The results indicate that, there were 3 functioning and 1 de-functioning bore wells in the micro watershed.

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

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	De-functioning	0	0	0	1	0	1
2	Functioning	0	0	1	2	0	3

Source of irrigation: The data regarding the source of irrigation in Virapura-2 micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 6.98 per cent of the farmers and canal was the irrigation source for 2.333 per cent of the farmers.

Table 19. Source of irrigation in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		LF (0)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	0	0.00	1	5.26	2	25.00	0	0.00	0	0.00	3	6.98
2	Canal	0	0.00	0	0.00	0	0.00	0	0.00	1	25.00	0	0.00	1	2.33

Depth of water (Avg in meters): The data regarding the depth of water in Virapura-2 micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 6.75 meters.

Table 20. Depth of water (Avg in meters) in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	LF (0)	All (43)
1	Bore Well	0.00	0.00	5.61	22.94	0.00	0.00	6.75

Irrigated Area (ha): The data regarding the irrigated area (ha) in Virapura-2 micro-watershed is presented in Table 21. The results indicate that small, semi medium and medium farmers had an irrigated area of 0.81 ha, 5 ha, 6.60 ha and 7.85 ha respectively.

Table 21. Irrigated Area (ha) in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Kharif	0.00	0.00	0.81	6.60	7.85	15.26
Total		0.00	0.00	0.81	6.60	7.85	15.26

Cropping pattern: The data regarding the cropping pattern in Virapura-2 micro-watershed is presented in Table 22. The results indicate that, farmers have grown bajra (4.19 ha), bengal gram (11.72 ha), green gram (9.13 ha), sorghum (5.7 ha), maize (25.15 ha), paddy (5.44 ha), red gram (2.18 ha), sunflower (14.92ha) and onion (0.89ha). Marginal farmers had grown Bengal gram, green gram, maize, and sunflower. Small farmers had bajra, Bengal gram, green gram, sorghum, maize, red gram and sunflower. Semi medium farmers had grown Bengal gram, green gram, sorghum, maize and paddy, Medium farmers had grown bajra, Bengal gram, maize, paddy, red gram and sunflower.

Table 22. Cropping pattern in Virapura-2 micro-watershed (Area in ha)

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Kharif - Bajra	0.00	0.00	2.97	0.00	1.23	4.19
2	Kharif - Bengal gram	0.00	0.56	5.84	3.7	1.62	11.72
3	Kharif – Green gram	0.00	1.30	6.60	1.23	0.00	9.13
4	Kharif - Sorghum	0.00	0.00	3.67	2.02	0.00	5.7
5	Kharif - Maize	0.00	2.30	11.87	8.14	2.83	25.15
6	Kharif - Paddy	0.00	0.00	0.00	2.04	3.40	5.44
7	Kharif - Red gram	0.00	0.00	0.56	0.00	1.62	2.18
8	Kharif-Sunflower	0	1.91	6.13	0	6.88	14.92
9	Rabi - Onion	0.00	0.00	0.00	0.00	0.89	0.89
Total		0.00	6.07	37.65	17.15	18.47	79.34

Cropping intensity: The data regarding the cropping intensity in Virapura-2 micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Virapura-2 micro-watershed was found to be 76.55 per cent.

Table 23. Cropping intensity (%) in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Cropping Intensity	0.00	100.00	91.37	90.57	49.35	76.55

Cost of cultivation of Bajra: The data regarding the cost of cultivation of bajra in Virapura-2 micro-watershed is presented in Table 24. The results indicate that, the total cost of cultivation for bajra was Rs. 16061.72. The gross income realized by the farmers was Rs. 16880.12. The net income from bajra cultivation was Rs. 818.40. Thus the benefit cost ratio was found to be 1:1.05.

Table 24. Cost of Cultivation of bajra in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	24.80	4011.55	24.98
2	Bullock		Pairs/day	2.60	1427.74	8.89
3	Tractor		Hours	1.53	1144.35	7.12
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.04	403.88	2.51
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.60	602.44	3.75
8	Fertilizer + micronutrients		Quintal	1.76	2915.99	18.15
9	Pesticides (PPC)		Kgs / liters	0.00	0.00	0.00
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	1226.41	7.64
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				471.88	2.94
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				12204.23	75.98
III	**Cost B2**					
18	Rental Value of Land				166.67	1.04
19	**Cost B2 = (Cost B1 + Rental value)**				12370.90	77.02
IV	**Cost C1**					
20	Family Human Labour			9.85	2220.67	13.83
21	**Cost C1 = (Cost B2 + Family Labour)**				14591.56	90.85
V	**Cost C2**					
22	Risk Premium				10.00	0.06
23	**Cost C2 = (Cost C1 + Risk Premium)**				14601.56	90.91
VI	**Cost C3**					
24	Managerial Cost				1460.16	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				16061.72	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		13.50	16880.12	
		b) Main Crop Sales Price (Rs.)			1250.00	
b.	Gross Income (Rs.)				16880.12	
c.	Net Income (Rs.)				818.40	
d.	Cost per Quintal (Rs./q.)				1189.40	
e.	Benefit Cost Ratio (BC Ratio)				1:1.05	

Cost of Cultivation of Bengal gram: The data regarding the cost of cultivation of Bengal gram in Virapura-2 micro-watershed is presented in Table 25. The results indicate that, the total cost of cultivation for Bengal gram was Rs. 36704.16. The gross income realized by the farmers was Rs. 47286.72. The net income from Bengal gram cultivation was Rs. 10582.56. Thus the benefit cost ratio was found to be 1:1.29.

