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

NARAYANPET-2(4D5B1R1a) MICROWATERSHED

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 Narayanapet-2 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
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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Narayanapet-2 Microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and 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 646 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 631 ha in the microwatershed is covered by soils, 3 ha by rock outcrops and about 13 ha by others (habitation and water bodies). The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 9 soil series and 19 soil phases (management units) and 3 land use class.*
- *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 250 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 66 per cent area of the microwatershed has soils that are moderately deep to very deep (75 - >150 cm) and 31 per cent soils are shallow to moderately shallow (25-75 cm).*
- *About 17 per cent area in the microwatershed has loamy soils and 81 per cent clayey soils at the surface.*
- *Entire area of the microwatershed is non gravelly (<15%) at the surface.*
- *About 59 per cent area of the microwatershed is very high (>200 mm/m) in available water capacity, 35 per cent is medium (101-150 mm/m), 2 per cent is low (51-100 mm/m) and 1 per cent area is very low (<50 mm/m) in available water capacity.*
- *Entire area in the microwatershed has very gently sloping (1-3% slope) lands.*

- *An area of about 84 per cent is moderately (e2) eroded and 13 per cent area is severely (e3) eroded.*
- *An area of about 19 per cent soils are neutral (pH 6.5-7.3) in soil reaction, 78 per cent soil are slightly to moderately alkaline (pH 7.3-8.4) and 1 per cent soils are strongly alkaline (8.4 - 9.0).*
- *The Electrical Conductivity (EC) of the soils in the entire area of the microwatershed is dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 40 per cent of the soils are low (<0.5%) in organic carbon, 37 per cent medium (0.5-0.75%) and 21 per cent high (>0.75).*
- *About 13 per cent area is low in available phosphorus, 69 per area is medium (23-57 kg/ha) and 15 per cent is high (>57 kg/ha).*
- *About 75 per cent is medium (145-337 kg/ha) in available potassium and 22 per cent is high (>337 kg/ha).*
- *Available sulphur is low (<10 ppm) in an area of about 35 per cent, medium (10 -20 ppm) in 62 per cent and high in 1 per cent area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in an area of about 32 per cent and medium (0.5-1.0 ppm) in an area of 65 per cent.*
- *Available iron is sufficient (>4.5 ppm) in the entire 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 97 per cent area and sufficient in 1 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	-	*623(97)*		*Sapota*	-	*15(2)*
Maize	-	-		*Pomegranate*	-	*429(66)*
Bajra	-	*429(66)*		*Musambi*	-	*428(66)*
Groundnut	-	*15 (2)*		*Lime*	-	*428(66)*
Sunflower	-	*429(66)*		*Amla*	-	*622(97)*
Redgram	-	*429(66)*		*Cashew*	-	-
Bengal gram	*29(5)*	*573(89)*		*Jackfruit*	-	*15(2)*
Cotton	*29(5)*	*579(90)*		*Jamun*	-	*383(59)*
Chilli	-	*429(66)*		*Custard apple*	-	*623(97)*
Tomato	-	*15(2)*		*Tamarind*	-	*383(59)*
Drumstick	-	*429(66)*		*Mulberry*	-	*15(2)*
Mango	-	*29(5)*		*Marigold*	-	*623(97)*
Guava	-	*15(2)*		*Chrysanthemum*	-	*623(97)*

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

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

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

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

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

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

The Land Resource Inventory is basically done for identifying the 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 other states.

The land resource inventory aims to provide site specific database for Narayanapet-2 microwatershed in Yadgir Taluk & 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-2 microwatershed is located in the northern part of Karnataka in Yadgir Taluk & District, Karnataka State (Fig.2.1). It comprises parts of Kanekal, and Kudlura villages. It lies between 16^0 34' and 16^0 36' North latitudes and 77^0 14' and 76^0 16' East longitudes covering an area of about 646 ha. It is about 33 km southeast of Yadgir town and is surrounded by Kanekal on the east, Hegganakera on the southwest, Killanakera on the north, Kyathanala on the south and Kudlura village on the western side.

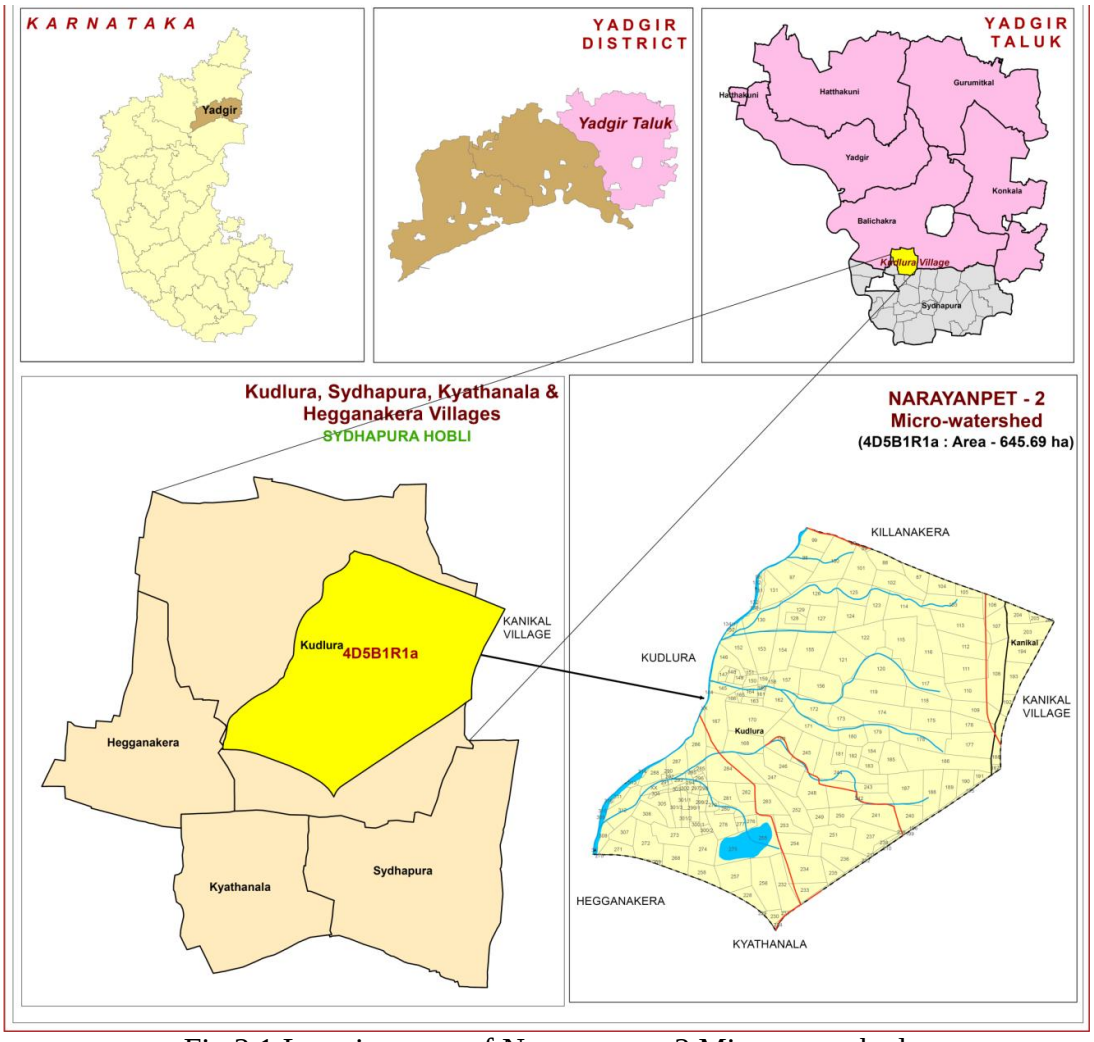


Fig.2.1 Location map of Narayanapet-2 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Figs.2.2a and b). Granite gneisses are essentially pink to gray and are coarse to medium grained. They consist primarily of quartz, feldspar, biotite and hornblende. The gray granite gneisses are highly weathered, fractured and fissured upto a depth of about

10 m. Dolerite dykes and quartz veins are common with variable width and found to occur in Narayanapet-2 microwatershed. The most widespread and characteristic development of alluvium in the watershed region lying between the rivers Krishna and Bhima is a wide belt, the underlying formation is gneiss and alluvial soils occur over gneiss, limestone and shale. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig.2.2a Granite and granite gneiss rocks

Fig. 2.2b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The 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 368-386 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 coldest 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, August and 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, Yadgir District

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**		

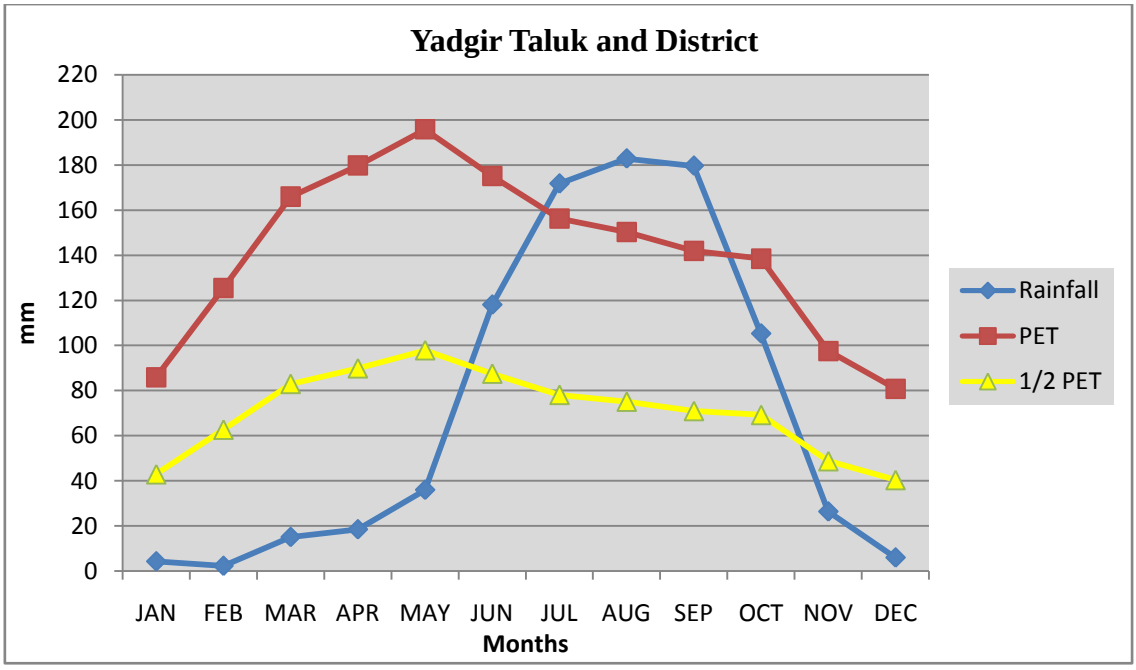


Fig 2.3 Rainfall distribution in Yadgir Taluk, Yadgir District

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 district 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 boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, sunflower, groundnut, red gram, mango, pomegranate, marigold and sapota. The cropping intensity is 120 per cent in the taluk. 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 Narayanapet-2 microwatershed is presented in Fig.2.4. The different crops and cropping systems adopted in the microwatershed is presented in the Figures 2.5 a & b.

