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

NARAYANAPET-1 (4D5B1S1b) MICROWATERSHED

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

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

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

The natural resources (land, water and vegetation) of the state need adequate and constant care and management, backed by site-specific technological interventions and investments particularly by the government. Detailed database pertaining to the nature of the land resources, their constraints, inherent potentials and suitability for various land based rural enterprises, crops and other uses is a prerequisite for preparing location-

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component-1 Land Resource Inventry. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on "Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of Narayanpet-1 Microwatershed, Yadgir 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: 16.05.2019

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Narayanpet-1 Microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and the 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 316 ha in Yadgir taluk & district, Karnataka. The climate is semiarid and categorized as drought-prone with an average annual rainfall of 866 mm, of which about 652 mm is received during south-west monsoon, 138 mm during north-east and the remaining 76 mm during the rest of the year. An area of 293 ha in the microwatershed is covered by soils, 23 ha by others (habitation and water body). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 6 soil series and 7 soil phases (management units) and six land management units.*
- *The length of crop growing period is about 120-150 days starting from 1st week of June to 4th week of October.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 26 major agricultural and horticultural crops was assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire area in the microwatershed is suitable for agriculture.*
- *About 24 per cent soils in the microwatershed are very deep (>150 cm), 41 per cent is deep (100-150 cm), 6 per cent is moderately deep (75-100 cm), 4 per cent is moderately shallow (50-75 cm), 12 per cent is shallow (25-50 cm) and 7 per cent soils are very shallow (<25 cm).*
- *About 4 per cent area in the microwatershed has loamy and 89 has clayey soils at the surface.*
- *Entire area in the microwatershed is non gravelly (<15%).*

- *About 64 per cent area of the microwatershed is very high (>200 mm/m) in available water capacity, 6 per cent is medium (101-150 mm/m), 4 per cent is low (51-100 mm/m) and 19 per cent is very low.*
- *About 4 per cent area in the microwatershed has nearly level (0-1% slope) lands and 89 per cent area is very gently sloping (1-3% slope) lands.*
- *About 4 per cent area in the microwatershed is slightly eroded (e1), 77 per cent area moderately (e2) eroded and 12 per cent area is severely eroded e3).*
- *An area of about 2 per cent area in the microwatershed is neutral (pH 6.5-7.3), 28 per cent soils is slightly to moderately alkaline (pH 7.3-8.4) and about 62 per cent soils are strongly to very strongly alkaline (pH 8.4 - >9.0).*
- *The Electrical Conductivity (EC) of 75 per cent area in the microwatershed are non saline (<2 dSm^{-1}), 12 per cent is low (2-4 dSm^{-1}) and 6 per cent is medium (4-8 dSm^{-1}).*
- *About 19 per cent of the soils are low (<0.5%) in organic carbon, 34 per cent is medium (0.5-0.75%) and 40 per cent is high (>0.75).*
- *About 30 per cent area is low in available phosphorus, 43 per area is medium (23-57 kg/ha) and 19 per cent is high (>57 kg/ha).*
- *Entire area in the microwatershed is high (>337 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in 9 per cent area, medium (10 -20 ppm) in an area of about 25 per cent and high (>20 ppm) in 59 per cent area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in an area of about 54 per cent, medium (0.5-1.0 ppm) in an area of 39 per cent and high (>1.0 ppm) in only 1 per cent area of the microwatershed.*
- *Available iron is sufficient (>4.5 ppm) in 51 per cent area and deficient in 42 per cent area of the microwatershed.*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Available zinc is deficient (<0.6 ppm) in an area of 59 per cent and sufficient (>0.6 ppm) in 34 per cent area of the microwatershed.*
- *The land suitability for 26 major crops grown in the microwatershed were 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	*75(24)*	*158(50)*	*Sapota*	-	-
Maize	-	*233(74)*	*Guava*	-	-
Redgram	-	*219(70)*	*Pomegranate*	-	*220(70)*
Bajra	-	*233(74)*	*Jackfruit*	-	-
Groundnut	-	*13(4)*	*Jamun*	-	*203(64)*
Sunflower	-	*220(70)*	*Musambi*	*128(41)*	*92(29)*
Cotton	*203(64)*	*31(10)*	*Lime*	*128(41)*	*92(29)*
Bengal gram	*203(64)*	*30(10)*	*Cashew*	-	-
Chilli	-	*105(33)*	*Custard apple*	*220(70)*	*13(4)*
Tomato	-	*13(4)*	*Amla*	*75(24)*	*158(50)*
Drumstick	-	*220(70)*	*Tamarind*	-	*203(64)*
Mulberry	-	-	*Marigold*	-	*233(74)*
Mango	-	-	*Chrysanthemum*	-	*233(74)*

- *Apart from the individual crop suitability, a proposed crop plan has been prepared for the identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.*
- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested to these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation 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. This would help in not only supplementing the farm income but also provide fodder and fuel and generate lot of biomass which would help in maintaining an ecological balance and also contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Soil being a vital natural resource on whose proper use depends the life supporting systems of a country and the socioeconomic development of its people. Soils provide food, fodder, fibre and fuel for meeting the basic human and animal needs. With the ever increasing growth in human and animal population, the demand on soil for more food and fodder production is on the increase. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, 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. The soils have been degrading at an estimated rate of one million hectares per year and ground water levels have been receding at an alarming rate resulting in decline in the ground water resource. Further, land degradation has emerged as a serious problem which has already affected about 38 lakh ha of cultivated area in the State. Soil erosion alone has degraded about 35 lakh ha. Almost all the uncultivated areas are facing various degrees of degradation, particularly soil erosion; salinity and alkalinity has emerged as a major problem 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 situation to be tackled by the farmers.

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

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

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

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

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

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

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Narayanpet-1 microwatershed is located in the northern part of Karnataka in Yadgir Taluk & District, Karnataka State (Fig.2.1). It comprises parts of Goodura and Badiyala villages. It lies between 16^0 28' and 16^0 30' North latitudes and 77^0 14' and 77^0 16' East longitudes covering an area of about 316 ha. It is about 40 km south of Yadgir town and is surrounded by Gudura village on the west and south, Badiyala village on the north, southeast and eastern side.

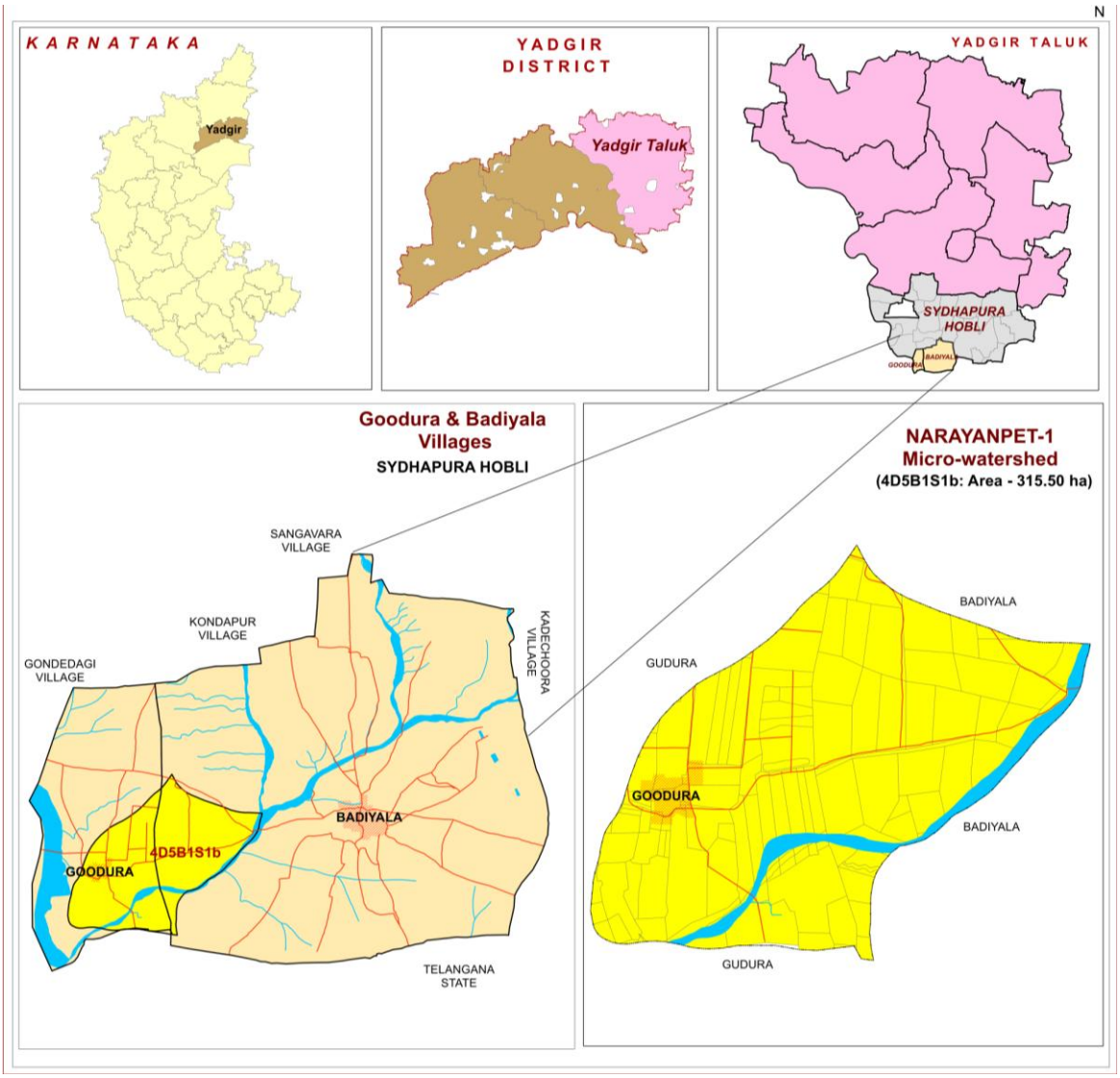


Fig.2.1 Location map of Narayanpet-1 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss (Fig.2.2). 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 Narayanpet-1 microwatershed.

Fig.2.2 Granite and granite gneiss rocks

2.3 Physiography

Physiographically, the area has been identified as granite gneiss landscape based on geology. The area has been further subdivided into five landforms, *viz;* mounds/ridges, summits, side slopes and very gently sloping uplands, plains and valleys based on slope and its relief features. The elevation ranges from 342-354 m above MSL. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

The area is drained by several parallel streams like Bori, Amerja and Kanga which finally join the river Bhima along its course. Though, they are not perennial, during rainy season they carry large quantities of rain water. The microwatershed has only few small tanks which are not capable of storing the water that flows during the rainy season. Due to this, the ground water recharge is very much affected. This is reflected in the failure of many bore wells in the villages. If the available rain water is properly harnessed by constructing new tanks and recharge structures at appropriate places in the villages, then the drinking and irrigation needs of the area can be easily met. The drainage network is parallel to sub parallel and dendritic.

2.5 Climate

The Yadgir district lies in the northern plains of Karnataka and falls under semiarid tract of the state and is categorized as drought- prone with total annual rainfall of 866 mm (Table 2.1). Of the total rainfall, maximum of 652 mm is received during the

south–west monsoon period from June to September, the north-east monsoon from October to early December contributes about 138 mm, and the remaining 76 mm during the rest of the year. The summer season starts during the middle of February and continues up to the first week of June. The period from December to the middle of February is the cold season. December is the coldest month with mean daily maximum and minimum temperatures being 29.5^0C and 10^0C respectively. During peak summer, temperature shoots up to 45^0C. Relative humidity varies from 26% in summer to 62% in winter. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo-Transpiration (PET) is 141 mm and varies from a low of 81 mm in December to 199 mm in the month of May. The PET is always higher than precipitation in all the months except July to end of September. Generally, the Length of crop Growing Period (LGP) is 120-150 days and starts from 1st week of June to 4th week of October.

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

Sl. No.	Months	Rainfall	PET	1/2 PET
1	January	4.30	86.0	43.0
2	February	2.30	125.5	62.7
3	March	15.10	166.0	83.0
4	April	18.50	179.8	89.9
5	May	36.0	198.8	97.9
6	June	118.0	175.1	87.5
7	July	171.80	156.3	78.1
8	August	182.9	150.3	75.1
9	September	179.7	142.0	71.0
10	October	105.3	138.5	69.2
11	November	26.4	97.60	48.6
12	December	6.0	80.90	40.4
Total		**866.3**	**141.4**	

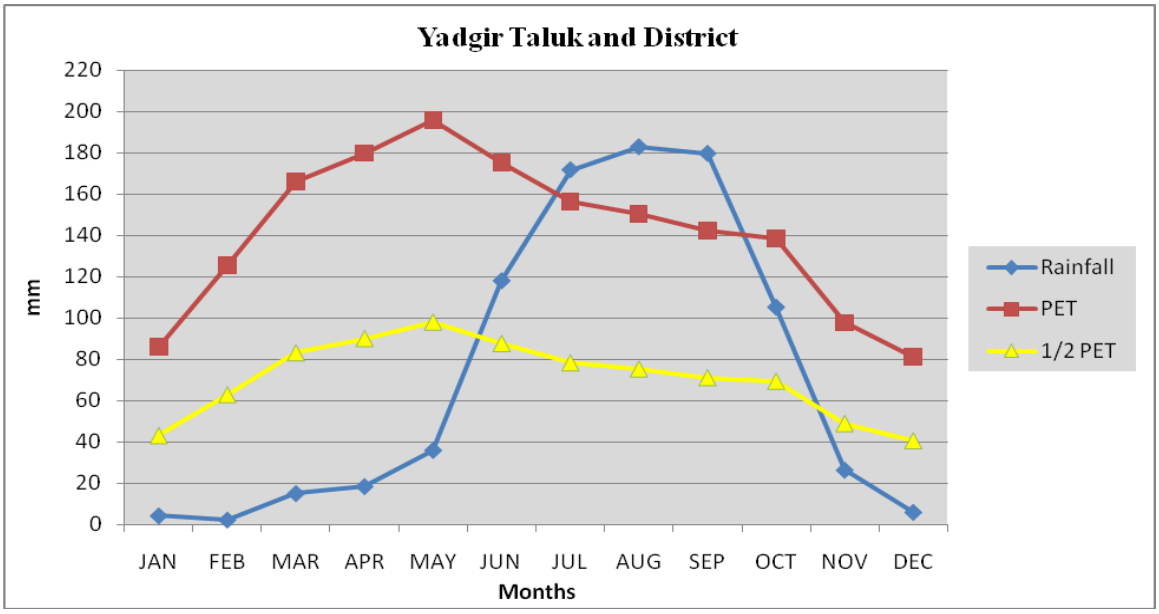


Fig 2.3 Rainfall distribution in Yadgir Taluk

2.6 Natural Vegetation

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

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

2.7 Land Utilization

About 72 per cent area (Table 2.2) in Yadgir taluk is cultivated at present. An area of about 2 per cent is permanently under pasture, 20 per cent under current fallows and 6 per cent under non-agricultural land and 5 per cent under currently barren. Forests occupy an area of about 7 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, groundnut, redgram and cotton. 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 Narayanpet-1 microwatershed is presented in Fig.2.5. The different crops and cropping systems adopted in the microwatershed is presented in Figures 2.4. Simultaneously, enumeration of wells (bore wells and open wells) and other conservation structures in the microwatershed was made and their location in different survey numbers is marked on the cadastral map.

Table 2.2 Land Utilization in Yadgir Taluk

Sl. No.	Agricultural land use	Area (ha)	Per cent
1.	Total geographical area	516088	-
2.	Total cultivated area	373617	72.4
3.	Area sown more than once	74081	14.3
4.	Trees and grooves	737	0.14
5.	Forest	33773	6.54
6.	Cultivable wasteland	2385	0.46
7.	Permanent Pasture land	11755	2.28
8.	Barren land	27954	5.41
9.	Non- Agriculture land	29623	5.73
10.	Current Fallows	105212	20.4

Fig. 2.4. Different Crops and Cropping Systems in Narayanpet-1 Microwatershed

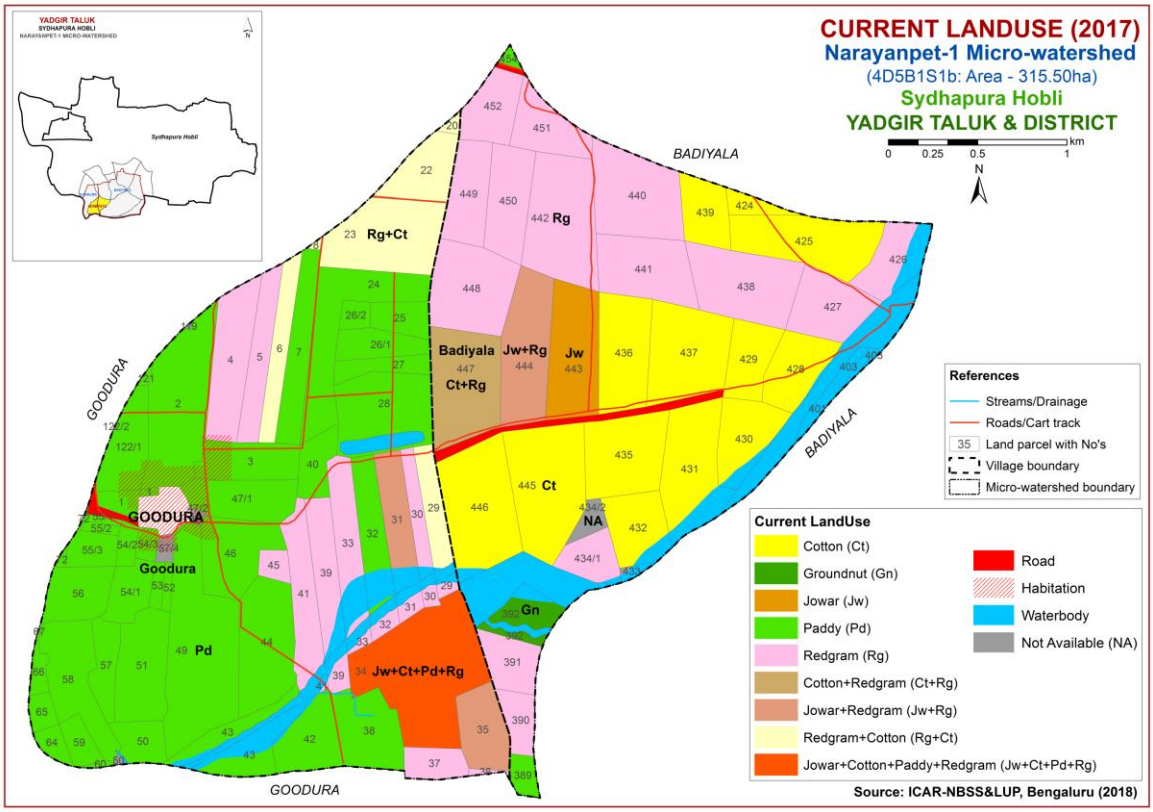


Fig.2.5 Current Land Use map of Narayanpet-1 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Narayanpet-1 microwatershed by the detailed study of all the soil site characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing area extent and their geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in 316 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 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 rock types, the landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig. 3.2). The cadastral map was overlaid on the satellite imagery (Fig.3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology and landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

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

Image Interpretation Legend for Physiography

G- Granite Gneiss Landscape

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

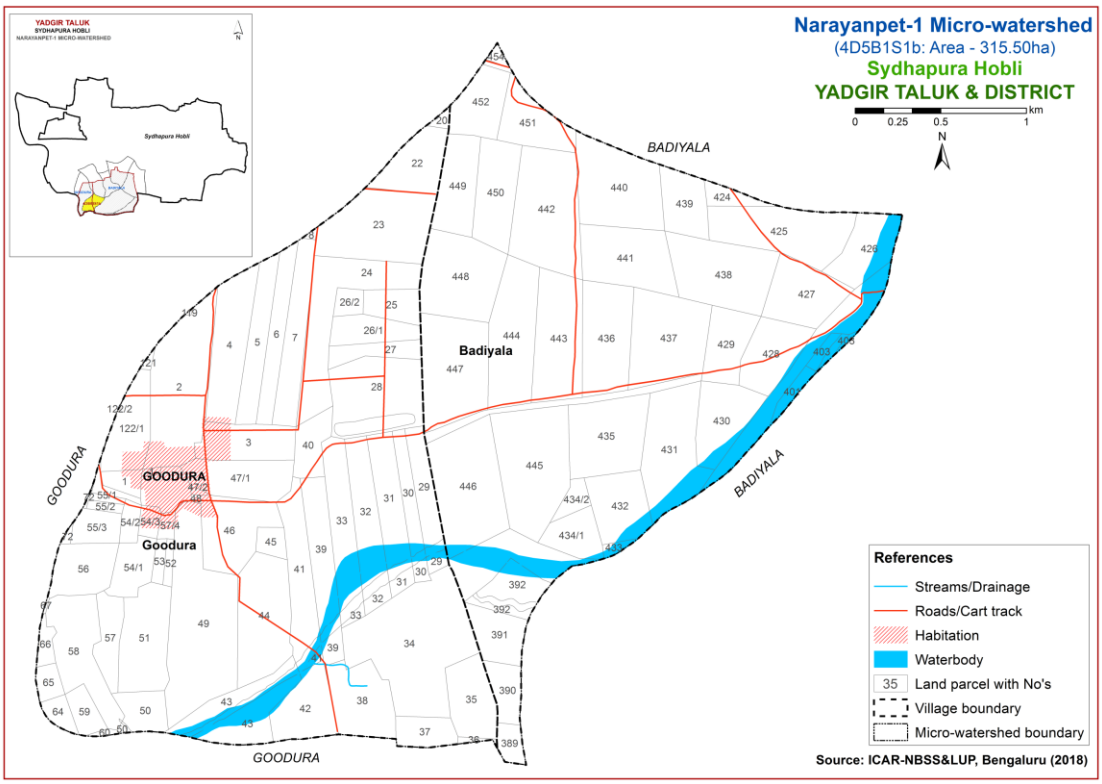


Fig 3.1 Scanned and Digitized Cadastral map of Narayanpet-1 Microwatershed

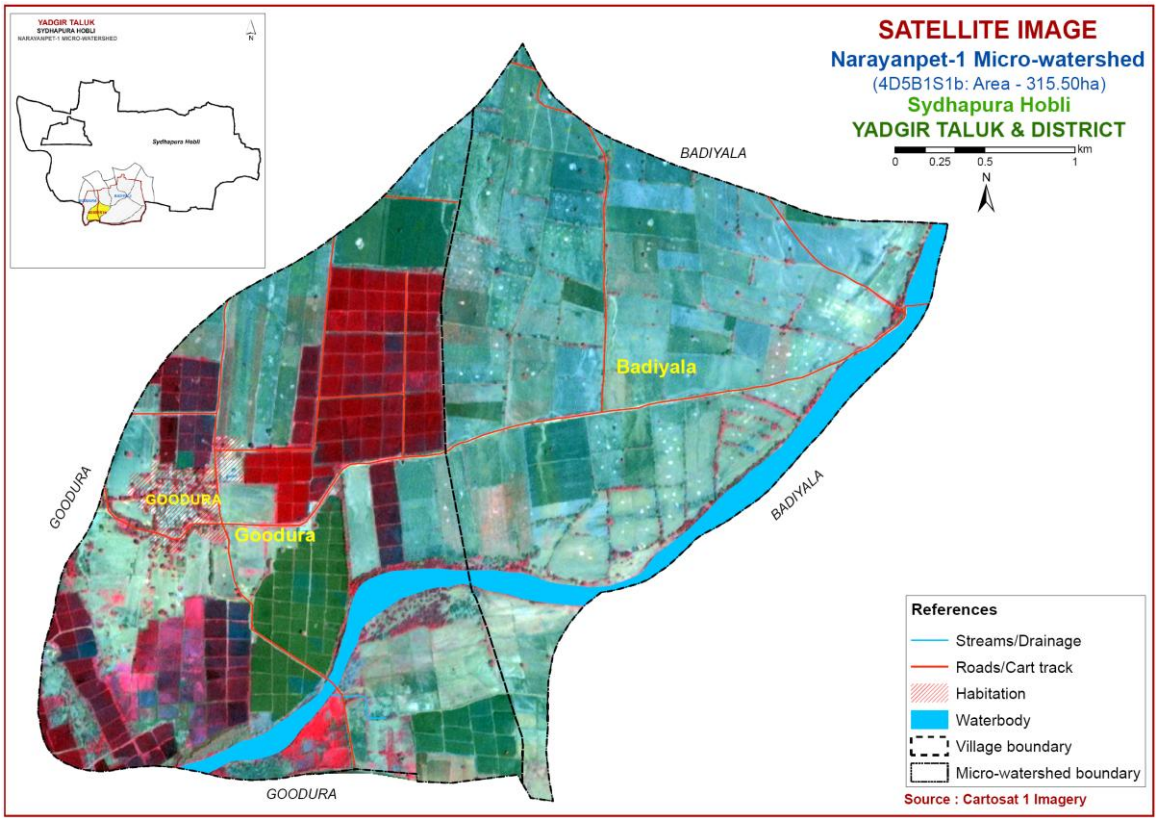


Fig.3.2 Satellite Image of Narayanpet-1 Microwatershed

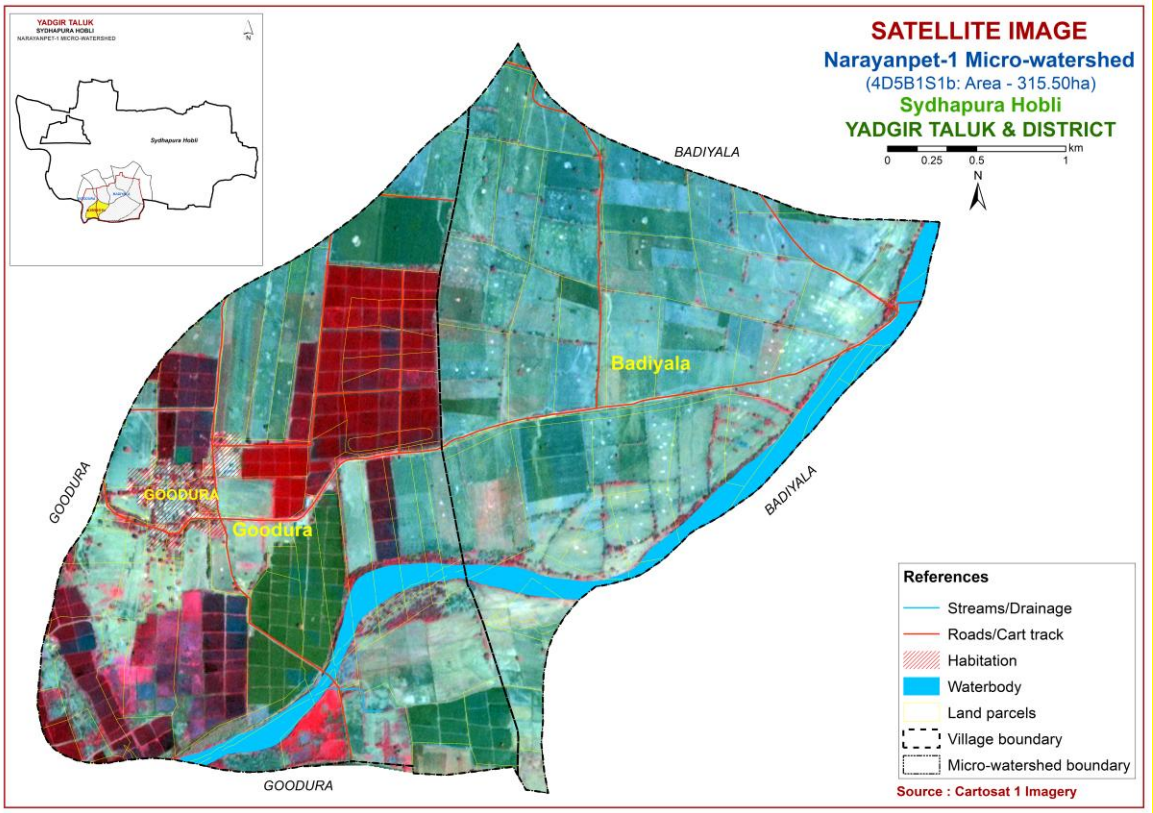


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Narayanpet-1 Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nalas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheets. While traversing, landforms and physiographic units identified were checked and preliminary soil legend was prepared by studying soils at few selected places. Then, intensive traversing of each physiographic unit like hills, ridges, uplands and valleys 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).

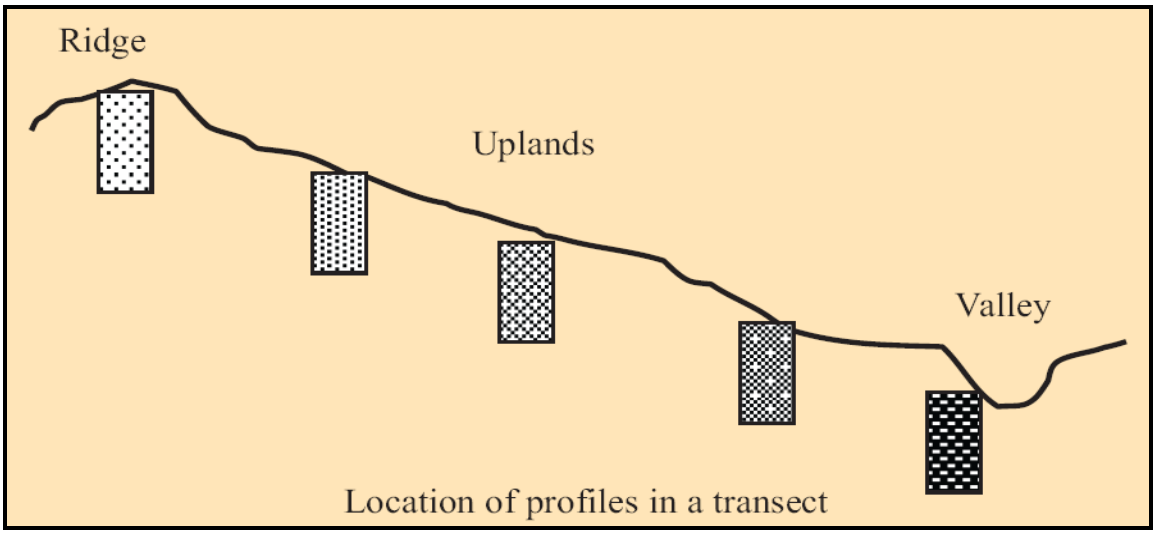


Fig: 3.4. Location of profiles in a transect

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

Based on the soil-site characteristics, the soils were grouped into different soil series (soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management). Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, nature of substratum etc, were used as the major differentiating characteristics for identifying soil

series occurring in the area. The differentiating characteristics used for identifying soil series are given in Table 3.1. Based on the above characteristics, 6 soil series were identified in the Narayanpet-1 microwatershed.

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

SOILS OF GRANITE GNEISS LANDSCAPE							
Sl. No.	**Soil Series**	**Depth (cm)**	**Colour (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcar-eousness**
1	BDP (Baddeppalli)	<25	7.5YR 3/2,3/4 5YR3/4	scl	-	Ap-AC	es
2	BDL (Badiyala)	25-50	7.5YR 2.5/3, 2.5/2.3/3 10YR 3/4,4/3	sl	-	Ap-Bw-BC	e
3	HLG (Halagera)	50-75	10YR 3/2,4/4 7.5YR 4/3,4/2	scl	-	Ap-Bw	es
4	GWD (Gowdagera)	75-100	10YR 3/1,3/2,4/2	scl	-	Ap-Bw	es
5	NGP (Naglapur)	100-150	10 YR 3/2,3/1,2/1	c	-	Ap-Bss	es
6	TMK (Thumakur)	>150	10YR 3/1,3/2,3/3,4/3	c	-	Ap-Bw	e

3.4 Soil Mapping

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

The soil map shows the geographic distribution of 7 mapping units representing 6 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 7 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Land Management Units (LMU's)

The 7 soil phases identified and mapped in the microwatershed were grouped into 6 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan

for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Narayanpet-1 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.

3.6 Laboratory Characterization

Soil samples for each soil series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from farmer's fields (32 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 using Kriging method, soil fertility maps for the 11 elements including pH and EC were generated for the microwatershed.

Table 3.2 Soil Map Unit description of Narayanpet-1 microwatershed

Soil Map unit No.	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape				
	BDP	Baddeppalli soils are very shallow (<25 cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam red soils occurring on very gently sloping uplands under cultivation		**21 (6.7)**
1		BDPiB2	Sandy clay surface, slope 1-3%, moderate erosion	21 (6.7)
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, slightly calcareous sandy loam soils occurring on very gently to gently sloping uplands under cultivation		**38 (11.96)**
6		BDLiB3	Sandy clay surface, slope 1-3%, severe erosion	38 (11.96)
	HLG	Halagera soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to dark yellowish brown and dark grayish brown, calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**13 (4.27)**
17		HLGiB2	Sandy clay surface, slope 1-3%, moderate erosion	13 (4.27)
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**17 (5.54)**
35		GWDiB2	Sandy clay surface, slope 1-3%, moderate erosion	17 (5.54)
	NGP	Nagalapur soils are deep (100-150 cm), moderately well drained, have very dark gray to very dark grayish brown, calcareous black cracking clay soils occurring on very gently sloping uplands under cultivation		**128 (40.65**)
48		NGPiB2	Sandy clay surface, slope 1-3%, moderate erosion	128 (40.65)
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have brown to very dark grayish brown, slightly calcareous clay black soils occurring on nearly level to very gently sloping lowlands under cultivation		**75 (23.67)**
103		TMKhA1	Sandy clay loam surface, slope 0-1%, slight erosion	13 (4.16)
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	62 (19.51)
1000	Others	Habitation and Water body		23 (7.2)

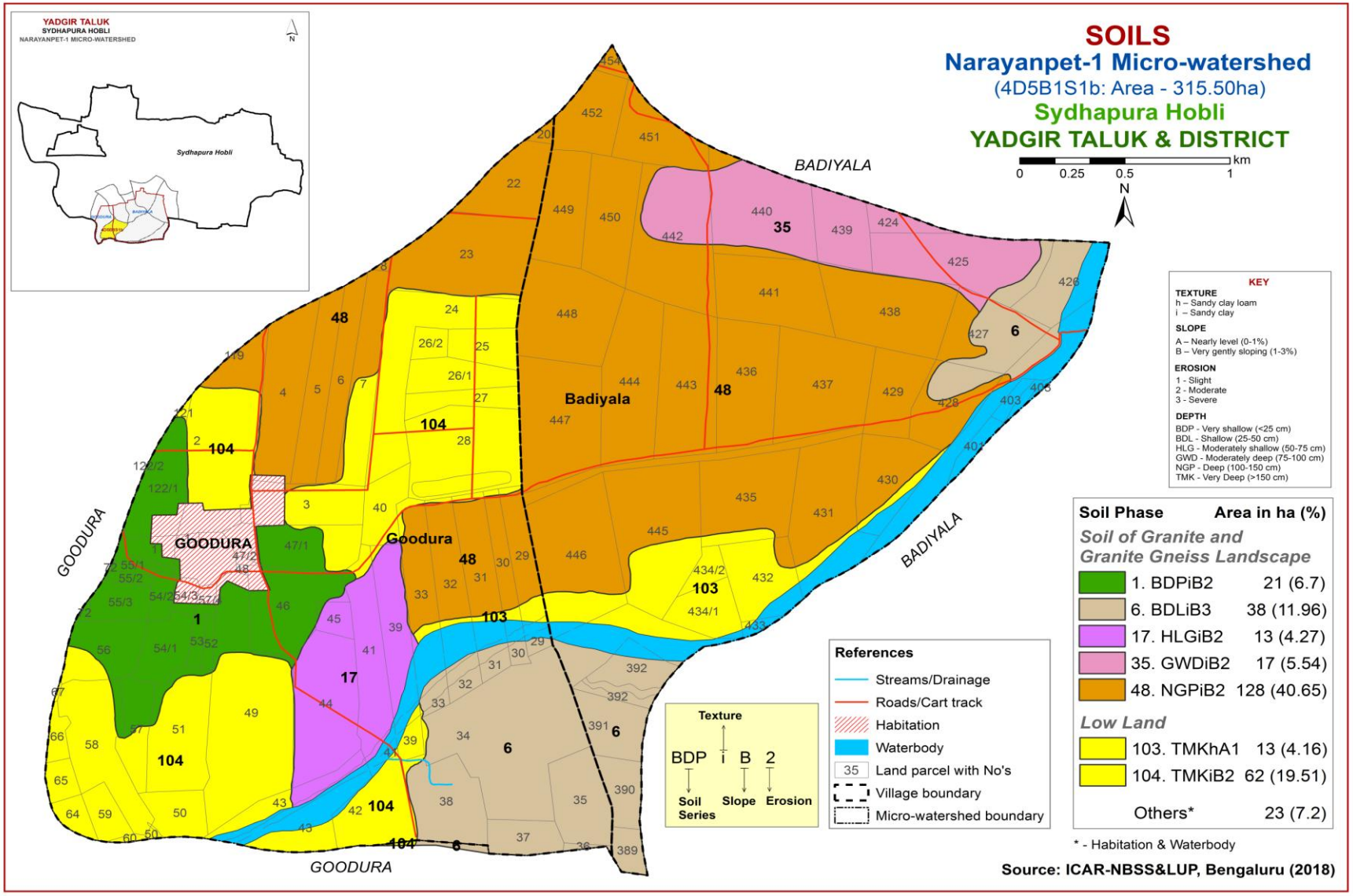


Fig 3.5 Soil phase or management units map of Narayanpet-1 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Narayanpet-1 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss landscapes based on geology. In all, 6 soil series were identified in these landscapes. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. In the granite gneiss landscape, it is by parent material, relief, time and climate.