Table 25. Cost of Cultivation of Bengal gram in Virapura-2 micro-watershedCost of

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	44.32	7758.58	21.14
2	Bullock		Pairs/day	1.67	920.08	2.51
3	Tractor		Hours	1.46	1094.14	2.98
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	101.36	9880.18	26.92
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	5.23	1045.74	2.85
8	Fertilizer + micronutrients		Quintal	2.19	3940.30	10.74
9	Pesticides (PPC)		Kgs / liters	0.89	1287.71	3.51
10	Irrigation		Number	4.32	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	2560.17	6.98
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1939.67	5.28
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				30426.57	82.90
III	**Cost B2**					
18	Rental Value of Land				208.33	0.57
19	**Cost B2 = (Cost B1 + Rental value)**				30634.90	83.46
IV	**Cost C1**					
20	Family Human Labour			11.29	2722.52	7.42
21	**Cost C1 = (Cost B2 + Family Labour)**				33357.42	90.88
V	**Cost C2**					
22	Risk Premium				10.00	0.03
23	**Cost C2 = (Cost C1 + Risk Premium)**				33367.42	90.91
VI	**Cost C3**					
24	Managerial Cost				3336.74	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				36704.16	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.90	47248.12	
		b) Main Crop Sales Price (Rs.)			3662.50	
	By Product	e) Main Product (q)		0.39	38.59	
		f) Main Crop Sales Price (Rs.)			100.00	
b.	Gross Income (Rs.)				47286.72	
c.	Net Income (Rs.)				10582.56	
d.	Cost per Quintal (Rs./q.)				2845.17	
e.	Benefit Cost Ratio (BC Ratio)				1:1.29	

Cultivation of Green gram: The data regarding the cost of cultivation of Green gram in Virapura-2 micro-watershed is presented in Table 26. The results indicate that, the total cost of cultivation for green gram was Rs. 25898.32. The gross income realized by the farmers was Rs. 46103.12. The net income from green gram cultivation was Rs. 20204.80. Thus the benefit cost ratio was found to be 1:1.78.

Table 26. Cost of Cultivation of Green gram in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	28.66	5870.18	22.67
2	Bullock		Pairs/day	2.15	1275.75	4.93
3	Tractor		Hours	1.40	1087.87	4.20
4	Machinery		Hours	0.35	257.60	0.99
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	9.20	1289.64	4.98
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	4.03	1629.69	6.29
8	Fertilizer + micronutrients		Quintal	4.97	4672.71	18.04
9	Pesticides (PPC)		Kgs / liters	0.94	890.85	3.44
10	Irrigation		Number	3.24	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	1251.24	4.83
14	Land revenue and Taxes			0.00	1.88	0.01
II	**Cost B1**					
16	Interest on working capital				1018.53	3.93
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				19245.94	74.31
III	**Cost B2**					
18	Rental Value of Land				285.71	1.10
19	**Cost B2 = (Cost B1 + Rental value)**				19531.66	75.42
IV	**Cost C1**					
20	Family Human Labour			17.46	4007.41	15.47
21	**Cost C1 = (Cost B2 + Family Labour)**				23539.07	90.89
V	**Cost C2**					
22	Risk Premium				4.86	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				23543.93	90.91
VI	**Cost C3**					
24	Managerial Cost				2354.39	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				25898.32	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.12	46103.12	
		b) Main Crop Sales Price (Rs.)			5057.14	
b.	Gross Income (Rs.)				46103.12	
c.	Net Income (Rs.)				20204.80	
d.	Cost per Quintal (Rs./q.)				2840.84	
e.	Benefit Cost Ratio (BC Ratio)				1:1.78	

Cultivation of Sorghum: The data regarding the cost of cultivation of Sorghum in Virapura-2 micro-watershed is presented in Table 27. The results indicate that, the total cost of cultivation for sorghum was Rs. 54260.50. The gross income realized by the farmers was Rs. 31863.00. The net income from sorghum cultivation was Rs. -22397.50. Thus the benefit cost ratio was found to be 1:0.59.

Table 27. Cost of Cultivation of Sorghum in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	70.40	24638.25	45.41
2	Bullock		Pairs/day	4.94	2964.00	5.46
3	Tractor		Hours	0.00	0.00	0.00
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.82	1778.40	3.28
7	FYM		Quintal	2.47	494.00	0.91
8	Fertilizer + micronutrients		Quintal	7.41	6125.60	11.29
9	Pesticides (PPC)		Kgs / liters	1.24	1235.00	2.28
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	39.52	0.07
14	Land revenue and Taxes			0.00	3.29	0.01
II	**Cost B1**					
16	Interest on working capital				1156.08	2.13
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				38434.14	70.83
III	**Cost B2**					
18	Rental Value of Land				333.33	0.61
19	**Cost B2 = (Cost B1 + Rental value)**				38767.48	71.45
IV	**Cost C1**					
20	Family Human Labour			33.35	10559.25	19.46
21	**Cost C1 = (Cost B2 + Family Labour)**				49326.73	90.91
V	**Cost C2**					
22	Risk Premium				1.00	0.00
23	**Cost C2 = (Cost C1 + Risk Premium)**				49327.73	90.91
VI	**Cost C3**					
24	Managerial Cost				4932.77	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				54260.50	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		24.70	29640.00	
		b) Main Crop Sales Price (Rs.)			1200.00	
	By Product	e) Main Product (q)		2.47	2223.00	
		f) Main Crop Sales Price (Rs.)			900.00	
b.	Gross Income (Rs.)				31863.00	
c.	Net Income (Rs.)				-22397.50	
d.	Cost per Quintal (Rs./q.)				2196.78	
e.	Benefit Cost Ratio (BC Ratio)				1:0.59	

Cost of Cultivation of Maize: The data regarding the cost of cultivation of Maize in Virapura-2 micro-watershed is presented in Table 28. The results indicate that, the total cost of cultivation for Maize was Rs. 27769.24. The gross income realized by the farmers was Rs. 46789.16. The net income from Maize cultivation was Rs. 19019.92. Thus the benefit cost ratio was found to be 1:1.68.