Table 2.2 Land Utilization in Yadgir District

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.	Cropping intensity	-	119.8
5.	Trees and grooves	737	0.14
6.	Forest	33773	6.54
7.	Cultivable wasteland	2385	0.46
8.	Permanent Pasture land	11755	2.28
9.	Barren land	27954	5.41
10.	Non- Agriculture land	29623	5.73
11.	Current Fallows	105212	20.4

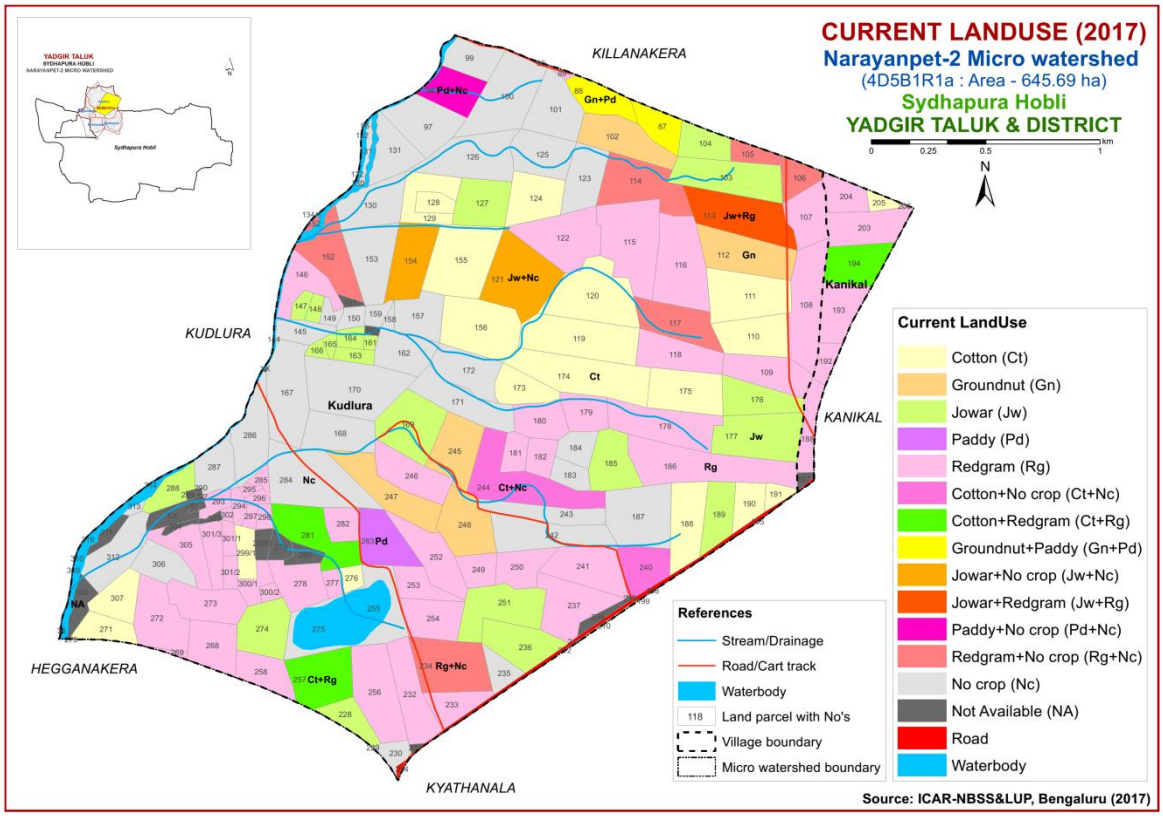


Fig.2.4 Current Land Use map of Narayanapet-2 Microwatershed

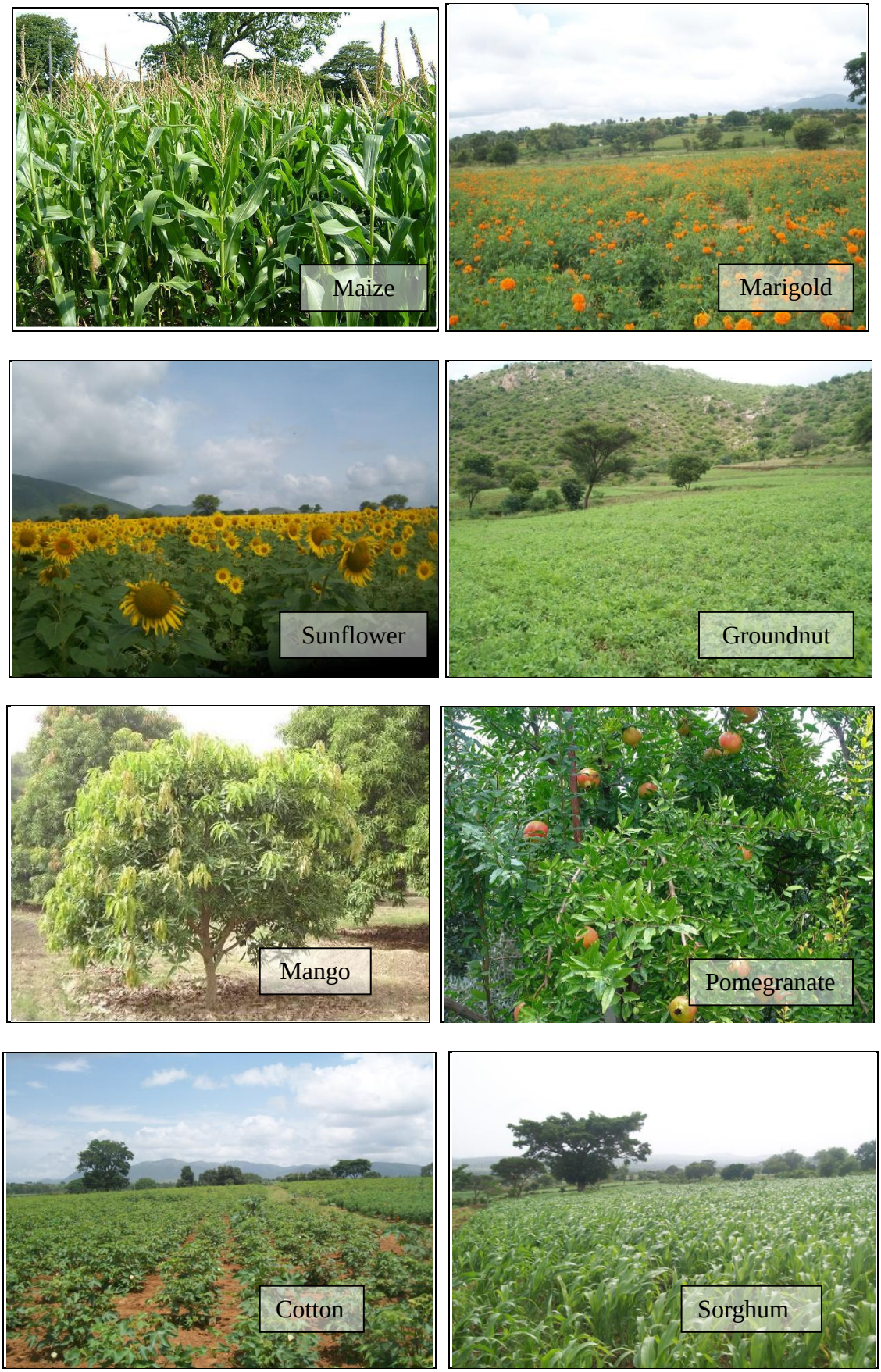


Fig. 2.5. Different Crops and Cropping Systems in Narayanapet-2 Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Narayanapet-2 microwatershed by the detailed study of all the soil characteristics (depth, texture, color, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site characteristics (slope of the land, erosion, drainage, occurrence of rock fragments etc.) and followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units, and showing their area extent and their geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in an area of 646 ha. 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 a 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 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, toposheet of the area (1:50,000 scale) were also 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 Color 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 and granite gneiss and alluvial landscapes. 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)
  - G24 Valleys/ lowlands
    - G241 Valleys, pink tones
    - G242 Valleys gray mixed with pink tones