A brief description of each of the 6 soil series identified followed by 7 soil phases (management units) mapped under each series are furnished below. The physical and chemical characteristics of soil series identified in Narayanpet-1 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 characteristics that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite Gneiss Landscape

In this landscape, 6 soil series have been identified and mapped. The Naglapur (NGP) series occupy a maximum area of 128 ha (41%) in the microwatershed followed by Thumakur (TMK) 75 ha (24%), Badiyala (BDL) 38 ha (12%), Baddeppalli (BDP) 21 ha (7%), Gowdagera (GWD) 17 ha (6%) and Halagera (HLG) 13 ha (4%). The brief description of the series along with the number of soil phases identified and mapped is given below.

4.1.1 Baddeppalli (BDP) Series: Baddeppalli soils are very shallow (<25cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Baddepalli series has been classified as a member of the loamy, mixed (calcareous), isohyperthermic family of Lithic Ustorthents.

The thickness of the soil is less than 25 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 and chroma 2 to 4. The texture varies from sandy clay loam and is calcareous. The available water capacity is very low (<50 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Baddeppalli (BDP) Series

4.1.2 Badiyala (BDL) Series: Badiyala soils are shallow (25-50 cm), well drained, have very dark brown, dark yellow brown and dark brown, slightly calcareous sandy loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Badiyala series has been classified as a member of the coarse-loamy, mixed, isohyperthermic family of Fluventic Haplustepts.

The thickness of the solum ranges from 28 to 50 cm. The thickness of A horizon ranges from 4 to 12 cm. Its colour is in 10YR hue with value 3 to 4 and chroma 3 to 4. The texture is loamy sand, sandy clay loam and sandy clay. The thickness of B horizon ranges from 27 to 45 cm. Its colour is in 10 YR and 7.5 YR hue with value 2 to 4 and chroma 3 to 4. Its texture is sandy loam and is slightly calcareous. The available water capacity is very low (<50mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

4.1.3 Halagera (HLG) Series: Halagera soils are moderately shallow (50-75 cm), well drained, have very dark grayish brown to dark yellowish brown, calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Halagera series has been classified as a member of the fine-loamy, mixed (calcareous), isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 51 to 75 cm. The thickness of A horizon ranges from 9 to 15 cm. Its colour is in 7.5 YR and 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture is loamy sand to sandy clay loam. The thickness of B horizon ranges from 44 to 66 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 4 and chroma 2 to 3. Its texture varies from sandy clay loam and is calcareous. The available water capacity is low (51-100 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Halagera (HLG) Series

4.1.4 Gowdagera (GWD) Series: Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have very dark gray to dark grayish brown, sodic, calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Gowdagera series has been classified as a member of the fine-loamy, mixed (calcareous), isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 8 to 16 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2 to 4. Its texture varies from sandy loam to sandy clay loam. The thickness of B horizon ranges from 61 to 91 cm. Its colour is in hue 10 YR with value 2 to 4 and chroma 1 to 4. Its texture is sandy clay loam and is calcareous, sodic soils. The available water capacity is medium (101-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Gowdagera (GWD) Series

4.1.5 Naglapur (NGP) Series: Naglapur soils are deep (100-150 cm), moderately well drained, have black to very dark grayish brown, calcareous cracking clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Naglapur series has been classified as a member of the very fine, smectitic (calcareous), isohyperthermic family of Typic Haplusterts.

The thickness of the solum ranges from 110 to 150 cm. The thickness of A horizon ranges from 6 to 25 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. The texture varies from sandy loam to sandy clay and clay. The thickness of B horizon ranges from 110 to 141 cm. Its colour is in 10 YR hue with value 2 to 3 and chroma 1 to 2. Texture is clay and is calcareous. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Naglapur (NGP) Series

4.1.6 Thumakur (TMK) Series: Thumakur soils are very deep (>150 cm), moderately well drained, have very dark gray to dark brown, sodic, slightly calcareous clay soils. They are developed from weathered granite gneiss and occur on nearly level to very gently sloping low lands under cultivation. The Thumakur series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 150-200 cm. The thickness of A horizon ranges from 7 to 14 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy loam to sandy clay and clay. The thickness of B horizon is >150 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 3. Texture varies from sandy clay to clay and is slightly calcareous, sodic soils. The available water capacity is very high (>200 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Thumakur (TMK) Series

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

Soil Series: Baddeppalli **(**BDP) **Pedon:** R-11

Location: $16^0$43'84.4"N $77^0$14'06.4"E, Halagera village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Loamy, mixed (calcareous), 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
0-16	Ap	58.67	17.02	24.31	19.03	13.74	9.62	10.57	5.71	<15	scl	16.19	8.18

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}							%	%
0-16	8.58	-	-	0.262	1.60	7.67	-	-	0.24	0.06	-	18.10	0.74	100	0.35

Contd...

Soil Series: Badiyala **(**BDL) **Pedon:** R-5

Location: $16^0$37'10.0"N $77^0$20'21.5", Gudalagunta village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Coarse-loamy, mixed, isohyperthermic Fluventic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	87.13	7.04	5.83	10.03	24.32	23.61	23.51	5.67	<15	ls	6.27	2.44
12-28	Bw1	64.63	13.30	22.07	6.74	13.07	22.30	17.01	5.50	<15	scl	16.34	7.83
28-52	BC	73.11	12.02	14.87	3.93	16.03	26.89	18.41	7.86	<15	sl	12.94	5.47

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	6.20	-	-	0.074	1.00	0.00	2.80	0.98	0.14	0.01	3.92	4.20	0.72	93	0.20
12-28	9.04	-	-	0.253	0.80	3.20	-	-	0.16	0.69	-	16.90	0.77	100	4.09
28-52	9.41	-	-	0.364	1.10	3.60	-	-	0.16	1.39	-	11.10	0.75	100	12.52

Contd...

Soil Series: Halagera **(**HLG) **Pedon:** R-4

Location: $16^0$44'29.3"N $77^0$13'56.3"E, Halagera village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine-loamy, mixed (calcareous), 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
0-8	Ap	81.02	8.42	10.56	10.41	24.08	18.98	19.08	8.47	<15	ls	9.10	4.79
8-22	Bw1	61.00	11.50	27.50	8.29	9.35	21.89	14.35	7.12	<15	scl	16.91	12.28
22-53	Bw2	61.41	13.80	24.79	15.98	15.67	12.62	11.78	5.36	15-35	scl	17.08	11.26

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}							%	%
0-8	8.49	-	-	0.185	0.30	2.99	-	-	0.24	0.06	-	8.80	0.83	100	0.69
8-22	8.57	-	-	0.116	0.45	4.03	-	-	0.11	0.02	-	19.50	0.71	100	0.12
22-53	8.70	-	-	0.113	0.27	7.67	-	-	0.11	0.05	-	15.50	0.63	100	0.33

Contd...

Soil Series: Gowdagera (GWD) **Pedon:** R-13

Location: $16^0$38'24.4"N $77^0$21'24.0"E, Madhawara village, Balichakara hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine-loamy, mixed (calcareous), 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
0-18	Ap	79.61	13.94	6.45	14.17	17.53	23.65	17.02	7.24	-	ls	11.36	3.86
18-42	BW1	69.09	10.58	21.06	10.54	16.58	22.01	14.43	5.53	-	scl	31.62	12.30
42-81	Bw2	51.37	13.51	35.60	7.59	10.55	16.24	11.60	5.38	-	sc	67.57	26.89

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	9.89	-	-	0.74	0.66	1.20	-	-	0.18	3.63	-	8.35	1.29	100	43.51
18-42	10.82	-	-	1.60	0.27	5.76	-	-	0.19	19.23	-	15.84	0.75	100	121.42
42-81	10.83	-	-	2.30	0.27	7.80	-	-	0.40	26.71	-	26.54	0.75	100	100.67

Contd...

Soil Series: Naglapur (NGP) **Pedon:** R-8

Location: $16^0$52'84.1"N $77^0$22'99.4"E, Gurumitkal village, Gurumitkal hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Very fine, smectitic (calcareous), 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
0-10	Ap	7.53	19.88	72.59	1.00	0.78	0.89	2.10	2.77	-	c	44.31	32.79
10-35	Bss1	6.55	18.76	74.68	0.80	0.92	0.80	1.72	2.30	-	c	43.09	31.62
35-60	Bss2	6.58	21.05	72.37	0.69	0.46	1.04	1.50	2.89	-	c	46.52	32.52
60-102	Bss3	7.48	19.74	72.78	1.61	1.38	0.69	1.61	2.19	-	c	51.12	35.62

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-10	7.42	-	-	0.24	0.84	1.30	-	-	0.84	0.15	-	67.10	0.92	100	0.22
10-35	8.52	-	-	0.291	0.64	2.86	-	-	0.17	0.29	-	65.20	0.87	100	0.45
35-60	7.89	-	-	0.134	0.62	4.55	-	-	0.15	0.20	-	65.00	0.90	100	0.30
60-102	8.68	-	-	0.213	0.54	8.32	-	-	0.17	0.15	-	64.10	0.88	100	0.24

Contd...

Soil Series: Thumakuru (TMK) **Pedon:** R-10

Location: $16^0$38'01.3"N $77^0$16'49.8"E, Kilankera village, Balichakra hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, mixed, isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-12	Ap	62.92	15.76	21.32	5.56	9.37	21.83	18.33	7.83	-	scl	17.98	6.60
12-29	Bw1	45.91	18.53	35.56	6.08	8.18	15.41	11.43	4.82	-	sc	33.40	11.79
29-74	Bw2	48.47	16.24	35.29	5.93	9.84	16.40	11.75	4.55	-	sc	28.66	11.19
74-132	Bw3	38.25	20.59	41.16	3.21	8.23	14.64	8.97	3.21	-	c	38.85	14.72
132-158	Bw4	36.87	19.99	43.14	3.54	7.61	13.08	8.57	4.07	-	c	44.36	15.75

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-12	9.60	-	-	0.35	0.48	1.44	-	-	0.23	3.62	-	21.83	1.02	100	16.57
12-29	9.72	-	-	1.27	0.50	1.44	-	-	0.59	20.88	-	30.50	0.86	100	68.48
29-74	9.16	-	-	3.44	0.31	3.72	-	-	0.38	25.84	-	28.68	0.81	100	90.10
74-132	9.33	-	-	2.52	0.23	4.92	-	-	0.82	20.25	-	34.99	0.85	100	57.87
132-158	9.23	-	-	2.07	0.31	3.48	-	-	0.70	21.03	-	34.24	0.79	100	61.41

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

Soil characteristics: Depth, texture, gravel content, calcareousness.

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

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

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

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

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

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

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

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

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

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

Class VIII: Soil and other miscellaneous areas (rock lands) that have very severe limitations that nearly preclude their use for any crop production, but suitable for wildlife, recreation and installation 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 used in grouping the soil map units. They are stony or rocky (0), erosion hazard (slope, erosion) (1), coarse texture (sand, loamy sand, sandy loam) (2), fine texture (cracking clay, silty clay) (3), slowly permeable subsoil (4), coarse underlying material (5), salinity/alkali (6), stagnation, overflow, high ground water table (7), soil depth (8) and fertility problems (9). The capability units thus identified have similar soil and land characteristics that respond similarly to a given level of management. The soils of the microwatershed have been classified upto land capability subclass level.

The 7 soil map units identified in the Narayanpet-1 microwatershed are grouped under two land capability classes and 4 land capability subclasses. About 293 ha (93%) in the microwatershed is suitable for agriculture (Fig. 5.1) and rest of the area of about 23 ha (7%) is under others (habitation and water body).

Good cultivable lands (Class II) cover maximum area of 234 ha (74%) of the microwatershed with minor problems of soil, drainage/ wetness and erosion and is distributed in the major part of the microwatershed. Fairly good cultivable lands occupy an area of 59 ha (19%) and are distributed in the northeastern, southern and western part of the microwatershed with very severe limitations of soil and erosion.

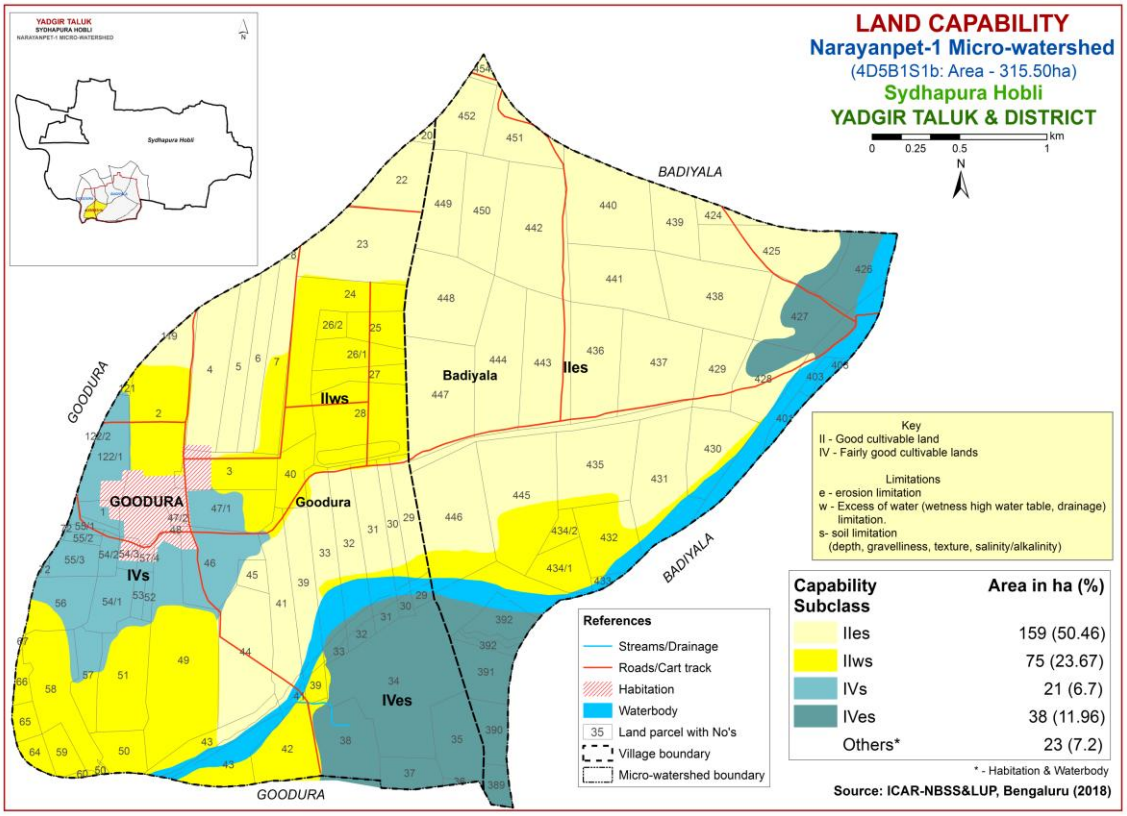


Fig. 5.1 Land Capability map of Narayanpet-1 Microwatershed

5.2 Soil Depth

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

Very deep soils (>150 cm) cover an area of 75 ha (24%) and are distributed in all parts of the microwatershed. Deep soils (100-150 cm) occur in 128 ha (41%) and are distributed in the major part of the microwatershed. Moderately deep soils (75-100 cm) occupy an area of about 17 ha (6%) and are distributed in the northern part of the microwatershed. Moderately shallow (50-75 cm) soils occur in 13 ha (4%) and are distributed in the southern part of the microwatershed. Shallow soils (50-75 cm) occur in an area of 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed. Very shallow soils (<25 cm) occur in an area of 21 ha (97%) and is distributed in the western part of the microwatershed.

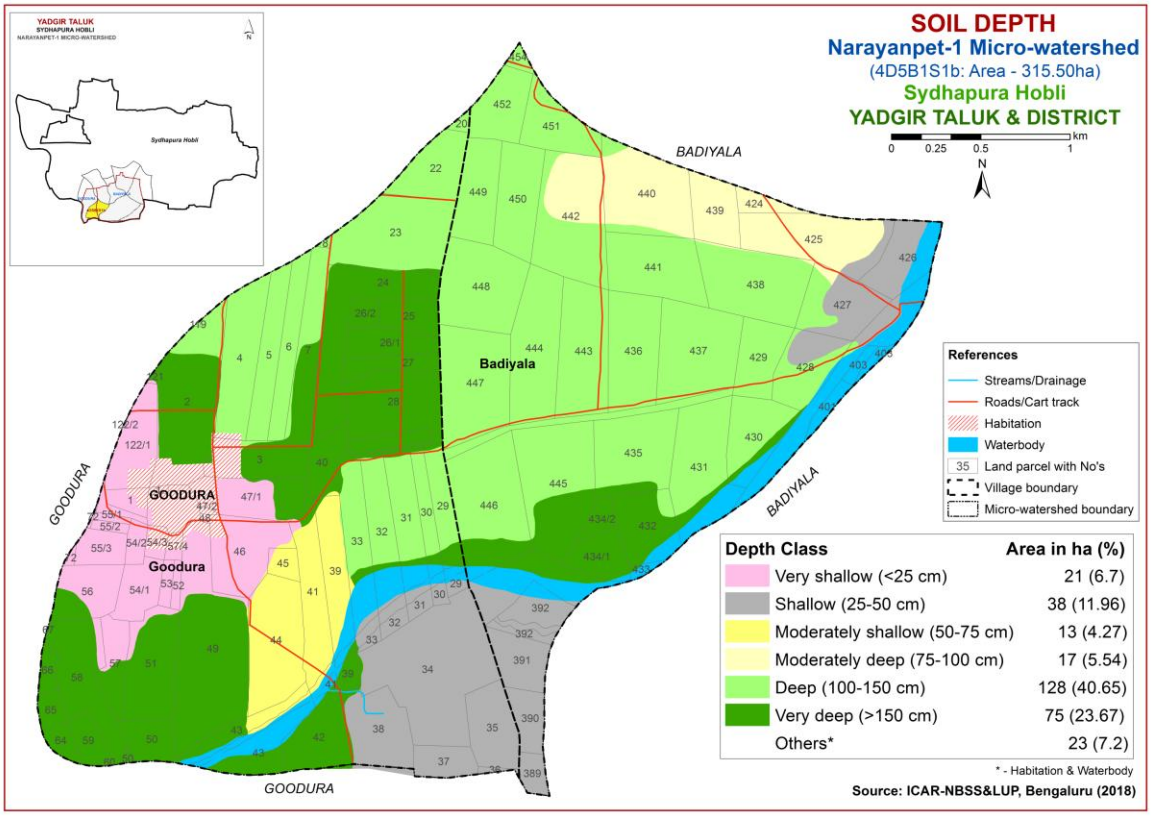


Fig. 5.2 Soil Depth map of Narayanpet-1 Microwatershed

The most productive lands covering about 203 ha (64%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep to very deep soils occurring in the major part of the microwatershed. Soil that are very shallow to shallow occur in 59 ha (19%). In these areas, only shallow rooted and short duration crops can be grown or these lands can be utilized for other than agricultural purpose.

5.3 Surface Soil Texture

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

An area of 13 ha (4%) in the microwatershed has loamy soils at the surface and is distributed in the eastern and central part of the microwatershed. Maximum area of 280 ha (89%) of the microwatershed has clayey soils at the surface. All these are the most productive lands with respect to surface soil texture that have high potential for soil-water

retention and availability, and nutrient retention and availability, but have problems of drainage, infiltration, workability and other physical problems in clayey soils.

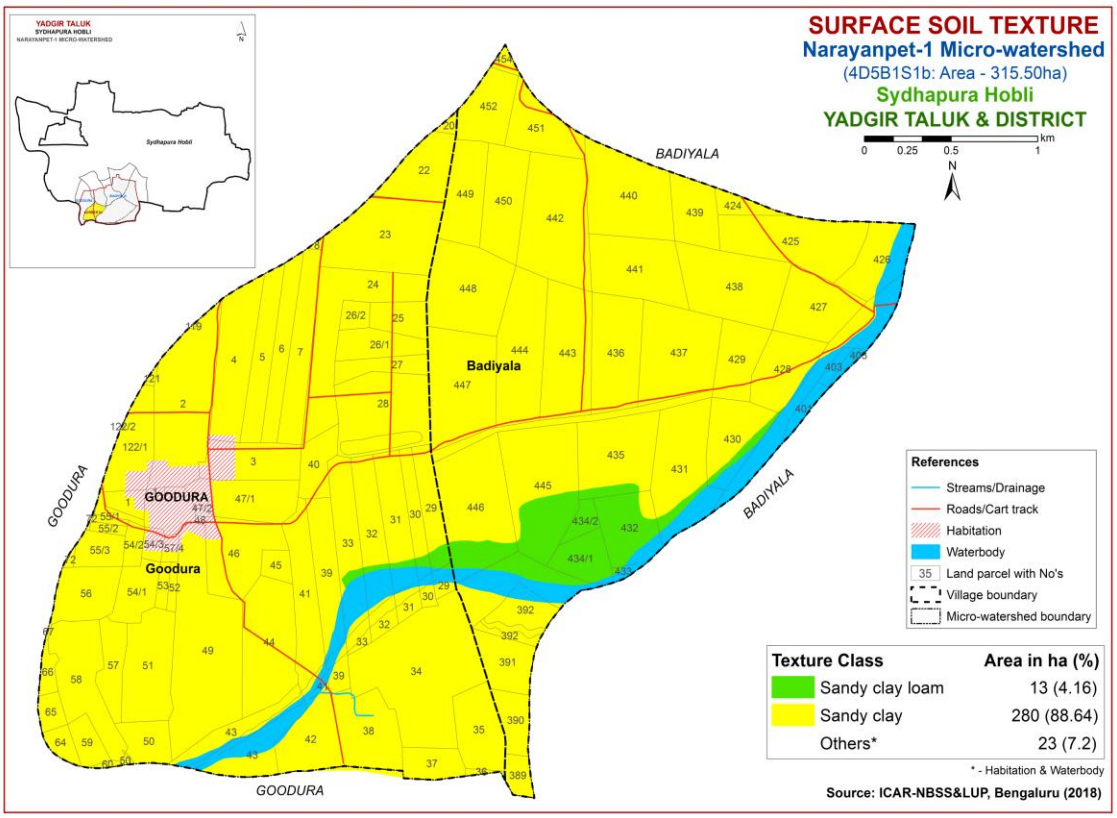


Fig. 5.3 Surface Soil Texture map of Narayanpet-1 Microwatershed

5.4 Soil Gravelliness

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

Entire cultivable area of 293ha (93%) has soils that are non gravelly (<15%). These soils are most productive with respect to gravelliness. They are non gravelly (<15%) and have potential for growing all annual and perennial crops.

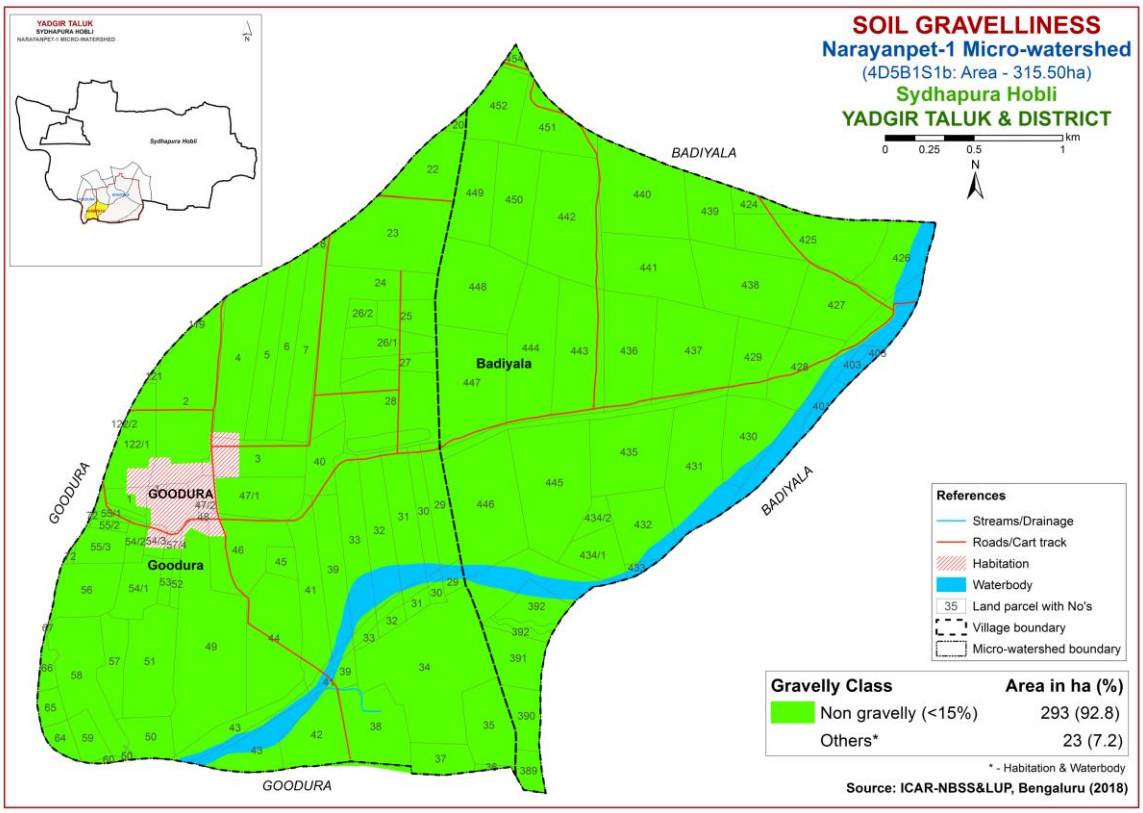


Fig. 5.4 Soil Gravelliness map of Narayanpet-1 Microwatershed

5.5 Available Water Capacity

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

An area of about 59 ha (19%) is very low (<50 mm/m) in available water capacity and is distributed in the northeastern, southeastern and western part of the microwatershed. About 13 ha (4%) is low (51-100 mm/m) and is distributed in the northeastern part of the microwatershed. 17 ha (6%) is medium (101-150 mm/m) and are distributed in the northern part of the microwatershed. Maximum area of 203 ha (64%) in the microwatershed has soils that are very high (>200 mm/m) in available water capacity and are distributed in the major part of the microwatershed.

Areas with very high in available water capacity cover about 203 ha (64%). If the rainfall is normal and well distributed, all climatically adapted long duration annual and perennial crops can be grown. Areas of 72 ha (23%) soils are very low to low in available water capacity where only short duration and drought resistance crops can be cultivated.

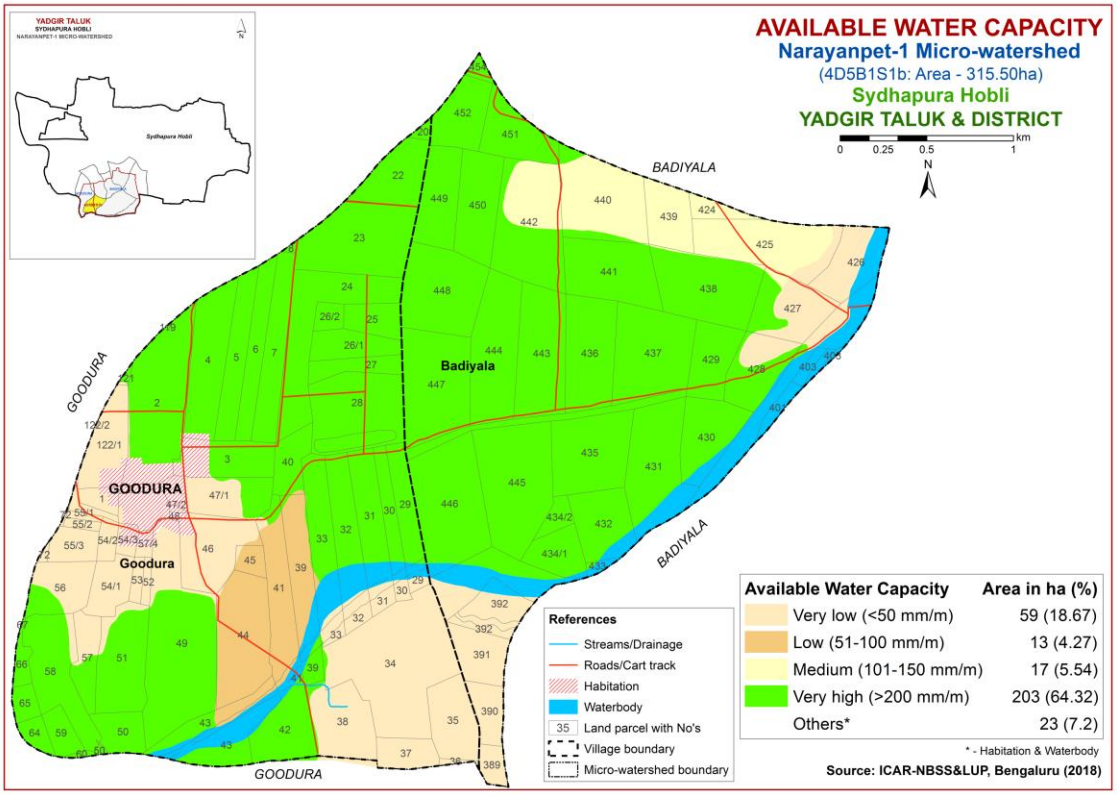


Fig. 5.5 Soil Available Water Capacity map of Narayanpet-1 Microwatershed

5.6 Soil Slope

Soil slope refers to the inclination of the surface of the land. It is defined by gradient, shape and length, and is an integral feature of any soil as a natural body. Slope is considered important in soil genesis, land use and land development. The length and gradient of slope influences the rate of runoff, infiltration, erosion and deposition. The soil map units were grouped into single slope class and a slope map was generated. The area extent and their geographical distribution in the microwatershed are shown in Figure 5.6.

An area of 13 ha (4%) in the microwatershed has nearly level (0-1% slope) lands and is distributed in the eastern and central part. Maximum area of 280 ha (89%) in the microwatershed has very gently sloping (1-3%) lands. Thus, entire area of the microwatershed suitable for all climatically adapted annual and perennial crops without much soil and water conservation and other land developmental measures.

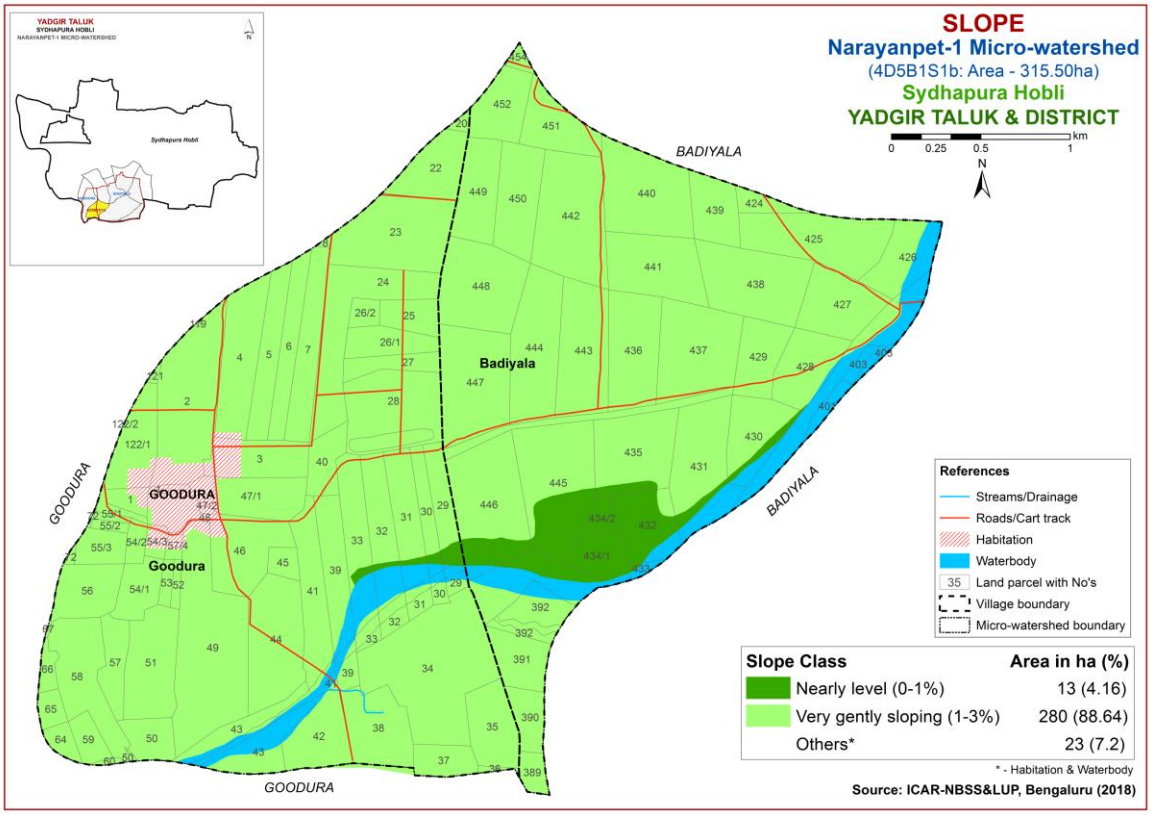


Fig. 5.6 Soil Slope map of Narayanpet-1 Microwatershed

5.7 Soil Erosion

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

Soils that are slightly eroded (e1 class) cover a small area of 13 ha (4%) and is distributed in the eastern and central part of the microwatershed. Moderately eroded (e2 class) soils cover maximum area of 242 ha (77%) of the microwatershed and is distributed in the major part of the microwatershed. About 38 ha (12%) area in the microwatershed is severely eroded (e3 class) and is distributed in the northeastern and southeastern part of the microwatershed. In areas of moderate and severe erosion, suitable agronomic practices along with soil and water conservation measures to be followed in order to control soil erosion.

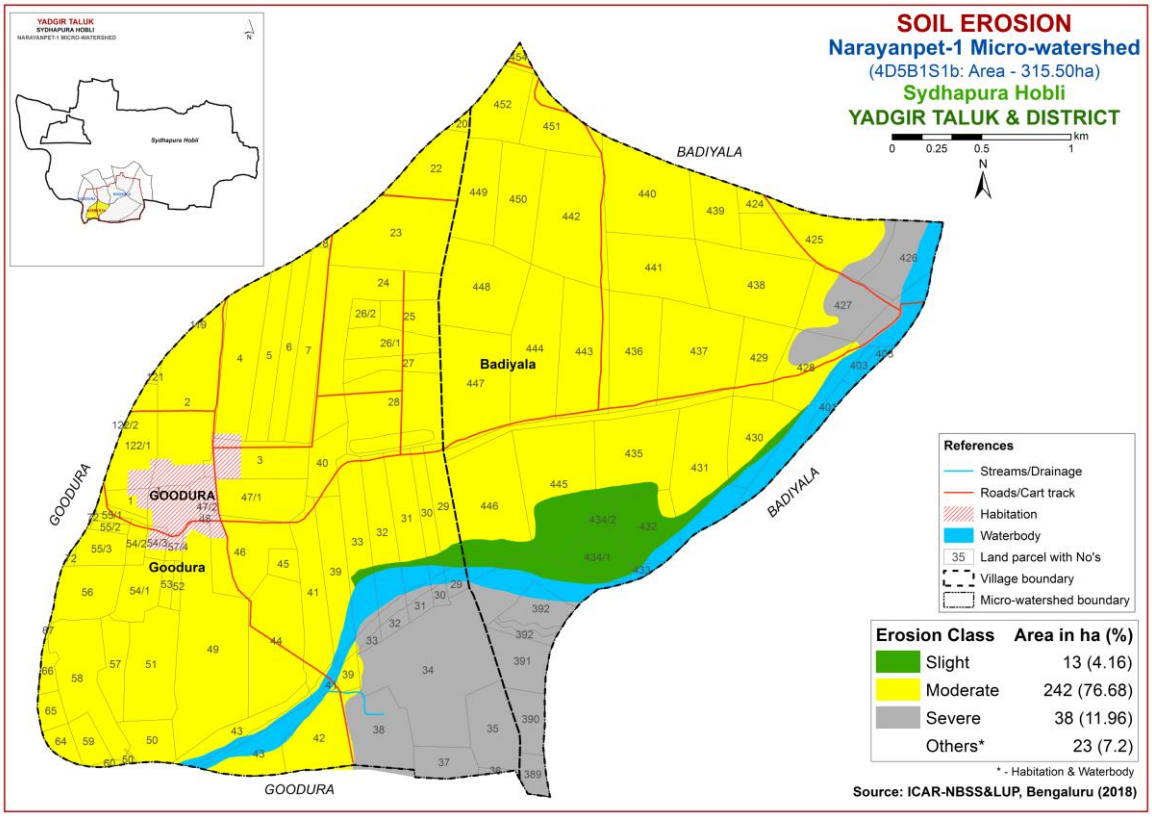


Fig. 5.7 Soil Erosion map of Narayanpet-1 Microwatershed

Chapter 6

FERTILITY STATUS

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

6.1 Soil Reaction (pH)

The soil fertility analysis of the Narayanpet-1 microwatershed for soil reaction (pH) showed that an area of 8 ha (2%) is neutral (pH6.5-7.3) and are distributed in the southwestern part of the microwatershed. Slightly alkaline (pH 7.3-7.8) soils occupy 18 ha (6%) and are distributed in the southwestern part of the microwatershed. About 71 ha (23%) is moderately alkaline (pH 7.8-8.4) and is distributed in the western, southern, central, southwestern and southeastern part of the microwatershed. Maximum area of 159 ha (50%) is strongly alkaline (pH 8.4-9.0) and is distributed in the major part of the microwatershed. Very strongly alkaline (pH >9.0) soils occupy 37 ha (12%) and is distributed in the northern and central part of the microwatershed.