Table 28. Cost of Cultivation of Maize in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	37.96	7927.69	28.55
2	Bullock		Pairs/day	2.00	1212.49	4.37
3	Tractor		Hours	1.23	956.86	3.45
4	Machinery		Hours	0.03	27.44	0.10
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	18.76	2266.89	8.16
7	FYM		Quintal	3.12	623.96	2.25
8	Fertilizer + micronutrients		Quintal	5.11	5034.94	18.13
9	Pesticides (PPC)		Kgs / liters	0.83	827.78	2.98
10	Irrigation		Number	8.59	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	967.35	3.48
14	Land revenue and Taxes			0.00	2.20	0.01
II	**Cost B1**					
16	Interest on working capital				1050.92	3.78
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				20898.52	75.26
III	**Cost B2**					
18	Rental Value of Land				342.59	1.23
19	**Cost B2 = (Cost B1 + Rental value)**				21241.11	76.49
IV	**Cost C1**					
20	Family Human Labour			17.23	3999.60	14.40
21	**Cost C1 = (Cost B2 + Family Labour)**				25240.71	90.89
V	**Cost C2**					
22	Risk Premium				4.06	0.01
23	**Cost C2 = (Cost C1 + Risk Premium)**				25244.77	90.91
VI	**Cost C3**					
24	Managerial Cost				2524.48	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				27769.24	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		35.45	44514.23	
		b) Main Crop Sales Price (Rs.)			1255.56	
	By Product	e) Main Product (q)		3.33	2274.93	
		f) Main Crop Sales Price (Rs.)			683.33	
b.	Gross Income (Rs.)				46789.16	
c.	Net Income (Rs.)				19019.92	
d.	Cost per Quintal (Rs./q.)				783.25	
e.	Benefit Cost Ratio (BC Ratio)				1:1.68	

Cost of cultivation of Paddy: The data regarding the cost of cultivation of Paddy in Virapura-2 micro-watershed is presented in Table 29. The results indicate that, the total cost of cultivation for Paddy was Rs. 50929.31. The gross income realized by the farmers was Rs. 89645.05. The net income from Paddy cultivation was Rs. 38715.74. Thus the benefit cost ratio was found to be 1:1.76.

Table 29. Cost of Cultivation of Paddy in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	92.68	18614.71	36.55
2	Bullock		Pairs/day	0.45	247.00	0.48
3	Tractor		Hours	4.20	2595.85	5.10
4	Machinery		Hours	0.80	478.28	0.94
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	71.16	5647.61	11.09
7	FYM		Quintal	8.98	1796.36	3.53
8	Fertilizer + micronutrients		Quintal	5.36	6371.11	12.51
9	Pesticides (PPC)		Kgs / liters	1.35	1846.06	3.62
10	Irrigation		Number	5.46	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	1144.01	2.25
14	Land revenue and Taxes			0.00	0.66	0.00
II	**Cost B1**					
16	Interest on working capital				1880.32	3.69
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				40621.96	79.76
III	**Cost B2**					
18	Rental Value of Land				600.00	1.18
19	**Cost B2 = (Cost B1 + Rental value)**				41221.96	80.94
IV	**Cost C1**					
20	Family Human Labour			19.46	5069.21	9.95
21	**Cost C1 = (Cost B2 + Family Labour)**				46291.17	90.89
V	**Cost C2**					
22	Risk Premium				8.20	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				46299.37	90.91
VI	**Cost C3**					
24	Managerial Cost				4629.94	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				50929.31	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		61.44	84173.88	
		b) Main Crop Sales Price (Rs.)			1370.00	
	By Product	e) Main Product (q)		6.51	5471.16	
		f) Main Crop Sales Price (Rs.)			840.00	
b.	Gross Income (Rs.)				89645.05	
c.	Net Income (Rs.)				38715.74	
d.	Cost per Quintal (Rs./q.)				828.92	
e.	Benefit Cost Ratio (BC Ratio)				1:1.76	

Cost of cultivation of Red gram: The data regarding the cost of cultivation of red gram in Virapura-2 micro-watershed is presented in Table 30. The results indicate that, the total cost of cultivation for red gram was Rs. 25709.83. The gross income realized by the farmers was Rs. 32750.60. The net income from red gram cultivation was Rs. 7040.77. Thus the benefit cost ratio was found to be 1:1.27.

Table 30. Cost of Cultivation of red gram in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	39.00	7515.51	29.23
2	Bullock		Pairs/day	5.06	2782.97	10.82
3	Tractor		Hours	0.93	694.69	2.70
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	6.02	903.59	3.51
7	FYM		Quintal	3.55	710.79	2.76
8	Fertilizer + micronutrients		Quintal	2.39	3011.98	11.72
9	Pesticides (PPC)		Kgs / liters	1.20	1260.88	4.90
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	339.31	1.32
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				707.67	2.75
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17927.39	69.73
III	**Cost B2**					
18	Rental Value of Land				166.67	0.65
19	**Cost B2 = (Cost B1 + Rental value)**				18094.05	70.38
IV	**Cost C1**					
20	Family Human Labour			19.97	5268.52	20.49
21	**Cost C1 = (Cost B2 + Family Labour)**				23362.57	90.87
V	**Cost C2**					
22	Risk Premium				10.00	0.04
23	**Cost C2 = (Cost C1 + Risk Premium)**				23372.57	90.91
VI	**Cost C3**					
24	Managerial Cost				2337.26	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				25709.83	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		9.92	32750.60	
		b) Main Crop Sales Price (Rs.)			3300.00	
b.	Gross Income (Rs.)				32750.60	
c.	Net Income (Rs.)				7040.77	
d.	Cost per Quintal (Rs./q.)				2590.56	
e.	Benefit Cost Ratio (BC Ratio)				1:1.27	

Cost of cultivation of Sunflower: The data regarding the cost of cultivation of sunflower in Virapura-2 micro-watershed is presented in Table 31. The results indicate that, the total cost of cultivation for sunflower was Rs. 22835.52. The gross income realized by the farmers was Rs. 55494.51. The net income from sunflower cultivation was Rs. 32658.99. Thus the benefit cost ratio was found to be 1:2.43.