DSe – Alluvial Landscape

DSe 1 – Summit

DSe 11 –

DSe 12 –

DSe 2 – Very gently sloping

DSe 21 – Very gently sloping, dark gray tone

DSe 22 – Very gently sloping, medium gray tone

DSe 23 – Very gently sloping, yellowish grey tone

DSe 24 – Very gently sloping, whitish grey tone

DSe 25 – Very gently sloping, whitish/ eroded/ calcareous tone

DSe 26- Very gently sloping, medium pink

DSe 3 – Valley/ Lowland

DSe 31 – Whitish gray/Calcareous

DSe 32 – Gray with pink patches

DSe 33 – Medium gray tone

DSe 34 – Lightish gray tone

DSe 35 – Dark gray tone

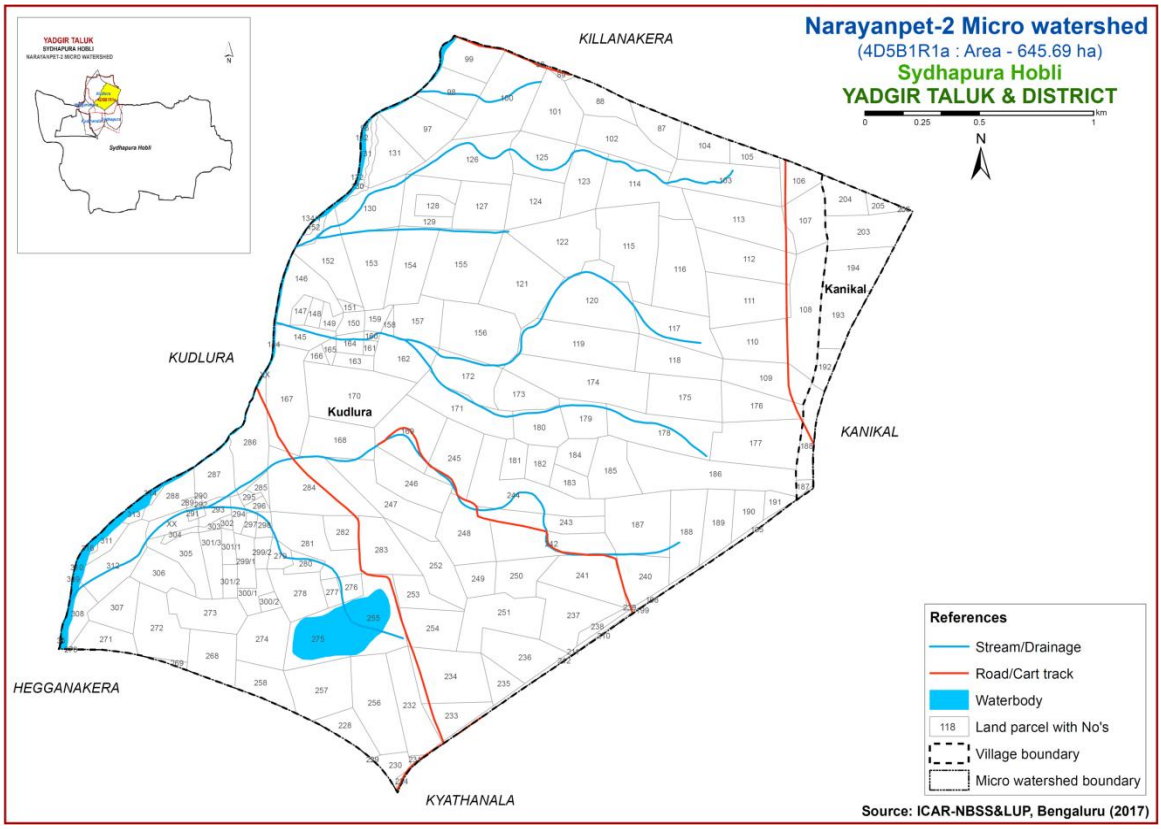


Fig 3.1 Scanned and Digitized Cadastral map of Narayanapet-2 Microwatershed

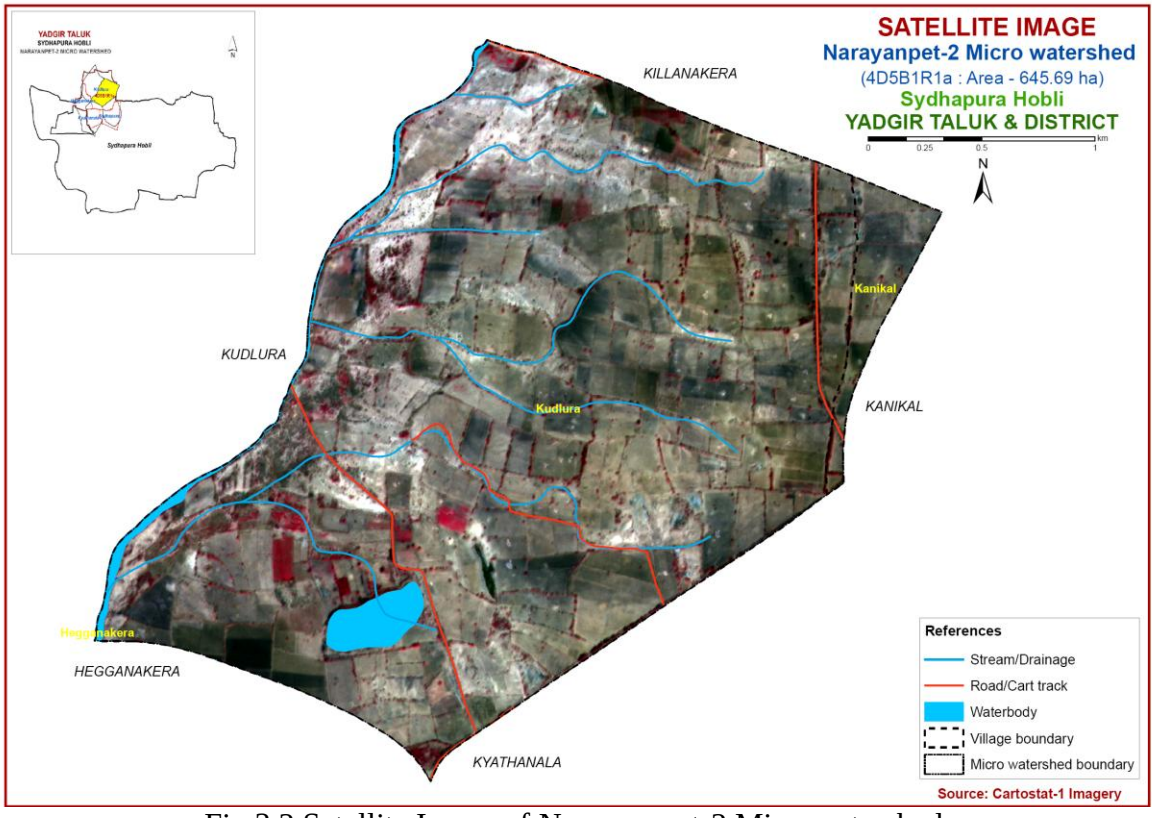


Fig.3.2 Satellite Image of Narayanapet-2 Microwatershed

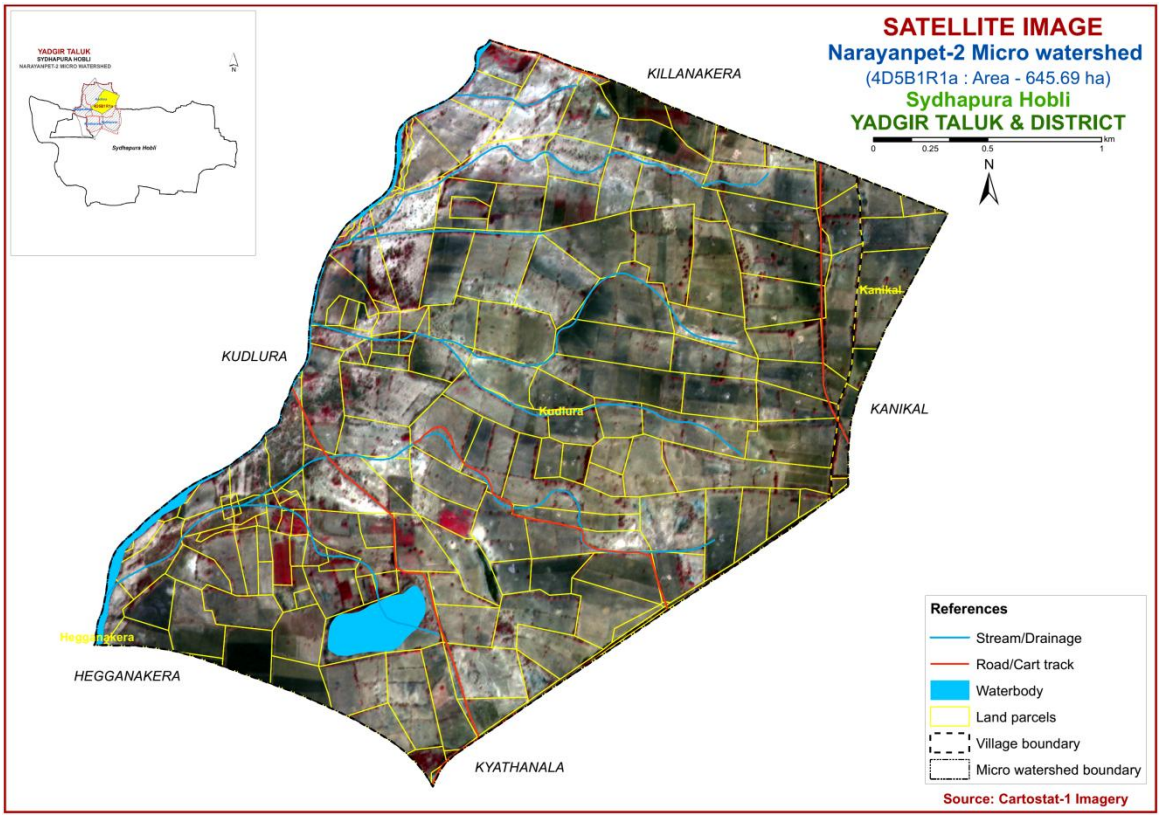


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Narayanapet-2 Microwatershed

3.3 Field Investigation

The field boundaries and survey numbers given on the cadastral sheet were located on the ground by following permanent features like roads, cart tracks, *nallas*, streams, tanks etc., and wherever changes were noticed, they were incorporated on the microwatershed cadastral map. Preliminary traverse of the microwatershed was carried out with the help of cadastral map, imagery and toposheet. 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).

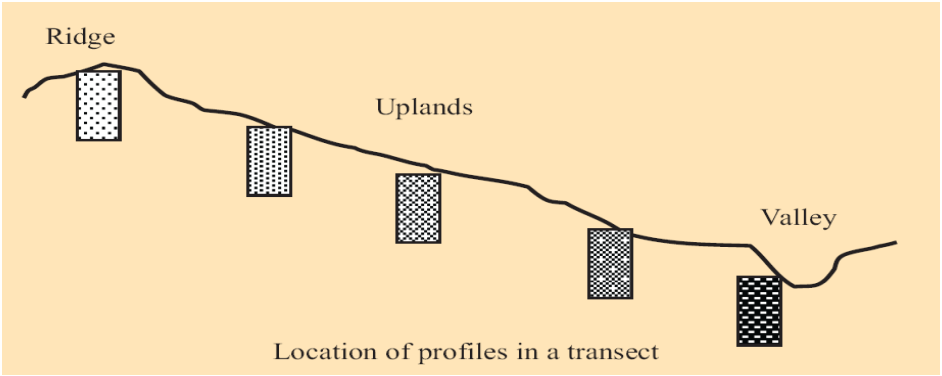


Fig: 3.4. Location of profiles in a transect

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, 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 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, color, kind of horizon and horizon sequence, calcareousness, 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 the soil series are given in Table 3.1. Based on the above characteristics, 9 soil series were identified in the Narayanapet-2 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)**	**Color (moist)**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareous-ness**
Soil of Granite and Granite Gneiss Landscape							
1	BDL (Badiyala)	25-50	7.5YR2.5/3,2.5/2,3/3 10YR 3/4,4/3	sc	-	Ap-A1	es
2	HSL(Hosalli)	75-100	10YR 5/4,4/4,4/6	sl-scl	-	Ap-Bw	es
3	GWD (Gowdagera)	75-100	10YR 3/1,3/2,4/2	sc-c	-	Ap-Bw	es
4	MDG(Mundargi)	100-150	10YR 4/4,3/3 7.5YR4/4	sc-c	-	Ap-Bw	-
Soil of Alluvial Landscape							
5	RMP(Rampur)	50-75	10YR3/1,5/4	sc-c	-	Ap-Bw	es
6	RHN(Rachanalli)	75-100	10YR 3/2,4/3	sc-c	-	Ap-Bw	es
7	KDR(Kudlura)	100-150	10YR3/1,3/2,4/1,5/2	sc-c	-	Ap-Bw	es
8	SWR (Sowrashtrahalli)	100-150	10YR4/1,3/2,3/1	c	-	Ap-Bss	es
9	HGN (Hegganakera)	>150	10YR4/2,4/1,3/1,4/1	c	-	Ap-Bss	es

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a

subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey about 11 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 19 mapping units representing 9 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 19 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 soil phase will have similar management needs and have to be treated accordingly.

The 19 soil phases identified and mapped in the microwatershed were grouped into 3 Land Management Unit (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 Unit(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 Narayanapet-2 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land Management Unitare expected to behave similarly for a given level of management.