6.2 Electrical Conductivity (EC)

The Electrical Conductivity in 237 ha (75%) area of the microwatershed is <2 dSm^{-1} (Fig 6.2) and as such these soils in the microwatershed are non-saline and is distributed in the major part of the microwatershed. About 38 ha (12%) is low (2-4 dSm^{-1}) and distributed in the central, western and southwestern part of the microwatershed. Small area of 18 ha (6%) is medium (4-8 dSm^{-1}) and is distributed in the western part of the microwatershed.

6.3 Organic Carbon

The soil organic carbon content (Fig.6.3) of the soils in the microwatershed is high (>0.75%) in a maximum area of about 126 ha (40%) and are distributed in the major part of the microwatershed. Medium (0.5-0.75%) in organic carbon content accounts for an area of about 107 ha (34%) and is distributed in the central, western, northern,

northeastern and eastern part of the microwatershed. Low (<0.5%) in an area of 59 ha (19%) and are distributed in the northern, northeastern and western part of the microwatershed.

6.4 Available Phosphorus

The soil fertility analysis revealed that available phosphorus (Fig.6.4) is low (<23 kg/ha) in an area of 95 ha (30%) and is distributed in the northern, central and eastern part of the microwatershed. An area of about 136 ha (43%) is medium (23-57 kg/ha) in available phosphorus and is distributed in all parts of the microwatershed. There is an urgent need to increase the dose of phosphorous in soils that are low and medium for all the crops by 25 per cent over the recommended dose to realize better crop performance. Available phosphorous is high (>57 kg/ha) in a maximum area of 61 ha (19%) and is distributed in the major part of the microwatershed.

6.5 Available Potassium

Available potassium content (Fig.6.5) is high (>337 kg/ha) in the entire area of the microwatershed.

6.6 Available Sulphur

Available sulphur content is high in a maximum area of 185 ha (59%) and are distributed in the major part of the microwatershed. Medium (10-20 ppm) in an area of about 80 ha (25%) and is distributed in the northern, northwestern, eastern and central part of the microwatershed. Available sulphur is low (<10 ppm) in an area of 28 ha (9%) and is distributed in the northern and central part of the microwatershed (Fig.6.6).

6.7 Available Boron

Available boron content (Fig.6.7) is low (<0.5ppm) in maximum area of 169 ha (54%) and is distributed in the major part of the microwatershed. An area of about 122 ha (39%) has available boron medium (0.5-1.0 ppm) and is distributed in all parts of microwatershed. Very small area of about 1 ha (<1%) is high (>1.0 ppm) in available boron and are distributed in the central and eastern part of microwatershed.

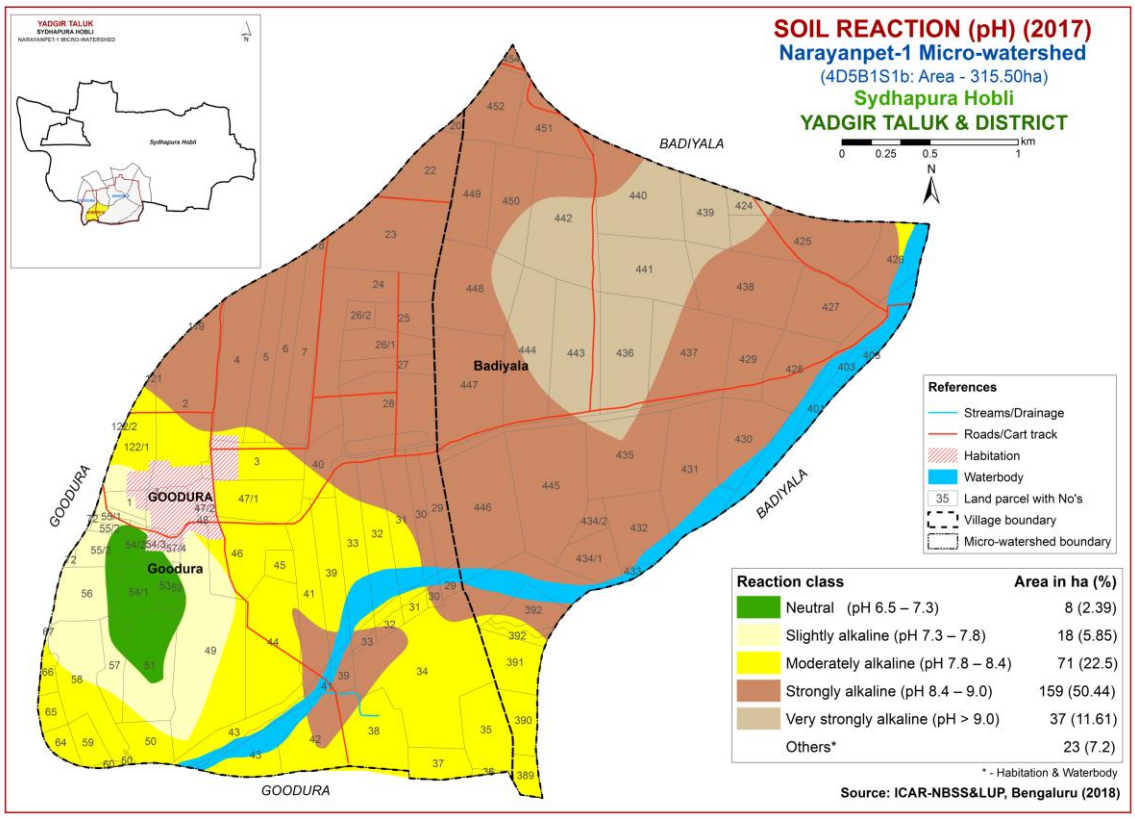


Fig.6.1 Soil Reaction (pH) map of Narayanpet-1 Microwatershed

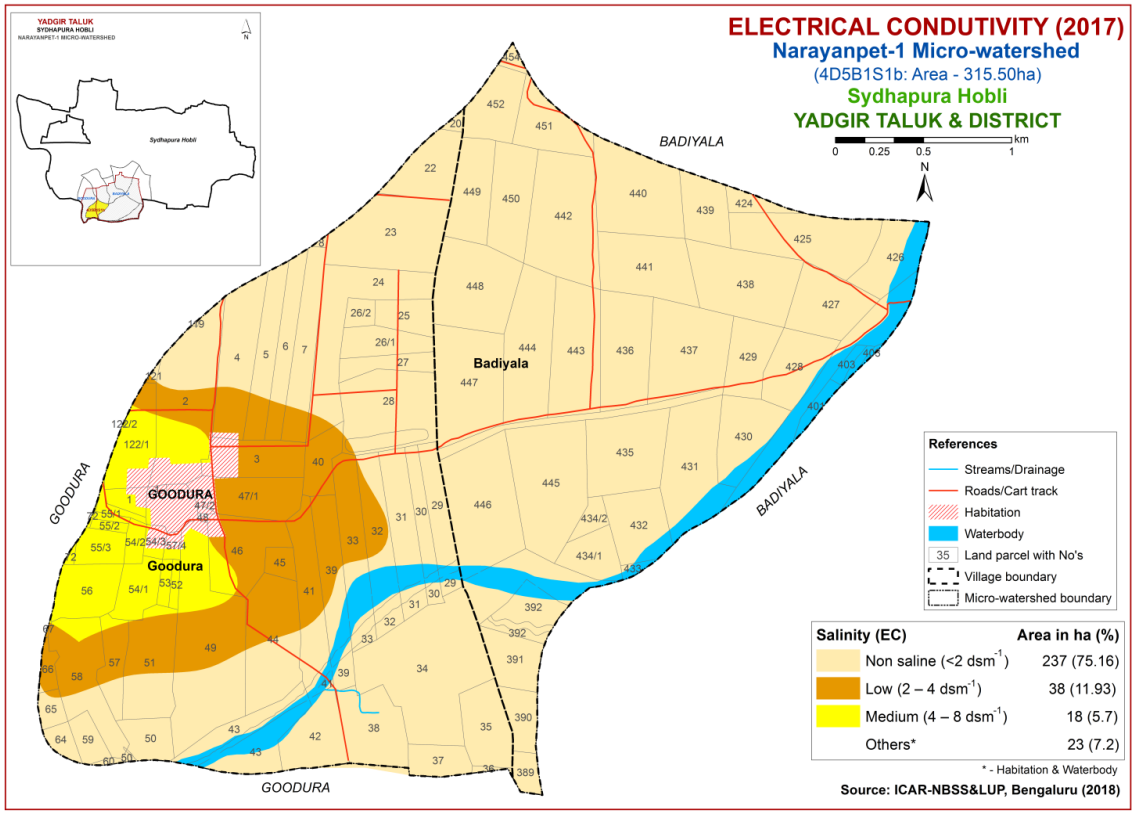


Fig.6.2 Electrical Conductivity (EC) map of Narayanpet-1 Microwatershed

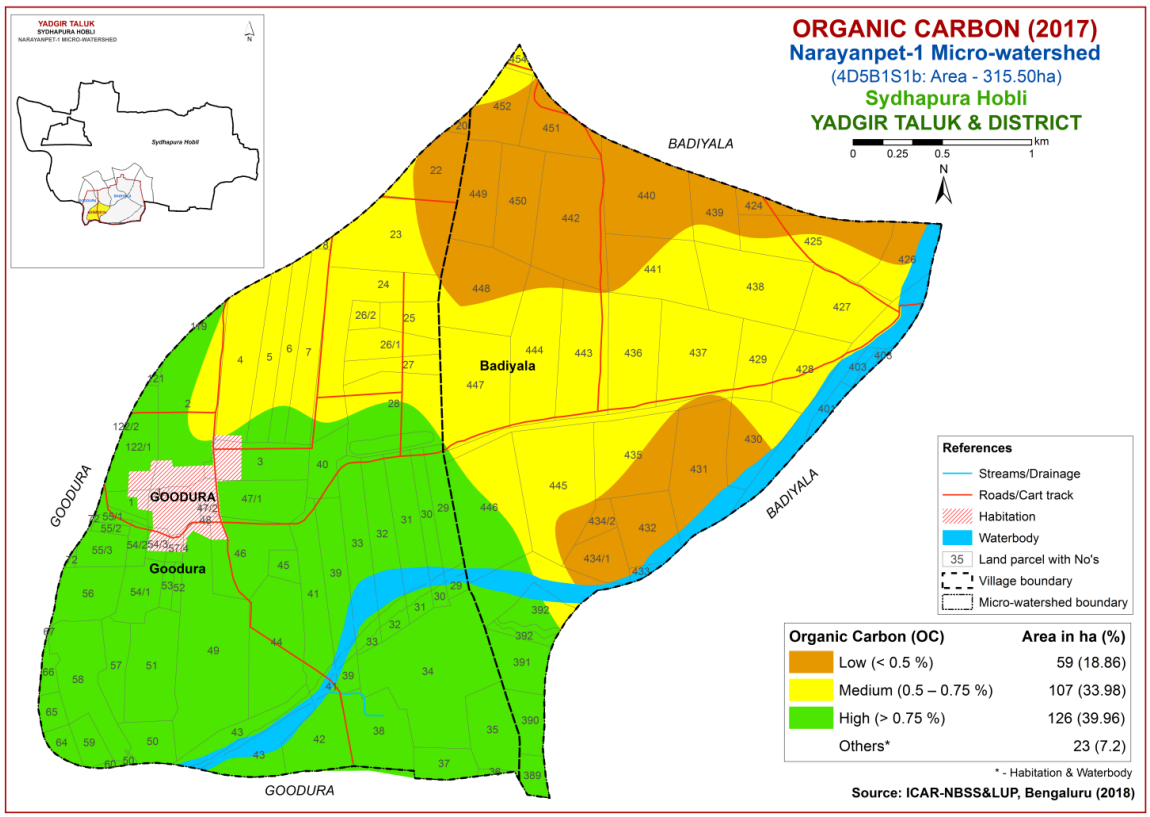


Fig.6.3 Soil Organic Carbon map of Narayanpet-1 Microwatershed

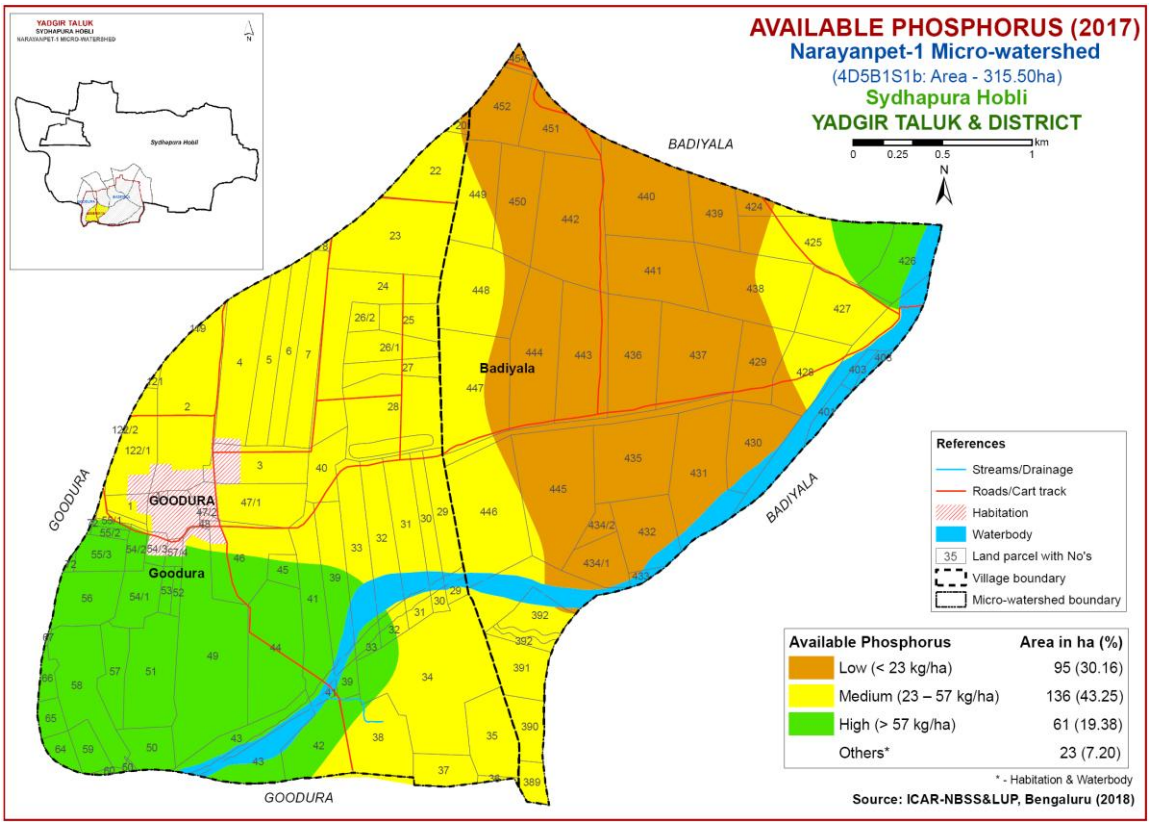


Fig.6.4 Soil available Phosphorus map of Narayanpet-1 Microwatershed

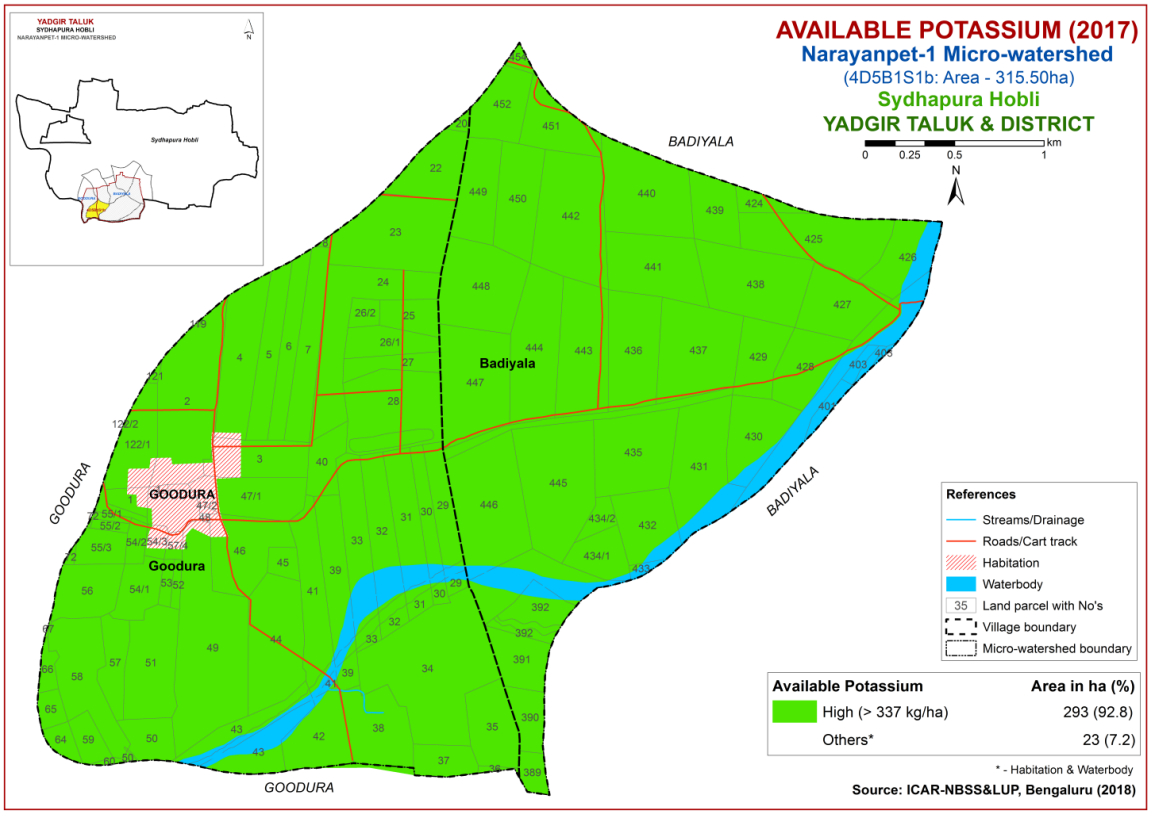


Fig.6.5 Soil available Potassium map of Narayanpet-1 Microwatershed

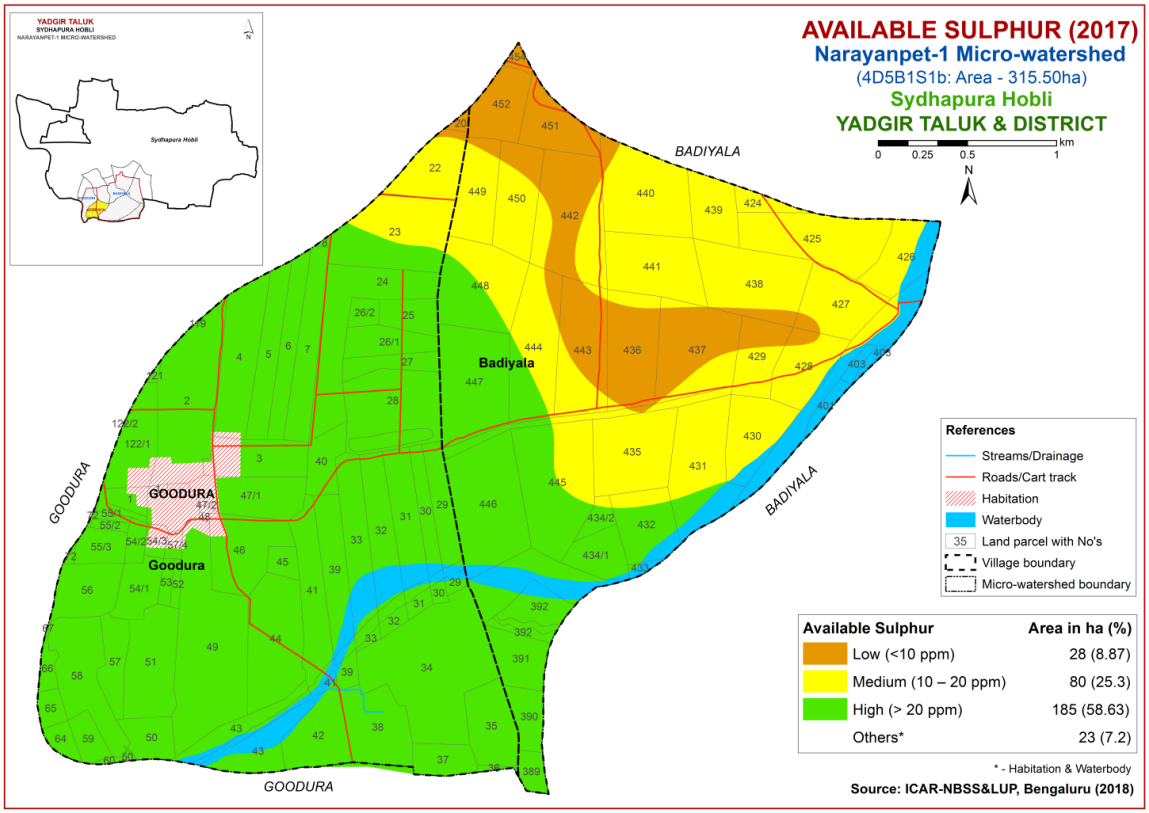


Fig.6.6 Soil available Sulphur map of Narayanpet-1 Microwatershed

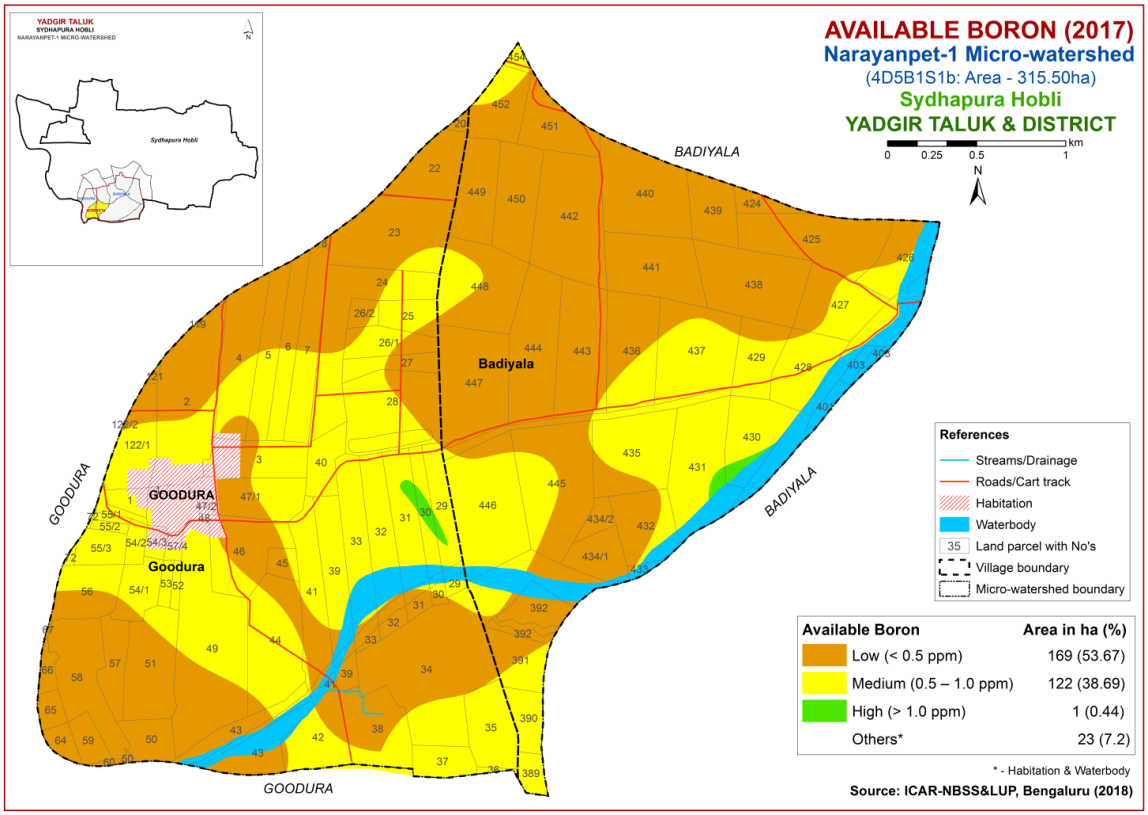


Fig.6.7 Soil available Boron map of Narayanpet-1 Microwatershed

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in a maximum area of about 162 ha (51%) and is distributed in the major part of the microwatershed. It is deficient (<4.5 ppm) in 131 ha (42%) and is distributed in all parts of the microwatershed (Fig 6.8).

6.9 Available Manganese

Available manganese content is sufficient (>1.0 ppm) in the entire 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).

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in maximum area of 187 ha (59%) and is distributed in the major part of the microwatershed. Sufficient (>0.6 ppm) in 106 ha (34%) area of the microwatershed and is distributed in all parts of the microwatershed (Fig 6.11).

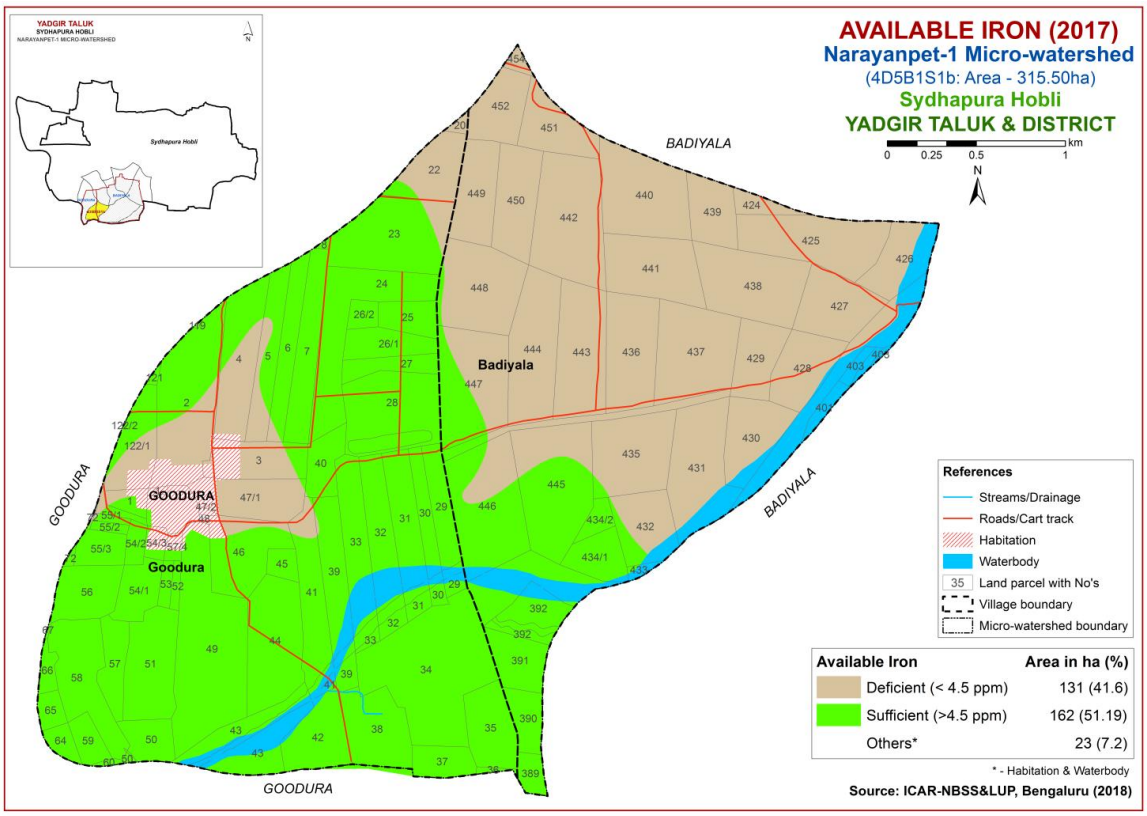


Fig.6.8 Soil available Iron map of Narayanpet-1 Microwatershed

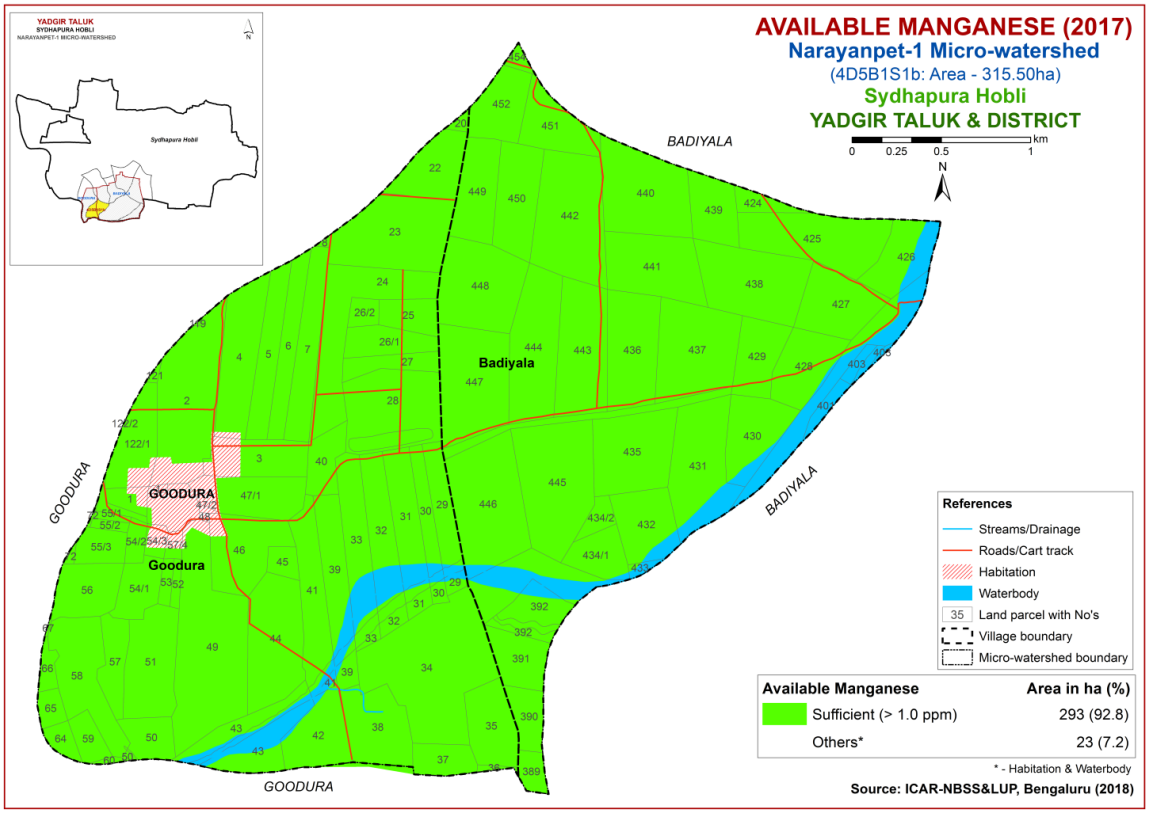


Fig.6.9 Soil available Manganese map of Narayanpet-1 Microwatershed

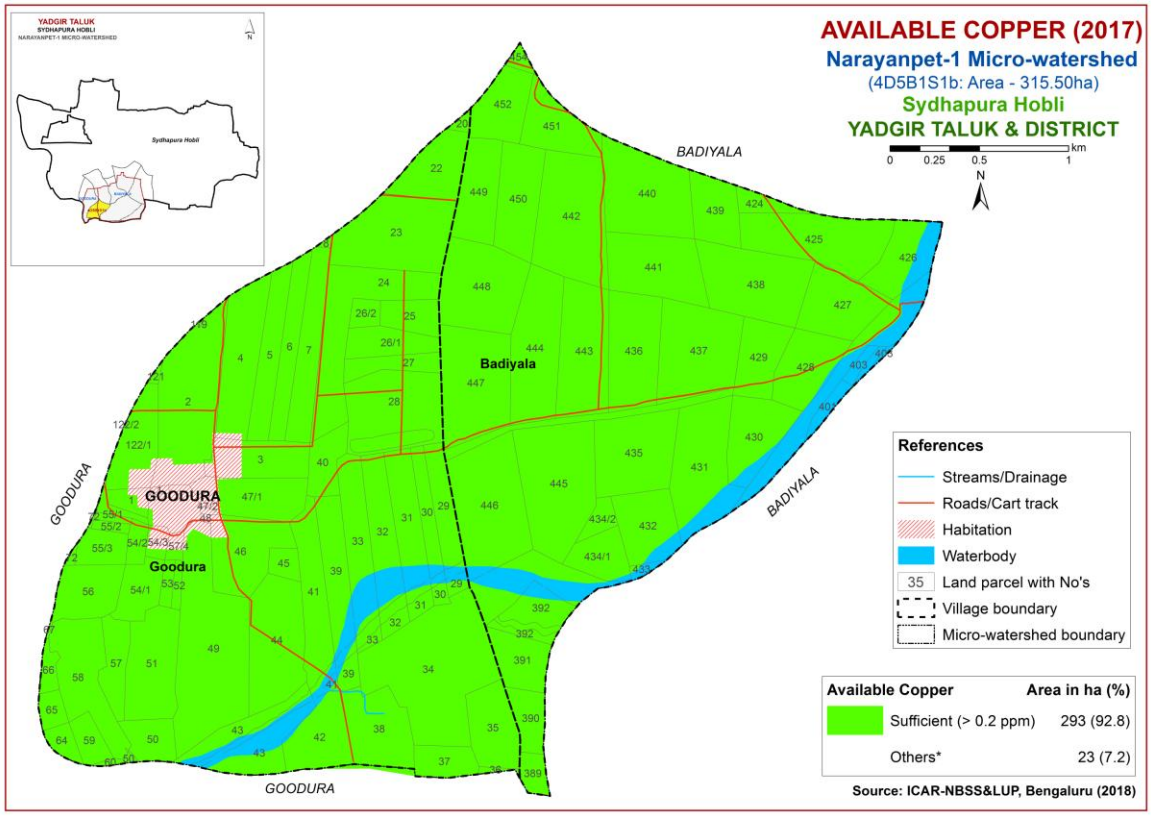


Fig.6.10 Soil available Copper map of Narayanpet-1 Microwatershed

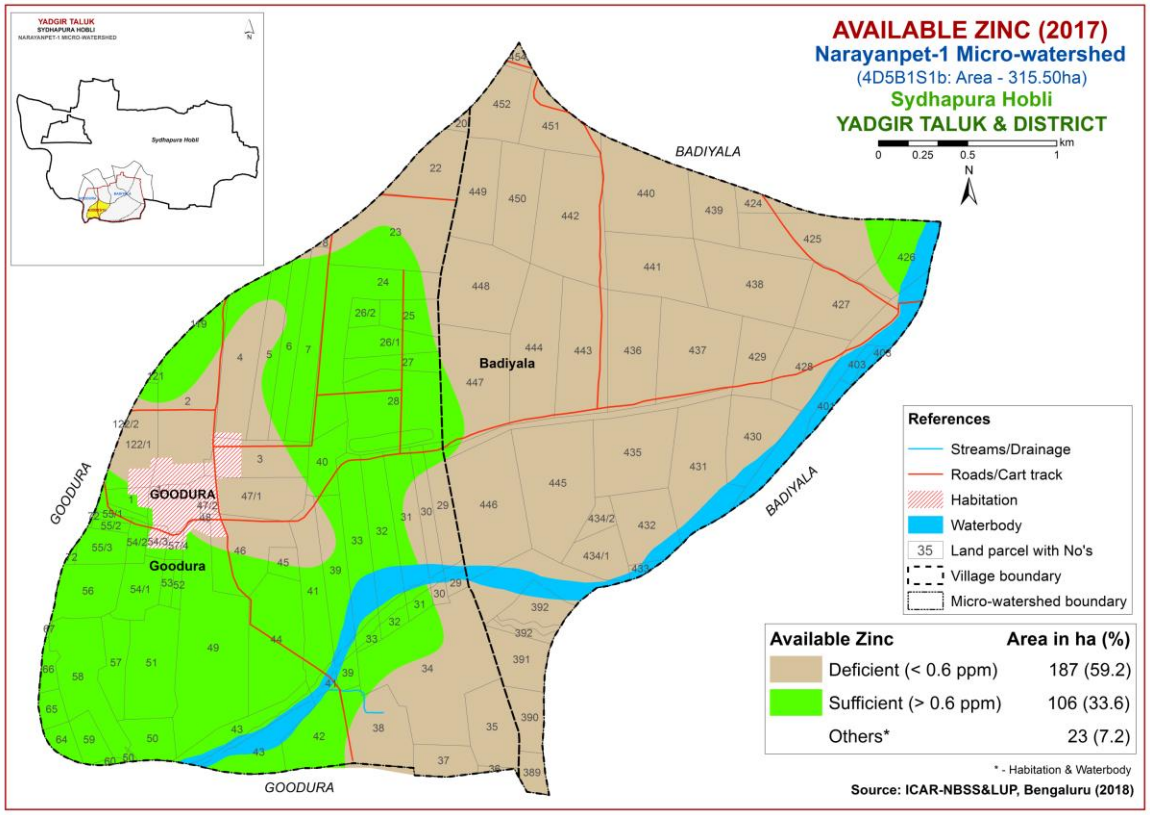


Fig.6.11 Soil available Zinc map of Narayanpet-1 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