Table 31. Cost of Cultivation of sunflower in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	30.95	4887.93	21.40
2	Bullock		Pairs/day	1.13	642.25	2.81
3	Tractor		Hours	1.46	1126.38	4.93
4	Machinery		Hours	0.69	505.28	2.21
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	5.28	2072.21	9.07
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	4.32	864.73	3.79
8	Fertilizer + micronutrients		Quintal	3.56	4273.73	18.72
9	Pesticides (PPC)		Kgs / liters	0.86	862.47	3.78
10	Irrigation		Number	2.72	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	908.84	3.98
14	Land revenue and Taxes			0.00	0.73	0.00
II	**Cost B1**					
16	Interest on working capital				969.74	4.25
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				17114.27	74.95
III	**Cost B2**					
18	Rental Value of Land				259.26	1.14
19	**Cost B2 = (Cost B1 + Rental value)**				17373.53	76.08
IV	**Cost C1**					
20	Family Human Labour			15.66	3378.04	14.79
21	**Cost C1 = (Cost B2 + Family Labour)**				20751.56	90.87
V	**Cost C2**					
22	Risk Premium				8.00	0.04
23	**Cost C2 = (Cost C1 + Risk Premium)**				20759.56	90.91
VI	**Cost C3**					
24	Managerial Cost				2075.96	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				22835.52	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		12.01	55494.51	
		b) Main Crop Sales Price (Rs.)			4622.22	
b.	Gross Income (Rs.)				55494.51	
c.	Net Income (Rs.)				32658.99	
d.	Cost per Quintal (Rs./q.)				1902.00	
e.	Benefit Cost Ratio (BC Ratio)				1:2.43	

Cost of cultivation of Onion: The data regarding the cost of cultivation of onion in Virapura-2 micro-watershed is presented in Table 32. The results indicate that, the total cost of cultivation for onion was Rs. 45678.79. The gross income realized by the farmers was Rs. 85327.27. The net income from onion cultivation was Rs. 39648.49. Thus the benefit cost ratio was found to be 1:1.87.

Table 32. Cost of Cultivation of Onion in Virapura-2 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	81.96	16840.91	36.87
2	Bullock		Pairs/day	2.25	1235.00	2.70
3	Tractor		Hours	2.25	1684.09	3.69
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.98	1347.27	2.95
6	Seed Inter Crop		Kgs.	0.00	0.00	0.00
7	FYM		Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients		Quintal	6.74	8757.27	19.17
9	Pesticides (PPC)		Kgs / liters	1.12	1122.73	2.46
10	Irrigation		Number	4.49	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	89.82	0.20
14	Land revenue and Taxes			0.00	0.00	0.00
II	**Cost B1**					
16	Interest on working capital				1348.47	2.95
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				32425.56	70.99
III	**Cost B2**					
18	Rental Value of Land				333.33	0.73
19	**Cost B2 = (Cost B1 + Rental value)**				32758.90	71.72
IV	**Cost C1**					
20	Family Human Labour			33.68	8757.27	19.17
21	**Cost C1 = (Cost B2 + Family Labour)**				41516.17	90.89
V	**Cost C2**					
22	Risk Premium				10.00	0.02
23	**Cost C2 = (Cost C1 + Risk Premium)**				41526.17	90.91
VI	**Cost C3**					
24	Managerial Cost				4152.62	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				45678.79	100.00
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		89.82	85327.27	
		b) Main Crop Sales Price (Rs.)			950.00	
b.	Gross Income (Rs.)				85327.27	
c.	Net Income (Rs.)				39648.49	
d.	Cost per Quintal (Rs./q.)				508.57	
e.	Benefit Cost Ratio (BC Ratio)				1:1.87	

Adequacy of fodder: The data regarding the adequacy of fodder in Virapura-2 micro-watershed is presented in Table 33. The results indicate that, 9.30 per cent of the households opined that dry fodder was adequate, 30.23 green fodder was adequate and 20.93 per cent was inadequate of the households.

Table 33. Adequacy of fodder in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0.00	0	0.00	2	10.53	2	25.00	0	0.00	4	9.30
2	Inadequate-Dry Fodder	0	0.00	1	14.29	7	36.84	1	12.50	0	0.00	9	20.93
3	Adequate-Green Fodder	0	0.00	1	14.29	9	47.37	3	37.50	0	0.00	13	30.23

Annual gross income: The data regarding the annual gross income in Virapura-2 micro-watershed is presented in Table 34. The results indicate that the annual gross income was Rs. 49,600 for landless farmers, for marginal farmers it was Rs. 72,985.71, for small farmers it was Rs. 109,237.37, for semi medium farmers it was Rs. 123,500 and for medium farmers it was Rs. 355,462.50.

Table 34. Annual gross income in Virapura-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Service/salary	0	0	20,842.11	0	3,000	9,488.37
2	Business	0	0	2,368.42	8,125	37,500	6,046.51
3	Wage	49,600	12,857.14	6,842.11	12,500	0	13,209.30
4	Agriculture	0	55,928.57	67,828.95	100,325	303,712.50	85,993.02
5	Non Farm income	0	0	8,684.21	2,550	11,250	5,358.14
6	Dairy Farm	0	4,200	2,671.58	0	0	1,864.19
Income(Rs.)		49,600	72,985.71	109,237.37	123,500	355,462.50	121,959.53

Average annual expenditure: The data regarding the average annual expenditure in Virapura-2 micro-watershed is presented in Table 35. The results indicate that the average annual expenditure is Rs. 10,583.65. For landless households it was Rs. 3,760, for marginal farmers it was Rs. 9,061.22, for small farmers it was Rs. 4,861.50, for semi medium farmers it was Rs. 11,812.50 and for medium farmers it was Rs. 46,500.