3.5 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 from farmer's fields (64 samples) for fertility status (major and micronutrients) at 250 m grid interval in the year 2017 were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated by using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Narayanapet-2 Microwatershed

Soil Map unit No.	Soil Series	Soil Phase	Mapping Unit Description	Area in ha (%)
Soils of Granite Gneiss Landscape				
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, calcareous sandy clay soils occurring on very gently to gently sloping uplands under cultivation		**7 (1.02)**
4		BDLhB2	Sandy clay loam surface, slopes 1-3%, moderate erosion	7 (1.02)
	HSL	Hosalli soils are moderately deep (75-100 cm), well drained, have yellowish brown to dark yellowish brown, calcareous sandy loam to sandy clay loam soils occurring on very gently sloping uplands under cultivation		**15 (2.27)**
33		HSLiB2	Sandy clay surface, slopes 1-3%, moderate erosion	15 (2.27)
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, calcareous sandy clay to clay soils occurring on very gently sloping uplands under cultivation		**6 (0.95)**
34		GWDcB2	Sandy loam surface, slopes 1-3%, moderate erosion	6 (0.95)
	MDG	Mundargi soils are deep (100-150 cm), moderately well drained, have brown to dark yellowish brown, sandy clay to clay soils occurring on very gently sloping uplands under cultivation		**29 (4.57)**
57		MDGcB2	Sandy loam surface, slopes 1-3%, moderate erosion	13 (2.07)
58		MDGiB2	Sandy clay surface, slopes 1-3%, moderate erosion	16 (2.5)
Soils of Alluvial Landscape				
	RMP	Rampur soils are moderately shallow (50-75 cm), moderately well drained, have yellowish brown to very dark gray, calcareous sandy clay to clay alluvial soils occurring on very gently sloping uplands under cultivation		**195 (30.10)**
71		RMPiB2	Sandy clay surface, slopes 1-3%, moderate erosion	185 (28.61)
72		RMPiB3	Sandy clay surface, slopes 1-3%, severe erosion	10 (1.49)
	RHN	Rachanalli soils are moderately deep (75-100 cm), moderately well drained, have brown to very dark grayish brown, calcareous sandy clay to clay alluvial soils occurring on very gently sloping uplands under cultivation		**25 (3.92)**
77		RHNcB2	Sandy loam surface, slopes 1-3%, moderate erosion	19 (3.0)
79		RHNmB2	Clay surface, slopes 1-3%, moderate erosion	6 (0.92)

	KDR	Kudlura soils are deep (100-150 cm), moderately well drained, have dark gray to very dark grayish brown, calcareous sandy clay to clay alluvial soils occurring on nearly level to very gently sloping uplands under cultivation		**216 (33.40)**
84		KDRcB2	Sandy loam surface, slopes 1-3%, moderate erosion	9 (1.46)
87		KDRiB2	Sandy clay surface, slopes 1-3%, moderate erosion	96 (14.87)
88		KDRiB3	Sandy clay surface, slopes 1-3%, severe erosion	64(9.86)
89		KDRmB2	Clay surface, slopes 1-3%, moderate erosion	47 (7.21)
	SWR	Sowrashtrahalli soils are deep (100-150 cm), moderately well drained, have dark gray to very dark grayish brown, calcareous black cracking clay soils occurring on very gently sloping lowlands under cultivation		**54 (8.33)**
90		SWRcB2	Sandy loam surface, slopes 1-3%, moderate erosion	54 (8.33)
	HGN	Hegganakera soils are very deep (>150 cm), moderately well drained, have dark gray to very dark grayish brown and brown, calcareous black cracking clay soils occurring on very gently sloping uplands under cultivation		**84 (12.98)**
93		HGNiB2	Sandy clay surface, slopes 1-3%, moderate erosion	24 (3.79)
94		HGNiB3	Sandy clay surface, slopes 1-3%, severe erosion	5 (0.77)
95		HGNmB2	Clay surface, slopes 1-3%, moderate erosion	48 (7.38)
96		HGNmB3	Clay surface, slopes 1-3%, severe erosion	7 (1.04)
999		Rock outcrops	Rock lands, both massive and bouldery	3(0.39)
1000		Others		13(2.08)

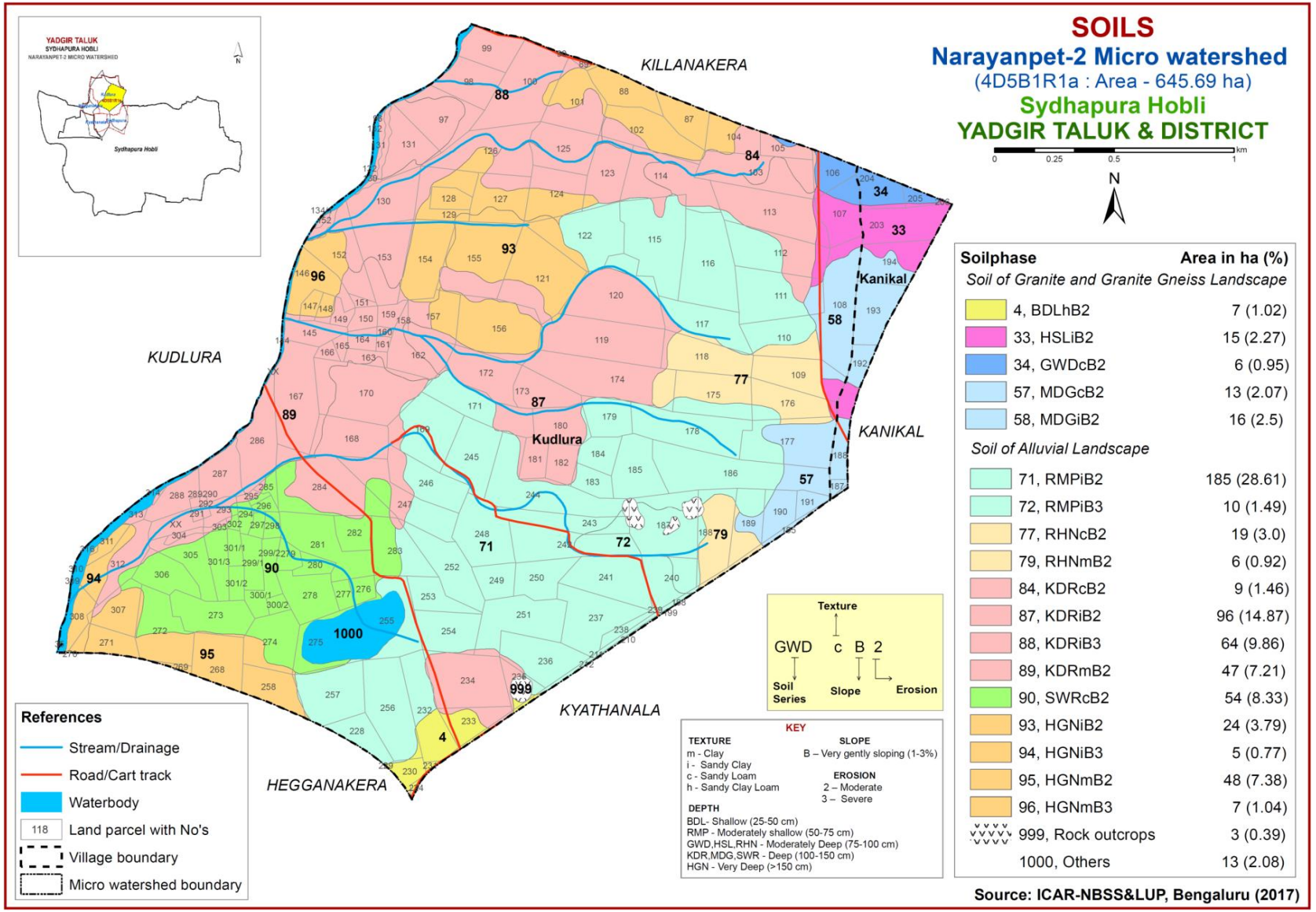


Fig 3.5 Soil Phase or Management Units - Narayanapet-2 Microwatershed

Chapter 4

THE SOILS

Detailed information pertaining to the nature, extent and their distribution of different kinds of soils occurring in Narayanapet-2 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 9 soil series are identified. 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 and climate.

A brief description of each of the 9 soil series identified followed by 19 soil phases (management units) mapped under each series are furnished below. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 4 soil series are identified and mapped. Brief description of each series identified is given below. Of these, MDG series occupies maximum area of 29 ha (5%) followed by HSL 15 ha (2%), BDL 7 ha (1%) and GWD 6 ha (1%). Brief description of each series identified and number of soil phases mapped is given below.

4.1.1 Badiyala (BDL) Series: Badiyala soils are shallow (25-50 cm), well drained, have very dark brown to dark yellow brown and dark brown, calcareous sandy clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation.

Landscape and Soil Profile characteristics of Badiyala (BDL) Series

The thickness of the soil 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 subsurface A 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 clay loam to sandy clay. The available water capacity is very low (<50mm/m). Only one phase was identified and mapped.

4.1.2 Hosalli (HSL) Series: Hosalli soils are moderately deep (75-100 cm), moderately well drained, have dark yellowish brown to yellowish brown, calcareous sandy loam to sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 6 to 15 cm. Its colour is in hue 10 YR and 7.5 YR with value 3 to 5 and chroma 2 to 4. Its texture varies from loamy sand to sandy loam and sandy clay loam. The thickness of B horizon ranges from 62 to 93 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 2 to 4. Its texture is sandy loam and sandy clay loam. The available water capacity is low (50-100 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Hosalli (HSL) Series

4.1.3 Gowdagera (GWD) Series: Gowdagera soils are moderately deep (75-100 cm), moderately well drained, very dark gray to dark grayish brown, calcareous sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation.

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 to clay. The available water capacity is medium (100-150 mm/m). Only one phase was identified and mapped.

Landscape and Soil Profile characteristics of Gowdagera (GWD) Series

4.1.4 Mundargi (MDG) Series: Mundargi soils are deep (100-150 cm), moderately well drained, dark brown to dark yellowish brown, and sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation.

The thickness of the solum ranges from 100 to 149 cm. The thickness of A horizon ranges from 8 to 20 cm. Its colour is in 10 YR hue with value 3 and chroma 1 to 4. The texture ranges from sandy loam to sandy clay loam and sandy clay. The thickness of B horizon ranges from 105 to 140 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture varies from sandy clay to clay. The available water capacity is very high (>200 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Mundargi (MDG) Series

4.2 Soils of Alluvial landscape

In this landscape, 5 soil series are identified and mapped. Brief description of each series identified is given below. Of these, KDR series occupies maximum area of 216 ha (33%) followed by RMP 195 ha (30%), HGN 84 ha (13%), SWR 54 ha (8%) and RHN

25 ha (4%). Brief description of each series identified and number of soil phases mapped is given below.

4.2.1 Rampur (RMP) Series: Rampur soils are moderately shallow (50-75 cm), moderately well drained, have very dark to yellowish brown, calcareous sandy clay to clay soils. They have developed from alluvium and occur on very gently sloping plains under cultivation.