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

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 26 major agricultural and horticultural crops grown in the state were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Table 7.1 Soil-Site Characteristics of Narayanpet-1 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p^+) kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face (%)	Sub-surface (%)								
BDPiB2	866	150	WD	<25	sc	scl	-	-	<50	1-3	moderate	8.58	0.26	00.35	18.10	100
BDLiB3	866	150	WD	25-50	sc	sl	-	-	<50	1-3	severe	6.20	0.07	00.20	4.20	93
HLGiB2	866	150	WD	50-75	sc	scl	-	-	51-100	1-3	moderate	8.49	0.19	00.69	8.80	100
GWDiB2	866	150	MWD	75-100	sc	scl	-	-	101-150	1-3	moderate	9.89	0.74	43.51	8.35	100
NGPiB2	866	150	MWD	100-150	sc	c	-	-	>200	1-3	moderate	7.42	0.24	00.22	67.10	100
TMKhA1	866	150	MWD	>150	scl	c	-	-	>200	0-1	slight	9.60	0.35	16.57	21.83	100
TMKiB2	866	150	MWD	>150	sc	c	-	-	>200	1-3	moderate	9.60	0.35	16.57	21.83	100

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

In Narayanpet-1 microwatershed, highly suitable (Class S1) lands for growing sorghum occupy an area of 75 ha (24%) and are distributed in all parts of the microwatershed. Maximum area of about 158 ha (50%) is moderately suitable (Class S2) for growing sorghum and are distributed in the major part of the microwatershed. They have minor limitations of drainage, rooting depth and calcareousness. 38 ha (12%) area is marginally suitable (Class S3) and is distributed in the northeastern and southeastern part of the microwatershed with moderate limitation of rooting depth. Currently Not suitable lands occur in 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.2 Crop suitability criteria for Sorghum

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	class	Well to mod. drained	imperfect	Poorly/ excessively	V. poorly
Soil reaction	pH	6.0-8.0	5.5-5.9;8.1-8.5	<5.5;8.6-9.0	>9.0
Surface soil texture	Class	c, cl, sicl, sc	l, sil, sic	sl, ls	s,fragmental skeletal
Soil depth	cm	100-75	50-75	30-50	<30
Gravel content	% vol.	5-15	15-30	30-60	>60
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

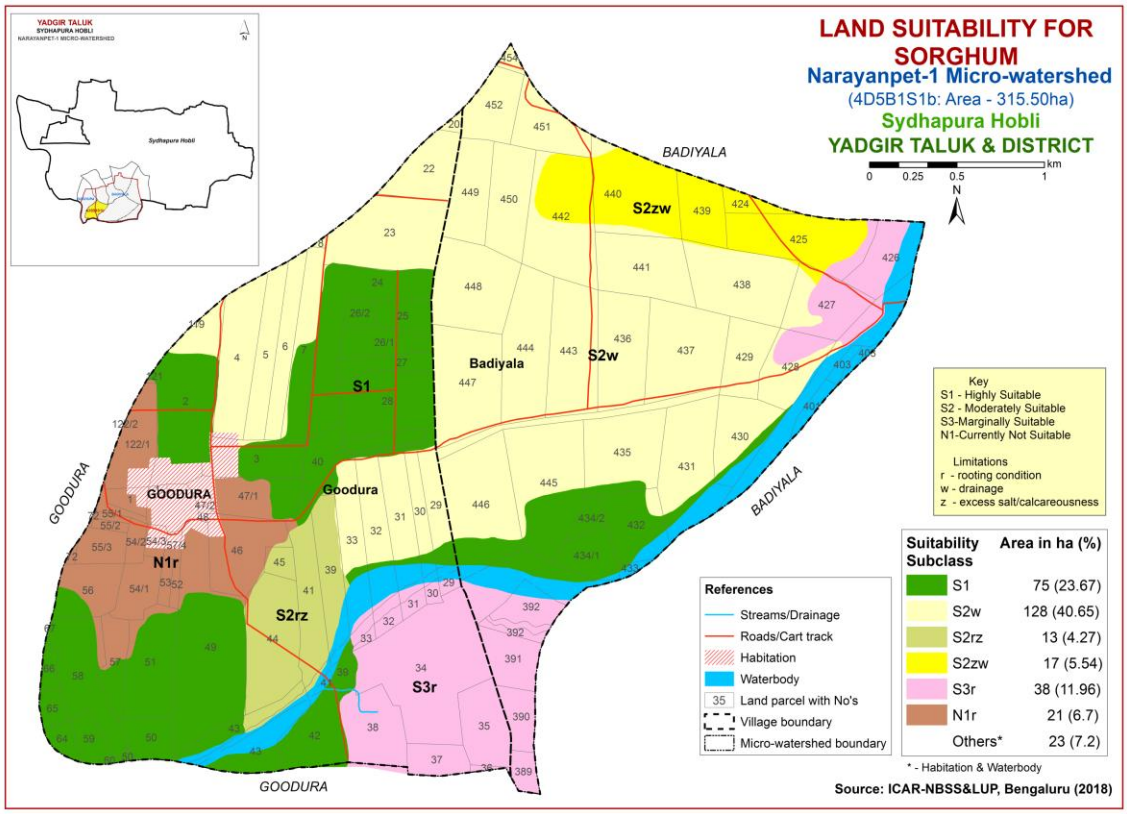


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Table 7.3 Crop suitability criteria for Maize

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

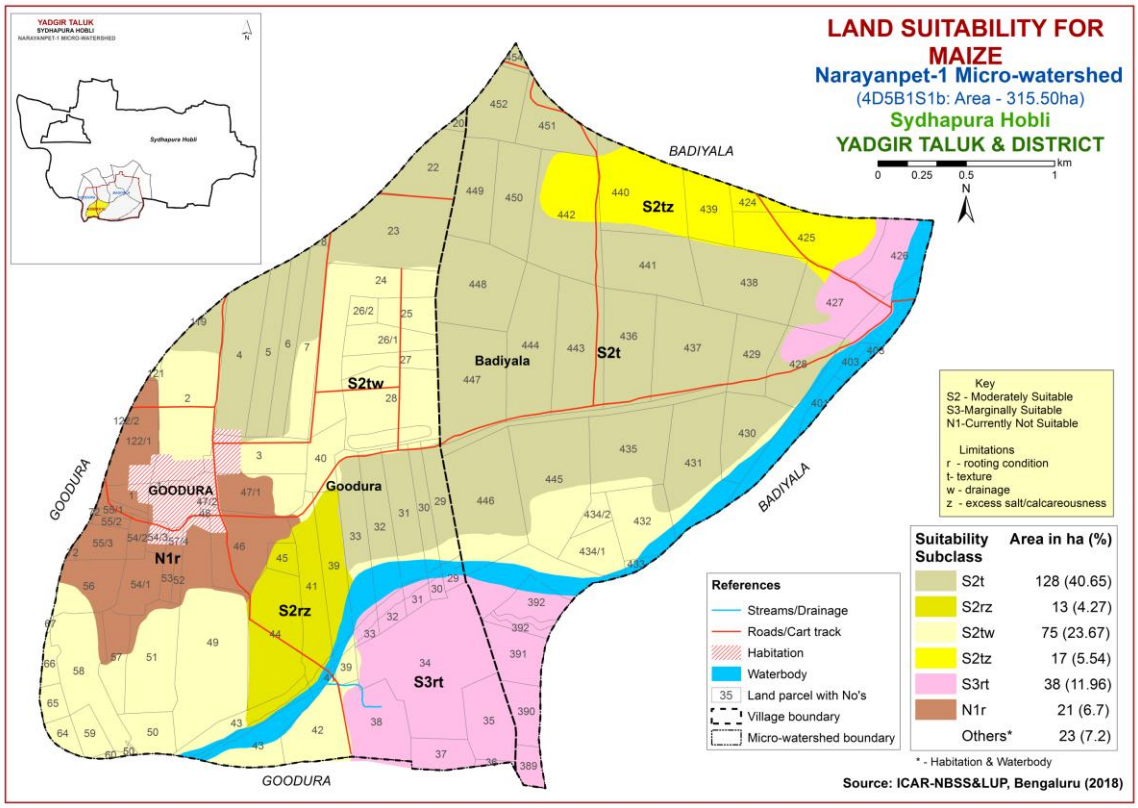


Fig. 7.2 Land Suitability map of Maize

In Narayanpet-1 microwatershed, no highly (Class S1) suitable lands available for growing maize. Moderately (Class S2) suitable lands occupy maximum area of 233 ha (74%). They have minor limitations of texture, rooting depth, calcareousness and

drainage. Marginally suitable (Class S3) lands occur in 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with moderate limitations of rooting depth and texture. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

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

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburgi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red gram (Table 7.4) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and 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 7.3.

In Narayanpet-1 microwatershed, there are no lands that are highly (Class S1) suitable for growing redgram. Maximum area of 219 ha (70%) is moderately suitable (Class S2) for red gram cultivation and is distributed in the major part of the microwatershed. They have minor limitations of texture, rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands occur in an area of 51 ha (16%) and are distributed in the central, northeastern and southeastern part of the microwatershed with moderate limitations of rooting depth, texture and calcareousness. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.4 Crop suitability criteria for Red gram

Crop requirement		Rating			
Soil–site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>210	180-210	150-180	<150
Soil drainage	class	Well drained	Mod. to well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-7.5	5.0-6.5;7.6-8.0	8.0-9.0	>9.0
Surface soil texture	Class	l, scl, sil, cl, sl	sicl, sic, c(m)	ls	s, fragmental
Soil depth	cm	>100	85-100	40-85	<40
Gravel content	% vol.	<20	20-35	35-60	>60
Salinity (EC)	dSm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

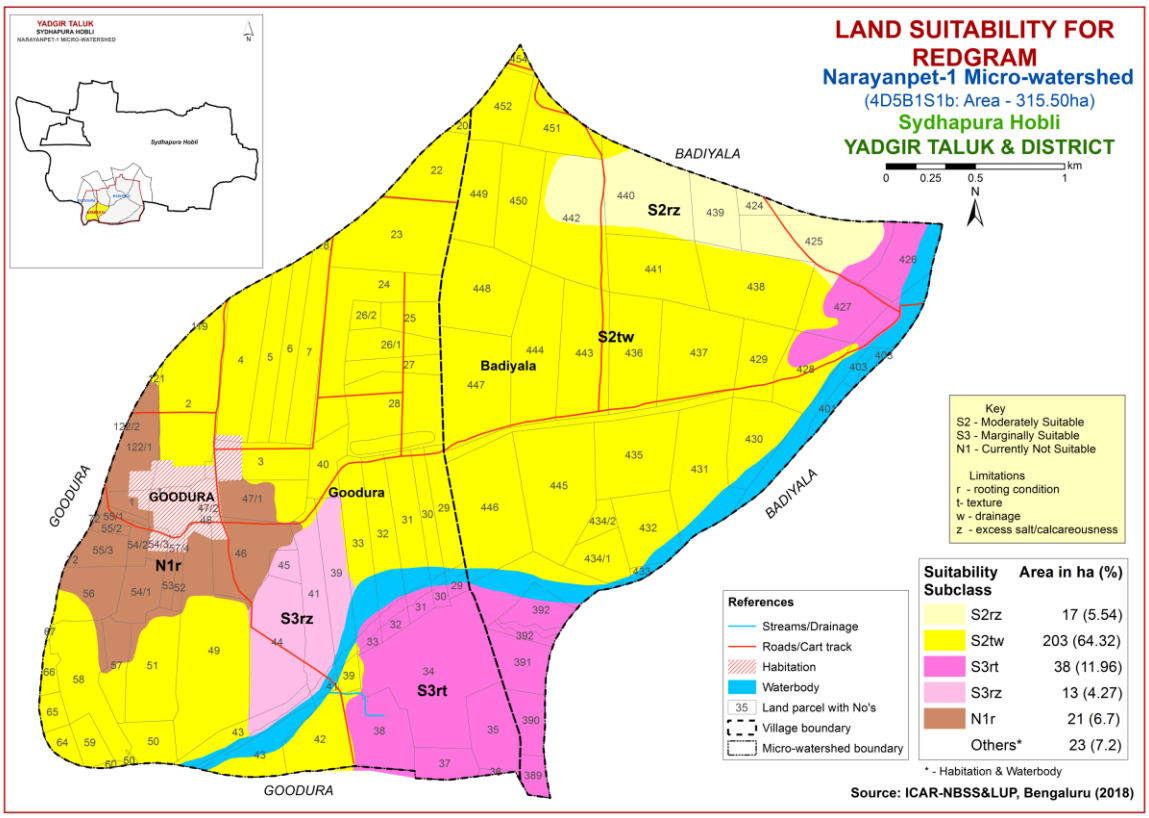


Fig. 7.3 Land Suitability map of Red gram

7.4 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the most important millet crop grown in an area of 2.34 lakh ha in the northern districts of Karnataka State. The crop requirements for growing bajra were matched with the soil-site characteristics and a land suitability map for growing bajra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.4.

Table 7.5 Crop suitability criteria for Bajra

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	class	Well to mod. drained	imperfect	Poorly/ excessively	V. poorly
Soil reaction	pH	6.0-8.0	5.5-5.9 8.1-8.5	<5.5 8.6-9.0	>9.0
Surface soil texture	Class	c, cl, sicl, sc	l, sil, sic	sl, ls	s,fragmental skeletal
Soil depth	cm	100-75	50-75	30-50	<30
Gravel content	% vol.	5-15	15-30	30-60	>60
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

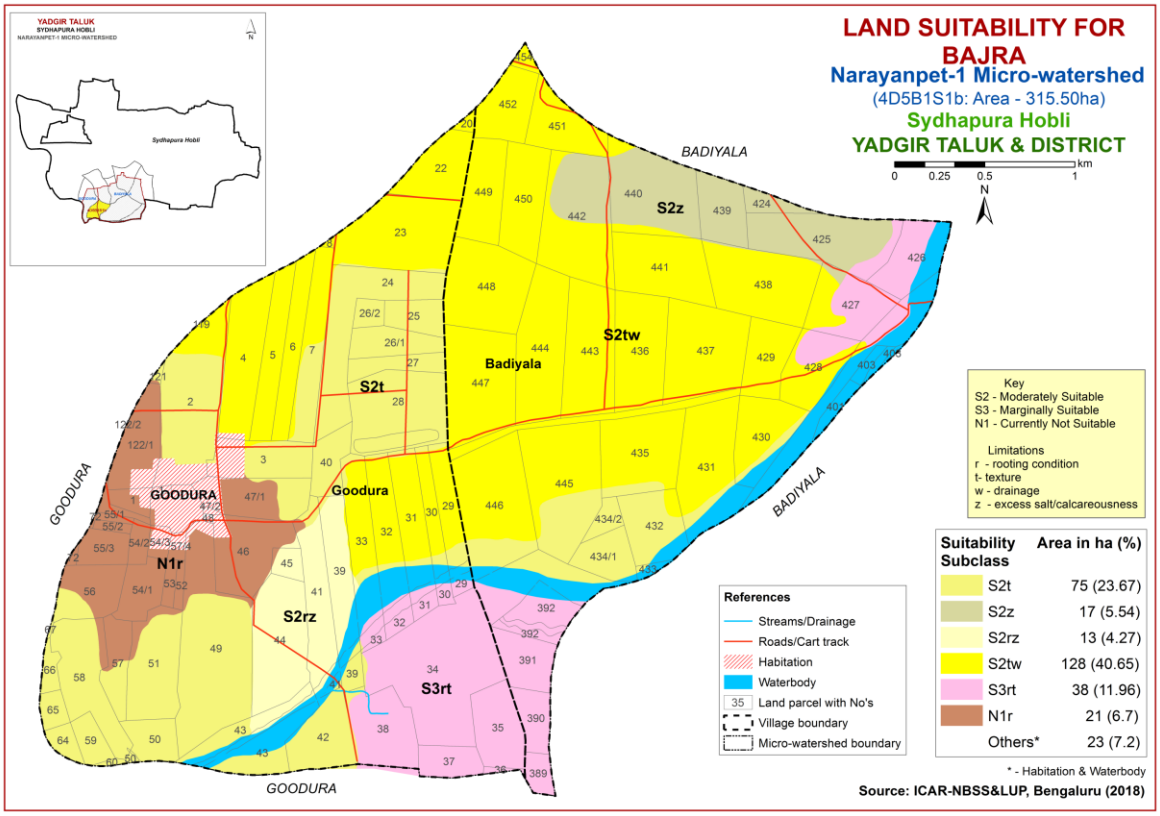


Fig. 7.4 Land Suitability map of Bajra

In Narayanpet-1 microwatershed, no lands that are highly (Class S1) suitable for growing bajra. Maximum area of about 233 ha (74%) is moderately suitable (Class S2) for growing bajra. They have minor limitations of drainage, rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands occur in 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with moderate limitations of rooting depth and texture. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

7.5 Land suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the most important oilseed crop grown in an area of 6.54 lakh ha in almost all the districts of the State. The crop requirements for growing groundnut (Table 7.5) were matched with the soil-site characteristics (Table 7.1) of soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

In Narayanpet-1 microwatershed, there are no highly suitable (Class S1) lands available for growing groundnut. The moderately suitable lands occur in 13 ha (4%) and are distributed in the southern and central part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of 258 ha (82%). They have moderate limitations of texture,

calcareousness, rooting depth and drainage. Currently Not suitable (Class N1) lands occur in 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.6 Land suitability criteria for Groundnut

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

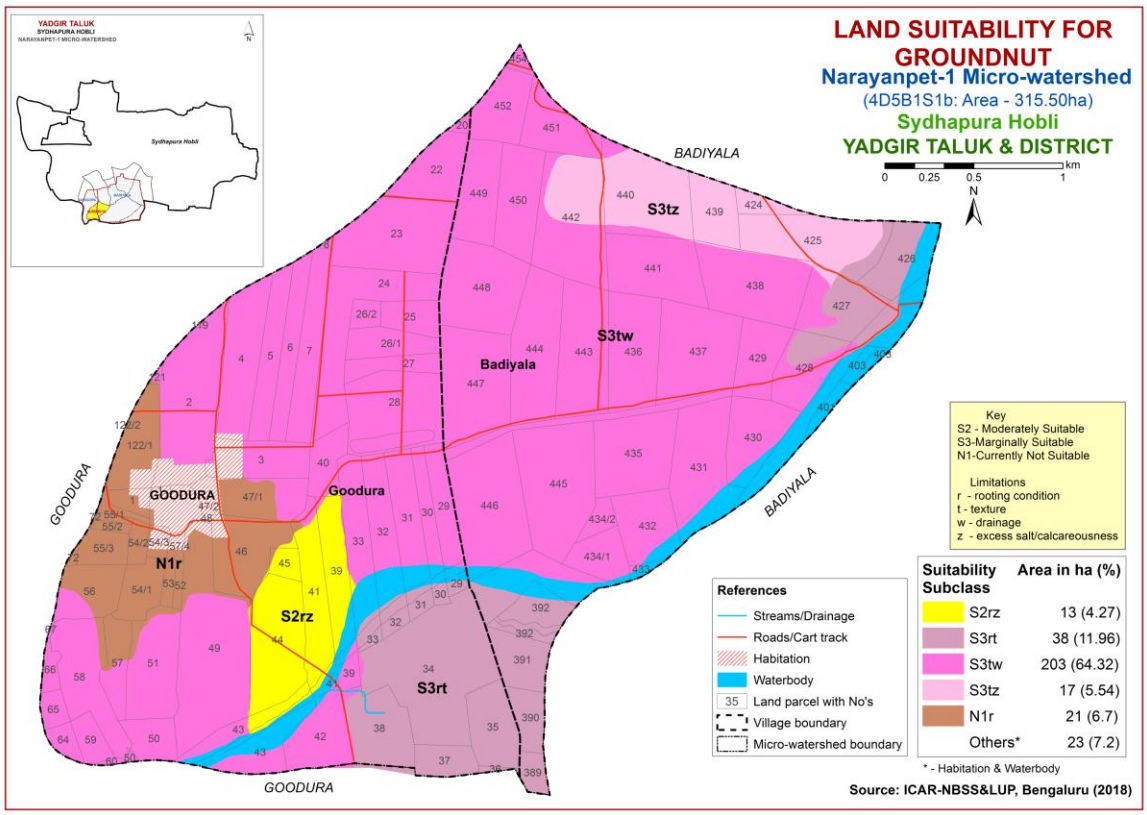


Fig. 7.5 Land Suitability map of Groundnut

7.6 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 7.6.

Table 7.7 Crop suitability criteria for Sunflower

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

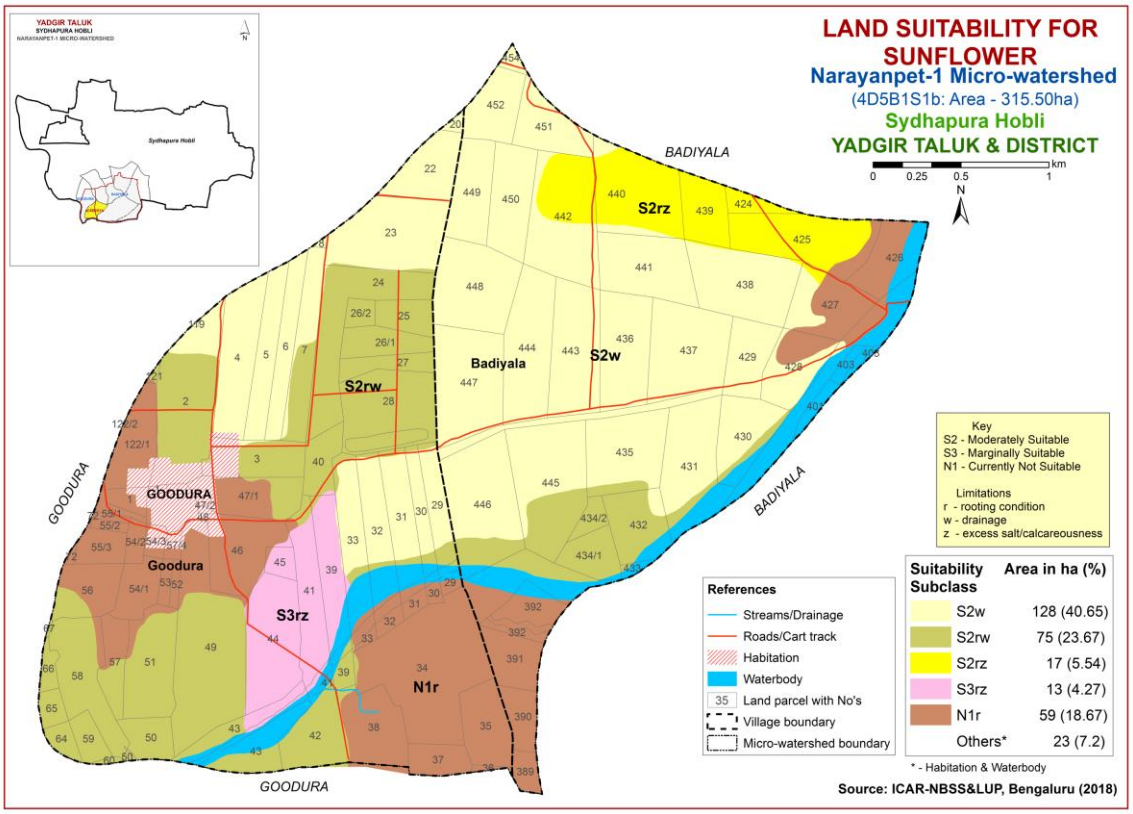


Fig. 7.6 Land Suitability map of Sunflower

In Narayanpet-1 microwatershed, no highly (Class S1) suitable lands available for growing sunflower in the microwatershed. Maximum area of about 220 ha (70%) is moderately suitable (Class S2) for sunflower and have minor limitations of rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands occur in an area of 13 ha (4%) and are distributed in the southern and central part of the microwatershed with

moderate limitations of rooting depth and calcareousness. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitation of rooting depth.

7.7 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, Kalaburgi, 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 7.7.

In Narayanpet-1 microwatershed, highly (Class S1) suitable lands for growing cotton occur in a maximum area of 203 ha (64%) and are distributed in the major part of the microwatershed. An area of about 31 ha (10%) is moderately suitable (Class S2) for growing cotton and is distributed in the northern, central and southern part of the microwatershed with minor limitations of calcareousness and rooting depth. Marginally suitable (Class S3) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with moderate limitation of rooting depth. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.8 Crop suitability criteria for Cotton

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

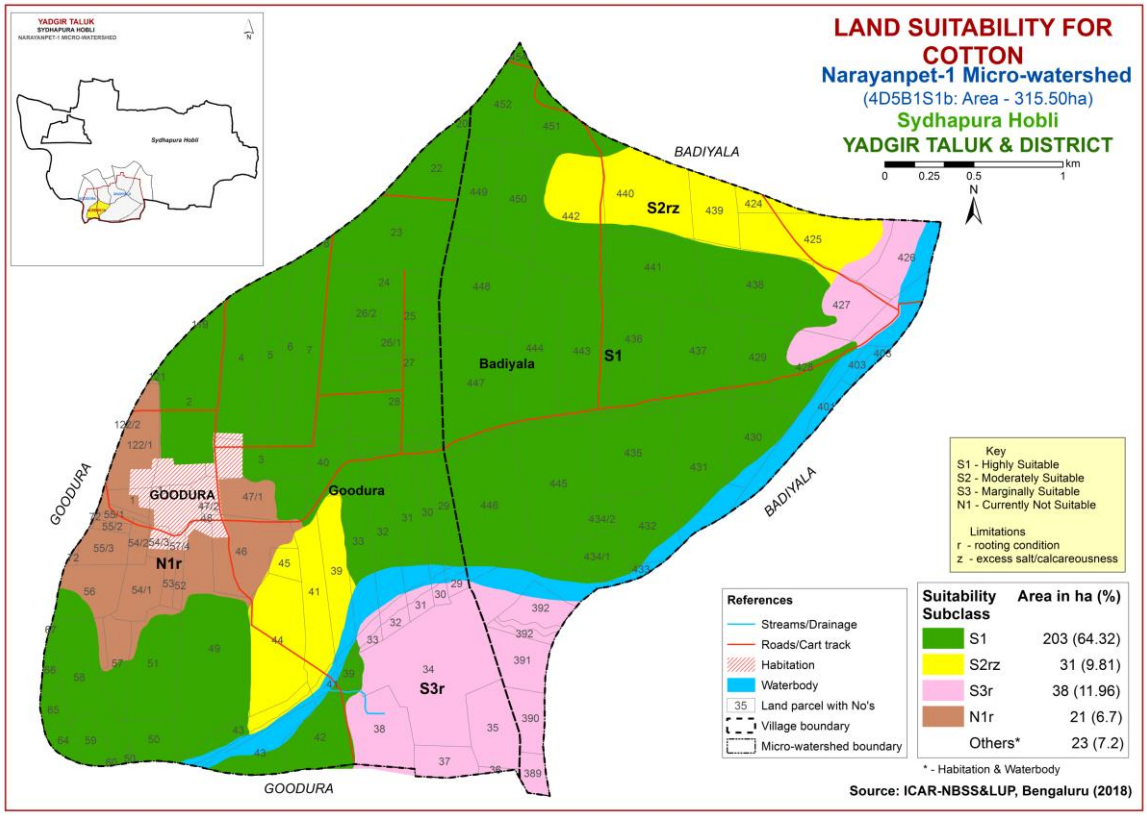


Fig. 7.7 Land Suitability map of Cotton

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, Kalaburgi, Dharwad, Belgaum and Bellary districts. The crop requirements for growing Bengal gram (Table 7.8) 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.

Table 7.9 Crop suitability criteria for Bengal gram

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Slope	%	<3	3-5	5-10	>10
LGP	Days	>100	90-100	70-90	<70
Soil drainage	Class	Well drained	Mod. to well drained; imper. drained	Poorly drained; excessively drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.7, 7.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	sl, c >60%	
Soil depth	cm	>75	51-75	25-50	<25
Gravel content	% vol.	<15	15-35	>35	
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

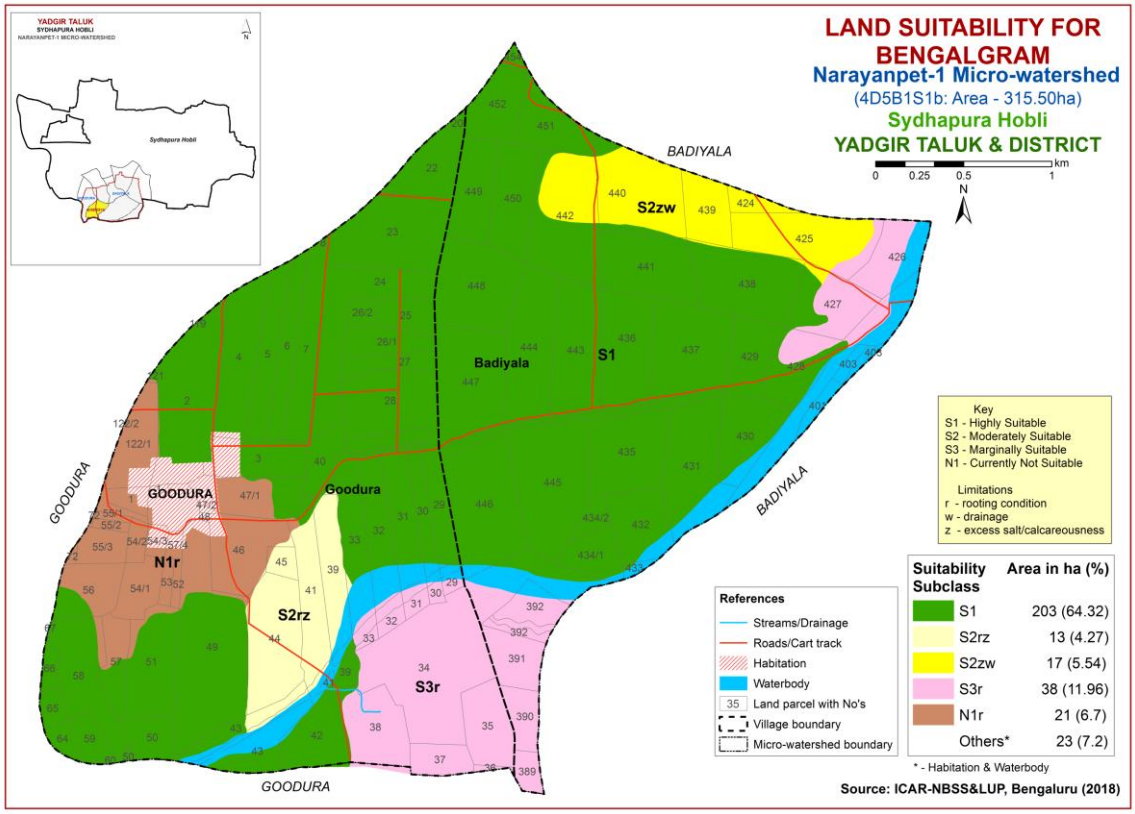


Fig. 7.8 Land Suitability map of Bengal gram

Highly (Class S1) suitable lands for growing bengal gram occur in a maximum area of 203 ha (64%) and is distributed in the major part of the microwatershed. An area of about 30 ha (10%) is moderately suitable (Class S2) for growing bengalgram with minor limitations of drainage, rooting depth and calcareousness. Marginally suitable (Class S3) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with moderate limitation of rooting depth. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

7.9 Land Suitability for Chilli (*Capsicum annuum)*

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

In Narayanpet-1 microwatershed, there are no highly (Class S1) suitable lands available for growing chilli. An area of about 105 ha (33%) is moderately suitable (Class S2) for growing chilli with minor limitations of drainage, rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands occupy maximum area of 166 ha (53%) and are distributed in the major part of the microwatershed with moderate limitations of

rooting depth, texture and drainage. Currently Not suitable lands (Class N1) occur in 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.10 Crop suitability criteria for Chilli

Crop requirement		Rating			
Soil –site characteristics	**Unit**	**Highly suitable(S1)**	**Moderately Suitable(S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
Mean temperature in growing season	^{0}C	20-30	30-35, 13-15	35-40, 10-12	>40,<10
Slope	%	<3	3-5	5-10	>10
LGP	Days	>150	120-150	90-120	<90
Soil drainage	class	Well drained	Moderately drained	Imp./ poor drained/excessively	Very poorly drained
Soil reaction	pH	6.5-7.8, 6.0-7.0	7.8-8.4	8.4-9.0, 5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl, sc, sic,c(m/k)	c(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

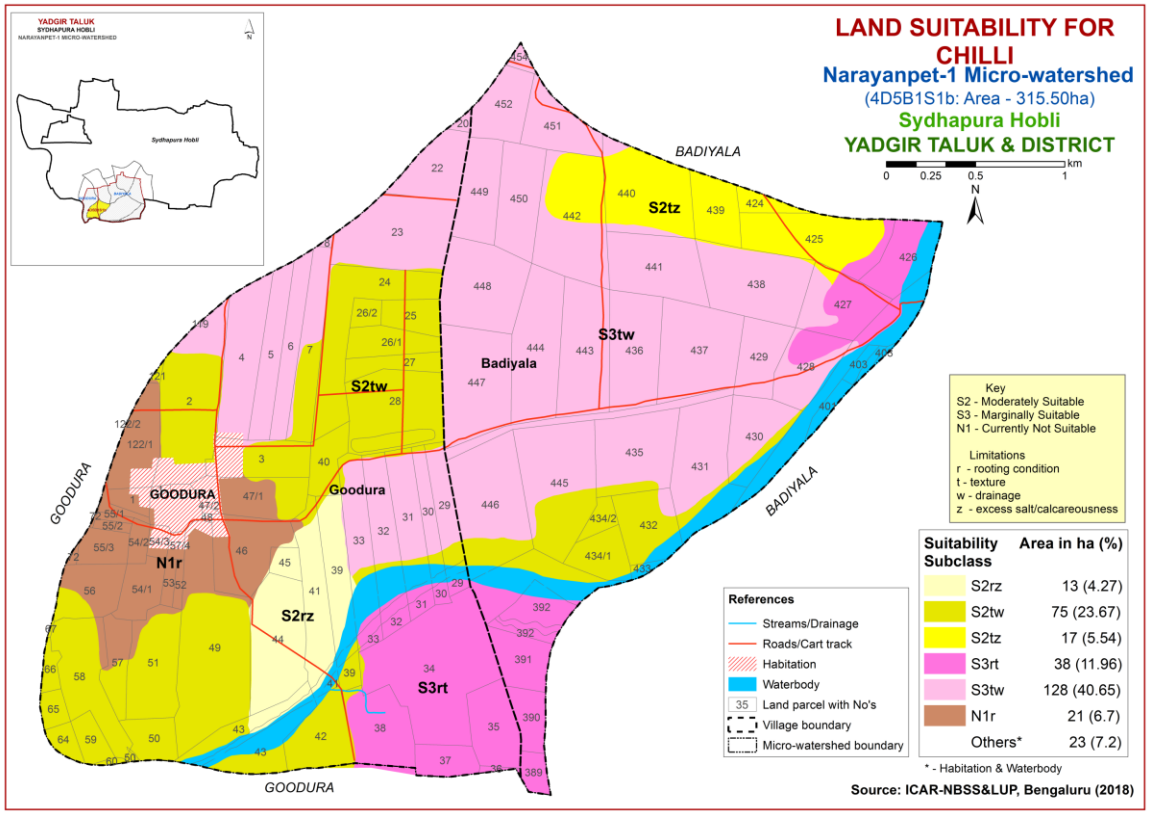


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Lycopersicon esculentum*)

Tomato is one of the most important fruit crop grown in about 0.61 lakh ha covering almost all the district of the state. The crop requirements for growing tomato

(Table 7.10) 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 geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

Table 7.11 Crop suitability criteria for Tomato

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
climate	Temperature in growing season	^{0}C	25-28	29-32 , 20-24	15-19 33-36	<15, >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Poorly drained	V. poorly drained
Nutrient availability	Texture	Class	l, sl, cl, scl	sic, sicl, sc,c(m/k)	c (ss), ls	s
	pH	1:2.5	6.0-7.3	5.5-6.0 7.3-8.4	8.4-9.0	>9.0
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	%vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	slight	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

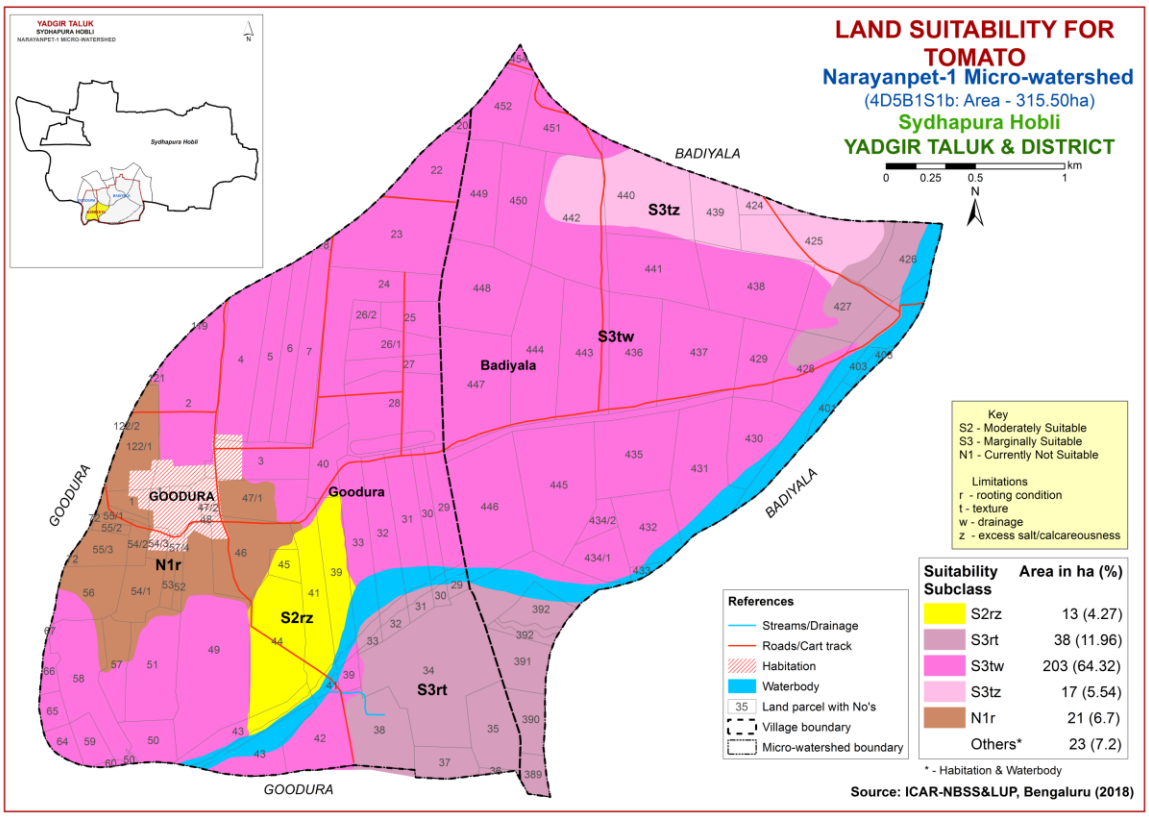


Fig 7.10 Land Suitability map of Tomato

In Narayanpet-1 microwatershed, there are no highly suitable (Class S1) lands available for growing tomato. Moderately (ClassS2) suitable lands occur in an area of 13 ha (4%) and are distributed in the southern and central part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover a maximum area of about 258 ha (82%) with moderate limitations of texture, calcareousness, rooting depth and drainage and is distributed in the major part of the microwatershed. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

7.11 Land Suitability for Drumstick (*Moringa oleifera*)

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

In Narayanpet-1 microwatershed, there are no highly (Class S1) suitable lands available for growing drumstick. Maximum area of about 220 ha (70%) is moderately suitable (Class S2) for drumstick with minor limitations of rooting depth, texture, calcareousness and drainage. Marginally suitable (Class S3) lands occur in a small area of 13 ha (4%) and are distributed in the southern and central part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. Currently Not suitable (class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed and they have severe limitations of rooting depth and texture.