Table 35. Average annual expenditure in Virapura-2 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	LL (5)	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Business	0	0	15,000	40,000	70,000	2,906.98
2	Wage	18,800	20,000	15,000	0	0	5,325.58
3	Agriculture	0	28,428.57	45,368.42	54,500	116,000	45,604.65
4	Dairy Farm	0	15,000	17,000	0	0	1,139.53
Total		18,800	63,428.57	92,368.42	94,500	186,000	455,096.99
Average		3,760	9,061.22	4,861.50	11,812.50	46,500	10,583.65

Forest species grown: The data regarding forest species grown in Virapura-2 micro-watershed is presented in Table 36. The results indicate that, households have planted 5 tamarind and banyan 35 neem trees in their field.

Table 36: Forest species grown in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Tamarind	0	0	0	0	0	0	3	0	2	0	5	0
2	Banyan	0	0	2	0	2	0	1	0	0	0	5	0
3	Neem	0	0	12	0	14	0	10	0	3	3	39	3

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

Average Additional investment capacity: The data regarding average additional investment capacity in Virapura-2 micro-watershed is presented in Table 37. The results indicated that, households have an average investment capacity of Rs. 2,209.3 for land development and Rs. 1,046.51 for improved crop production.

Table 37: Source of funds for additional investment capacity in Virapura-2 micro-watershed

Sl.No.	Particulars	MF (7)	SF (19)	SMF (8)	MDF (4)	All (43)
1	Land development	5,714.29	2,894.74	0	0	2,209.30
2	Improved crop production	2,857.14	1,315.79	0	0	1,046.51

Source of additional investment: The data regarding source of funds for additional investment in Virapura-2 micro-watershed is presented in Table 38. The results indicated that loan from bank was the source of additional investment for 20 per cent for land development and improved crop production.

Table 38: Source of funds for additional investment capacity in Virapura-2 micro-watershed

Sl.No	Item	Land development		Improved crop production	
		N	%	N	%
1	Loan from bank	9	20.0	9	20.0

Table 39. Marketing of the agricultural produce in Virapura-2 micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	57.0	0.0	57.0	100.0	1250.0
2	Bengalgram	141.0	0.0	141.0	100.0	3662.5
3	Greengram	82.0	0.0	82.0	100.0	5057.14
4	Sorghum	43.0	0.0	63.0	100.0	1783.33
5	Maize	829.0	0.0	829.0	100.0	1255.56
6	Onion	80.0	0.0	80.0	100.0	950.0
7	Paddy	343.0	0.0	343.0	100.0	1370.0
8	Redgram	19.0	0.0	19.0	100.0	3300.0
9	Sunflower	185.0	0.0	185.0	100.0	4622.22

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Virapura-2 micro-watershed is presented in Table 39. The results

indicated that, bajra, Bengal gram, green gram, sorghum, maize, onion, paddy, red gram and sunflower was sold to the extent of 100 per cent.

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Virapura-2 micro-watershed is presented in Table 40. The results indicated that, about 6.98 per cent of the farmers sold their produce to agent/ traders and contract marketing arrangement and 39.53 per cent of the farmers sold their produce to local/village merchants, regulated market and cooperative marketing society.

Table 40. Marketing Channels used for sale of agricultural produce in Virapura-2 micro-watershed

Sl.No.	Particulars	MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%
1	Agent/Traders	0	0.00	0	0.00	3	37.50	0	0.00	3	6.98
2	Local/village Merchant	6	85.71	9	47.37	2	25.00	0	0.00	17	39.53
3	Regulated Market	0	0.00	9	47.37	3	37.50	5	125.00	17	39.53
4	Cooperative marketing Society	1	14.29	8	42.11	3	37.50	5	125.00	17	39.53
5	Contract marketing arrangement	1	14.29	0	0.00	0	0.00	2	50.00	3	6.98

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Virapura-2 micro-watershed is presented in Table 41. The results indicated that, 127.91 per cent of the households used tractor and 4.65 per cent of them used truck as a mode of transportation for their agricultural produce.

Table 41. Mode of transport of agricultural produce in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Tractor	0	0.00	8	114.29	26	136.84	11	137.50	10	250.00	55	127.91
2	Truck	0	0.00	0	0.00	0	0.00	0	0.00	2	50.00	2	4.65

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Virapura-2 micro-watershed is presented in Table 42. The results indicated that, 32.56 per cent of the households have experienced soil and water erosion problems in the farm.

Table 42. Incidence of soil and water erosion problems in Virapura-2 micro-watershed

Sl.No.	Particulars	MF (7)		SF (19)		SMF (8)		MDF(4)		All (43)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	3	42.86	9	47.37	2	25	0	0	14	32.56

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Virapura-2 micro-watershed is presented in Table 43. The results indicated that, 39.53 per cent have shown interest in soil test.

Table 43. Interest shown towards soil testing in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		LF (0)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0.00	6	85.71	9	47.37	2	25.00	0	0.00	0	0.00	17	39.53

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Virapura-2 micro-watershed is presented in Table 44. The results indicated that, 90.7 per cent of the households used firewood, 2.33 per cent of the households used kerosene and 6.98 per cent of the households used LPG as a source of fuel.

Table 44. Usage pattern of fuel for domestic use in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	5	100.00	7	100.00	18	94.74	6	75.00	3	75.00	39	90.70
2	Kerosene	0	0.00	0	0.00	0	0.00	1	12.50	0	0.00	1	2.33
3	LPG	0	0.00	0	0.00	1	5.26	1	12.50	1	25.00	3	6.98

Source of drinking water: The data regarding source of drinking water in Virapura-2 micro-watershed is presented in Table 45. The results indicated that, piped supply was the major source of drinking water for 51.16 per cent of the households and bore well was the source of drinking water for 48.84 per cent of the households in micro watershed.