The thickness of the solum ranges from 53 to 75 cm. The thickness of A horizon ranges from 6 to 12 cm. Its colour is in 7. 5 YR and 10 YR hue with value 4 to 5 and chroma 3 to 6. The texture is sandy loam to sandy clay loam and sandy clay. The thickness of B horizon ranges from 48 to 65 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 to 5 and chroma 1 to 6. Its texture is sandy clay to clay. The available water capacity is low (51-100 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Rampura (RMP) Series

4.2.2 Rachanalli (RHN) Series: Rachanalli soils are moderately deep (75-100 cm), moderately well drained, very dark grayish brown to dark brown, calcareous sandy clay to clay soils. They have developed from alluvium and occur on very gently sloping plains under cultivation.

The thickness of the solum ranges from 76 to 100 cm. The thickness of A horizon ranges from 6 to 13 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 and sandy clay. The thickness of B horizon ranges from 66 to 92 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 1 to 3. Its texture is sandy clay and clay. The available water capacity is high (150-200 mm/m). Two phases were identified and mapped.

Landscape and Soil Profile characteristics of Rachanalli (RHN) Series

4.2.3 Kudlura (KDR) Series: Kudlura soils are deep (100-150 cm), moderately well drained, very dark gray to grayish brown, calcareous sandy clay to clay soils. They have developed from alluvium and occur on nearly level to very gently sloping plains under cultivation.

The thickness of the solum ranges from 110 to 149 cm. The thickness of A horizon ranges from 6 to 22 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture ranges from sandy loam, sandy clay loam, sandy clay and clay. The thickness of B horizon ranges from 115 to 143 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 3. Texture is sandy clay to clay and is calcareous in nature. The available water capacity is very high (>200 mm/m). Four phases were identified and mapped.

Landscape and Soil Profile characteristics of Kudlura (KDR) Series

4.2.4 Sowrashtrahalli (SWR) Series: Sowrashtrahalli soils are very deep (>150 cm), moderately well drained, have very dark gray to dark gray calcareous cracking clay soils. They are developed from alluvium and occur on very gently sloping low lands under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 9 to 20 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 2. Texture varies from sandy clay 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 4. Texture varies from sandy clay to 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 Sowrashtrahalli (SWR) Series

4.2.5 Hegganakera (HGN) Series: Hegganakera soils are very deep (>150 cm), moderately well drained, very dark gray to dark grayish brown, calcareous cracking clay soils. They have developed from alluvium and occur on very gently sloping plains under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 7 to 9 cm. Its colour is in hue 10 YR with value 3 to 4 and chroma 1 to 3 with clay texture. The thickness of B horizon ranges from 152 to 175 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay. The available water capacity is very high (>200 mm/m). Four phases were identified and mapped.

Landscape and Soil Profile characteristics of Hegganakera (HGN) Series

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

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

The 19 soil map units identified in the Narayanapet-2 microwatershed are grouped under 2 land capability classes and 2 land capability subclasses. An area of 630 ha (98%) in the microwatershed is suitable for agriculture and about 16 ha (2%) is covered by rock outcrops and others (habitation and water bodies) (Fig. 5.1).

Good cultivable lands (Class II) cover an area of about 83 per cent and are distributed in the major part of the microwatershed with minor problems of soil and erosion. Moderately good cultivable lands (Class III) cover an area of about 14 per cent and are distributed in the central, western, northern, southern, southwestern and south-eastern part of the microwatershed with moderate problems of soil and erosion.

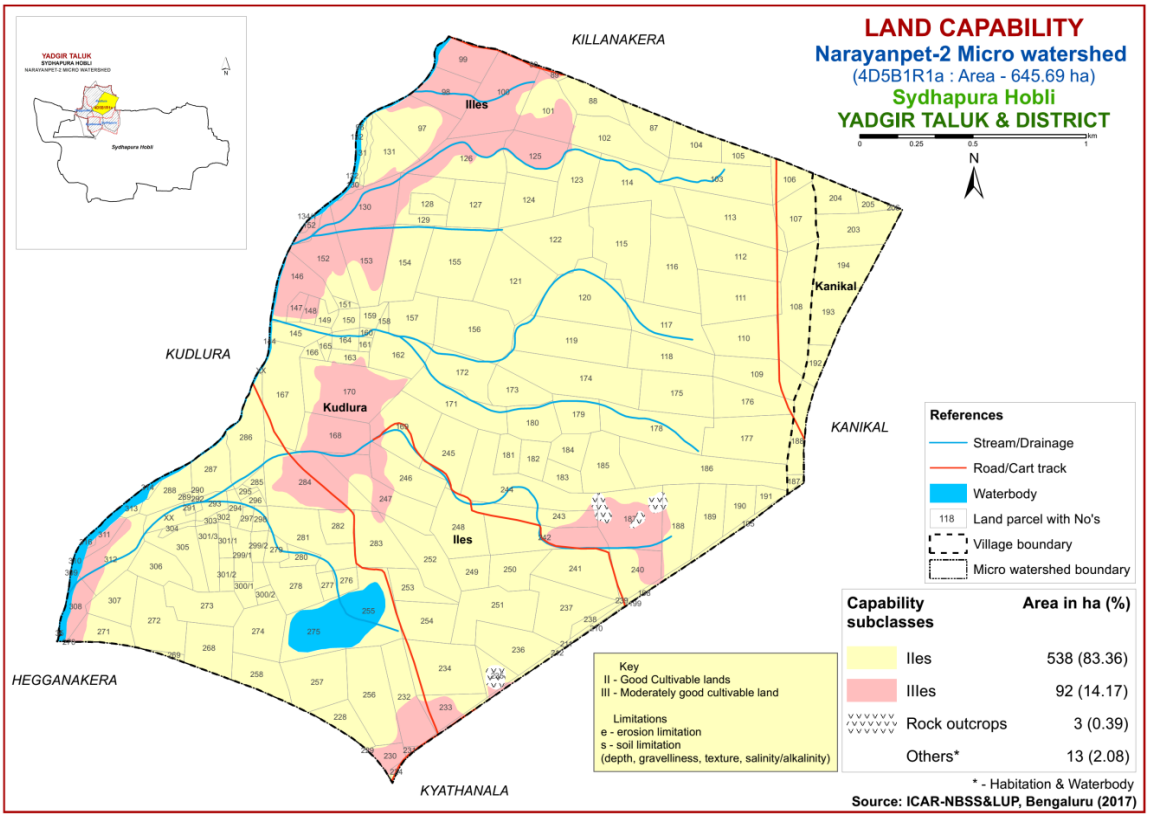


Fig. 5.1 Land Capability map of Narayanapet-2 Microwatershed

5.2 Soil Depth

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

Shallow (25-50 cm) soils occur in small area of 7 ha (1%) and are distributed in the southern part of the microwatershed. Moderately shallow (50-75 cm) soils occupy an area of about 194 ha (30%) and are distributed in the central, eastern and southern part of the microwatershed. Moderately deep (75-100 cm) soils occupy an area of 46 ha (7%) and are distributed in the eastern and northeastern part of the microwatershed. Deep (100-150 cm) soils occupy maximum area of 299 ha (46%) and are distributed in the major part of the microwatershed. Very deep (>150 cm) soils cover an area of 84 ha (13%) and are distributed in the southwestern, western, central and northern part of the microwatershed.

The most productive lands 383 ha (59%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep to very deep (100 to >150 cm depth) soils occurring in major part of the microwatershed.

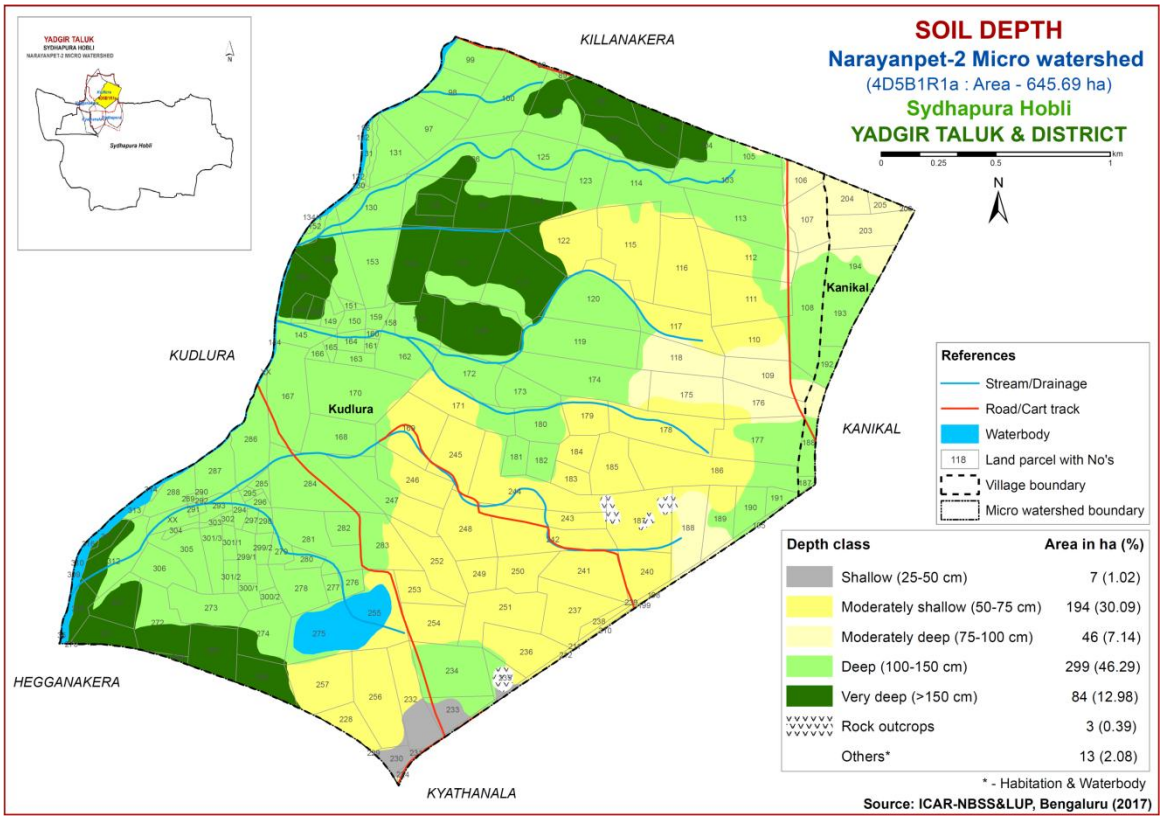


Fig. 5.2 Soil Depth map of Narayanapet-2 Microwatershed

5.3 Surface Soil Texture

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

An area of about 109 ha (17%) has soils that are loamy at the surface and are distributed in the southwestern, central, eastern and northeastern part of the microwatershed. An area of 521 ha (81%) has soils that are clayey at the surface and occur in the major part of the microwatershed.