Table 7.12 Crop suitability criteria for Drumstick

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

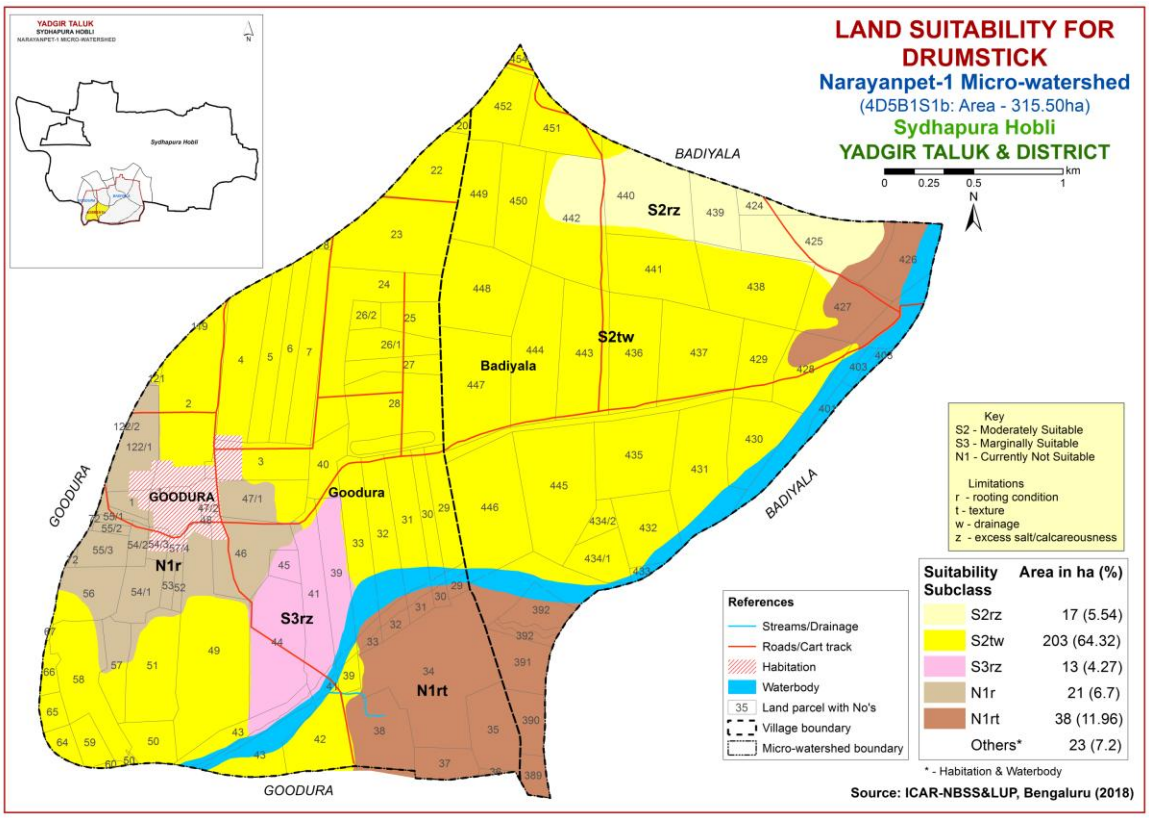


Fig 7.11 Land Suitability map of Drumstick

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is one of the important leaf crop grown for rearing silk worms in about 1,66,000 ha area in all the districts of the state. The crop requirements for growing mulberry (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

Table 7.13 Crop suitability criteria for Mulberry

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

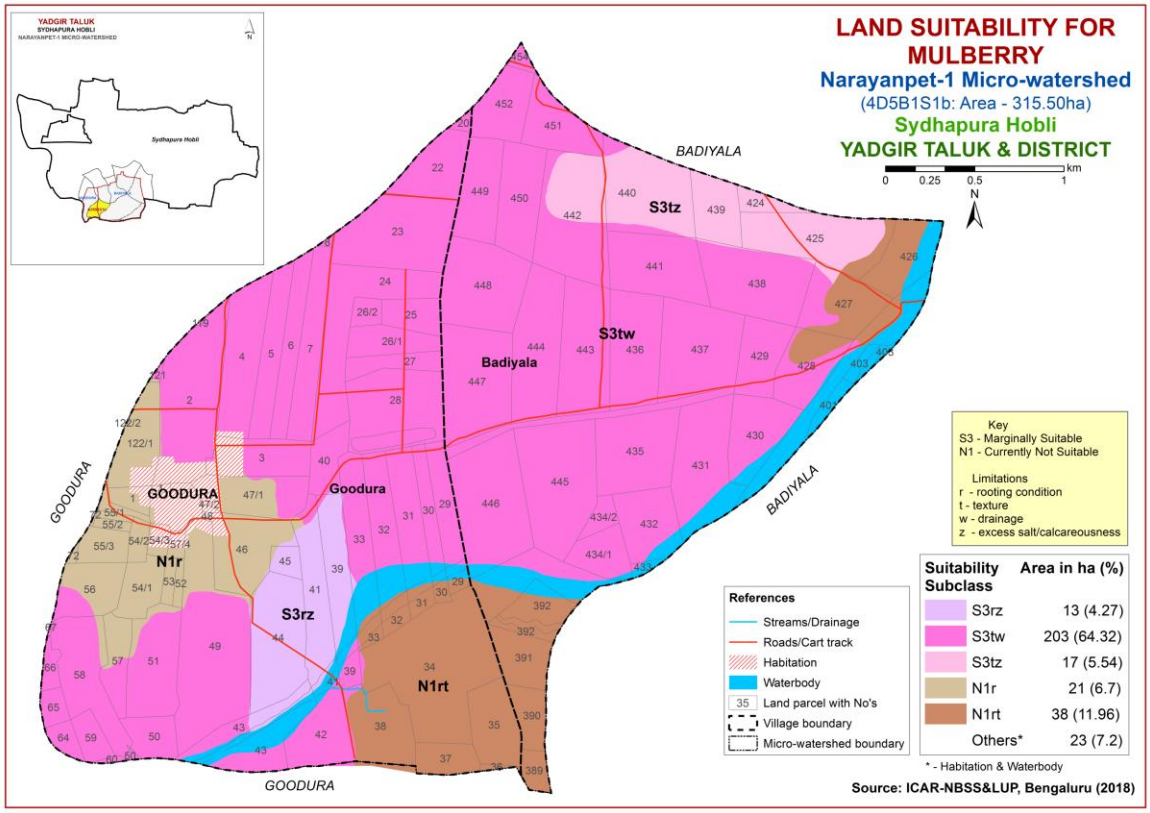


Fig 7.12 Land Suitability map of Mulberry

In Narayanpet-1 microwatershed, no highly (Class S1) and moderately (Class S2) suitable lands available for growing mulberry. Maximum area of about 233 ha (74%) is marginally suitable (Class S3) for growing mulberry with moderate limitations of texture, rooting depth, calcareousness and drainage. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed and have severe limitations of rooting depth and texture.

7.13 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 173080 ha in all the districts of the State. The crop requirements for growing mango (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

No highly (Class S1) and moderately (Class S2) suitable lands available for growing mango in the microwatershed. Maximum area of about 220 ha (70%) is marginally suitable (Class S3) for growing mango and is distributed in the major part of the microwatershed with moderate limitations of rooting depth, texture, calcareousness and drainage. Currently Not suitable (Class N1) lands occur in an area of 72 ha (23%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed and have severe limitations of rooting depth and calcareousness.

Table 7.14 Crop suitability criteria for Mango

Crop requirement			Rating			
soil-site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable (S2)**	**Marginally suitable (S3)**	**Not suitable(N)**
climate	Temp in growing season	^{0}C	28-32	24-27 33-35	36-40	20-24
	Min. temp. before flowering	^{0}C	10-15	15-22	>22	
Soil moisture	Growing period	Days	>180	150-180	120-150	<120
Soil aeration	Soil drainage	class	Well drained	Mod. To imper. drained	Poor drained	Very poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	sc, l, sil, cl	sl, sc, sic, l, c	c (<60%)	c (>60%),
	pH	1:2.5	5.5-7.5	7.6-8.55.0-5.4	8.6-9.0 4.0-4.9	>9.0 <4.0
	OC	%	High	medium	low	
	$CaCO_3$ in root zone	%	Non calcareous	<5	5-10	>10
Rooting conditions	Soil depth	cm	>200	125-200	75-125	<75
	Gravel content	% vol.	Non gravelly	<15	15-35	>35
Soil toxicity	Salinity	dS/m	Non saline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

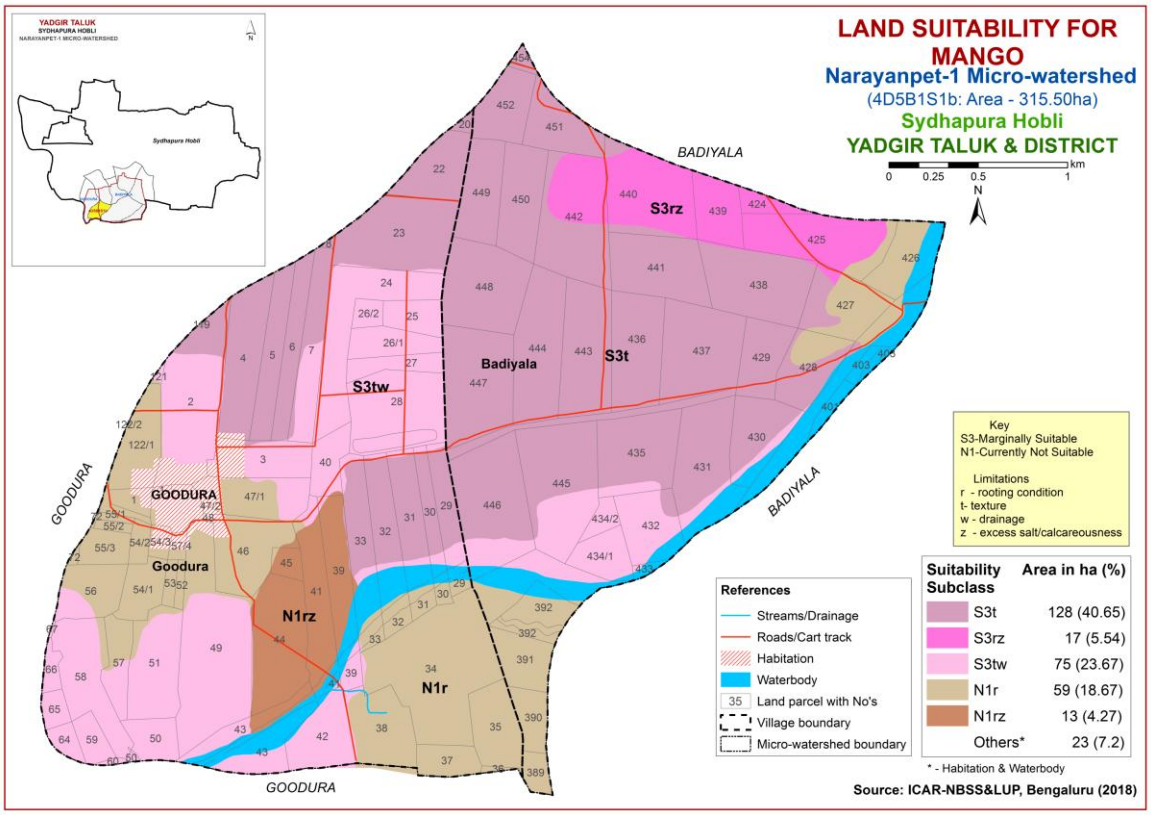


Fig. 7.13 Land Suitability map of Mango

7.14 Land Suitability for Sapota (*Manilkara zapota*)

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

Table 7.15 Crop suitability criteria for Sapota

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

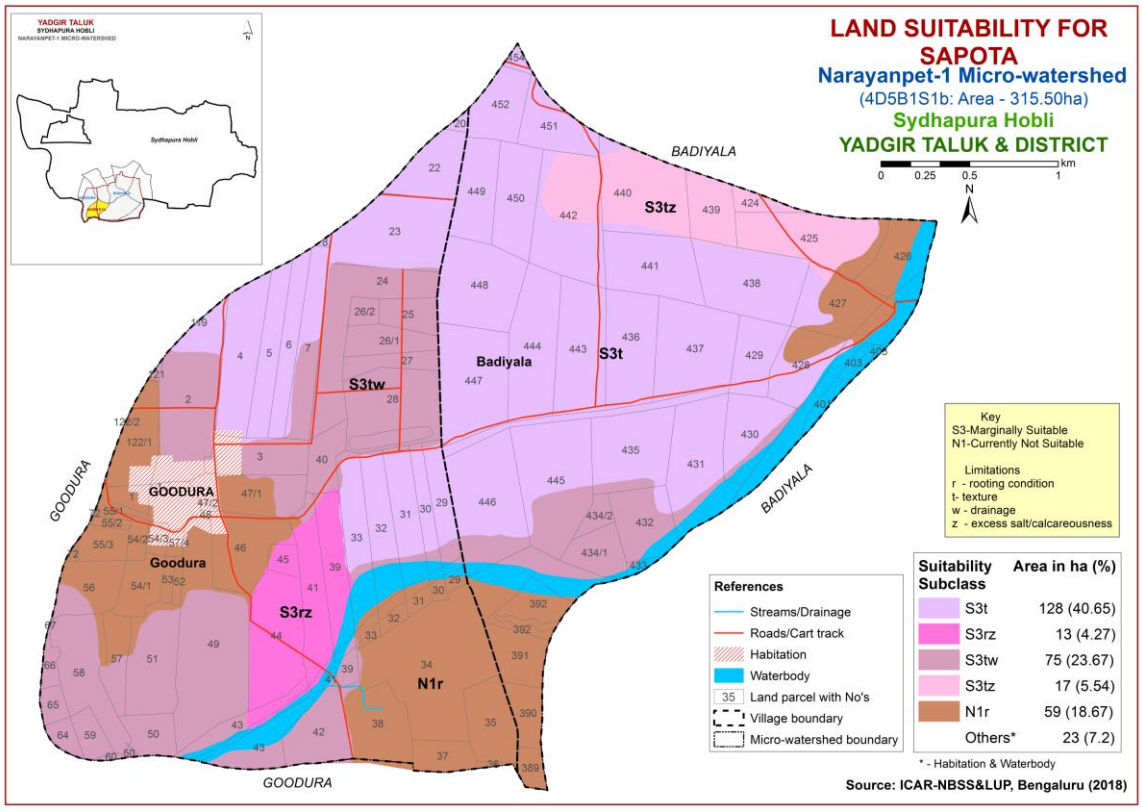


Fig. 7.14 Land Suitability map of Sapota

No highly (Class S1) and moderately (Class S2) suitable lands available for growing sapota in the microwatershed. Maximum area of about 233 ha (74%) is marginally suitable (Class S3) for growing sapota with moderate limitations of texture, rooting depth, calcareousness and drainage. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed and have severe limitation of rooting depth.

7.15 Land Suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in about 6558 ha in the State of Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga, Bangalore, Kolar, Chikkaballapur and Chamarajnagar districts. The crop requirements for growing guava (Table 7.15) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

No highly (Class S1) and moderately (Class S2) suitable lands available for growing guava in the microwatershed. Maximum area of about 233 ha (74%) is marginally suitable (Class S3) for growing guava with moderate limitations of texture, rooting depth, calcareousness and drainage. They are distributed in the major part of the microwatershed. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.16 Crop suitability criteria for Guava

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

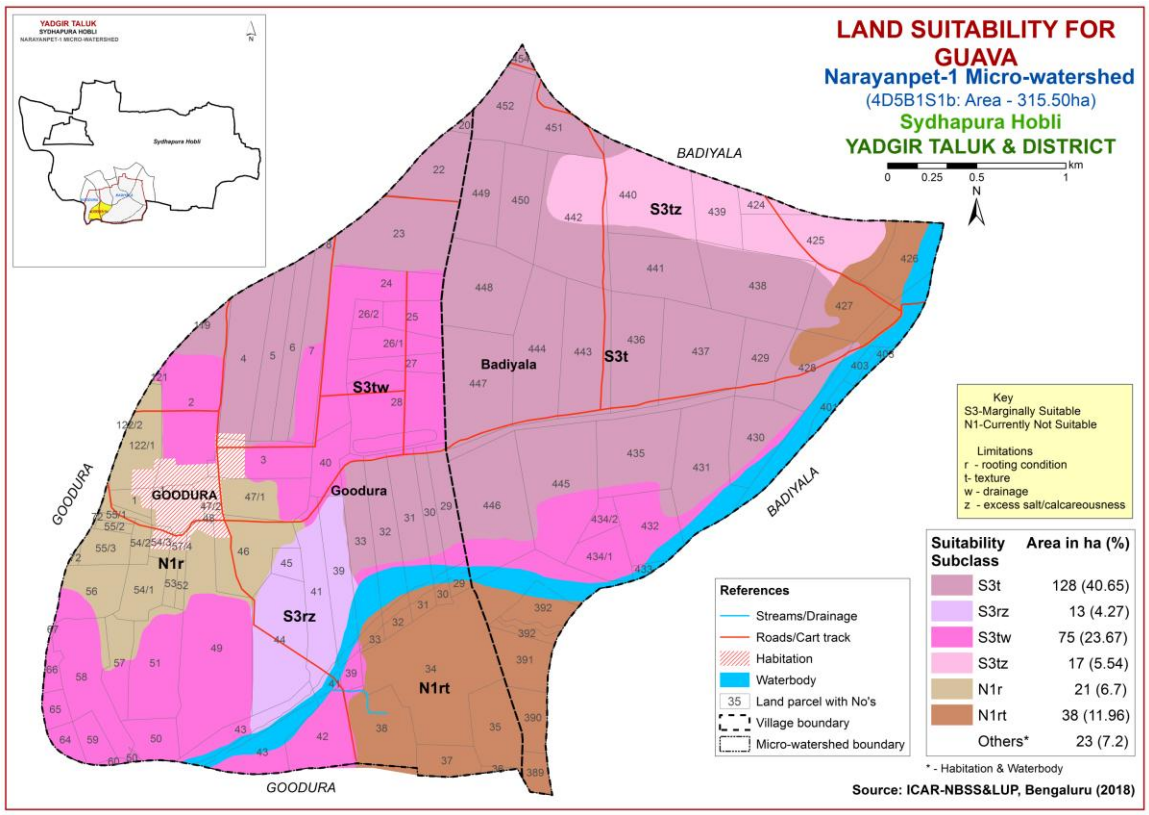


Fig 7.15 Land Suitability map of Guava

7.16 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the most important fruit crop commercially grown in about 18488 ha in Karnataka in an area of about 0.16 lakh ha mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.16) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing pomegranate was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

In Narayanpet-1 microwatershed, no highly (Class S1) suitable lands available for growing pomegranate. Maximum area of about 220 ha (70%) is moderately suitable (Class S2) for pomegranate and are distributed in the major part of the microwatershed with minor limitations of rooting depth, texture, calcareousness and drainage. Marginally suitable (Class N3) lands occupy a small area of 13 ha (4%) in the microwatershed and are distributed in the southern and central part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.17 Crop suitability criteria for Pomegranate

Crop requirement			Rating			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
climate	Temperature in growing season	^{0}C	30-34	35-38,25-29	39-40 15-24	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	class	Well drained	imperfectly drained		
Nutrient availability	Texture	Class	sl, scl, l, cl	c, sic, sicl	cl, s, ls	
	pH	1:2.5	5.5-7.5	7.6-8.5	8.6-9.0	
Rooting conditions	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	nil	15-35	>35	
Soil toxicity	Salinity	ds/m	Nil	<9	>9	<50
	Sodicity	%	nil			
Erosion	Slope	%	<3	3-5	5-10	

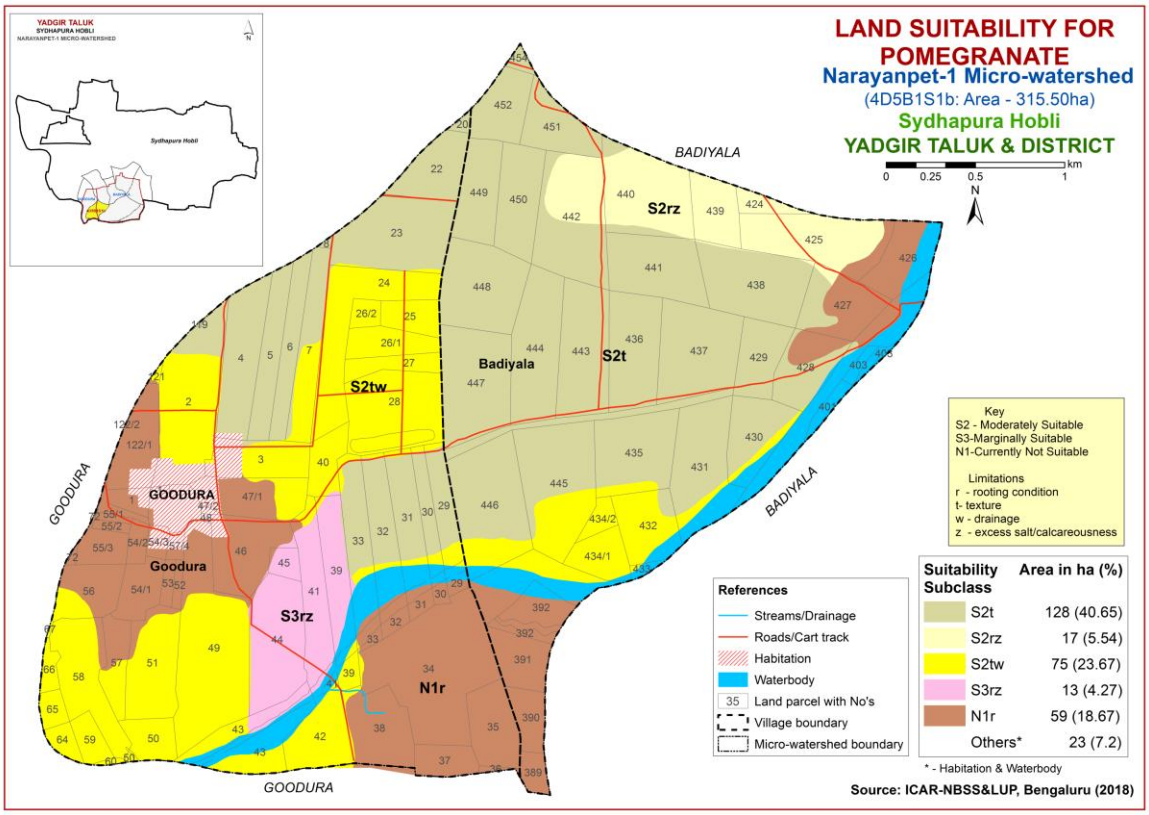


Fig 7.16 Land Suitability map of Pomegranate

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in almost all the districts of the state. The crop requirements for growing jackfruit (Table 7.17) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.17.

No highly (Class S1) and moderately (Class S2) suitable lands available for growing jackfruit in the microwatershed. Maximum area of about 233 ha (74%) is marginally suitable (Class S3) for growing jackfruit with moderate limitations of texture, rooting depth, calcareousness and drainage. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.18 Crop suitability criteria for Jackfruit

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

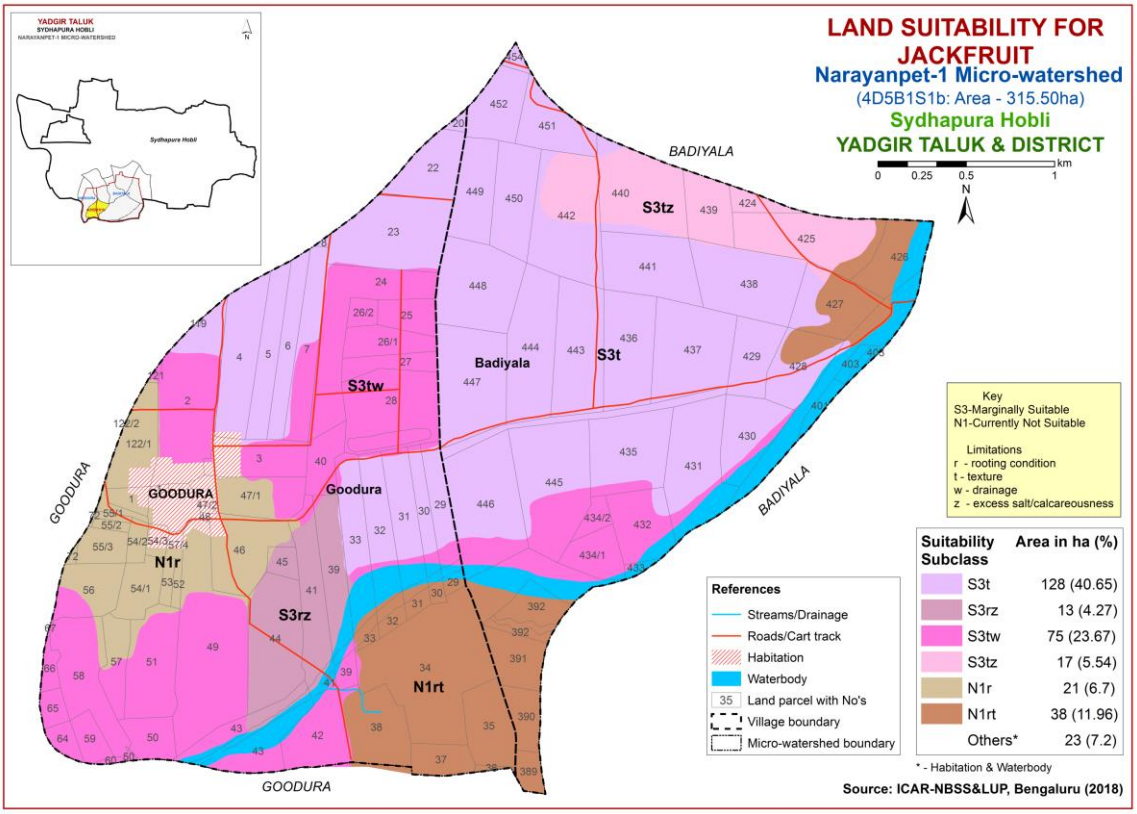


Fig 7.17 Land Suitability map of Jackfruit

7.18 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is one of the most important fruit crop grown in almost all the districts of the state. The crop requirements for growing jamun (Table 7.18) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.18.

In Narayanpet-1 microwatershed, no highly suitable (Class S1) lands available for growing jamun. Maximum area of about 203 ha (64%) is moderately suitable (Class S2) for jamun and is distributed in the major part of the microwatershed. They have minor limitations of texture and drainage. An area of about 31ha (10%) is marginally suitable (Class S3) for growing jamun and are distributed in the central, southern and northeastern part of the microwatershed. They have moderate limitations of rooting depth and calcareousness. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.19 Crop suitability criteria for Jamun

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

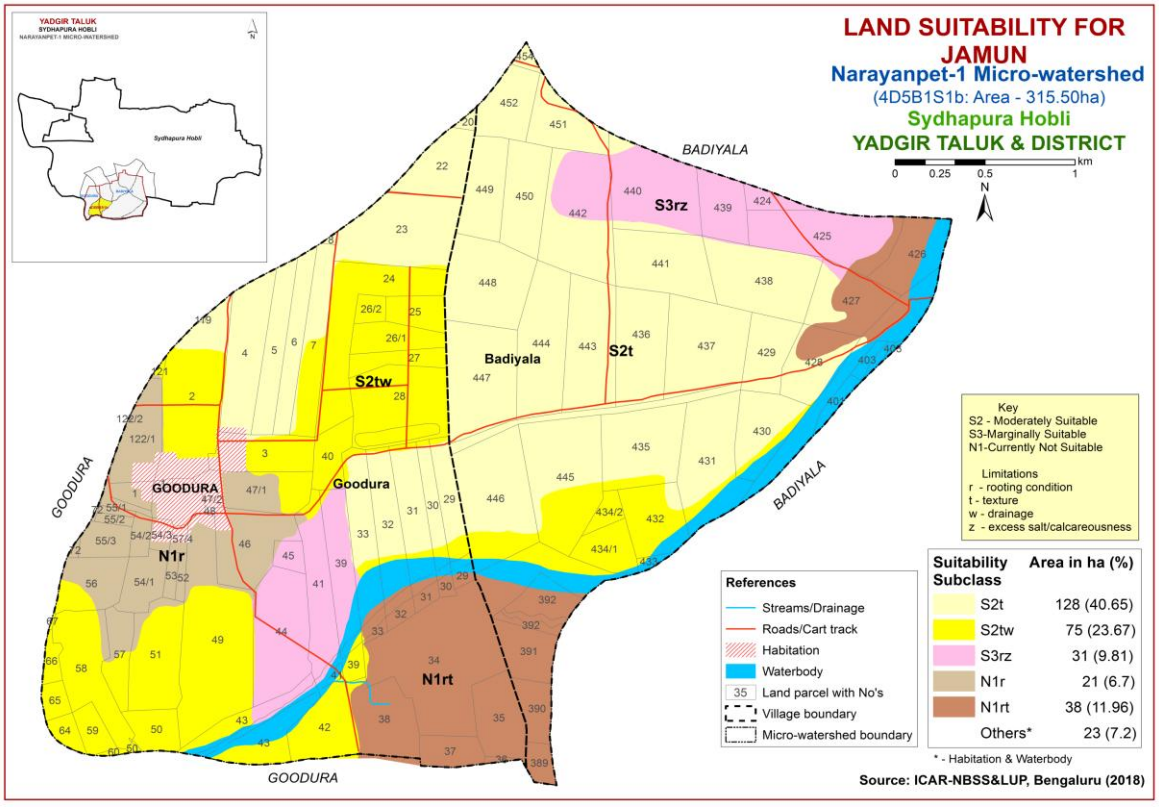


Fig 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

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

Table 7.20 Crop suitability criteria for Musambi

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temp in growing season	^{0}C	28-30	31-35 24-27	36-40 20-23	>40 <20
Soil moisture	Growing period	Days	240-265	180-240	150-180	<150
Soil aeration	Soil drainage	class	Well drained	Mod. to imper. drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl, l, sicl, cl, s	sc, sc, c	c (>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.4/ 7.6-8.0	4.0-5.4 8.1-8.5	<4.0 >8.5
	$CaCO_3$ in root zone	%	Non calcareous	Upto 5	5-10	>10
Rooting condition	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

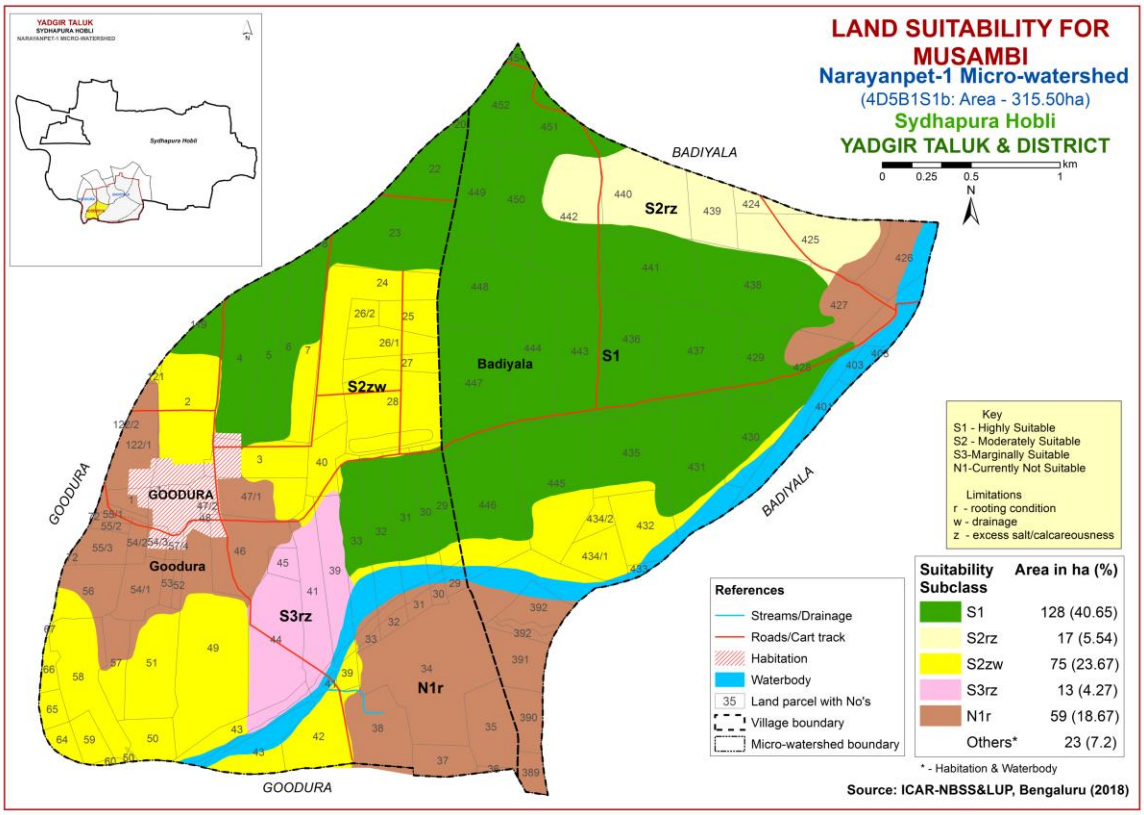


Fig 7.19 Land Suitability map of Musambi

In Narayanpet-1 microwatershed, highly (Class S1) suitable lands for growing musambi occupy maximum area of 128 ha (41% and is distributed in the major part of the microwatershed. An area of 92 ha (29%) is moderately suitable (Class S2) for musambi and is distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands occur in an area of 13 ha (4%) and are distributed in the southern and central part of the microwatershed with moderate limitations of rooting depth and calcareousness. Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed. They have severe limitation of rooting depth.

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in 11752 ha in almost all the districts of the state. The crop requirements for growing lime (Table 7.19) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.20.