Table 45. Source of drinking water in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	5	100.00	6	85.71	9	47.37	2	25.00	0	0.00	22	51.16
2	Bore Well	0	0.00	1	14.29	10	52.63	6	75.00	4	100.00	21	48.84

Source of light: The data regarding source of light in Virapura-2 micro-watershed is presented in Table 46. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 46. Source of light in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	5	100.00	7	100.00	19	100.00	8	100.00	4	100.00	43	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Virapura-2 micro-watershed is presented in Table 47. The results indicated that, 44.19 per cent of the households possess sanitary toilet facility.

Table 47. Existence of Sanitary toilet facility in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	1	20.00	3	42.86	9	47.37	3	37.50	3	75.00	19	44.19

Possession of PDS card: The data regarding possession of PDS card in Virapura-2 micro-watershed is presented in Table 48. The results indicated that, 6.98 per cent of the

sampled households possessed APL and 76.74 per cent of the sample households possessed BPL card and 16.28 per cent of the households did not possess any PDS card.

Table 48. Possession of PDS card in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0.00	0	0.00	0	0.00	0	0.00	3	75.00	3	6.98
2	BPL	4	80.00	7	100.00	15	78.95	6	75.00	1	25.00	33	76.74
3	Not Possessed	1	20.00	0	0.00	4	21.05	2	25.00	0	0.00	7	16.28

Participation in NREGA program: The data regarding participation in NREGA programme in Virapura-2 micro-watershed is presented in Table 49. The results indicated that, 37.21 per cent of the households participated in NREGA programme.

Table 49. Participation in NREGA programme in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	2	40.00	1	14.29	4	21.05	5	62.50	4	100.00	16	37.21

Adequacy of food items: The data regarding adequacy of food items in Virapura-2 micro-watershed is presented in Table 50. The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 58.14 per cent, oilseeds were adequate for 4.65 per cent, vegetables were adequate for 11.63 per cent, milk and egg were adequate for 53.49 per cent and meat were adequate for 51.16 per cent.

Table 50. Adequacy of food items in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	5	100.00	7	100.00	19	100.00	8	100.00	4	100.00	43	100.00
2	Pulses	5	100.00	7	100.00	9	47.37	4	50.00	0	0.00	25	58.14
3	Oilseed	0	0.00	1	14.29	0	0.00	1	12.50	0	0.00	2	4.65
4	Vegetables	1	20.00	0	0.00	2	10.53	2	25.00	0	0.00	5	11.63
5	Milk	5	100.00	6	85.71	8	42.11	4	50.00	0	0.00	23	53.49
6	Egg	5	100.00	6	85.71	9	47.37	3	37.50	0	0.00	23	53.49
7	Meat	5	100.00	6	85.71	9	47.37	2	25.00	0	0.00	22	51.16

Table 51. Response on Inadequacy of food items in Virapura-2 micro-watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Pulses	0	0.00	0	0.00	10	52.63	4	50.00	4	100.00	18	41.86
2	Oilseed	5	100.00	6	85.71	12	63.16	4	50.00	0	0.00	27	62.79
3	Vegetables	4	80.00	6	85.71	9	47.37	3	37.50	0	0.00	22	51.16
4	Fruits	5	100.00	7	100.00	14	73.68	3	37.50	1	25.00	30	69.77
5	Milk	0	0.00	1	14.29	10	52.63	4	50.00	3	75.00	18	41.86
6	Egg	0	0.00	1	14.29	10	52.63	4	50.00	4	100.00	19	44.19

Response on Inadequacy of food items: The data regarding inadequacy of food items in Virapura-2 micro-watershed is presented in Table 51. The results indicated that, pulses

and milk were inadequate for 41.86 per cent, oilseeds and fruits were inadequate for 62.79 per cent, vegetables were inadequate for 51.16 per cent, fruits were inadequate for 69.77 per cent, milk were inadequate for 41.86 per cent and egg were inadequate were 44.19 per cent of the households.

Response on market surplus of food items: The data regarding market surplus of food items in Virapura-2 micro watershed is presented in Table 52. The results indicated that, oilseeds were market surplus for 30.23 per cent, vegetables were market surplus for 37.21 per cent and meat were market surplus for 18.60 per cent of the households.

Table 52. Response on Market surplus of food items in Virapura-2 micro watershed

Sl.No.	Particulars	LL (5)		MF (7)		SF (19)		SMF (8)		MDF (4)		All (43)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Oilseed	0	0.00	0	0.00	6	31.58	3	37.50	4	100.00	13	30.23
2	Vegetables	0	0.00	1	14.29	8	42.11	3	37.50	4	100.00	16	37.21
3	Fruits	0	0.00	0	0.00	3	15.79	2	25.00	3	75.00	8	18.60

Farming constraints: The data regarding farming constraints experienced by households in Virapura-2 micro-watershed is presented in Table 53. The results indicated that, lower fertility status of the soil and high rate of interest on credit was the constraint experienced by 46.51 per cent of the households, wild animal menace on farm field (55.81%),inadequacy of irrigation water (41.86%), high cost of fertilizers and plant protection chemicals and less rainfall (48.84%), lack of marketing facilities in the area (4.65%), low price for the agricultural commodities(2.33%), lack of transport for safe transport of the agricultural produce to the market and Source of Agri-technology information (44.19%).