Entire area has most productive lands with respect to surface soil texture. The clayey soils (81%) have high potential for soil-water retention and availability, and nutrient retention and availability, but have more problems of drainage, infiltration,

workability and other physical problems. The other productive lands are loamy soils (17%) which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems.

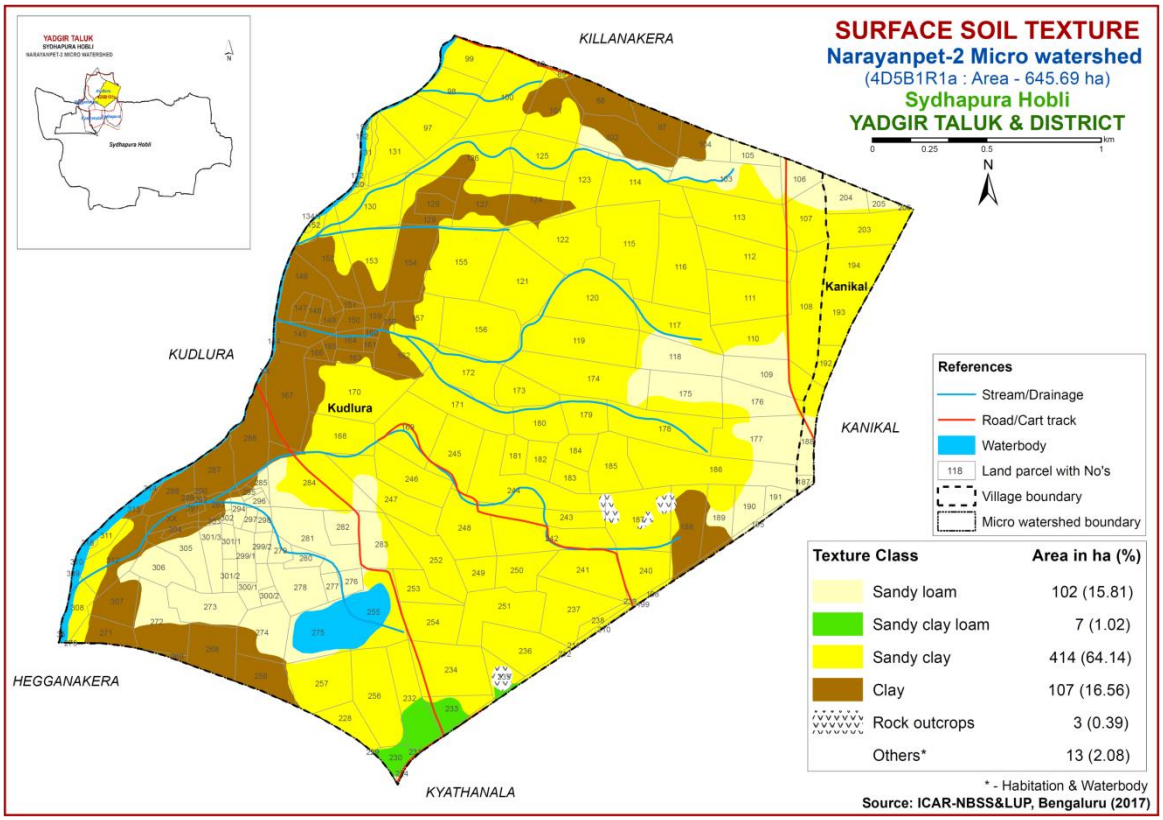


Fig. 5.3 Surface Soil Texture map of Narayanapet-2 Microwatershed

5.4 Soil Gravelliness

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

Non gravelly (<15%) soils cover entire area of the microwatershed. These are the most productive soils, where all climatically adapted short and long duration crops can be grown.

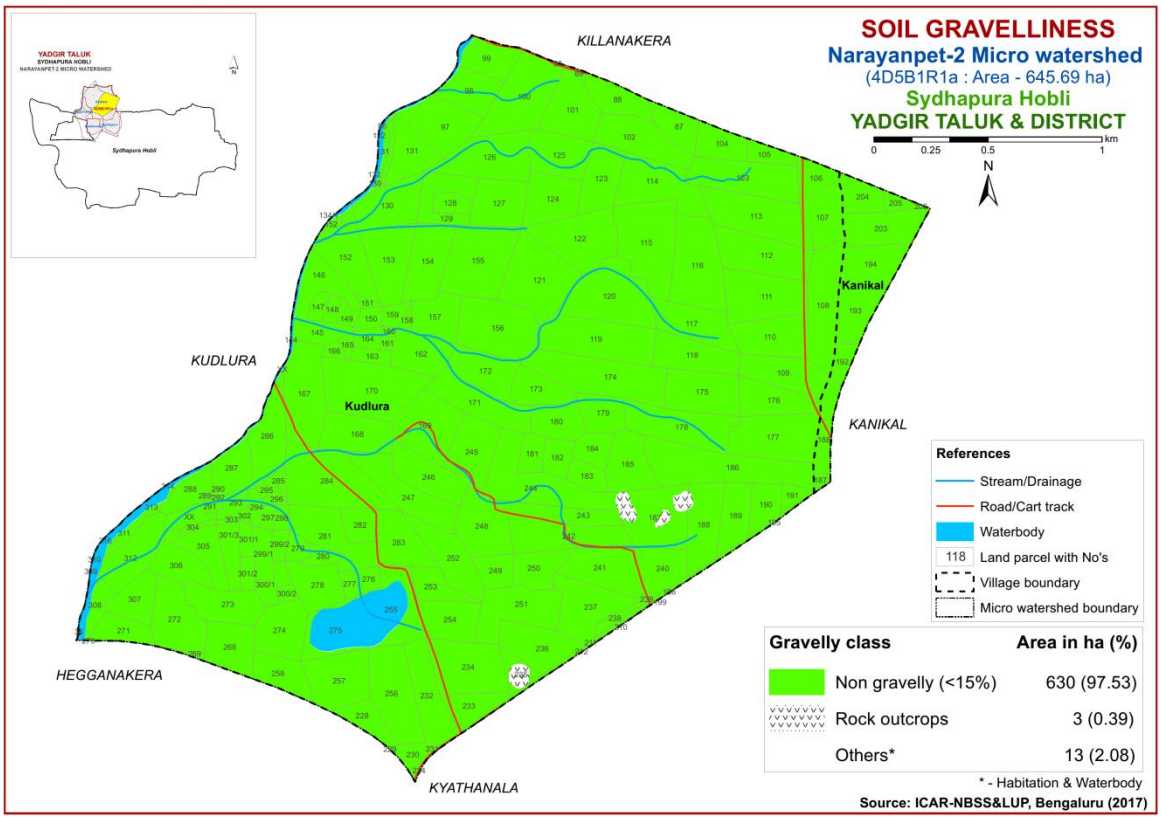


Fig. 5.4 Soil Gravelliness map of Narayanapet-2 Microwatershed

5.5 Available Water Capacity

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

An area of about 7 ha (1%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the southern part of the microwatershed and 15 ha (2%) are low (51-100 mm/m) and are distributed in the eastern and northeastern part of the microwatershed, An area of about 226 ha (34%) is medium (101-150 mm/m) in available water capacity and are distributed in the central, southern, eastern and northeastern part of the microwatershed. Very high (>200 mm/m) in 383 ha (59%) and are distributed in all parts of the microwatershed.

About 22 ha (2%) area in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses.

An area of 383 ha (59%) are potential areas with regard to AWC where all climatically adapted annual and perennial crops can be grown.

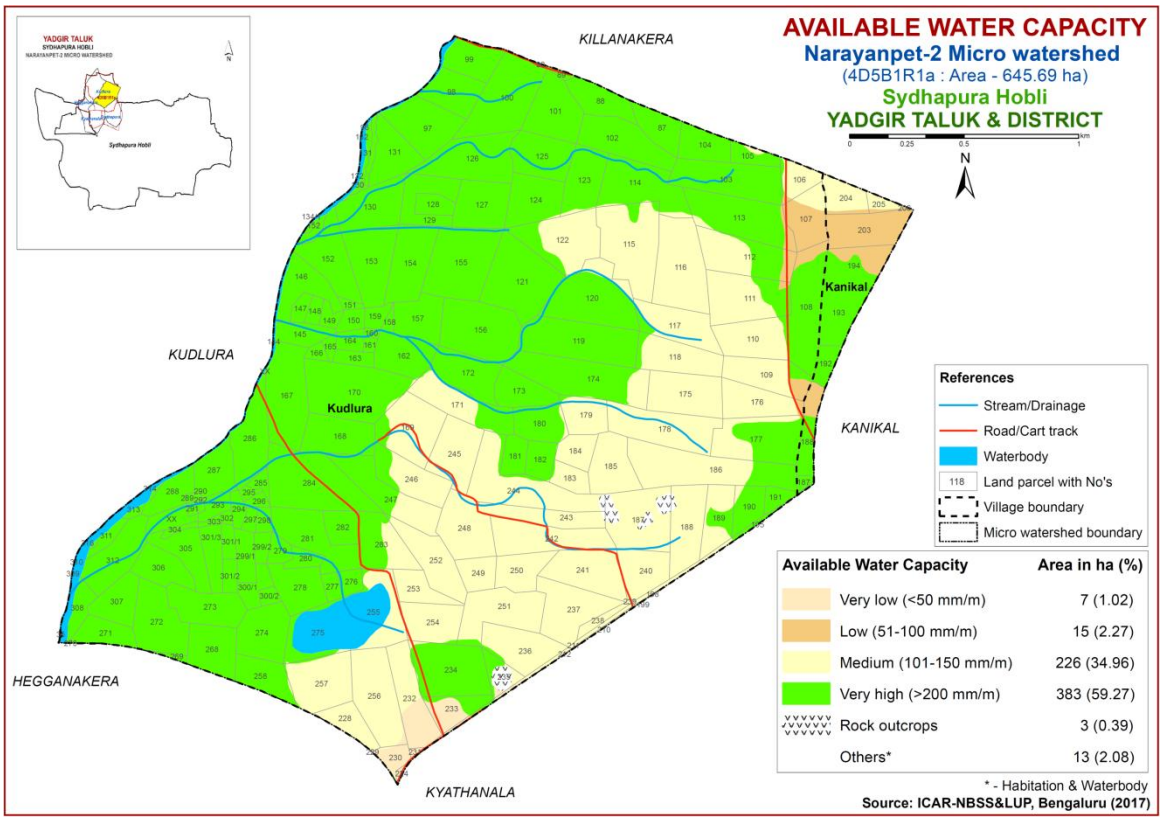


Fig. 5.5 Soil Available Water Capacity map of Narayanapet-2 Microwatershed

5.6 Soil Slope

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

Entire area of the microwatershed falls under very gently sloping (1-3% slope) lands and have high potential in respect of soil slopes. In these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