Table 7.21 Crop suitability criteria for Lime

Crop requirement			**Rating**			
Soil –site characteristics		**Unit**	**Highly suitable(S1)**	**Moderately suitable(S2)**	**Marginally suitable(S3)**	**Not suitable(N)**
Climate	Temp in growing season	^{0}C	28-30	31-35 24-27	36-40 20-23	>40 <20
Soil moisture	Growing period	Days	240-265	180-240	150-180	<150
Soil aeration	Soil drainage	class	Well drained	Mod. to imper.drained	poorly	Very poorly
Nutrient availability	Texture	Class	scl, l, sicl, cl, s	sc, sc, c	c (>70%)	s, ls
	pH	1:2.5	6.0-7.5	5.5-6.4/ 7.6-8.0	4.0-5.4 8.1-8.5	<4.0 >8.5
	$CaCO_3$ in root zone	%	Non calcareous	Upto 5	5-10	>10
Rooting condition	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

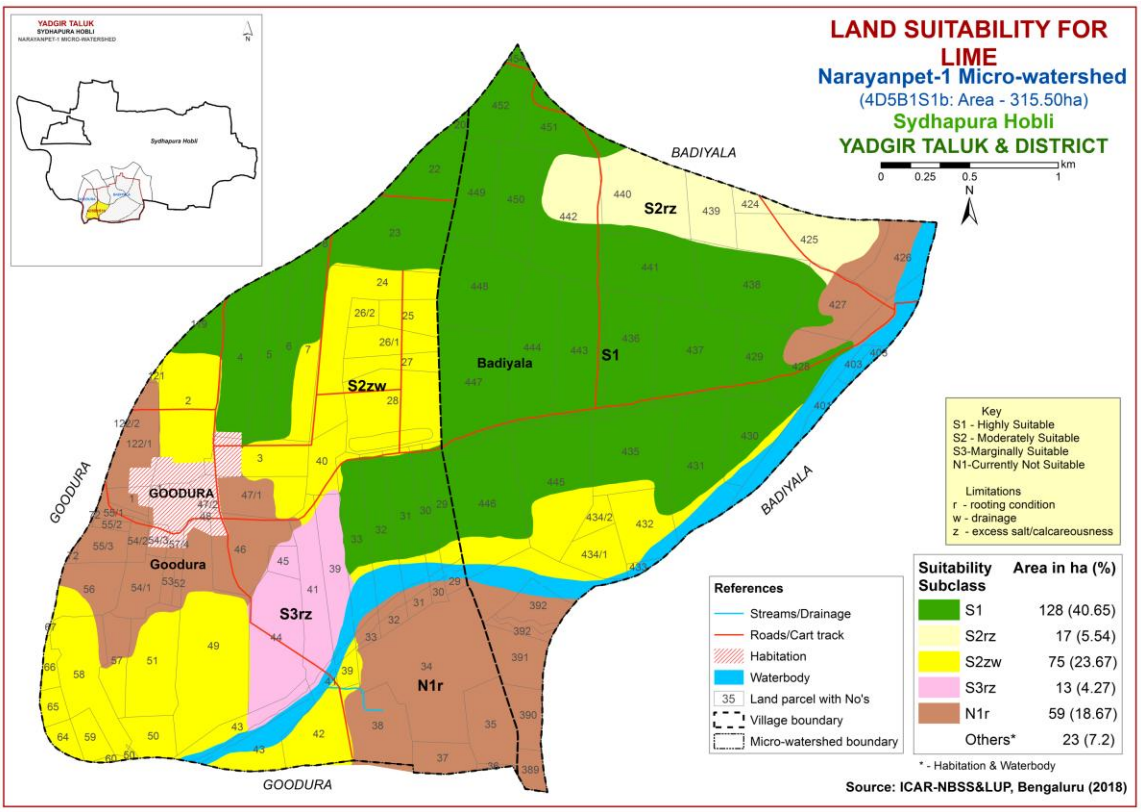


Fig 7.20 Land Suitability map of Lime

In Narayanpet-1 microwatershed highly (Class S1) suitable lands for growing lime occur in a maximum area of 128 ha (41%) and are distributed in the central, northern and northwestern part of the microwatershed. An area of about 92 ha (29%) is moderately suitable (Class S2) for lime and are distributed in all parts of the microwatershed with minor limitations of rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands occupy 13 ha (4%) and are distributed in the southern and central part of the microwatershed with moderate limitations of rooting depth and calcareousness. Currently Not suitable (Class N1) lands occur in an area of 59 ha (19%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed. They have severe limitation of rooting depth.

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important plantation nut crop grown in an area of about 70552 ha in almost all the districts. The crop requirements for growing Cashew (Table 7.20) 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 is given in Figure 7.21.

Entire area in the microwatershed is currently not suitable (Class N1) for cashew and has severe limitations of texture, rooting depth, and calcareousness.

Table 7.22 Crop suitability criteria for Cashew

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

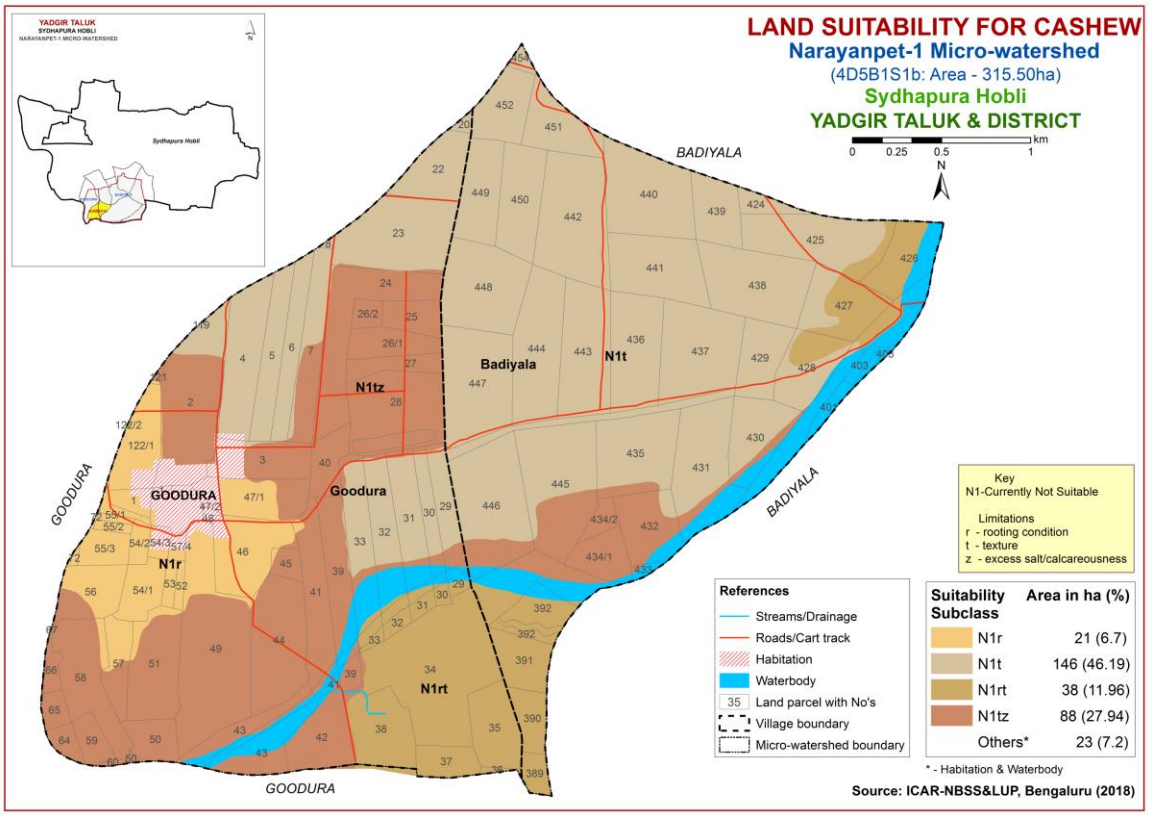


Fig 7.21 Land Suitability map of Cashew

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the state. The crop requirements for growing custard apple (Table 7.21) 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 is given in Figure 7.22.

In Narayanpet-1 microwatershed, highly (Class S1) suitable lands for growing custard apple occur in a maximum area of 220 ha (70%) and are distributed in the major part of the microwatershed. An area of about 13 ha (4%) is moderately suitable (Class S2) for growing custard apple with minor limitations of rooting depth and calcareousness and is distributed in the southern and central part of the microwatershed. Marginally suitable

(Class S3) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with severe limitation of rooting depth. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the eastern part of the microwatershed with severe limitation of rooting depth.

Table 7.23 Crop suitability criteria for Custard Apple

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable (S1)	Moderately Suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl, cl, sc, c (red), c (black)	-	sl, ls	-
	pH	1:2.5	6.0-7.3	7.3-8.4	5.0-5.5,8.4-9.0	>9.0
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15-35	35-60	60-80	-
Erosion	Slope	%	0-3	3-5	>5	

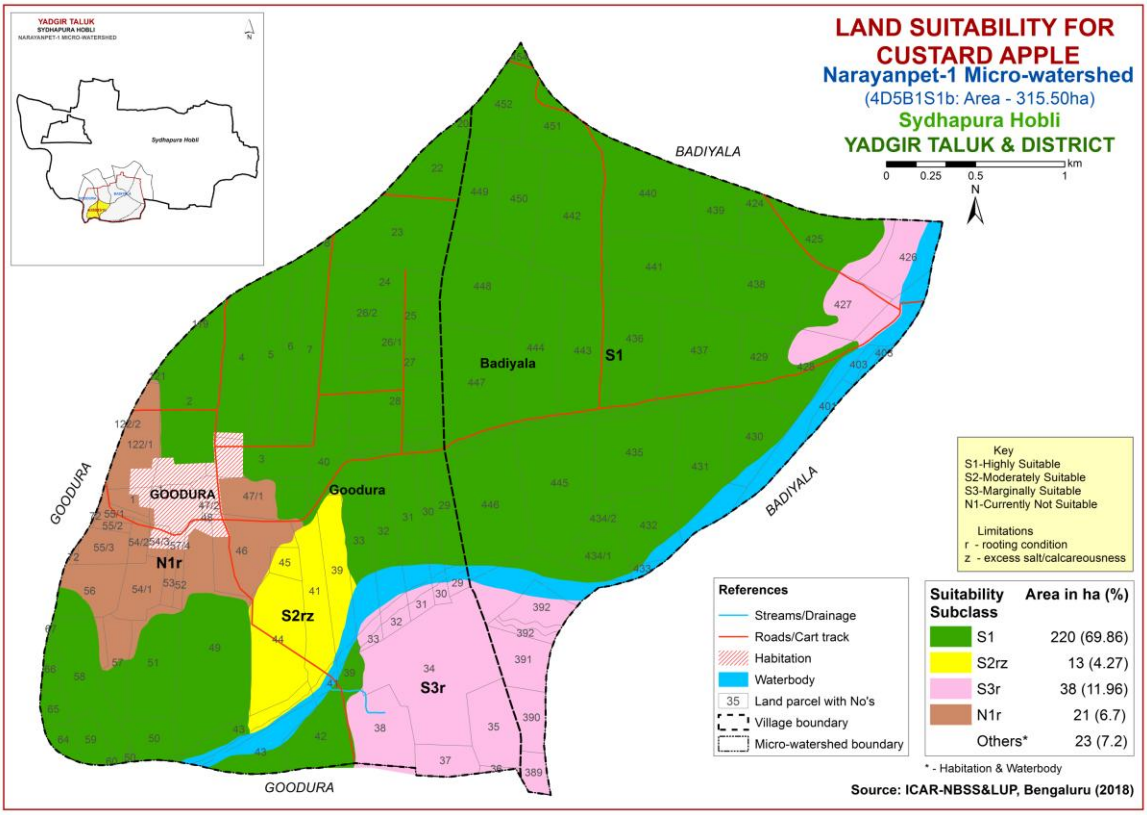


Fig 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important medicinal and fruit plant grown in 151 ha in almost all the districts of the state. The crop requirements for growing amla (Table 7.22) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.23.

In Narayanpet-1 microwatershed highly (Class S1) suitable lands for growing amla occur in an area of 75 ha (24%) and are distributed in the all parts of the microwatershed. Maximum area of about 158 ha (50%) is moderately suitable (Class S2) for growing amla and is distributed in the major part of the microwatershed with minor limitations of drainage, rooting depth, texture and calcareousness. Marginally suitable (Class N1) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southeastern part of the microwatershed with moderate limitations of rooting depth and texture. Currently Not suitable (Class N1) lands occur in 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.24 Crop suitability criteria for Amla

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

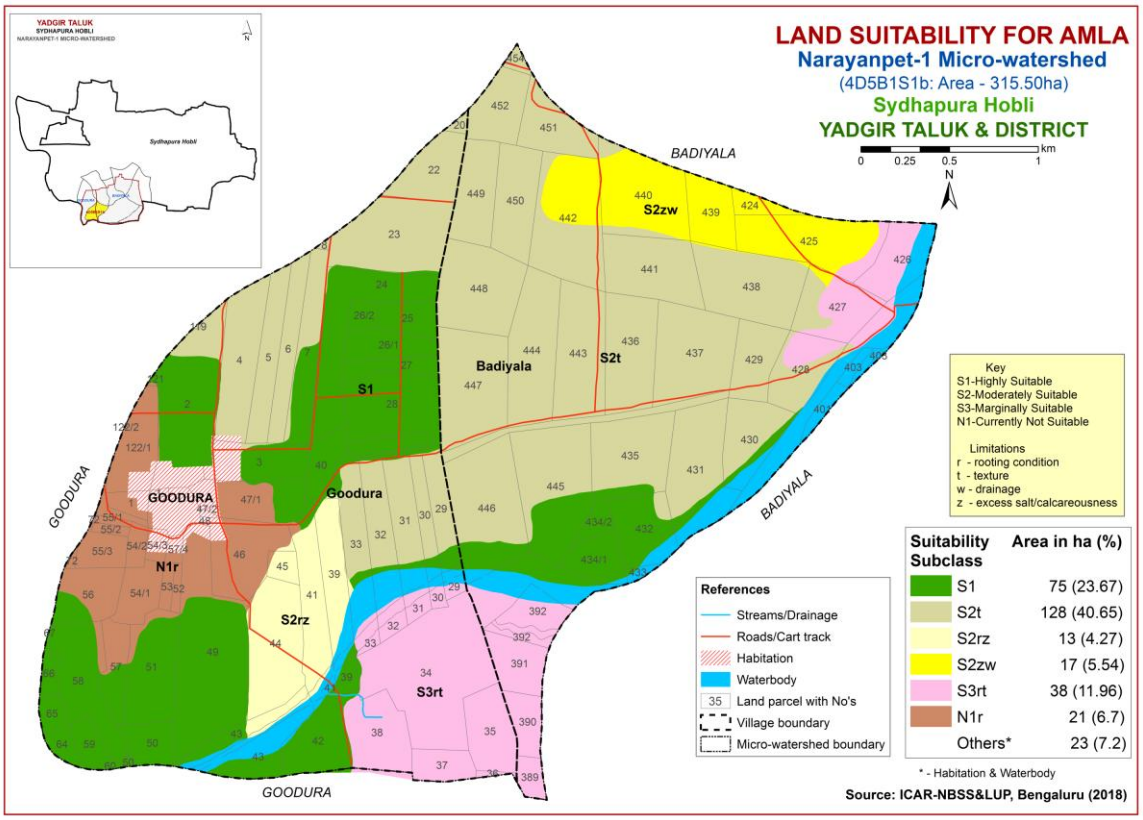


Fig 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop raised in 14897 ha in all the districts of the state. The crop requirements for growing tamarind (Table 7.23) 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 geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.24.

Table 7.25 Crop suitability criteria for Tamarind

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Poorly drained	V. Poorly drained
Nutrient availability	Texture	Class	scl, 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
Rooting conditions	Soil depth	cm	>150	100-150	75-100	<50
	Gravel content	% vol.	<15	15-35	35-60	60-80
Erosion	Slope	%	0-3	3-5	5-10	>10

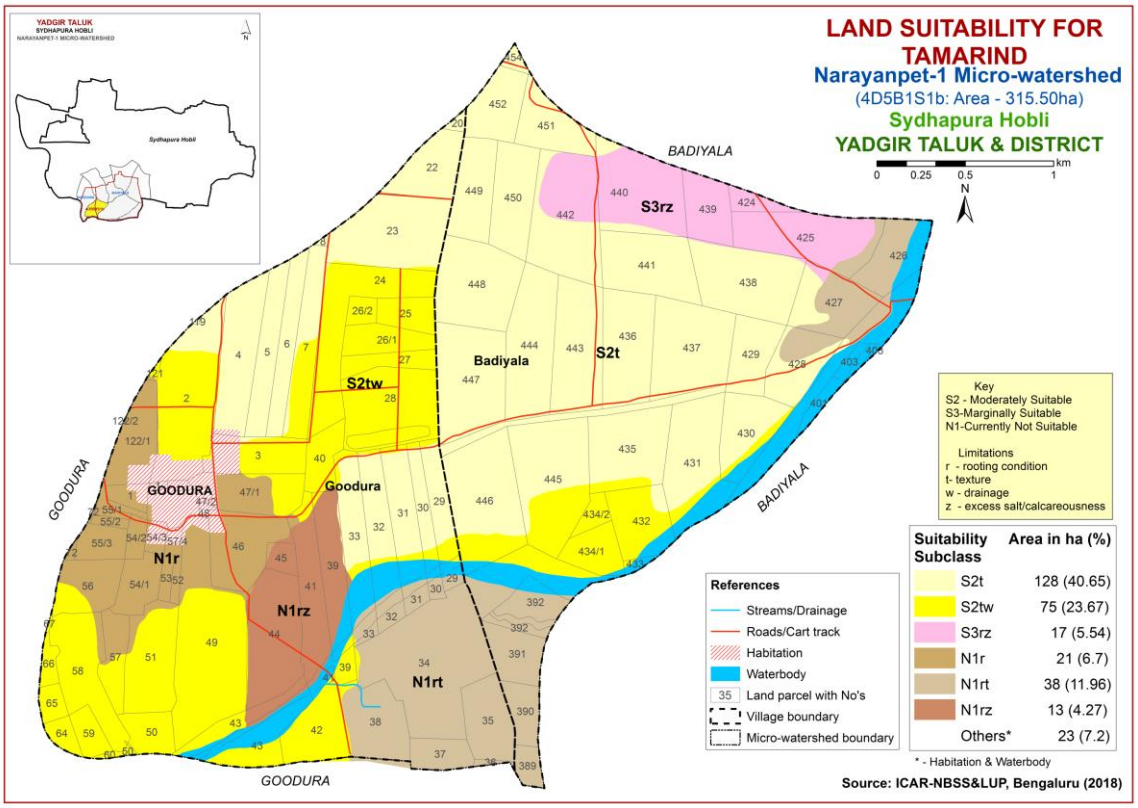


Fig 7.24 Land Suitability map of Tamarind

No highly suitable (Class S1) lands available for growing tamarind in the microwatershed. Moderately suitable (Class S2) lands occur in a maximum area of 203 ha (64%) and are distributed in the major part of the microwatershed. They have minor limitations of texture and drainage. An area of about 17 ha (6%) is marginally suitable (Class S3) for growing tamarind and are distributed in the northeastern part of the

microwatershed with moderate limitations of rooting depth and calcareousness. Currently Not suitable (Class N1) lands occur in 72 ha (23%) and are distributed in the northeastern, southeastern, western and central part of the microwatershed with severe limitations of rooting depth, texture and calcareousness.

7.25 Land suitability for Marigold (*Tagetes sps.)*

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 for growing marigold (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.25.

In Narayanpet-1 microwatershed, there are no lands that are highly (Class S1) suitable for growing marigold. Maximum area of about 233 ha (74%) is moderately suitable (Class S2) for growing marigold with minor limitations of drainage, rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

Table 7.26 Land suitability criteria for Marigold

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

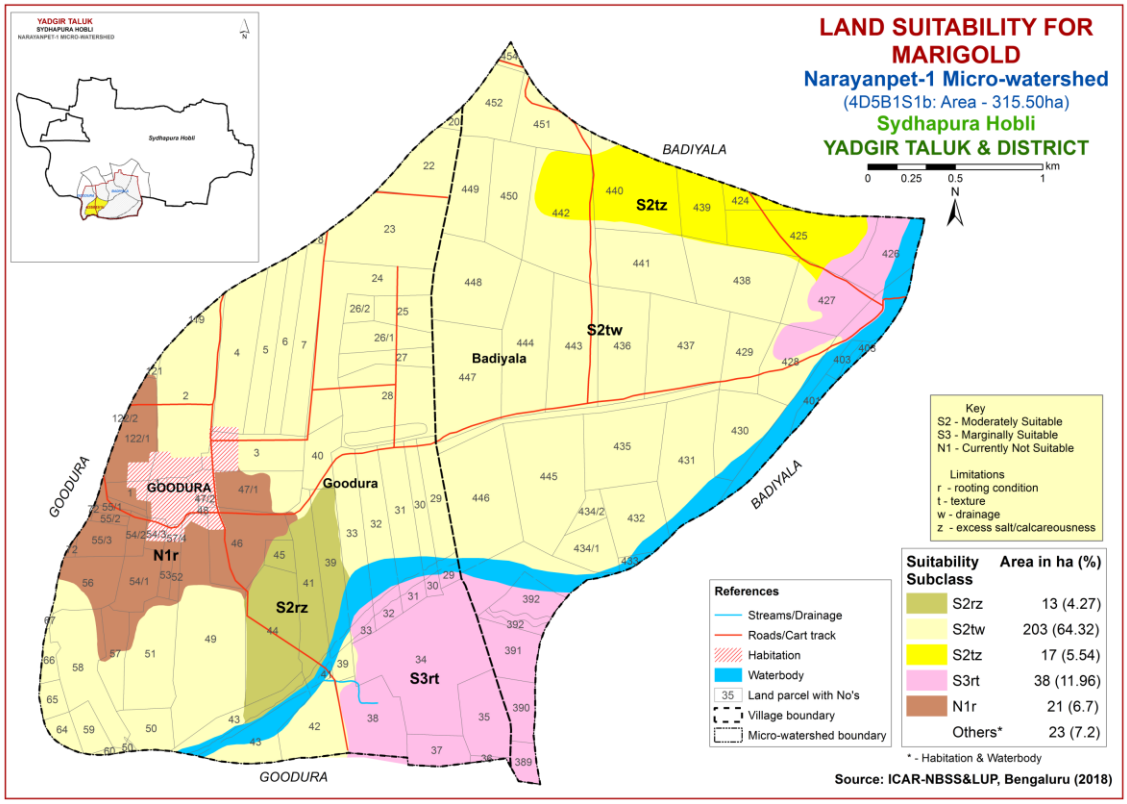


Fig. 7.25 Land Suitability map of Marigold

7.26 Land suitability for Chrysanthemum (*Dendranthema grandiflora*)

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 for growing chrysanthemum (Table 7.25) 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

Table 7.27 Land suitability criteria for Chrysanthemum

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

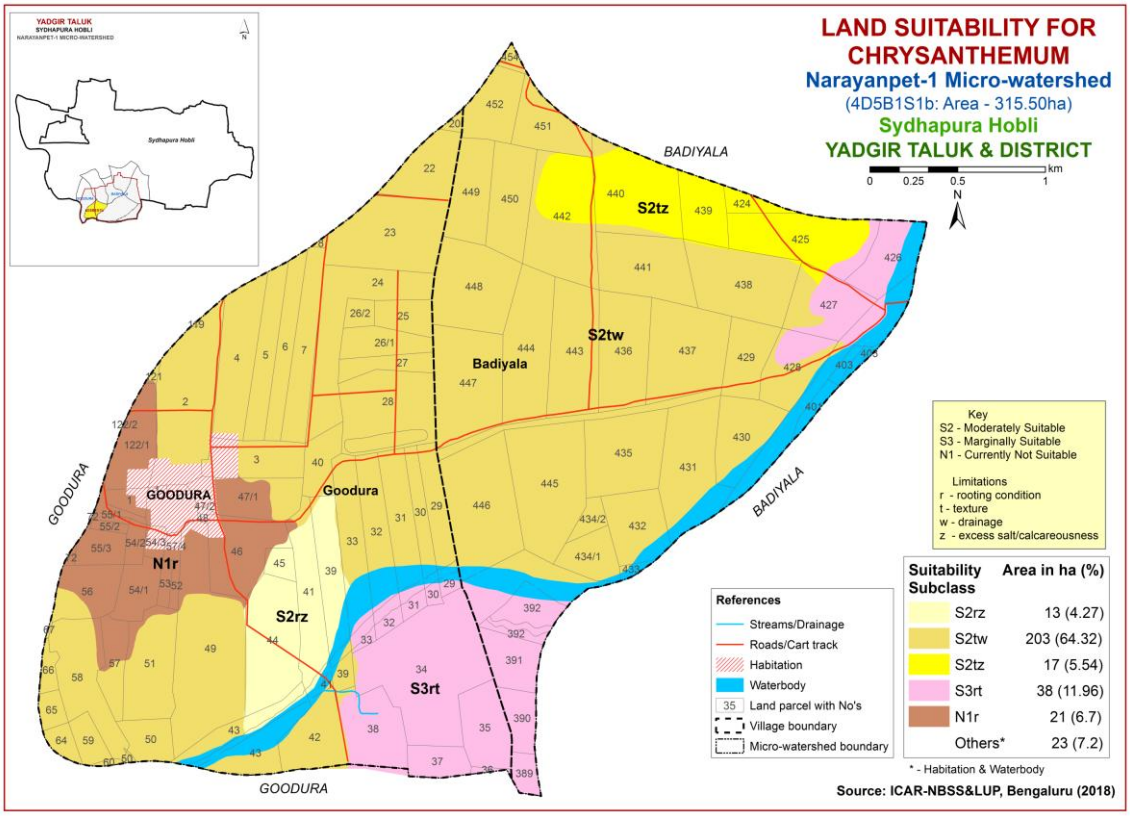


Fig. 7.26 Land Suitability map of Chrysanthemum

In Narayanpet-1 microwatershed, there are no lands that are highly (Class S1) suitable for growing Chrysanthemum. Maximum area of about 233 ha (74%) is moderately suitable (Class S2) for growing marigold with minor limitations of drainage, rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands occur in an area of 38 ha (12%) and are distributed in the northeastern and southwestern part of the microwatershed with moderate limitations of rooting depth and texture. Currently Not suitable (Class N1) lands occur in an area of 21 ha (7%) and are distributed in the western and central part of the microwatershed with severe limitation of rooting depth.

7.27 Land Management Units (LMUs)

The 7 soil map units identified in Narayanpet-1 microwatershed have been grouped into six Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig.7.27) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The 6 soil map units that have been grouped into six Land Management Units along with brief description of soil and site characteristics are given below.

LMU NO.	Soil Map Unit	Soil and site characteristics
1	103.TMKhA1 104.TMKiB2	Very deep, lowland black clay soils, slopes 0-3%, non gravelly, slight to moderate erosion
2	48.NGPiB2	Deep black loamy sand soils, slopes 1-3%, non gravelly, moderate erosion
3	35.GWDiB2	Moderately deep, black calcareous clay soils, slopes 1-3%, non gravelly, moderate erosion
4	17.HLGiB2	Moderately shallow, black sandy clay loam to sandy clay soils, slopes 1-3%, moderate erosion
5	6.BDLiB3	Shallow, black clay soils, slopes 1-3%, non gravelly, severely eroded
6	1.BDPiB2	Very shallow, black clay soils, slopes 1-3%, non gravelly, moderate erosion

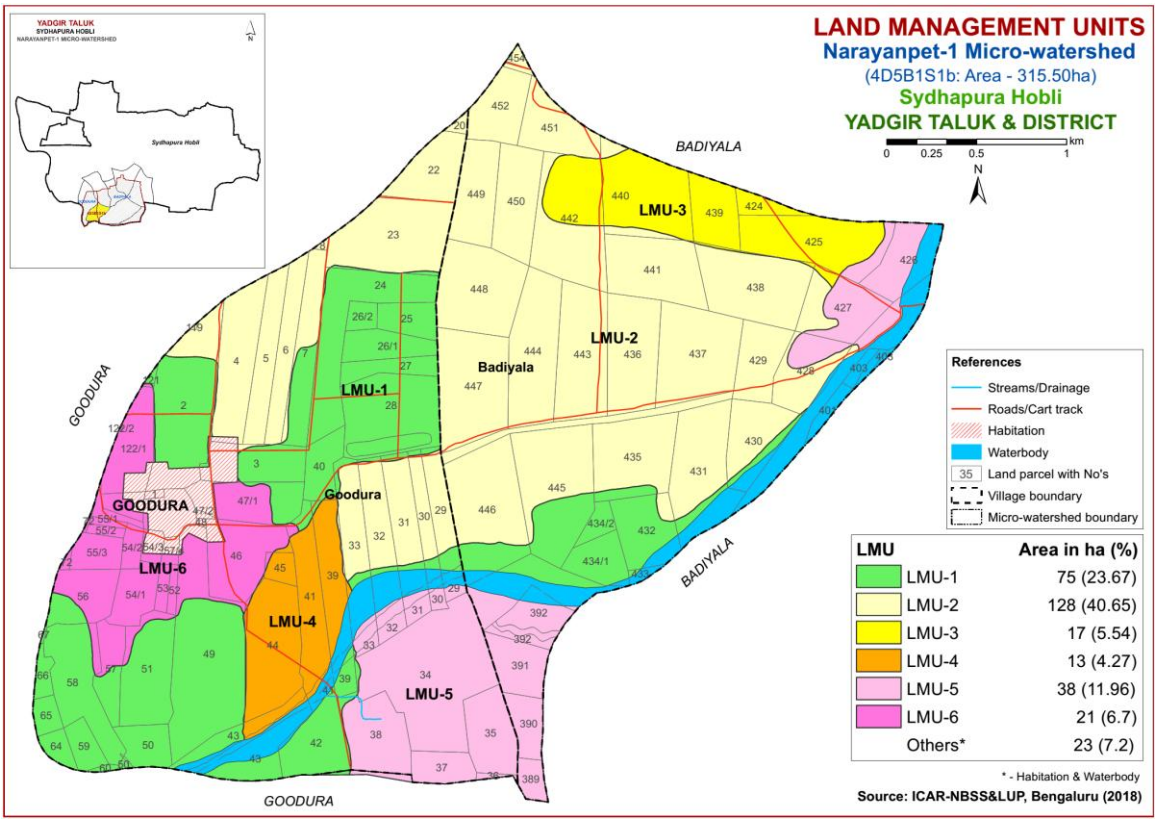


Fig. 7.27 Land Management Units (LMU's) map of Narayanpet-1 microwatershed

7.28 Proposed Crop Plan for Narayanpet-1 Microwatershed

After assessing the land suitability for the 26 crops, a 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 26 crops. The resultant proposed crop plan is presented in Table 7.26.

Table 7.28 Proposed Crop Plan for Narayanpet-1 Micro watershed

Proposed LMU	Soil Map Units	Survey Number	Soil characters	Field Crops	Horticulture Crops	Suitable Interventions
1	103.TMKhA1 104.TMKiB2	**Badiyala :** 432,434/1,434/2 **Goodura:**2,3,24,25,26/1,26/2,27,28,40,42,43,49,50,51,58,59,60,64,65,66,67, 121	Very deep, lowland black clay soils, slopes 0-3%, non gravelly, slight to moderate erosion	Sunflower, Cotton, Bengal gram, Bajra	**Fruit crops:** Lime, Musambi, Amla, Jamun **Vegetables:** Chilli, Drumstick, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, suitable soil and water conservation practices
2	48.NGPiB2	**Badiyala:**428,429,430,431,435,436,437,438,441,442,443,444,445,446,447,448,449,450, 451,452, 454 **Goodura:**4,5,6,7,8,20,22,23, 29, 30,31,32,33,119	Deep black loamy sand soils, slopes 1-3%, non gravelly, moderate erosion	Bajra	**Fruit crops:** Amla, Jamun, Custard apple, Tamarind **Vegetables:** Drumstick	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
3	35.GWDiB2	**Badiyala:** 424,425,439,440	Moderately deep, black calcareous clay soils, slopes 1-3%, non gravelly, moderate erosion	Sunflower, Sorghum, Maize, Cotton, Bengal gram, Soybean, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Jamun, Amla, Custard apple **Vegetables:** Bhendi, Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
4	17.HLGiB2	**Goodura :** 39,41,44,45	Moderately shallow, black sandy clay loam to sandy clay soils, slopes 1-3%,	Sunflower, Cotton, Bengal gram, Bajra	**Fruit crops:** Lime, Musambi, Amla, Jamun **Vegetables:**	Application of FYM, Biofertilizers and micronutrients, suitable soil and

			moderate erosion		Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	water conservation practices
5	6.BDLiB3	**Badiyala**:389,390,391,392,426, 427 **Goodura:** 34,35,36,37,38	Shallow, black clay soils, slopes 1-3%, non gravelly, severely eroded	Bajra	**Fruit crops:** Amla, Jamun, Custard apple, Tamarind **Vegetables:** Drumstick	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
6	1.BDPiB2	**Goodura:**1,46,47/1,52,53,54/1,54/2,55/1,55/2,55/3,56,57,72,122/1,122/2	Very shallow, black clay soils, slopes 1-3%, non gravelly, moderate erosion	Sunflower, Bengal gram, Soybean, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Jamun, Amla, Custard apple **Vegetables:** Bhendi, Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, 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 unfavourable conditions occur

Characteristics of Narayanpet-1 Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of NGP (128 ha), TMK (75 ha), BDL (38 ha), BDP (21 ha), GWD (17 ha) and HLG (13 ha).
- As per land capability classification, entire area comes under arable land category (Class II and IV). The major limitations identified in the arable lands were soil, drainage/wetness and erosion.
- On the basis of soil reaction, an area of about 8 ha (2%) is neutral (pH 6.5-7.3), 18 ha (6%) is slightly alkaline (pH 7.3-7.8), 71 (23%) is moderately alkaline (pH 7.8-

8.4), 159 ha (50%) is strongly alkaline (pH 8.4-9.0) and 37 ha (12%) is very strongly alkaline (pH >9.0) in reaction. Thus, major portion of the area in the microwatershed is alkaline 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

(Slightly alkaline to moderately alkaline soils)

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

Neutral soils

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

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

Soil Degradation

Soil erosion is one of the major factor affecting the soil health in the microwatershed. An area of 13 ha (4%) is slightly eroded. Maximum area of 280 ha in the microwatershed is suffering from moderate and severe erosion. These areas require immediate soil and water conservation and other 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 (Saturation Plan) in IWMP is focusing on preparation of

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

   In this connection, how various outputs of Sujala-III are of use in addressing these objectives of Net Planning (Saturation Plan) 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 may be adopted.
- **Gravelliness:** More gravel content is favourable 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, drainage/wetness and soil are the major constraints in Narayanpet-1 microwatershed.
- **Organic Carbon:** In an area of about 59 ha (19%), the OC content is low (<0.5%), 107 ha (34%) is medium (0.5-0.75%) and about 126 ha (40%) area is high (>0.75%). In the areas of low and medium OC, needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops cost Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen

fertilizer needs to be supplemented by 25% in addition to the recommended level in 166 ha area where OC is <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 in these plots.

- **Available Phosphorus**: In 95 ha (30%) area, the available phosphorus is low and about 136 ha (43%) is medium. Hence for all the crops, 25% additional P-needs to be applied, where it is low or medium in available phosphorus. It is high in 61 ha (19%) area of the microwatershed.
- **Available Potassium:** Available potassium is high in the entire area of the microwatershed.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is low in 28 ha (9%) area of the microwatershed and medium in 80 ha (25%). These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected. It is high in an area of 185 ha (59%).
- **Available Boron:** It is low in 169 ha (54%) area of the microwatershed and medium in 122 ha (39%). For all these areas, application of borax @ 10 kg/ha as soil application and 0.2% sodium tetra borate as foliar spray on standing crop. High in small area of about 1 ha (<1%) in the microwatershed.
- **Available Iron:** It is deficient in 131 ha (42%) area and it is sufficient in 162 ha (51%) area in the microwatershed. To manage iron deficiency, iron sulphate @ 25 ka/ha needs to be applied.
- **Available Manganese:** Entire area of 293 ha (93%) in the microwatershed is sufficient (>1.0 ppm) in available manganese content.
- **Available Copper:** Entire area of 293 ha (93%) in the microwatershed is sufficient (>0.2 ppm) in available copper content.
- **Available Zinc:** About 187 ha (59%) area is deficient in available zinc. In these areas application of zinc sulphate @25kg/ha is to be followed. Around 106 ha (34%) area is sufficient (>0.6 ppm).

Soil alkalinity: An area of about 285 ha (90%) in the microwatershed has soils that are alkaline in reaction. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and, provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc., are recommended.