Table 53. Farming constraints Experienced in Virapura-2 micro-watershed

Sl. No.	Particulars	MF (7)		SF (19)		SMF (8)		MDF(4)		All (43)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	6	85.71	11	57.89	3	37.50	0	0	20	46.51
2	Wild animal menace on farm field	6	85.71	13	68.42	5	62.50	0	0	24	55.81
3	Frequent incidence of pest and diseases	7	100	19	100	6	75	4	100	36	83.72
4	Inadequacy of irrigation water	5	71.43	10	52.63	3	37.50	0	0	18	41.86
5	High cost of Fertilizers and plant protection chemicals	6	85.71	11	57.89	2	25	2	50	21	48.84
6	High rate of interest on credit	6	85.71	9	47.37	4	50	1	25	20	46.51
7	Low price for the agricultural commodities	0	0	0	0	0	0	1	25	1	2.33
8	Lack of marketing facilities in the area	0	0	1	5.26	1	12.50	0	0	2	4.65
9	Lack of transport for safe transport of the Agril produce to the market.	1	14.29	10	52.63	4	50	4	100	19	44.19
10	Less rainfall	1	14.29	10	52.63	6	75	4	100	21	48.84
11	Source of Agri-technology information(Newspaper/TV/Mobile)	1	14.29	10	52.63	4	50	4	100	19	44.19

Chapter 5

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyze the data. About 43 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 111 (54.95%) men and 91 (45.05%) women among the sampled households. The average family size of landless farmers' was 4.4, marginal farmers' and small farmers' was 4.5, semi medium farmers' was 4.75 and medium farmers' was 6. The data indicated that, 40 (20.79%) people were in 0-15 years of age, 78 (38.61%) were in 16-35 years of age, 63 (31.19%) were in 36-60 years of age and 19 (9.41%) were above 61 years of age.

The results indicated that Virapura-2 had 17.82 per cent illiterates, 26.73 per cent of them had primary school education, 1.49 per cent of them had middle school education, 28.22 per cent of them had high school education, 10.89 per cent of them had PUC education, 0.99 per cent had diploma education, 0.50 per cent of them did ITI and 10.40 per cent of them had degree level education.

The results indicate that, 76.74 per cent of household heads were practicing agriculture and 23.26 per cent of the household heads were agricultural labour. The results indicate that agriculture was the major occupation for 33.66 per cent of the household members, 39.11 per cent were agricultural labourers, 20.79 per cent were students, 2.48 per cent were housewives and 2.97 per cent were children.

The results show that, 0.50 per cent were in cooperative bank and 99.50 per cent of the population in the micro watershed has not participated in any local institutions.

The results indicate that 95.35 per cent of the households possess katcha house and 4.65 per cent of the households possess semi pacca house.

The results show that 79.07 per cent of the households possess TV, 55.81 per cent of them possess mixer/grinder, 2.33 per cent of them possess refrigerator and computer/laptop, 32.56 per cent of them possess bicycle, 51.16 per cent of them possess motor cycle and 93.02 per cent of them possess mobile phones. The results show that the average value of television was Rs. 5,600, mixer grinder was Rs. 1,231, refrigerator was Rs. 13,000, bicycle was 764, motor cycle was Rs. 31,043, mobile phones was 31,043 and computer/laptop was Rs. 32,000.

About 16.28 per cent of the households possess bullock cart, 41.86 per cent of them possess plough, 11.63 per cent of them possess seed/fertilizer drill and tractor, 2.33 per cent of them possess irrigation pump and harvester, 4.65 per cent of them possess power tiller, 13.95 per cent of them possess sprayer, 69.77 per cent of them possess weeder, 18.60 per cent of them possess chaff cutter and 9.30 of them possess earth remover. The results show that the average value of bullock cart was Rs. 13,428, plough was Rs. 4,338, seed/fertilizer drill was Rs. 2,900, irrigation pump was Rs. 15,000, power tiller was Rs.75,000, tractor was Rs. 280,000, sprayer was Rs. 2,283, weeder was Rs.41, harvester was Rs.100, chaff cutter was Rs. 2,012 and earth remover/ duster was Rs. 11,000.

The results indicate that, 16.28 per cent of the households possess bullocks, 13.95 per cent of the households possess local cow, 9.30 per cent possess crossbreed cow and 2.33 per cent of them possess buffalo.

The results indicate that, average own labour men available in the micro watershed was 1.63, average own labour (women) available was 1.18, average hired labour (men) available was 21.18 and average hired labour (women) available was 21.32. The results indicate that 44.19 per cent of the households opined that the hired labour was adequate and hired labour was inadequate.

The results indicate that, households of the Virapura-2 micro-watershed possess 50.03 ha (79.67 %) of dry land and 12.77 ha (20.33 %) of irrigated land. Marginal farmers possess 5.51 ha (100%) of dry land. Small farmers possess 28.13 ha (97.20%) of dry land and 0.81 ha (2.80%) of irrigated land. Semi medium farmers possess 10.71 ha (72.28%) of dry land and 4.11 (27.72%) for irrigated land. Medium farmers possess 5.68 ha (41.97%) for dry land and 7.85 ha (58.03 %) for irrigated land.

The results indicate that, the average value of dry land was Rs. 311,697.20 and the average value of irrigated land was Rs. 328,811.42. In case of marginal famers, the average land value was Rs. 852,975.77 for dry land. In case of small famers, the average land value was Rs. 266,470.19 for dry land and Rs. 1,235,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 289,380.20 for dry land and Rs. 413,694.59 for irrigated land. In case of medium farmers, the average land value was Rs. 52,815.40 for dry land and Rs. 190,979.39 for irrigated land.

The results indicate that, there were 3 functioning and 1 de-functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 6.98 per cent of the farmers and canal was the irrigation source for 2.333 per cent of the farmers. The results indicate that, the depth of bore well was found to be 6.75 meters.

The results indicate that small, semi medium and medium farmers had an irrigated area of 0.81 ha, 5 ha, 6.60 ha and 7.85 ha respectively. The results indicate that, farmers

have grown bajra (4.19 ha), bengal gram (11.72 ha), green gram (9.13 ha), sorghum (5.7 ha), maize (25.15 ha), paddy (5.44 ha), red gram (2.18 ha), sunflower (14.92ha) and onion (0.89ha). Marginal farmers had grown Bengal gram, green gram, maize, and sunflower. Small farmers had bajra, Bengal gram, green gram, sorghum, maize, red gram and sunflower. Semi medium farmers had grown Bengal gram, green gram, sorghum, maize and paddy; Medium farmers had grown bajra, Bengal gram, maize, paddy, red gram and sunflower. The results indicate that, the cropping intensity in Virapura-2 micro-watershed was found to be 76.55 per cent.