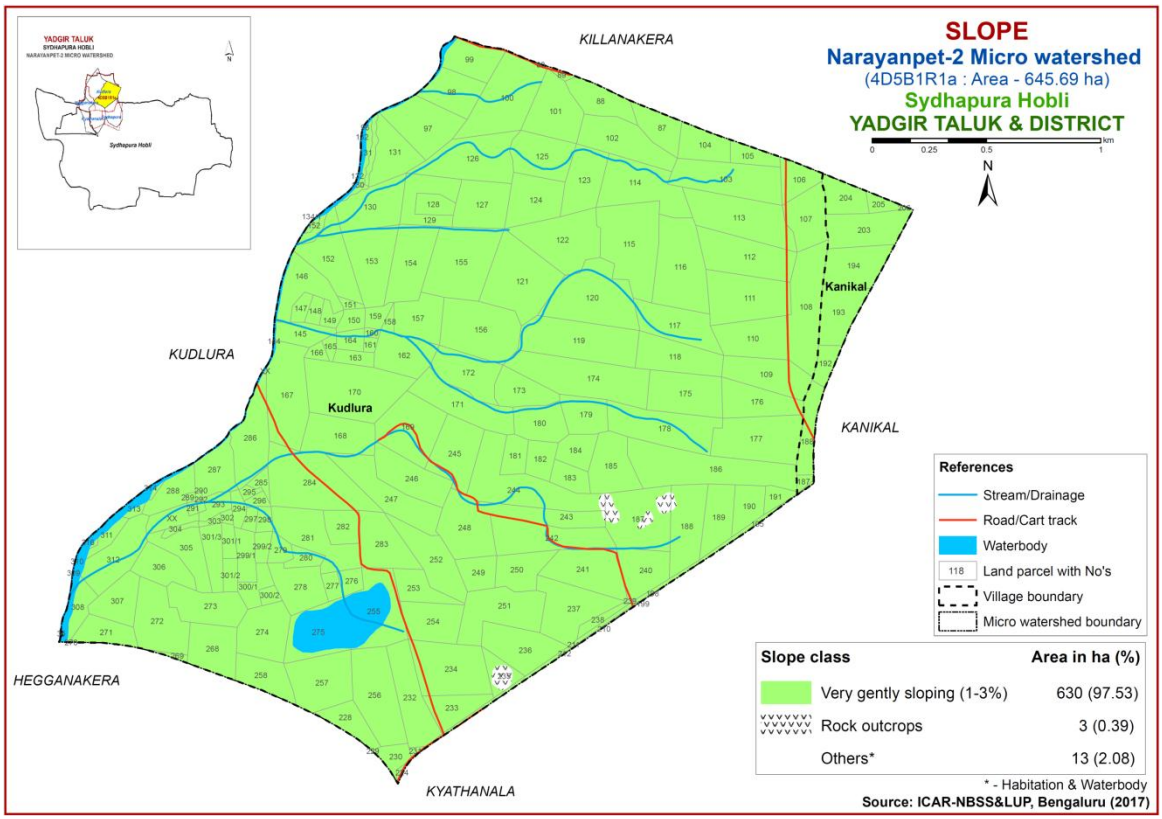


Fig. 5.6 Soil Slope map of Narayanapet-2 Microwatershed

5.7 Soil Erosion

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

Soils that are moderately eroded (e2 class) cover an area of 545 ha (84%) and are distributed in all parts of the microwatershed. Severely eroded soils cover an area of 85 ha (13%) and are distributed in the western, central, northwestern, southwestern and eastern part of the microwatershed.

Entire area in the microwatershed is problematic because of moderate and severe erosion. For these areas, taking up soil and water conservation and other land development measures are needed.

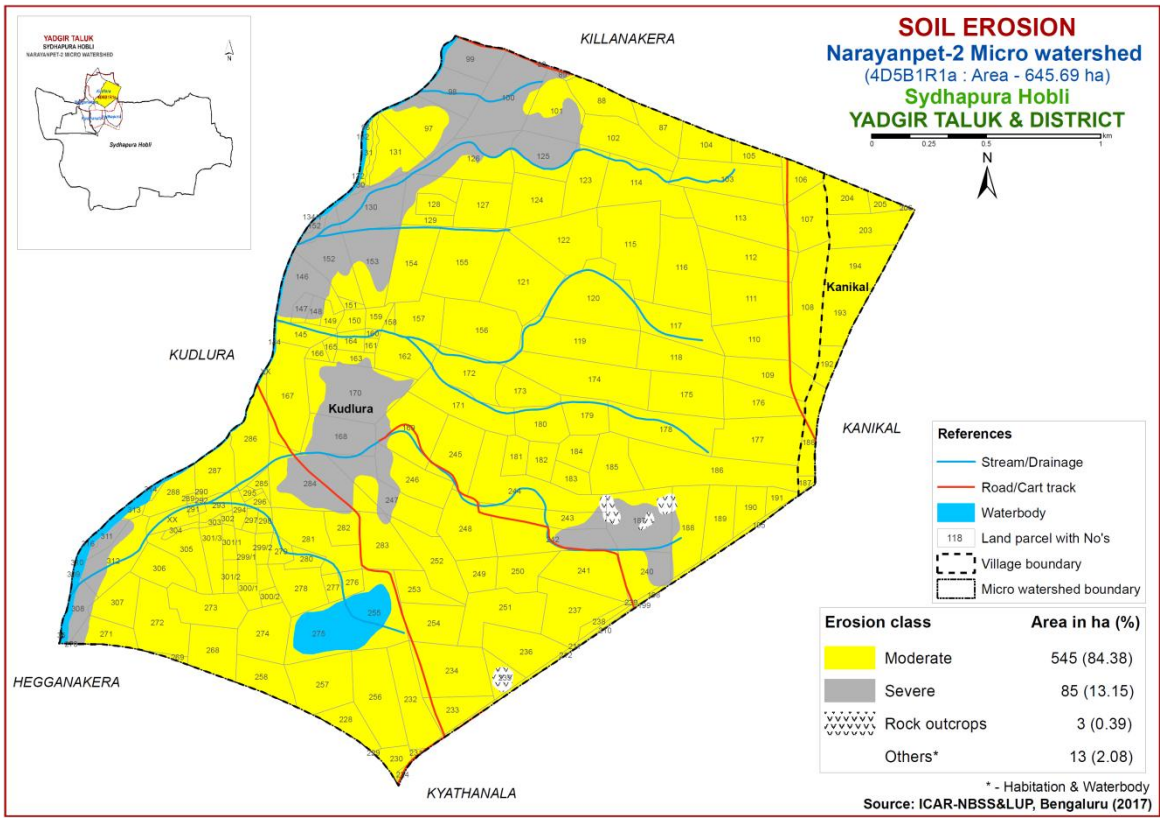


Fig. 5.7 Soil Erosion map of Narayanapet-2 Microwatershed

Chapter 6

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 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, boron, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil analysis of the Narayanapet-2 microwatershed for soil reaction (pH) showed that an area of about 125 ha (19%) is neutral (pH 6.5-7.3) and are distributed in the south-eastern, eastern, northeastern and central part of the microwatershed. An area of about 247 ha (38%) is slightly alkaline (pH 7.3-7.8) and are distributed in the central, south-eastern, northeastern and southern part of the microwatershed. Maximum area of about 254 ha (39%) are moderately alkaline (pH 7.8-8.4) and are distributed in the major part of the microwatershed. 5 ha (1%) area is strongly alkaline (pH 8.4-9.0) and are distributed in the northwestern part of the (Fig. 6.1).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (an index of available Nitrogen) in the soils of the microwatershed is high (>0.75) in an area of about 135 ha (21%) and are distributed in the southern, southwestern, western, northwestern and northeastern part of the microwatershed, medium (0.5-0.75%) covering an area of about 236 ha (37%) and are distributed in the major part of the microwatershed, whereas low (<0.5%) in maximum area of about 259 ha (40%) and are distributed in all parts of the microwatershed (Fig. 6.3).