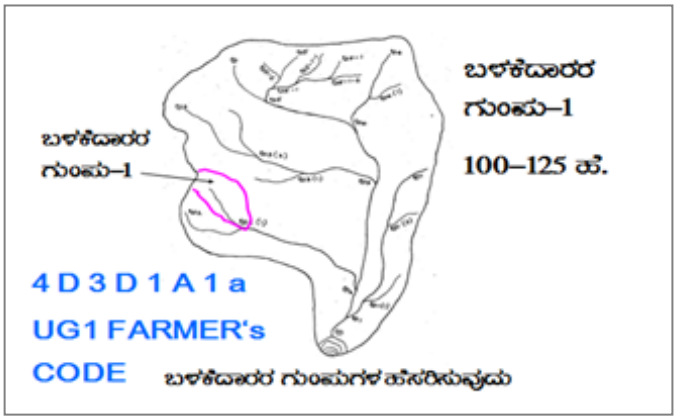
Land Suitability for various crops: Areas that are highly, moderately, marginally and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth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

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



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

Steps for Survey and Preparation of Treatment Plan

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

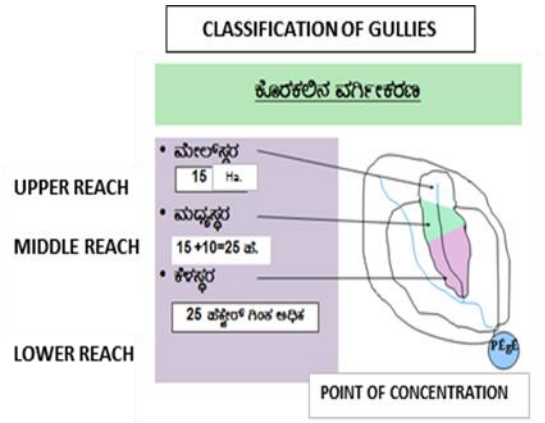
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

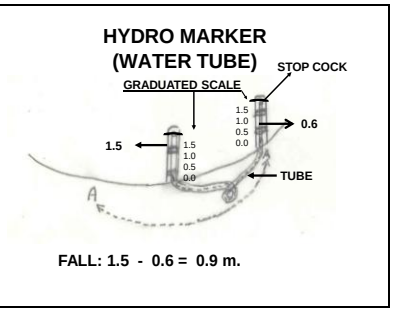
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

Bund section is decided considering the soil texture class and gravelliness class ($bg_{0...}$ b=loamy sand, g_0 = <15% gravel). The recommended sections for different soils are given below.

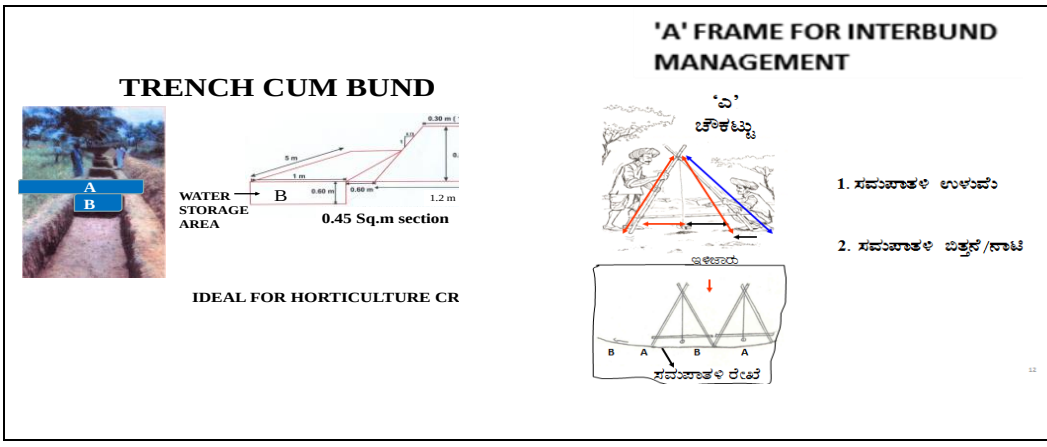
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soil	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow black 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
m^2	m	m^3	L(m)	W(m)	D(m)	Quantity (m^3)	m	
0.375	6	2.25	5.85	0.85	0.45	2.24	0.15	Shallow
0.45	6	2.7	5.4	1.2	0.43	2.79	0.6	Shallow
0.45	6	2.7	5	0.85	0.65	2.76	1	Moderately Shallow
0.54	5.6	3.02	5.5	0.85	0.7	3.27	0.1	Moderately shallow
0.54	5.5	2.97	5	1.2	0.5	3	0.5	Shallow
0.72	6.2	4.46	6	1.2	0.7	5.04	0.2	Moderately shallow
0.72	5.2	3.74	5.1	0.85	0.9	3.9	0.1	Moderately deep

B. Water Ways

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas/hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff in water budgeting and quality of water in the wells and site suitability.
e) Detailed Levelling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthen 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 the kind of conservation structures recommended has been prepared, which shows the spatial distribution and extent of area. Small area of about 21 ha (7%) requires Trench cum bunding, maximum area of 259 ha (82%) requires Graded Bunding and 13 ha (4%) requires Strengthening of existing bunds.

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

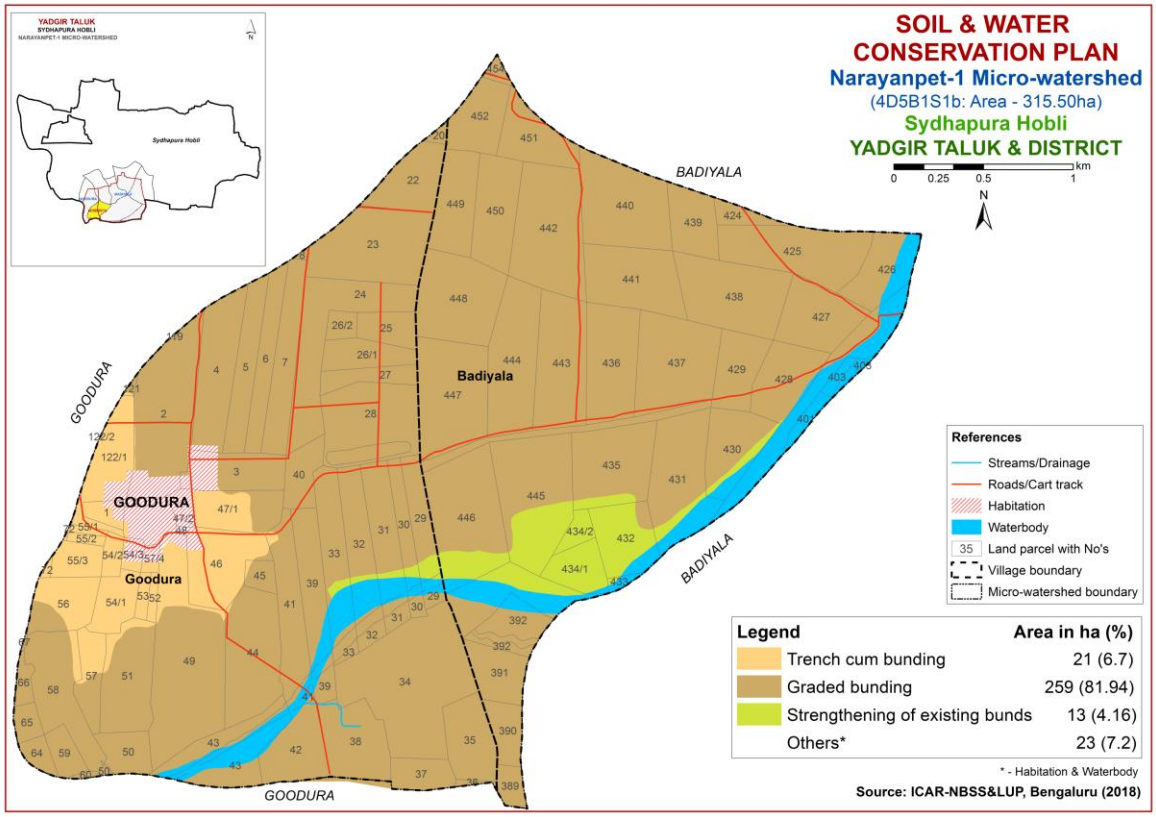


Fig. 9.1 Soil and Water Conservation Plan map of Narayanpet-1 Microwatershed

9.3 Greening of Microwatershed

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

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

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like Nerale (*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

Narayanpet-1 Microwatershed

Soil Phase Information

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Goodura	1	0.91	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	2	7.74	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	3	3.2	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	4	4.79	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	5	3.04	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	6	2.72	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	7	3.62	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Goodura	8	0.08	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	20	0.24	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	22	3.06	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	23	6.52	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	24	6.21	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	25	1.6	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	26/1	2.03	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	26/2	0.69	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	27	1.45	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	28	5.32	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	29	2.5	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+Cotton (Rg+Ct)	Not Available	IIes	Graded bunding
Goodura	30	1.85	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	31	3.55	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Redgram (Jw+Rg)	Not Available	IIes	Graded bunding
Goodura	32	3.73	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Goodura	33	3.87	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Goodura	34	11.16	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Jowar+Cotton+Paddy+Redgram(Jw+Ct+Pd+Rg)	Not Available	IVes	Graded bunding
Goodura	35	3.15	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Jowar+Redgram (Jw+Rg)	Not Available	IVes	Graded bunding
Goodura	36	0.15	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Goodura	37	1.62	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Goodura	38	3.96	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IVes	Graded bunding
Goodura	39	3.78	HLGiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	40	1.79	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	41	3.91	HLGiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	42	3.28	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	43	4.31	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	44	5.74	HLGiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Goodura	45	0.76	HLGiB2	LMU-4	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Goodura	46	4.19	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	47/1	3.58	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	47/2	0.09	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Goodura	48	0.06	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Goodura	49	10.4	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	50	1.75	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	51	4.58	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	52	0.35	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	53	0.46	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	54/1	1.96	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	54/2	0.69	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	54/3	0.57	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Goodura	55/1	0.22	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	55/2	0.31	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	55/3	1.42	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	56	2.83	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	57	1.94	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	57/4	0.38	Habitation	Others	Others	Others	Others	Others	Others	Others	Habitation	Not Available	Others	Others
Goodura	58	4.73	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	59	1.12	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	60	0.13	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	64	0.76	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	65	0.76	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	66	0.63	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	67	0.04	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	72	0.17	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	119	0.02	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Goodura	121	0.12	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Goodura	122/1	3.15	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Goodura	122/2	0.01	BDPiB2	LMU-6	Very shallow (<25 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IVs	Trench cum bunding
Badiyala	389	0.88	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IVes	Graded bunding
Badiyala	390	1.59	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	391	2.38	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	392	2.13	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Groundnut (Gn)	Not Available	IVes	Graded bunding
Badiyala	401	0.6	Water body	Others	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others
Badiyala	403	0.47	Water body	Others	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Badiyala	424	0.89	GWDiB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	425	5.92	GWDiB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	426	3.15	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	427	3.82	BDLiB3	LMU-5	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Badiyala	428	3.36	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	429	2.81	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	430	3.61	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	431	6.1	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	432	3.4	TMKhA1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Cotton (Ct)	Not Available	IIws	Strengthening of existing bunds
Badiyala	433	0.28	Water body	Others	Others	Others	Others	Others	Others	Others	Water body	Not Available	Others	Others
Badiyala	434/1	2.06	TMKhA1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Redgram (Rg)	Not Available	IIws	Strengthening of existing bunds
Badiyala	434/2	0.78	TMKhA1	LMU-1	Very deep (>150 cm)	Sandy clay loam	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Not Available (NA)	Not Available	IIws	Strengthening of existing bunds
Badiyala	435	5.28	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	436	4.97	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	437	6.07	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	438	5.98	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	439	2.6	GWDiB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	440	6.13	GWDiB2	LMU-3	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	441	4.96	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	442	7.17	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	443	5.55	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Badiyala	444	5.83	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Redgram (Jw+Rg)	Not Available	IIes	Graded bunding
Badiyala	445	7.55	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Badiyala	446	7.29	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding

Village	Survey No	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Badiyala	447	6.38	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Badiyala	448	5.78	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	449	3.43	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	450	3.9	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	451	3.03	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	452	2.89	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Badiyala	454	0.23	NGPiB2	LMU-2	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding

Appendix II

Narayanpet-1 Microwatershed

Soil Fertility Information

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Goodura	1	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Habitation	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	3	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	4	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	5	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	6	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	7	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)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	8	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	20	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)
Goodura	22	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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)
Goodura	23	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)
Goodura	24	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)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	25	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)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	26/1	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)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	26/2	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	27	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	28	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)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	29	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	30	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	31	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	33	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Goodura	34	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	36	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	37	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	38	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	39	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	40	Strongly alkaline (pH 8.4 – 9.0)	Low (2 – 4 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	41	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	42	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	43	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	44	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	45	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	46	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	47/1	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	47/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Goodura	48	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Goodura	49	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	50	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	51	Neutral (pH 6.5 – 7.3)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	52	Neutral (pH 6.5 – 7.3)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	53	Neutral (pH 6.5 – 7.3)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	54/1	Neutral (pH 6.5 – 7.3)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	54/2	Neutral (pH 6.5 – 7.3)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	54/3	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Goodura	55/1	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	55/2	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Goodura	55/3	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	56	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	57	Slightly alkaline (pH 7.3 – 7.8)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	57/4	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Goodura	58	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	59	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	60	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	64	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	65	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	66	Moderately alkaline (pH 7.8 – 8.4)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	67	Slightly alkaline (pH 7.3 – 7.8)	Low (2 – 4 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	72	Slightly alkaline (pH 7.3 – 7.8)	Medium (4 – 8 dsm)	High (> 0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	119	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	121	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Goodura	122/1	Moderately alkaline (pH 7.8 – 8.4)	Medium (4 – 8 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Goodura	122/2	Moderately alkaline (pH 7.8 – 8.4)	Medium (4 – 8 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	389	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	390	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	391	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	392	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	401	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	403	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	424	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	425	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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)
Badiyala	426	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 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)	Sufficient (> 0.6 ppm)
Badiyala	427	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)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Badiyala	428	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)
Badiyala	429	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Badiyala	430	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	431	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	432	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	433	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Badiyala	434/1	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	434/2	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	435	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Badiyala	436	Very strongly alkaline (pH > 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)
Badiyala	437	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)
Badiyala	438	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Badiyala	439	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	440	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	441	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Badiyala	442	Very strongly alkaline (pH > 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)
Badiyala	443	Very strongly alkaline (pH > 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)
Badiyala	444	Very strongly alkaline (pH > 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 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)
Badiyala	445	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 – 0.75 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	446	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 0.75 %)	Medium (23 – 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 – 1.0 ppm)	Sufficient (>4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	447	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)	High (> 20 ppm)	Low (< 0.5 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Badiyala	448	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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)
Badiyala	449	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	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)
Badiyala	450	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 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)
Badiyala	451	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)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Badiyala	452	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)
Badiyala	454	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)

Appendix III

Narayanpet-1 Microwatershed

Soil Suitability Information

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Goodura	1	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	2	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	3	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	4	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	5	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	6	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	7	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	8	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	20	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	22	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	23	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	24	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	25	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	26/1	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	26/2	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	27	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	28	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	29	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	30	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	31	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	32	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	33	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	34	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Goodura	35	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Goodura	36	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Goodura	37	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Goodura	38	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Goodura	39	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Goodura	40	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	41	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Goodura	42	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	43	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	44	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Goodura	45	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Goodura	46	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	47/1	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	47/2	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
Goodura	48	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
Goodura	49	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	50	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	51	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Goodura	52	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	53	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	54/1	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	54/2	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	54/3	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
Goodura	55/1	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	55/2	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	55/3	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	56	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	57	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	57/4	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
Goodura	58	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	59	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	60	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	64	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	65	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	66	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	67	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	72	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	119	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Goodura	121	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Goodura	122/1	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Goodura	122/2	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r	N1r
Badiyala	389	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	390	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	391	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	392	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	401	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
Badiyala	403	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
Badiyala	424	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	425	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	426	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	427	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Badiyala	428	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	429	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	430	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	431	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	432	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	433	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
Badiyala	434/1	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	434/2	S3tw	S2tw	S3tw	S1	S3tw	S1	S2tw	S2zw	S1	S2rw	S2tw	S1	S3tw	S1	N1tz	S2tw	S2zw	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Badiyala	435	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	436	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	437	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	438	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Red gram	Amla	Jackfruit	Custard apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drum stick	Mulberry
Badiyala	439	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	440	S3rz	S2tz	S3tz	S2zw	S3tz	S2rz	S3rz	S2rz	S2zw	S2rz	S2rz	S2zw	S3tz	S1	N1t	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2z	S2rz	S3tz
Badiyala	441	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	442	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	443	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	444	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	445	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	446	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	447	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	448	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	449	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	450	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	451	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	452	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Badiyala	454	S3t	S2t	S3t	S2w	S3t	S1	S2t	S1	S1	S2w	S2tw	S2t	S3t	S1	N1t	S2t	S1	S3tw	S3tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

CONTENTS

LIST OF TABLES

Chapter 1

SALIENT FINDINGS OF THE SURVEY

- *The data on households sampled for socio economic survey indicated that 35 farmers were sampled in Narayanpet-1 micro-watershed among them 4 (11.43 %) were landless, 6 (17.14 %) were marginal farmers, 14 (40 %) were small farmers, 9 (25.71 %) were semi medium farmers and 2 (5.71 %) were medium farmers.*
- *The data indicated that there were 94 (58.39 %) men and 67 (41.61 %) women among the sampled households. The average family size of landless farmers' was 4, marginal farmers' was 4.8, small farmers' was 4.6, semi medium farmers' was 5.7 and medium farmers' was 6.*
- *The data indicated that, 38 (23.60 %) people were in 0-15 years of age, 71 (44.10 %) were in 16-35 years of age, 43 (26.71 %) were in 36-60 years of age and 9 (5.59 %) were above 61 years of age.*
- *The results indicated that Narayanpet-1 had 41.61 per cent illiterates, 0.62 per cent Functional Literate, 29.19 per cent of them had primary school, 5.59 per cent of them had middle school, 7.45 per cent of them had high school education, 4.97 per cent of them had PUC, 1.24 per cent of them had Diploma, 0.62 per cent of them had ITI, 4.35 per cent of them had Degree and 1.24 per cent of them had Masters education.*
- *The results indicate that, 65.71 per cent of household heads were practicing agriculture, 14.29 per cent of the household heads were agricultural labourers, 17.14 per cent of the household heads were General labourers and 5.71 per cent of the household heads were Housewives.*
- *The results indicate that agriculture was the major occupation for 42.24 per cent of the household members, 8.70 per cent were agricultural labourers, 9.94 per cent were General Labour, 0.62 per cent were Government Service, 3.11 per cent were Private Service, 24.22 per cent were Student, 6.83 per cent were Housewife and 3.73 per cent were children.*
- *The results show that, 0.62 per cent of the population in the micro watershed has participated in User Group.*
- *The results indicate that 8.57 per cent of the households possess thatched house, 77.14 per cent of the households possess katcha house and 14.29 per cent of them possess pucca/RCC house.*
- *The results show that 68.57 per cent of the households possess TV, 42.86 per cent of the households possess mixer/grinder, 20 per cent of the households possess Bicycle, 28.57 per cent of the households possess Motor Cycle, 2.86 per cent of the households possess auto and Landline Phone and 94.29 per cent of the households possess mobile phones.*

- *The results show that the average value of television was Rs. 3,645, mixer/grinder was Rs. 1,400, Bicycle was Rs. 1,142, motor cycle was Rs. 32,500, auto was Rs. 60,000, Landline Phone was Rs. 2,000 and mobile phone was Rs. 1,280.*
- *About 8.57 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 5.71 per cent of them possess seed/fertilizer drill, 2.86 per cent of them possess tractor, 5.71 per cent of them possess Sprayer and 74.29 per cent of them possess Weeder.*
- *The results show that the average value of bullock cart was Rs. 25,000, plough was Rs. 2,500, seed/fertilizer drill was Rs. 3,500, tractor was Rs. 700,000, sprayer was Rs. 3,750 and weeder was Rs. 30.*
- *The results indicate that, 34.29 per cent of the households possess bullocks, 2.86 per cent of the households possess local cow and 5.71 per cent of the households possess Sheep.*
- *The results indicate that, average own labour men available in the micro watershed was 1.45, average own labour (women) available was 1.39, average hired labour (men) available was 13.61 and average hired labour (women) available was 14.42.*
- *The results indicate that, 88.57 per cent of the households opined that the hired labour was adequate.*
- *The results indicate that, households of the Narayanpet-1 micro-watershed possess 58.53 ha (98.64 %) of dry land and 0.81 ha (1.36 %) of irrigated land. Marginal farmers possess 4.18 ha (100 %) of dry land. Small farmers possess 20.19 ha (96.15 %) of dry land and 0.81 ha (3.85 %) of irrigated land. Semi medium farmers possess 24.76 ha (100%) of dry land. Medium farmers possess 9.40 ha (100%) of dry land.*
- *The results indicate that, the average value of dry land was Rs. 284,349.72 and the average value of irrigated land was Rs. 988,000. In case of marginal famers, the average land value was Rs. 728,578.34 for dry land. In case of small famers, the average land value was Rs. 309,430.75 for dry land and Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 246,273.29 for dry land. In case of medium farmers, the average land value was Rs. 132,967.27 for dry land.*
- *The results indicate that, canal was the major irrigation source in the micro water shed for 2.86 per cent of the farmers.*
- *The results indicate that, small farmers had an irrigated area of 0.81 ha.*
- *The results indicate that, farmers have grown red gram (14.01 ha), cotton (33.81 ha), paddy (0.81 ha), Red gram (14.01 ha) and Sorghum (7.81 ha). Marginal farmers have grown red gram and cotton. Small farmers have grown red gram, cotton, sorghum and paddy. Semi medium farmers have grown sorghum, red gram and cotton. Medium farmers have grown red gram and cotton.*

- *The results indicate that, the cropping intensity in Narayanpet-1 micro-watershed was found to be 90.89 per cent.*
- *The results indicate that, 57.14 per cent of the households have bank account.*
- *The results indicate that, 57.14 per cent of the households have availed credit from different sources.*
- *The results indicate that, the total cost of cultivation for Cotton was Rs. 24097.92. The gross income realized by the farmers was Rs. 50036.33. The net income from Cotton cultivation was Rs. 25938.41. Thus the benefit cost ratio was found to be 1: 2.08.*
- *The results indicate that, the total cost of cultivation for Sorghum was Rs. 10861.55. The gross income realized by the farmers was Rs. 24428.78. The net income from Sorghum cultivation was Rs. 13567.23. Thus the benefit cost ratio was found to be 1: 2.25.*
- *The results indicate that, the total cost of cultivation for Red gram was Rs. 20532.37. The gross income realized by the farmers was Rs. 31589.33. The net income from Red gram cultivation was Rs. 11056.96. Thus the benefit cost ratio was found to be 1: 1.54.*
- *The results indicate that, the total cost of cultivation for Paddy was Rs. 33932.61. The gross income realized by the farmers was Rs. 160550. The net income from Paddy cultivation was Rs. 126617.39. Thus the benefit cost ratio was found to be 1: 4.73.*
- *The results indicate that, 42.86 per cent of the households opined that dry fodder was adequate.*
- *The results indicate that the annual gross income was Rs. 162,500 for landless farmers, for marginal farmers it was Rs. 65,016.67, for small farmers it was Rs. 117,403.57, semi medium farmers it was Rs. 182,027.78 and medium farmers it was Rs. 179,500.*
- *The results indicate that the average annual expenditure is Rs. 17,092.40. For landless households it was Rs. 30,625, for marginal farmers it was Rs. 2,833.33, for small farmers it was Rs. 12,643.71, for semi medium farmers it was Rs. 23,246.91 and medium farmers it was Rs. 36,250.*
- *The results indicate that, sampled households have grown 1mango trees in their field.*
- *The results indicate that, households have planted 4 Teak, 30 neem, 2 tamarind, 6 Banyan and 2 acacia trees in their field and also 2 teak and 5 neem in backyard.*
- *The results indicated that, households have an average investment capacity of Rs. 12,942.86 for land development Rs. 18,142.86 for Irrigation facility, Rs. 1,228.57 for improved crop production and Rs. 2,485.71 for improved livestock management.*

- *The results indicated that Government subsidy was the source of additional investment for 2.78 per cent for land development and improved livestock management, Loan from bank was the source of additional investment for 22.22 per cent for land development and 13.89 per cent for irrigation facility, 25 per cent for improved crop production and 16.67 per cent for improved livestock management, soft loan was the source of additional investment for 2.78 per cent for improved livestock management.*
- *The results indicated that, cotton was sold to the extent of 100 per cent, Paddy was sold to the extent of 60 per cent, Redgram was sold to the extent of 71.26 per cent and Sorghum to the extent of 90.48 per cent.*
- *The results indicated that, about 94.29 per cent of the farmers sold their produce to local/village merchants.*
- *The results indicated that, 2.86 per cent of the households have used cart as a mode of transportation and 91.43 per cent of the households have used Tractor as a mode of transportation.*
- *The results indicated that, 88.57 per cent of the households have experienced soil and water erosion problems in the farm.*
- *The results indicated that, 88.57 per cent have shown interest in soil test.*
- *The results indicated that, 85.71 per cent of the households used firewood, 5.71 per cent of the households used Kerosene and 14.29 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 94.29 per cent and 2.86 per cent of the households used bore well in the micro watershed.*
- *The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- *The results indicated that, 48.57 per cent of the households possess sanitary toilet facility.*
- *The results indicated that, 97.14 per cent of the sampled households possessed BPL cards and 2.86 per cent of the sampled households Not Possessed.*
- *The results indicated that, 65.71 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 97.14 per cent of the households, oilseed were adequate for 88.57 per cent, vegetables were adequate for 65.71 per cent, milk were adequate for 80 per cent and Egg were adequate for 8.57 per cent.*
- *The results indicated that, pulses were inadequate for 2.86 per cent of the households, oilseeds were inadequate for 11.43 per cent, vegetables were inadequate for 31.43 per cent, fruits were inadequate for 100 per cent, milk were*

inadequate for 20 per cent, egg were inadequate for 88.57 per cent and meat were inadequate for 100 per cent of the households.

- *The results indicated that, lower fertility status of the soil, wild animal menace on farm field and Frequent incidence of pest and diseases was the constraint experienced by 88.57 per cent of the households, Inadequacy of irrigation water (2.86 %), High cost of Fertilizers and plant protection chemicals, High rate of interest on credit and Low price for the agricultural commodities (85.71 %), Lack of marketing facilities in the area (82.86 %), high rate of interest on credit (11.43%), low price for the agricultural commodities (20%), lack of marketing facilities in the area (17.14%), Inadequate extension services (5.71 %) and lack of transport for safe transport of the Agril produce to the market (80%).*

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**

Yadgir District is one of the 30 districts of Karnataka state in southern India. This district was carved out from the erstwhile Gulbarga district as the 30th district of Karnataka on 10 April 2010. Yadgir town is the administrative headquarters of the district. The district comprises of 3 taluks namely, Shahapur, Yadgiri and Shorapur (There are 16 hoblies, 117 Gram Panchayats, 4 Municipalities,8 Towns/ Urban agglomeration and 487 inhabited & 32 un-inhabited villages The district occupies an area of 5,160.88 km².

Yadgir district is the second smallest district in the state, area wise is very rich in cultural traditions. The vast stretch of fertile black soil of the district is known for bumper red gram and jowar crops. The district is a "Daal bowl" of the state. The district is also known for cluster of cement industries and a distinct stone popularly known as "Malakheda Stone". Two main rivers, Krishna and Bhima, and a few tributaries flow in this region. Krishna and Bhima Rivers drain the district. They constitute the two major river basins of the district. Kagna and Amarja are the two sub - basins of Bhima River, which occur within the geographical area of the district

According to the 2011 census Yadgir district has a population of 1, 172,985, roughly equal to the nation of Timor-Lesteor the US state of Rhode Island. This gives it a ranking of 404th in India (out of a total of 640). The district has a population density of 224 inhabitants per square kilometre (580/sq mi). Its population growth rate over the decade 2001-2011 was 22.67%. Yadgir has a sex ratio of 984 females for every 1000 males, and a literacy rate of 52.36%.

Description of the micro watershed

Narayanpet-1 micro-watershed in Kodlur sub-watershed (Yadgir taluk and district) is located in between $16^0$29’47.507’’ to $16^0$28’37.175’’ North latitudes and $77^0$15’47.017’’ to $77^0$14’15.481’’East longitudes, covering an area of about 315.36 ha, bounded by Badiyala and Goodura villages.

Methodology followed in assessing socio-economic status of households

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

Chapter 4

SALIENT FEATURES OF THE SURVEY

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Narayanpet-1 micro-watershed is presented in Table 1 and it indicated that 35 farmers were sampled in Narayanpet-1 micro-watershed among them 4 (11.43 %) were landless, 6 (17.14 %) were marginal farmers, 14 (40 %) were small farmers, 9 (25.71 %) were semi medium farmers and 2 (5.71 %) were medium farmers.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	4	11.43	6	17.14	14	40	9	25.71	2	5.71	35	100

Population characteristics: The population characteristics of households sampled for socio-economic survey in Narayanpet-1 micro-watershed is presented in Table 2. The data indicated that there were 94 (58.39 %) men and 67 (41.61 %) women among the sampled households. The average family size of landless farmers' was 4, marginal farmers' was 4.8, small farmers' was 4.6, semi medium farmers' was 5.7 and medium farmers' was 6.

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

Sl.No.	Particulars	LL (16)		MF (29)		SF (60)		SMF (43)		MDF (13)		All (161)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	10	62.50	16	55.17	35	58.33	26	60.47	7	53.85	94	58.39
2	Women	6	37.50	13	44.83	25	41.67	17	39.53	6	46.15	67	41.61
Total		16	100	29	100	60	100	43	100	13	100	161	100
Average		4		4.83		4.28		4.77		6.5		4.6	

Age wise classification of population: The age wise classification of household members in Narayanpet-1 micro-watershed is presented in Table 3. The data indicated that, 38 (23.60 %) people were in 0-15 years of age, 71 (44.10 %) were in 16-35 years of age, 43 (26.71 %) were in 36-60 years of age and 9 (5.59 %) were above 61 years of age.

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

Sl. No.	Particulars	LL (16)		MF (29)		SF (60)		SMF (43)		MDF (13)		All (161)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	6	37.50	11	37.93	11	18.33	10	23.26	0	0	38	23.60
2	16-35 years of age	5	31.25	11	37.93	25	41.67	21	48.84	9	69.23	71	44.10
3	36-60 years of age	5	31.25	7	24.14	19	31.67	9	20.93	3	23.08	43	26.71
4	> 61 years	0	0	0	0	5	8.33	3	6.98	1	7.69	9	5.59
Total		16	100	29	100	60	100	43	100	13	100	161	100

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

Narayanpet-1 had 41.61 per cent illiterates, 0.62 per cent Functional Literate, 29.19 per cent of them had primary school, 5.59 per cent of them had middle school, 7.45 per cent of them had high school education, 4.97 per cent of them had PUC, 1.24 per cent of them had Diploma, 0.62 per cent of them had ITI, 4.35 per cent of them had Degree and 1.24 per cent of them had Masters education.

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

Sl. No.	Particulars	LL (16)		MF (29)		SF (60)		SMF (43)		MDF (13)		All (161)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	6	37.50	7	24.14	32	53.33	17	39.53	5	38.46	67	41.61
2	Functional Literate	0	0	0	0	1	1.67	0	0	0	0	1	0.62
3	Primary School	6	37.50	14	48.28	11	18.33	13	30.23	3	23.08	47	29.19
4	Middle School	1	6.25	2	6.90	4	6.67	2	4.65	0	0	9	5.59
5	High School	1	6.25	3	10.34	2	3.33	4	9.30	2	15.38	12	7.45
6	PUC	2	12.50	0	0	4	6.67	1	2.33	1	7.69	8	4.97
7	Diploma	0	0	1	3.45	1	1.67	0	0	0	0	2	1.24
8	ITI	0	0	0	0	1	1.67	0	0	0	0	1	0.62
9	Degree	0	0	2	6.90	1	1.67	3	6.98	1	7.69	7	4.35
10	Masters	0	0	0	0	0	0	1	2.33	1	7.69	2	1.24
11	Others	0	0	0	0	3	5	2	4.65	0	0	5	3.11
Total		16	100	29	100	60	100	43	100	13	100	161	100

Occupation of household heads: The data regarding the occupation of the household heads in Narayanpet-1 micro-watershed is presented in Table 5. The results indicate that, 65.71 per cent of household heads were practicing agriculture, 14.29 per cent of the household heads were agricultural labourers, 17.14 per cent of the household heads were General labourers and 5.71 per cent of the household heads were Housewives.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	3	50	11	78.57	8	88.89	1	50	23	65.71
2	Agricultural Labour	2	50	1	16.67	1	7.14	1	11.11	0	0	5	14.29
3	General Labour	2	50	2	33.33	2	14.29	0	0	0	0	6	17.14
4	Housewife	0	0	0	0	1	7.14	0	0	1	50	2	5.71
Total		4	100	6	100	15	100	9	100	2	100	36	100

Occupation of the household members: The data regarding the occupation of the household members in Narayanpet-1 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 42.24 per cent of the household members, 8.70 per cent were agricultural labourers, 9.94 per cent were General Labour, 0.62 per cent were Government Service, 3.11 per cent were Private Service, 24.22 per cent were Student, 6.83 per cent were Housewife and 3.73 per cent were children.

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

Sl. No.	Particulars	LL (16)		MF (29)		SF (60)		SMF (43)		MDF (13)		All (161)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	0	0	7	24.14	33	55	22	51.16	6	46.15	68	42.24
2	Agricultural Labour	5	31.25	2	6.90	3	5	3	6.98	1	7.69	14	8.70
3	General Labour	3	18.75	6	20.69	6	10	1	2.33	0	0	16	9.94
4	Government Service	0	0	0	0	0	0	0	0	1	7.69	1	0.62
5	Private Service	2	12.50	0	0	2	3.33	1	2.33	0	0	5	3.11
6	Student	6	37.50	12	41.38	11	18.33	10	23.26	0	0	39	24.22
7	Others	0	0	0	0	0	0	1	2.33	0	0	1	0.62
8	Housewife	0	0	1	3.45	2	3.33	3	6.98	5	38.46	11	6.83
9	Children	0	0	1	3.45	3	5	2	4.65	0	0	6	3.73
Total		16	100	29	100	60	100	43	100	13	100	161	100

Institutional participation of the household members: The data regarding the institutional participation of the household members in Narayanpet-1 micro-watershed is presented in Table 7. The results show that, 0.62 per cent of the population in the micro watershed has participated in User Group.

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

Sl.No.	Particulars	LL (16)		MF (29)		SF (60)		SMF (43)		MDF (13)		All (161)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	User Group	0	0	1	3.45	0	0	0	0	0	0	1	0.62
2	No Participation	16	100	28	96.55	60	100	43	100	13	100	160	99.38
Total		16	100	29	100	60	100	43	100	13	100	161	100

Type of house owned: The data regarding the type of house owned by the households in Narayanpet-1 micro-watershed is presented in Table 8. The results indicate that 8.57 per cent of the households possess thatched house, 77.14 per cent of the households possess katcha house and 14.29 per cent of them possess pucca/RCC house.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0	1	16.67	2	14.29	0	0	0	0	3	8.57
2	Katcha	4	100	4	66.67	10	71.43	7	77.78	2	100	27	77.14
3	Pucca/RCC	0	0	1	16.67	2	14.29	2	22.22	0	0	5	14.29
Total		4	100	6	100	14	100	9	100	2	100	35	100

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Narayanpet-1 micro-watershed is presented in Table 9. The results show that 68.57 per cent of the households possess TV, 42.86 per cent of the households possess mixer/grinder, 20 per cent of the households possess Bicycle, 28.57 per cent of the households possess Motor Cycle, 2.86 per cent of the households possess auto and Landline Phone and 94.29 per cent of the households possess mobile phones.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	2	50	4	66.67	10	71.43	6	66.67	2	100	24	68.57
2	Mixer/Grinder	1	25	3	50	7	50	2	22.22	2	100	15	42.86
3	Bicycle	1	25	0	0	4	28.57	2	22.22	0	0	7	20
4	Motor Cycle	0	0	2	33.33	3	21.43	3	33.33	2	100	10	28.57
5	Auto	0	0	0	0	1	7.14	0	0	0	0	1	2.86
6	Landline Phone	0	0	0	0	0	0	1	11.11	0	0	1	2.86
7	Mobile Phone	4	100	6	100	13	92.86	8	88.89	2	100	33	94.29
8	Blank	0	0	0	0	1	7.14	0	0	0	0	1	2.86

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Narayanpet-1 micro-watershed is presented in Table 10. The results show that the average value of television was Rs. 3,645, mixer/grinder was Rs. 1,400, Bicycle was Rs. 1,142, motor cycle was Rs. 32,500, auto was Rs. 60,000, Landline Phone was Rs. 2,000 and mobile phone was Rs. 1,280.

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

Average value (Rs.)