The results indicate that, the total cost of cultivation for bajra was Rs. 16061.72. The gross income realized by the farmers was Rs. 16880.12. The net income from bajra cultivation was Rs. 818.40. Thus the benefit cost ratio was found to be 1:1.05. The total cost of cultivation for Bengal gram was Rs. 36704.16. The gross income realized by the farmers was Rs. 47286.72. The net income from Bengal gram cultivation was Rs. 10582.56. Thus the benefit cost ratio was found to be 1:1.29. The total cost of cultivation for green gram was Rs. 25898.32. The gross income realized by the farmers was Rs. 46103.12. The net income from green gram cultivation was Rs. 20204.80. Thus the benefit cost ratio was found to be 1:1.78. The total cost of cultivation for sorghum was Rs. 54260.50. The gross income realized by the farmers was Rs. 31863.00. The net income from sorghum cultivation was Rs. -22397.50. Thus the benefit cost ratio was found to be 1:0.59. The total cost of cultivation for Maize was Rs. 27769.24. The gross income realized by the farmers was Rs. 46789.16. The net income from Maize cultivation was Rs. 19019.92. Thus the benefit cost ratio was found to be 1:1.68.

The total cost of cultivation for Paddy was Rs. 50929.31. The gross income realized by the farmers was Rs. 89645.05. The net income from Paddy cultivation was Rs. 38715.74. Thus the benefit cost ratio was found to be 1:1.76. The total cost of cultivation for red gram was Rs. 25709.83. The gross income realized by the farmers was Rs. 32750.60. The net income from red gram cultivation was Rs. 7040.77. Thus the benefit cost ratio was found to be 1:1.27. The total cost of cultivation for sunflower was Rs. 22835.52. The gross income realized by the farmers was Rs. 55494.51. The net income from sunflower cultivation was Rs. 32658.99. Thus the benefit cost ratio was found to be 1:2.43. The total cost of cultivation for onion was Rs. 45678.79. The gross income realized by the farmers was Rs. 85327.27. The net income from onion cultivation was Rs. 39648.49. Thus the benefit cost ratio was found to be 1:1.87.

The results indicate that, 9.30 per cent of the households opined that dry fodder was adequate, 30.23 green fodder was adequate and 20.93 per cent was inadequate of the households.

The results indicate that the annual gross income was Rs. 49,600 for landless farmers, for marginal farmers it was Rs. 72,985.71, for small farmers it was Rs. 109,237.37, for semi medium farmers it was Rs. 123,500 and for medium farmers it was

Rs. 355,462.50. The results indicate that the average annual expenditure is Rs. 10,583.65. For landless households it was Rs. 3,760, for marginal farmers it was Rs. 9,061.22, for small farmers it was Rs. 4,861.50, for semi medium farmers it was Rs. 11,812.50 and for medium farmers it was Rs. 46,500.

The results indicate that, households have planted 5 tamarind and banyan 35 neem trees in their field.

The results indicated that, households have an average investment capacity of Rs. 2,209.3 for land development and Rs. 1,046.51 for improved crop production. The results indicated that loan from bank was the source of additional investment for 20 per cent for land development and improved crop production.

The results indicated that, bajra, Bengal gram, green gram, sorghum, maize, onion, paddy, red gram and sunflower were sold to the extent of 100 per cent. The results indicated that, about 6.98 per cent of the farmers sold their produce to agent/ traders and contract marketing arrangement and 39.53 per cent of the farmers sold their produce to local/village merchants, regulated market and cooperative marketing society. The results indicated that, 127.91 per cent of the households used tractor and 4.65 per cent of them used truck as a mode of transportation for their agricultural produce.

The results indicated that, 32.56 per cent of the households have experienced soil and water erosion problems in the farm. The results indicated that, 39.53 per cent have shown interest in soil test.

The results indicated that, 90.7 per cent of the households used firewood, 2.33 per cent of the households used kerosene and 6.98 per cent of the households used LPG as a source of fuel. The results indicated that, piped supply was the major source of drinking water for 51.16 per cent of the households and bore well was the source of drinking water for 48.84 per cent of the households in micro watershed.

Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 44.19 per cent of the households possess sanitary toilet facility. The results indicated that, 6.98 per cent of the sampled households possessed APL and 76.74 per cent of the sample households possessed BPL card and 16.28 per cent of the households did not possess any PDS card. The results indicated that, 37.21 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 58.14 per cent, oilseeds were adequate for 4.65 per cent, vegetables were adequate for 11.63 per cent, milk and egg were adequate for 53.49 per cent and meat were adequate for 51.16 per cent.

The results indicated that, pulses and milk were inadequate for 41.86 per cent, oilseeds and fruits were inadequate for 62.79 per cent, vegetables were inadequate for

51.16 per cent, fruits were inadequate for 69.77 per cent, milk were inadequate for 41.86 per cent and egg were inadequate were 44.19 per cent of the households.

The results indicated that, oilseeds were market surplus for 30.23 per cent; vegetables were market surplus for 37.21 per cent and meat were market surplus for 18.60 per cent of the households.

The results indicated that, lower fertility status of the soil and high rate of interest on credit was the constraint experienced by 46.51 per cent of the households, wild animal menace on farm field (55.81%),inadequacy of irrigation water (41.86%), high cost of fertilizers and plant protection chemicals and less rainfall (48.84%), lack of marketing facilities in the area (4.65%), low price for the agricultural commodities(2.33%), lack of transport for safe transport of the agricultural produce to the market and Source of Agri-technology information (44.19%).