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Television	5,500	3,375	3,500	3,250	4,250	3,645
2	Mixer/Grinder	1,000	1,333	1,285	1,000	2,500	1,400
3	Bicycle	2,000	0	1,000	1,000	0	1,142
4	Motor Cycle	0	27,500	28,333	31,666	45,000	32,500
5	Auto	0	0	60,000	0	0	60,000
6	Landline Phone	0	0	0	2,000	0	2,000
7	Mobile Phone	1,500	1,210	1,166	1,383	1,500	1,280

Farm Implements owned: The data regarding the farm implements owned by the households in Narayanpet-1 micro-watershed is presented in Table 11. About 8.57 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 5.71 per cent of them possess seed/fertilizer drill, 2.86 per cent of them possess tractor, 5.71 per cent of them possess Sprayer and 74.29 per cent of them possess Weeder.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0	0	0	2	14.29	0	0	1	50	3	8.57
2	Plough	0	0	2	33.33	4	28.57	3	33.33	1	50	10	28.57
3	Seed/Fertilizer Drill	0	0	0	0	0	0	2	22.22	0	0	2	5.71
4	Tractor	0	0	0	0	0	0	1	11.11	0	0	1	2.86
5	Sprayer	0	0	0	0	1	7.14	1	11.11	0	0	2	5.71
6	Weeder	3	75	4	66.67	12	85.71	6	66.67	1	50	26	74.29
7	Blank	1	25	2	33.33	2	14.29	2	22.22	1	50	8	22.86

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Narayanpet-1 micro-watershed is presented in

Table 12. The results show that the average value of bullock cart was Rs. 25,000, plough was Rs. 2,500, seed/fertilizer drill was Rs. 3,500, tractor was Rs. 700,000, sprayer was Rs. 3,750 and weeder was Rs. 30.

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

Average Value (Rs.)

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Bullock Cart	0	0	25,000	0	25,000	25,000
2	Plough	0	2,500	2,250	2,833	2,500	2,500
3	Seed/Fertilizer Drill	0	0	0	3,500	0	3,500
4	Tractor	0	0	0	700,000	0	700,000
5	Sprayer	0	0	5,000	2,500	0	3,750
6	Weeder	37	33	29	27	50	30

Livestock possession by the households: The data regarding the Livestock possession by the households in Narayanpet-1 micro-watershed is presented in Table 13. The results indicate that, 34.29 per cent of the households possess bullocks, 2.86 per cent of the households possess local cow and 5.71 per cent of the households possess Sheep.

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0	2	33.33	6	42.86	3	33.33	1	50	12	34.29
2	Local cow	0	0	0	0	0	0	1	11.11	0	0	1	2.86
3	Sheep	0	0	0	0	0	0	2	22.22	0	0	2	5.71
4	blank	4	100	4	66.67	8	57.14	5	55.56	1	50	22	62.86

Average Labour availability: The data regarding the average labour availability in Narayanpet-1 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.45, average own labour (women) available was 1.39, average hired labour (men) available was 13.61 and average hired labour (women) available was 14.42.

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

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
		N	N	N	N	N	N
1	Hired labour Female	0	8.50	12.71	19.22	22.50	14.42
2	Own Labour Female	0	1	1.50	1.44	1.50	1.39
3	Own labour Male	0	1.33	1.50	1.44	1.50	1.45
4	Hired labour Male	0	9.33	12.50	16.78	20	13.61

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

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	0	0	6	100	14	100	9	100	2	100	31	88.57

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Narayanpet-1 micro-watershed is presented in Table 15. The results indicate that, 88.57 per cent of the households opined that the hired labour was adequate.

Distribution of land (ha): The data regarding the distribution of land (ha) in Narayanpet-1 micro-watershed is presented in Table 16. The results indicate that, households of the Narayanpet-1 micro-watershed possess 58.53 ha (98.64 %) of dry land and 0.81 ha (1.36 %) of irrigated land. Marginal farmers possess 4.18 ha (100 %) of dry land. Small farmers possess 20.19 ha (96.15 %) of dry land and 0.81 ha (3.85 %) of irrigated land. Semi medium farmers possess 24.76 ha (100%) of dry land. Medium farmers possess 9.40 ha (100%) of dry land.

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

Sl.No.	Particulars	MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	4.18	100	20.19	96.15	24.76	100	9.40	100	58.53	98.64
2	Irrigated	0	0	0.81	3.85	0	0	0	0	0.81	1.36
Total		4.18	100	21	100	24.76	100	9.40	100	59.34	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Narayanpet-1 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 284,349.72 and the average value of irrigated land was Rs. 988,000. In case of marginal famers, the average land value was Rs. 728,578.34 for dry land. In case of small famers, the average land value was Rs. 309,430.75 for dry land and Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 246,273.29 for dry land. In case of medium farmers, the average land value was Rs. 132,967.27 for dry land.

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

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
		N	N	N	N	N	N
1	Dry	0	728,578.34	309,430.75	246,273.29	132,967.27	284,349.72
2	Irrigated	0	0	988,000	0	0	988,000

Source of irrigation: The data regarding the source of irrigation in Narayanpet-1 micro-watershed is presented in Table 18. The results indicate that, canal was the major irrigation source in the micro water shed for 2.86 per cent of the farmers.

Table 18. Source of irrigation in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Canal	0	0	0	0	1	7.14	0	0	0	0	1	2.86

Irrigated Area (ha): The data regarding the irrigated area (ha) in Narayanpet-1 micro-watershed is presented in Table 19. The results indicate that, small farmers had an irrigated area of 0.81 ha.

Table 19. Irrigated Area (ha) in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Kharif	0	0	0.81	0	0	0.81

Cropping pattern: The data regarding the cropping pattern in Narayanpet-1 micro-watershed is presented in Table 20. The results indicate that, farmers have grown red gram (14.01 ha), cotton (33.81 ha), paddy (0.81 ha), Red gram (14.01 ha) and Sorghum (7.81 ha). Marginal farmers have grown red gram and cotton. Small farmers have grown red gram, cotton, sorghum and paddy. Semi medium farmers have grown sorghum, red gram and cotton. Medium farmers have grown red gram and cotton.

Table 20. Cropping pattern in Narayanpet-1 micro-watershed (Area in ha)

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Kharif - Cotton	0	2.52	9.49	14.02	7.78	33.81
2	Kharif - Red gram (togari)	0	0.85	4.92	6.62	1.62	14.01
3	Kharif - Sorghum	0	0	5.79	2.02	0	7.81
4	Kharif - Paddy	0	0	0.81	0	0	0.81
Total		0	3.37	21	22.66	9.4	56.44

Cropping intensity: The data regarding the cropping intensity in Narayanpet-1 micro-watershed is presented in Table 21. The results indicate that, the cropping intensity in Narayanpet-1 micro-watershed was found to be 90.89 per cent.

Table 21. Cropping intensity (%) in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Cropping Intensity	0	100	100.04	96.55	65.93	90.89

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Narayanpet-1 micro-watershed is presented in Table 22. The results indicate that, 57.14 per cent of the households have bank account.

Table 22. Possession of bank account and savings in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0	2	33.33	11	78.57	6	66.67	1	50	20	57.14

Borrowing status: The data regarding the borrowing status in Narayanpet-1 micro-watershed is presented in Table 23. The results indicate that, 57.14 per cent of the households have availed credit from different sources.

Table 23. Borrowing status in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0	2	33.33	11	78.57	6	66.67	1	50	20	57.14

Cost of cultivation of Cotton: The data regarding the cost of cultivation of Cotton in Narayanpet-1 micro-watershed is presented in Table 24. The results indicate that, the total cost of cultivation for Cotton was Rs. 24097.92. The gross income realized by the farmers was Rs. 50036.33. The net income from Cotton cultivation was Rs. 25938.41. Thus the benefit cost ratio was found to be 1: 2.08.

Table 24. Cost of Cultivation of Cotton in Narayanpet-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	35.24	5854.70	24.30
2	Bullock		Pairs/day	3.72	1861.68	7.73
3	Tractor		Hours	1.76	1323.08	5.49
4	Machinery		Hours	0.10	73.38	0.30
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	4.37	5195.33	21.56
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	7.20	864.50	3.59
8	Fertilizer + micronutrients		Quintal	1.75	1405.02	5.83
9	Pesticides (PPC)		Kgs / liters	0.84	845.80	3.51
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	344.76	1.43
14	Land revenue and Taxes			0	5.31	0.02
II	**Cost B1**					
16	Interest on working capital				997.28	4.14
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				18770.83	77.89
III	**Cost B2**					
18	Rental Value of Land				407.41	1.69
19	**Cost B2 = (Cost B1 + Rental value)**				19178.23	79.58
IV	**Cost C1**					
20	Family Human Labour			13.12	2728.97	11.32
21	**Cost C1 = (Cost B2 + Family Labour)**				21907.20	90.91
V	**Cost C2**					
22	**Cost C2 = (Cost C1 + Risk Premium)**				21907.20	90.91
VI	**Cost C3**					
23	Managerial Cost				2190.72	9.09
24	**Cost C3 = (Cost C2 + Managerial Cost)**				24097.92	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		10.15	50036.33	
		b) Main Crop Sales Price (Rs.)			4927.78	
b.	Gross Income (Rs.)				50036.33	
c.	Net Income (Rs.)				25938.41	
d.	Cost per Quintal (Rs./q.)				2373.26	
e.	Benefit Cost Ratio (BC Ratio)				1:2.08	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of Sorghum in Narayanpet-1 micro-watershed is presented in Table 25. The results indicate that, the total cost of cultivation for Sorghum was Rs. 10861.55. The gross income realized by the farmers was Rs. 24428.78. The net income from Sorghum cultivation was Rs. 13567.23. Thus the benefit cost ratio was found to be 1: 2.25.

Table 25. Cost of Cultivation of Sorghum in Narayanpet-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	19.46	3380.86	31.13
2	Bullock		Pairs/day	1.40	701.42	6.46
3	Tractor		Hours	1.38	1035.07	9.53
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.52	926.32	8.53
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	1.02	878.84	8.09
9	Pesticides (PPC)		Kgs / liters	0.58	575.76	5.30
10	Depreciation charges			0	6.94	0.06
11	Land revenue and Taxes			0	4.94	0.05
II	**Cost B1**					
12	Interest on working capital				285.71	2.63
13	**Cost B1 = (Cost A1 + sum of 15 and 16)**				7795.85	71.77
III	**Cost B2**					
14	Rental Value of Land				400	3.68
15	**Cost B2 = (Cost B1 + Rental value)**				8195.85	75.46
IV	**Cost C1**					
16	Family Human Labour			8.48	1678.29	15.45
17	**Cost C1 = (Cost B2 + Family Labour)**				9874.14	90.91
V	**Cost C2**					
18	**Cost C2 = (Cost C1 + Risk Premium)**				9874.14	90.91
VI	**Cost C3**					
19	Managerial Cost				987.41	9.09
20	**Cost C3 = (Cost C2 + Managerial Cost)**				10861.55	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		11.41	24421.87	
		b) Main Crop Sales Price (Rs.)			2140	
	By Product	e) Main Product (q)		0.35	6.91	
		f) Main Crop Sales Price (Rs.)			20	
b.	Gross Income (Rs.)				24428.78	
c.	Net Income (Rs.)				13567.23	
d.	Cost per Quintal (Rs./q.)				951.76	
e.	Benefit Cost Ratio (BC Ratio)				1:2.25	

Cost of cultivation of Red gram: The data regarding the cost of cultivation of Red gram in Narayanpet-1 micro-watershed is presented in Table 26. The results indicate that, the total cost of cultivation for Red gram was Rs. 20532.37. The gross income realized by the farmers was Rs. 31589.33. The net income from Red gram cultivation was Rs. 11056.96. Thus the benefit cost ratio was found to be 1: 1.54.

Table 26. Cost of Cultivation of Red gram in Narayanpet-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	25.58	4344.21	21.16
2	Bullock		Pairs/day	2.67	1333.05	6.49
3	Tractor		Hours	1.94	1455.88	7.09
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	14.98	4559.93	22.21
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	12.35	1482	7.22
8	Fertilizer + micronutrients		Quintal	1.30	1036.75	5.05
9	Pesticides (PPC)		Kgs / liters	0.65	647.97	3.16
10	Irrigation		Number	0	0	0
11	Repairs			0	0	0
12	Msc. Charges (Marketing costs etc)			0	0	0
13	Depreciation charges			0	60.37	0.29
14	Land revenue and Taxes			0	4.94	0.02
II	**Cost B1**					
16	Interest on working capital				927.20	4.52
17	**Cost B1 = (Cost A1 + sum of 15 and 16)**				15852.30	77.21
III	**Cost B2**					
18	Rental Value of Land				408.33	1.99
19	**Cost B2 = (Cost B1 + Rental value)**				16260.64	79.20
IV	**Cost C1**					
20	Family Human Labour			11.95	2405.15	11.71
21	**Cost C1 = (Cost B2 + Family Labour)**				18665.79	90.91
V	**Cost C2**					
22	Risk Premium				0	0
23	**Cost C2 = (Cost C1 + Risk Premium)**				18665.79	90.91
VI	**Cost C3**					
24	Managerial Cost				1866.58	9.09
25	**Cost C3 = (Cost C2 + Managerial Cost)**				20532.37	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		6.74	31589.33	
		b) Main Crop Sales Price (Rs.)			4687.50	
b.	Gross Income (Rs.)				31589.33	
c.	Net Income (Rs.)				11056.96	
d.	Cost per Quintal (Rs./q.)				3046.77	
e.	Benefit Cost Ratio (BC Ratio)				1:1.54	

Cost of Cultivation of Paddy: The data regarding the cost of cultivation of Paddy in Narayanpet-1 micro-watershed is presented in Table 27. The results indicate that, the total cost of cultivation for Paddy was Rs. 33932.61. The gross income realized by the farmers was Rs. 160550. The net income from Paddy cultivation was Rs. 126617.39. Thus the benefit cost ratio was found to be 1: 4.73.

Table 27. Cost of Cultivation of Paddy in Narayanpet-1 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	**Cost A1**					
1	Hired Human Labour		Man days	60.51	9941.75	29.30
2	Bullock		Pairs/day	0	0	0
3	Tractor		Hours	6.18	4631.25	13.65
4	Machinery		Hours	0	0	0
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	74.10	7410	21.84
6	Seed Inter Crop		Kgs.	0	0	0
7	FYM		Quintal	0	0	0
8	Fertilizer + micronutrients		Quintal	2.47	1976	5.82
9	Pesticides (PPC)		Kgs / liters	1.24	1235	3.64
10	Irrigation		Number	3.71	0	0
11	Depreciation charges			0	792.87	2.34
12	Land revenue and Taxes			0	4.94	0.01
II	**Cost B1**					
13	Interest on working capital				1274.52	3.76
14	**Cost B1 = (Cost A1 + sum of 15 and 16)**				27266.33	80.35
III	**Cost B2**					
15	**Cost B2 = (Cost B1 + Rental value)**				27266.33	80.35
IV	**Cost C1**					
16	Family Human Labour			17.29	3581.50	10.55
17	**Cost C1 = (Cost B2 + Family Labour)**				30847.83	90.91
V	**Cost C2**					
18	**Cost C2 = (Cost C1 + Risk Premium)**				30847.83	90.91
VI	**Cost C3**					
19	Managerial Cost				3084.78	9.09
20	**Cost C3 = (Cost C2 + Managerial Cost)**				33932.61	100
VII	**Economics of the Crop**					
a.	Main Product	a) Main Product (q)		61.75	98800	
		b) Main Crop Sales Price (Rs.)			1600	
	By Product	e) Main Product (q)		617.50	61750	
		f) Main Crop Sales Price (Rs.)			100	
b.	Gross Income (Rs.)				160550	
c.	Net Income (Rs.)				126617.39	
d.	Cost per Quintal (Rs./q.)				549.52	
e.	Benefit Cost Ratio (BC Ratio)				1:4.73	

Adequacy of fodder: The data regarding the adequacy of fodder in Narayanpet-1 micro-watershed is presented in Table 28. The results indicate that, 42.86 per cent of the households opined that dry fodder was adequate.

Table 28. Adequacy of fodder in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0	2	33.33	7	50	5	55.56	1	50	15	42.86

Annual gross income: The data regarding the annual gross income in Narayanpet-1 micro-watershed is presented in Table 29. The results indicate that the annual gross income was Rs. 162,500 for landless farmers, for marginal farmers it was Rs. 65,016.67, for small farmers it was Rs. 117,403.57, semi medium farmers it was Rs. 182,027.78 and medium farmers it was Rs. 179,500.

Table 29 Annual gross income in Narayanpet-1 micro-watershed

(Avg. value in Rs.)

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Service/salary	60,000	0	17,142.86	0	0	13,714.29
2	Business	0	0	5,000	27,777.78	0	9,142.86
3	Wage	102,500	33,666.67	26,642.86	71,766.67	37,500	48,740
4	Agriculture	0	31,350	68,617.86	82,483.33	142,000	62,145.71
Income(Rs.)		162,500	65,016.67	117,403.57	182,027.78	179,500	133,742.86

Average annual expenditure: The data regarding the average annual expenditure in Narayanpet-1 micro-watershed is presented in Table 30. The results indicate that the average annual expenditure is Rs. 17,092.40. For landless households it was Rs. 30,625, for marginal farmers it was Rs. 2,833.33, for small farmers it was Rs. 12,643.71, for semi medium farmers it was Rs. 23,246.91 and medium farmers it was Rs. 36,250.

Table 30. Average annual expenditure in Narayanpet-1 micro-watershed

(Avg. value in Rs.)

Sl.No.	Particulars	LL (4)	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
1	Service/salary	100,000	0	100,000	0	0	5,714.29
2	Business	0	0	40,000	120,000	0	4,571.43
3	Wage	22,500	2,500	3,583.33	30,222.22	25,000	12,714.29
4	Agriculture	0	14,500	33,428.57	59,000	47,500	30,371.43
Total		122,500	17,000	177,011.90	209,222.22	72,500	598,234.13
Average		30,625	2,833.33	12,643.71	23,246.91	36,250	17,092.40

Horticulture species grown: The data regarding horticulture species grown in Narayanpet-1 micro-watershed is presented in Table 31. The results indicate that, sampled households have grown 1mango trees in their field.

Table 31. Horticulture species grown in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Mango	0	0	0	0	0	0	1	0	0	0	1	0

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

Forest species grown: The data regarding forest species grown in Narayanpet-1 micro-watershed is presented in Table 32. The results indicate that, households have planted 4 Teak, 30 neem, 2 tamarind, 6 Banyan and 2 acacia trees in their field and also 2 teak and 5 neem in backyard.

Table 32: Forest species grown in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Teak	0	0	0	1	4	0	0	1	0	0	4	2
2	Neem	0	0	9	2	11	2	7	1	3	0	30	5
3	Tamarind	0	0	0	0	1	0	1	0	0	0	2	0
4	Acacia	0	0	0	0	0	0	2	0	0	0	2	0
5	Banyan	0	0	2	0	3	0	0	0	1	0	6	0

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

Average Additional investment capacity: The data regarding average additional investment capacity in Narayanpet-1 micro-watershed is presented in Table 33. The results indicated that, households have an average investment capacity of Rs. 12,942.86 for land development Rs. 18,142.86 for Irrigation facility, Rs. 1,228.57 for improved crop production and Rs. 2,485.71 for improved livestock management.

Table 33: Average Additional investment capacity in Narayanpet-1 micro-watershed

Sl.No.	Particulars	MF (6)	SF (14)	SMF (9)	MDF (2)	All (35)
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Land development	2,000	1,142.86	45,000	10,000	12,942.86
2	Irrigation facility	13,333.33	13,214.29	30,000	50,000	18,142.86
3	Improved crop production	2,000	928.57	333.33	7,500	1,228.57
4	Improved livestock management	500	2,071.43	5,777.78	1,500	2,485.71

Source of additional investment: The data regarding source of funds for additional investment in Narayanpet-1 micro-watershed is presented in Table 34. The results indicated that Government subsidy was the source of additional investment for 2.78 per cent for land development and improved livestock management, Loan from bank was the source of additional investment for 22.22 per cent for land development and 13.89 per cent for irrigation facility, 25 per cent for improved crop production and 16.67 per cent for improved livestock management, soft loan was the source of additional investment for 2.78 per cent for improved livestock management.

Table 34: Source of funds for additional investment capacity in Narayanpet-1 micro –watershed

Sl. No	Item	Land development		Irrigation facility		Improved crop production		Improved livestock management	
		N	%	N	%	N	%	N	%
1	Government subsidy	1	2.78	3	8.33	0	0.0	1	2.78
2	Loan from bank	8	22.22	5	13.89	9	25.0	6	16.67
3	Soft loan	0	0.0	0	0.0	0	0.0	1	2.78

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Narayanpet-1 micro-watershed is presented in Table 35. The results indicated that, cotton was sold to the extent of 100 per cent, Paddy was sold to the extent of 60 per cent, Redgram was sold to the extent of 71.26 per cent and Sorghum to the extent of 90.48 per cent.

Table 35. Marketing of the agricultural produce in Narayanpet-1 micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Cotton	350	0	350	100	4927.78
2	Paddy	50	20	30	60	1600.0
3	Redgram	87	25	62	71.26	4166.67
4	Sorghum	105	10	95	90.48	2140.0

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Narayanpet-1 micro-watershed is presented in Table 36. The results indicated that, about 94.29 per cent of the farmers sold their produce to local/village merchants.

Table 36. Marketing Channels used for sale of agricultural produce in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Local/village Merchant	0	0	7	116.67	14	100	9	100	3	150	33	94.29

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Narayanpet-1 micro-watershed is presented in Table 37. The results indicated that, 2.86 per cent of the households have used cart as a mode of transportation and 91.43 per cent of the households have used Tractor as a mode of transportation.

Table 37. Mode of transport of agricultural produce in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cart	0	0	1	16.67	0	0	0	0	0	0	1	2.86
2	Tractor	0	0	6	100	14	100	9	100	3	150	32	91.43

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Narayanpet-1 micro-watershed is presented in Table 38. The results indicated that, 88.57 per cent of the households have experienced soil and water erosion problems in the farm.

Table 38. Incidence of soil and water erosion problems in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	0	0	6	100	14	100	9	100	2	100	31	88.57

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Narayanpet-1 micro-watershed is presented in Table 39. The results indicated that, 88.57 per cent have shown interest in soil test.

Table 39. Interest shown towards soil testing in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	0	0	6	100	14	100	9	100	2	100	31	88.57

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Narayanpet-1 micro-watershed is presented in Table 40. The results indicated that, 85.71 per cent of the households used firewood, 5.71 per cent of the households used Kerosene and 14.29 per cent of the households used LPG as a source of fuel.

Table 40. Usage pattern of fuel for domestic use in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	4	100	6	100	12	85.71	7	77.78	2	100	31	88.57
2	Kerosene	0	0	0	0	1	7.14	1	11.11	0	0	2	5.71
3	LPG	0	0	1	16.67	2	14.29	2	22.22	0	0	5	14.29

Source of drinking water: The data regarding source of drinking water in Narayanpet-1 micro-watershed is presented in Table 41. The results indicated that, piped supply was the major source of drinking water for 94.29 per cent and 2.86 per cent of the households used bore well in the micro watershed.

Table 41. Source of drinking water in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	4	100	4	66.67	14	100	9	100	2	100	33	94.29
2	Bore Well	0	0	1	16.67	0	0	0	0	0	0	1	2.86

Source of light: The data regarding source of light in Narayanpet-1 micro-watershed is presented in Table 42. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 42. Source of light in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	4	100	6	100	14	100	9	100	2	100	35	100

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facilit**y** in Narayanpet-1 micro-watershed is presented in Table 43. The results indicated that, 48.57 per cent of the households possess sanitary toilet facility.

Table 43. Existence of Sanitary toilet facility in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	1	25	1	16.67	9	64.29	4	44.44	2	100	17	48.57

Possession of PDS card: The data regarding possession of PDS card in Narayanpet-1 micro-watershed is presented in Table 44. The results indicated that, 97.14 per cent of the sampled households possessed BPL cards and 2.86 per cent of the sampled households Not Possessed.

Table 44. Possession of PDS card in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	BPL	4	100	6	100	14	100	9	100	1	50	34	97.14
2	Not Possessed	0	0	0	0	0	0	0	0	1	50	1	2.86

Participation in NREGA program: The data regarding participation in NREGA programme in Narayanpet-1 micro-watershed is presented in Table 45. The results indicated that, 65.71 per cent of the households participated in NREGA programme.

Table 45. Participation in NREGA programme in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	3	75	4	66.67	8	57.14	6	66.67	2	100	23	65.71

Adequacy of food items: The data regarding adequacy of food items in Narayanpet-1 micro-watershed is presented in Table 46 The results indicated that, cereals were adequate for 100 per cent of the households, pulses were adequate for 97.14 per cent of the households, oilseed were adequate for 88.57 per cent, vegetables were adequate for 65.71 per cent, milk were adequate for 80 per cent and Egg were adequate for 8.57 per cent.

Table 46. Adequacy of food items in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	4	100	6	100	14	100	9	100	2	100	35	100
2	Pulses	4	100	6	100	14	100	8	88.89	2	100	34	97.14
3	Oilseed	2	50	6	100	13	92.86	8	88.89	2	100	31	88.57
4	Vegetables	1	25	5	83.33	9	64.29	7	77.78	1	50	23	65.71
5	Milk	3	75	3	50	11	78.57	9	100	2	100	28	80
6	Egg	0	0	0	0	2	14.29	1	11.11	0	0	3	8.57

Response on Inadequacy of food items: The data regarding inadequacy of food items in Narayanpet-1 micro-watershed is presented in Table 47. The results indicated that, pulses were inadequate for 2.86 per cent of the households, oilseeds were inadequate for 11.43 per cent, vegetables were inadequate for 31.43 per cent, fruits were inadequate for 100 per cent, milk were inadequate for 20 per cent, egg were inadequate for 88.57 per cent and meat were inadequate for 100 per cent of the households.

Table 47. Response on Inadequacy of food items in Narayanpet-1 micro-watershed

Sl.No.	Particulars	LL (4)		MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Pulses	0	0	0	0	0	0	1	11.11	0	0	1	2.86
2	Oilseed	2	50	0	0	1	7.14	1	11.11	0	0	4	11.43
3	Vegetables	3	75	1	16.67	4	28.57	2	22.22	1	50	11	31.43
4	Fruits	4	100	6	100	14	100	9	100	2	100	35	100
5	Milk	1	25	3	50	3	21.43	0	0	0	0	7	20
6	Egg	4	100	5	83.33	12	85.71	8	88.89	2	100	31	88.57
7	Meat	4	100	6	100	14	100	9	100	2	100	35	100

Farming constraints: The data regarding farming constraints experienced by households in Narayanpet-1 micro-watershed is presented in Table 48. The results indicated that, lower fertility status of the soil, wild animal menace on farm field and Frequent incidence of pest and diseases was the constraint experienced by 88.57 per cent of the households, Inadequacy of irrigation water (2.86 %), High cost of Fertilizers and plant protection chemicals, High rate of interest on credit and Low price for the agricultural commodities (85.71 %), Lack of marketing facilities in the area (82.86 %), high rate of interest on credit (11.43%), low price for the agricultural commodities (20%), lack of marketing facilities in the area (17.14%), Inadequate extension services (5.71 %) and lack of transport for safe transport of the Agril produce to the market (80%).

Table 48. Farming constraints Experienced in Narayanpet-1 micro-watershed

Sl. No.	Particulars	MF (6)		SF (14)		SMF (9)		MDF (2)		All (35)	
		N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	6	100	14	100	9	100	2	100	31	88.57
2	Wild animal menace on farm field	6	100	14	100	9	100	2	100	31	88.57
3	Frequent incidence of pest and diseases	6	100	14	100	9	100	2	100	31	88.57
4	Inadequacy of irrigation water	0	0	0	0	0	0	1	50	1	2.86
5	High cost of Fertilizers and plant protection chemicals	6	100	13	92.86	9	100	2	100	30	85.71
6	High rate of interest on credit	6	100	13	92.86	9	100	2	100	30	85.71
7	Low price for the agricultural commodities	6	100	13	92.86	9	100	2	100	30	85.71
8	Lack of marketing facilities in the area	6	100	13	92.86	8	88.89	2	100	29	82.86
9	Inadequate extension services	0	0	0	0	0	0	2	100	2	5.71
10	Lack of transport for safe transport of the Agril produce to the market.	5	83.33	13	92.86	8	88.89	2	100	28	80

Chapter 5

SUMMARY

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

The data on households sampled for socio economic survey indicated that 35 farmers were sampled in Narayanpet-1 micro-watershed among them 4 (11.43 %) were landless, 6 (17.14 %) were marginal farmers, 14 (40 %) were small farmers, 9 (25.71 %) were semi medium farmers and 2 (5.71 %) were medium farmers.

The data indicated that there were 94 (58.39 %) men and 67 (41.61 %) women among the sampled households. The average family size of landless farmers' was 4, marginal farmers' was 4.8, small farmers' was 4.6, semi medium farmers' was 5.7 and medium farmers' was 6.

The data indicated that, 38 (23.60 %) people were in 0-15 years of age, 71 (44.10 %) were in 16-35 years of age, 43 (26.71 %) were in 36-60 years of age and 9 (5.59 %) were above 61 years of age.

The results indicated that Narayanpet-1 had 41.61 per cent illiterates, 0.62 per cent Functional Literate, 29.19 per cent of them had primary school, 5.59 per cent of them had middle school, 7.45 per cent of them had high school education, 4.97 per cent of them had PUC, 1.24 per cent of them had Diploma, 0.62 per cent of them had ITI, 4.35 per cent of them had Degree and 1.24 per cent of them had Masters education.

The results indicate that, 65.71 per cent of household heads were practicing agriculture, 14.29 per cent of the household heads were agricultural labourers, 17.14 per cent of the household heads were General labourers and 5.71 per cent of the household heads were Housewives.

The results indicate that agriculture was the major occupation for 42.24 per cent of the household members, 8.70 per cent were agricultural labourers, 9.94 per cent were General Labour, 0.62 per cent were Government Service, 3.11 per cent were Private Service, 24.22 per cent were Student, 6.83 per cent were Housewife and 3.73 per cent were children.

The results show that, 0.62 per cent of the population in the micro watershed has participated in User Group. The results indicate that 8.57 per cent of the households

possess thatched house, 77.14 per cent of the households possess katcha house and 14.29 per cent of them possess pucca/RCC house.

The results show that 68.57 per cent of the households possess TV, 42.86 per cent of the households possess mixer/grinder, 20 per cent of the households possess Bicycle, 28.57 per cent of the households possess Motor Cycle, 2.86 per cent of the households possess auto and Landline Phone and 94.29 per cent of the households possess mobile phones.

The results show that the average value of television was Rs. 3,645, mixer/grinder was Rs. 1,400, Bicycle was Rs. 1,142, motor cycle was Rs. 32,500, auto was Rs. 60,000, Landline Phone was Rs. 2,000 and mobile phone was Rs. 1,280.

About 8.57 per cent of the households possess bullock cart, 28.57 per cent of them possess plough, 5.71 per cent of them possess seed/fertilizer drill, 2.86 per cent of them possess tractor, 5.71 per cent of them possess Sprayer and 74.29 per cent of them possess Weeder.

The results show that the average value of bullock cart was Rs. 25,000, plough was Rs. 2,500, seed/fertilizer drill was Rs. 3,500, tractor was Rs. 700,000, sprayer was Rs. 3,750 and weeder was Rs. 30. The results indicate that, 34.29 per cent of the households possess bullocks, 2.86 per cent of the households possess local cow and 5.71 per cent of the households possess Sheep.

The results indicate that, average own labour men available in the micro watershed was 1.45, average own labour (women) available was 1.39, average hired labour (men) available was 13.61 and average hired labour (women) available was 14.42. The results indicate that, 88.57 per cent of the households opined that the hired labour was adequate.

The results indicate that, households of the Narayanpet-1 micro-watershed possess 58.53 ha (98.64 %) of dry land and 0.81 ha (1.36 %) of irrigated land. Marginal farmers possess 4.18 ha (100 %) of dry land. Small farmers possess 20.19 ha (96.15 %) of dry land and 0.81 ha (3.85 %) of irrigated land. Semi medium farmers possess 24.76 ha (100%) of dry land. Medium farmers possess 9.40 ha (100%) of dry land.

The results indicate that, the average value of dry land was Rs. 284,349.72 and the average value of irrigated land was Rs. 988,000. In case of marginal famers, the average land value was Rs. 728,578.34 for dry land. In case of small famers, the average land value was Rs. 309,430.75 for dry land and Rs. 988,000 for irrigated land. In case of semi medium famers, the average land value was Rs. 246,273.29 for dry land. In case of medium farmers, the average land value was Rs. 132,967.27 for dry land.

The results indicate that, canal was the major irrigation source in the micro water shed for 2.86 per cent of the farmers. The results indicate that, small farmers had an irrigated area of 0.81 ha. The results indicate that, farmers have grown red gram (14.01 ha), cotton (33.81 ha), paddy (0.81 ha), Red gram (14.01 ha) and Sorghum (7.81 ha). Marginal farmers have grown red gram and cotton. Small farmers have grown red gram, cotton, sorghum and paddy. Semi medium farmers have grown sorghum, red gram and cotton. Medium farmers have grown red gram and cotton.

The results indicate that, the cropping intensity in Narayanpet-1 micro-watershed was found to be 90.89 per cent. The results indicate that, 57.14 per cent of the households have bank account. The results indicate that, 57.14 per cent of the households have availed credit from different sources.

The results indicate that, the total cost of cultivation for Cotton was Rs. 24097.92. The gross income realized by the farmers was Rs. 50036.33. The net income from Cotton cultivation was Rs. 25938.41. Thus the benefit cost ratio was found to be 1: 2.08.

The results indicate that, the total cost of cultivation for Sorghum was Rs. 10861.55. The gross income realized by the farmers was Rs. 24428.78. The net income from Sorghum cultivation was Rs. 13567.23. Thus the benefit cost ratio was found to be 1: 2.25.

The results indicate that, the total cost of cultivation for Red gram was Rs. 20532.37. The gross income realized by the farmers was Rs. 31589.33. The net income from Red gram cultivation was Rs. 11056.96. Thus the benefit cost ratio was found to be 1: 1.54. The results indicate that, the total cost of cultivation for Paddy was Rs. 33932.61. The gross income realized by the farmers was Rs. 160550. The net income from Paddy cultivation was Rs. 126617.39. Thus the benefit cost ratio was found to be 1: 4.73.

The results indicate that, 42.86 per cent of the households opined that dry fodder was adequate. The results indicate that the annual gross income was Rs. 162,500 for landless farmers, for marginal farmers it was Rs. 65,016.67, for small farmers it was Rs. 117,403.57, semi medium farmers it was Rs. 182,027.78 and medium farmers it was Rs. 179,500.

The results indicate that the average annual expenditure is Rs. 17,092.40. For landless households it was Rs. 30,625, for marginal farmers it was Rs. 2,833.33, for small farmers it was Rs. 12,643.71, for semi medium farmers it was Rs. 23,246.91 and medium farmers it was Rs. 36,250.

The results indicate that, sampled households have grown 1mango trees in their field. The results indicate that, households have planted 4 Teak, 30 neem, 2 tamarind, 6 Banyan and 2 acacia trees in their field and also 2 teak and 5 neem in backyard.

The results indicated that, households have an average investment capacity of Rs. 12,942.86 for land development Rs. 18,142.86 for Irrigation facility, Rs. 1,228.57 for improved crop production and Rs. 2,485.71 for improved livestock management. The results indicated that Government subsidy was the source of additional investment for 2.78 per cent for land development and improved livestock management, Loan from bank was the source of additional investment for 22.22 per cent for land development and 13.89 per cent for irrigation facility, 25 per cent for improved crop production and 16.67 per cent for improved livestock management, soft loan was the source of additional investment for 2.78 per cent for improved livestock management.

The results indicated that, cotton was sold to the extent of 100 per cent, Paddy was sold to the extent of 60 per cent, Redgram was sold to the extent of 71.26 per cent and Sorghum to the extent of 90.48 per cent. The results indicated that, about 94.29 per cent of the farmers sold their produce to local/village merchants.

The results indicated that, 2.86 per cent of the households have used cart as a mode of transportation and 91.43 per cent of the households have used Tractor as a mode of transportation. The results indicated that, 88.57 per cent of the households have experienced soil and water erosion problems in the farm.

The results indicated that, 88.57 per cent have shown interest in soil test. The results indicated that, 85.71 per cent of the households used firewood, 5.71 per cent of the households used Kerosene and 14.29 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 94.29 per cent and 2.86 per cent of the households used bore well in the micro watershed. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

The results indicated that, 48.57 per cent of the households possess sanitary toilet facility. The results indicated that, 97.14 per cent of the sampled households possessed BPL cards and 2.86 per cent of the sampled households Not Possessed. The results indicated that, 65.71 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 97.14 per cent of the households, oilseed were adequate for 88.57 per cent, vegetables were adequate for 65.71 per cent, milk were adequate for 80 per cent and Egg were adequate for 8.57 per cent.

The results indicated that, pulses were inadequate for 2.86 per cent of the households, oilseeds were inadequate for 11.43 per cent, vegetables were inadequate for 31.43 per cent, fruits were inadequate for 100 per cent, milk were inadequate for 20 per

cent, egg were inadequate for 88.57 per cent and meat were inadequate for 100 per cent of the households.

The results indicated that, lower fertility status of the soil, wild animal menace on farm field and Frequent incidence of pest and diseases was the constraint experienced by 88.57 per cent of the households, Inadequacy of irrigation water (2.86 %), High cost of Fertilizers and plant protection chemicals, High rate of interest on credit and Low price for the agricultural commodities (85.71 %), Lack of marketing facilities in the area (82.86 %), high rate of interest on credit (11.43%), low price for the agricultural commodities (20%), lack of marketing facilities in the area (17.14%), Inadequate extension services (5.71 %) and lack of transport for safe transport of the Agril produce to the market (80%).