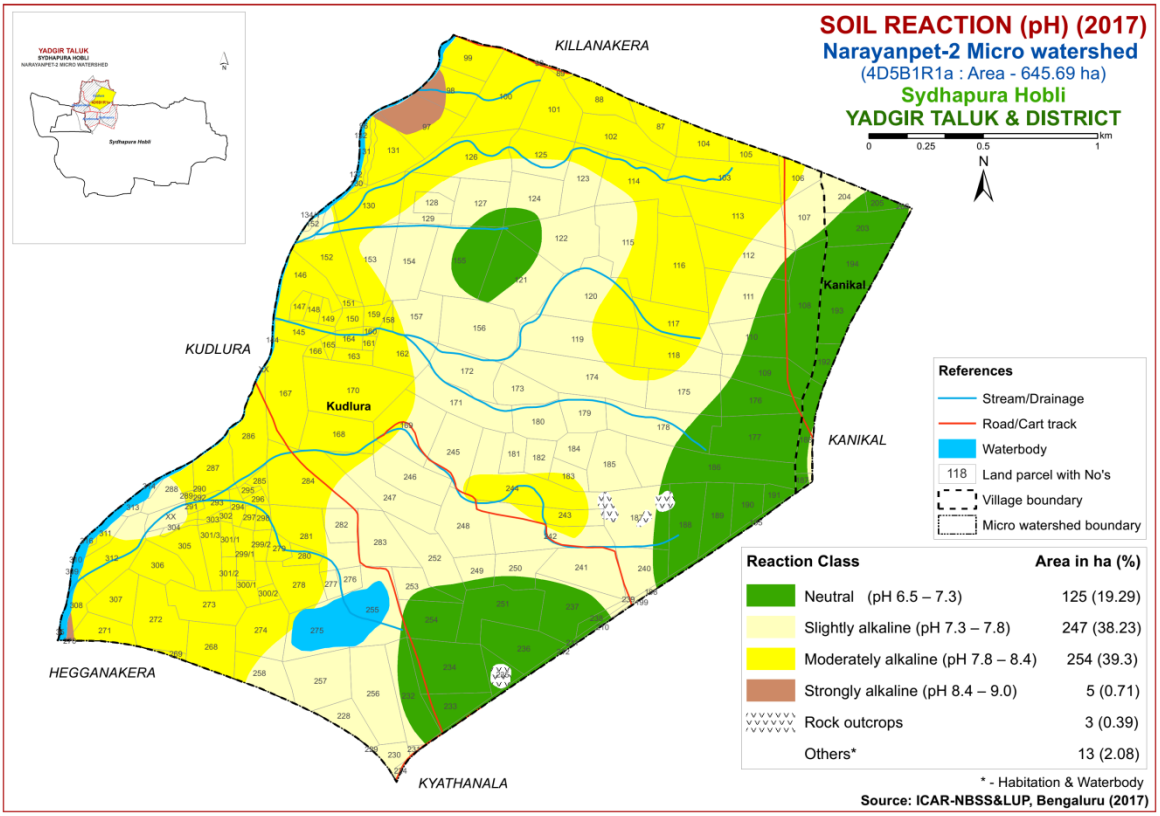


Fig.6.1 Soil Reaction (pH) map of Narayanapet-2 Microwatershed

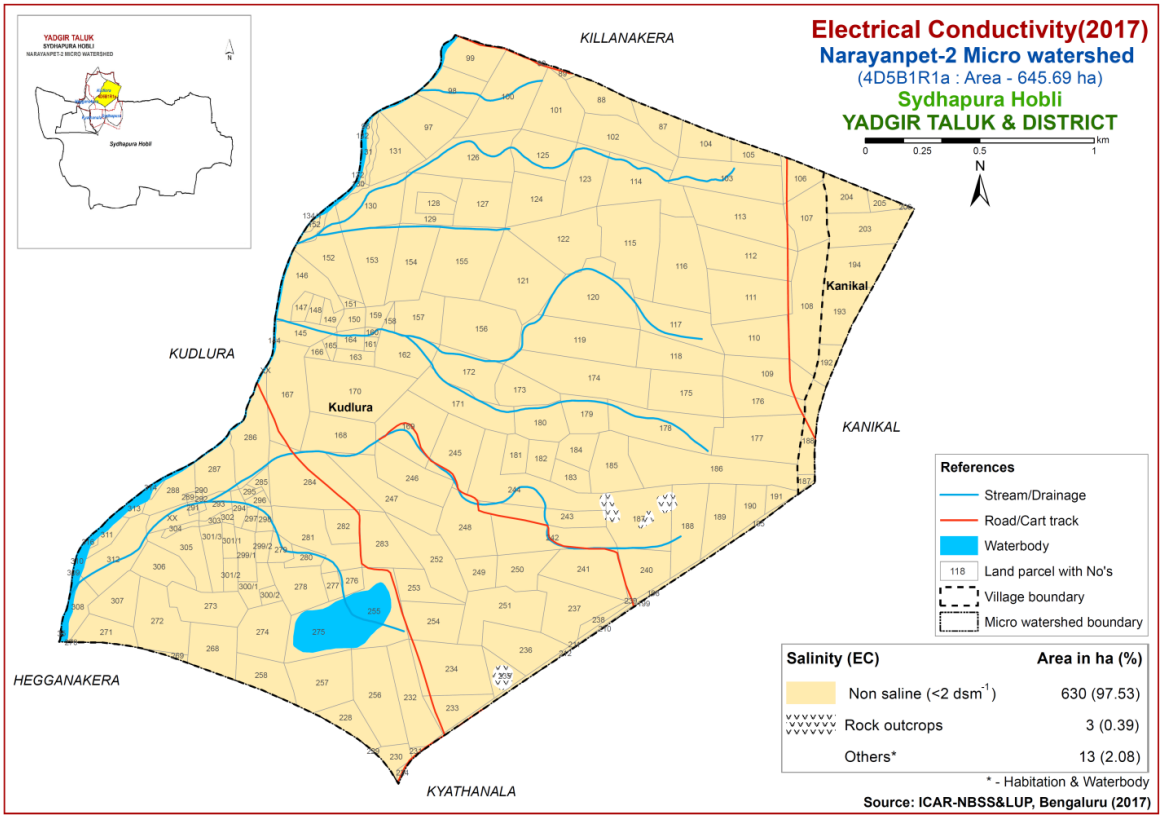


Fig.6.2 Electrical Conductivity (EC) map of Narayanapet-2 Microwatershed

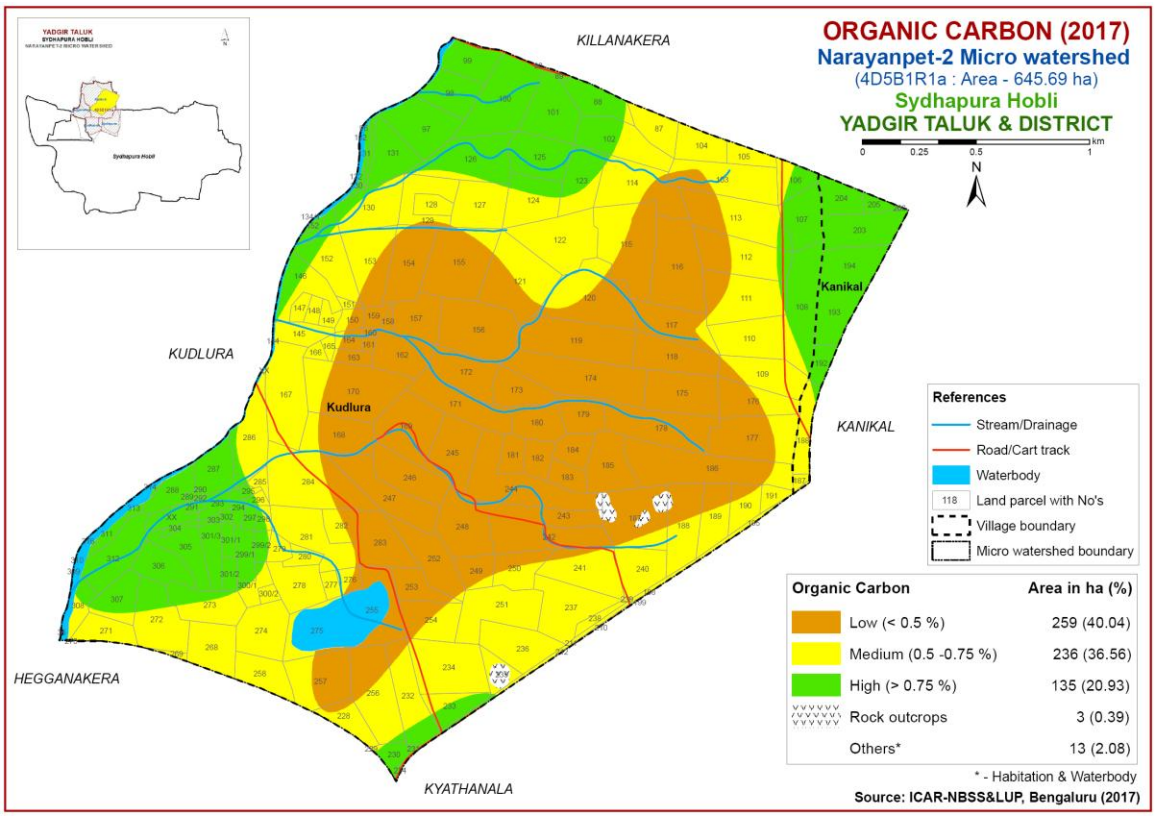


Fig.6.3 Soil Organic Carbon map of Narayanapet-2 Microwatershed

6.4 Available Phosphorus

Available phosphorus content is low (<23 kg/ha) in an area 85 ha (13%) and are distributed in the western and central part of the microwatershed. Medium (23-57 kg/ha) in maximum area of about 448 ha (69%) and occur in all parts of the microwatershed and high (>57 kg/ha) in an area of about 97 ha (15%) and are distributed in the central, southern, southeastern and eastern part of the microwatershed (Fig. 6.4).

6.5 Available Potassium

Available potassium content is medium (145-337 kg/ha) in maximum area of about 486 ha (75%) and are distributed in all parts of the microwatershed (Fig. 6.5). High (>337 kg/ha) in an area of 144 ha (22%) and are distributed in the southern, southwestern, western, northern and central part of the microwatershed.

6.6 Available Sulphur

An area of about 226 ha (35%) is low (<10 ppm) in available sulphur content and are distributed in the southwestern, southern, central, southeastern, eastern and northeastern part of the microwatershed and medium (10-20 ppm) in maximum area of about 399 ha (62%) and are distributed in all parts of the microwatershed. High in very small area of about 4 ha (1%) and are distributed in the northern and northwestern part of the microwatershed (Fig. 6.6).

6.7 Available Boron

Available boron content is medium (0.5-1.0 ppm) in maximum area of 423 ha (65%) and are distributed in the major part of the microwatershed. An area of about 207 ha (32%) is low (<0.5 ppm) in available boron and are distributed in the northwestern, central, northeastern, southwestern, southeastern and southern part of the microwatershed (Fig. 6.7).

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in the entire area of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

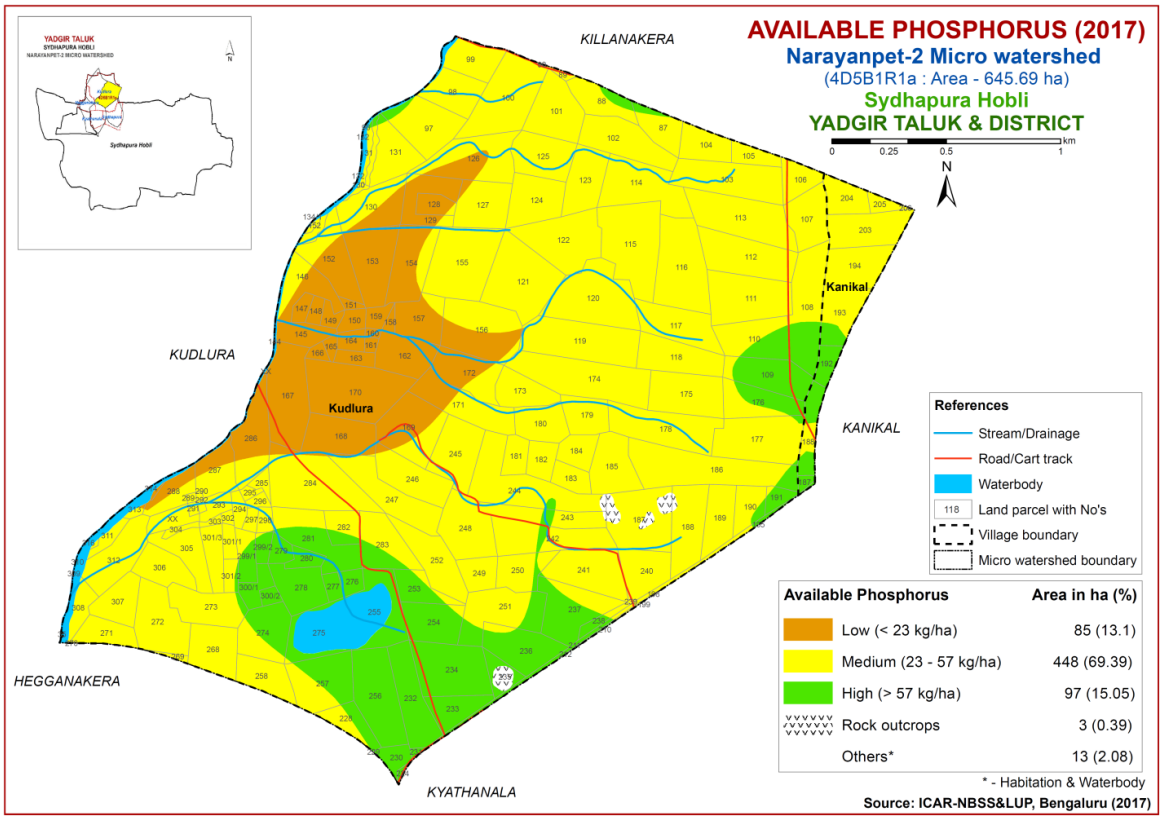


Fig.6.4 Soil Available Phosphorus map of Narayanapet-2 Microwatershed

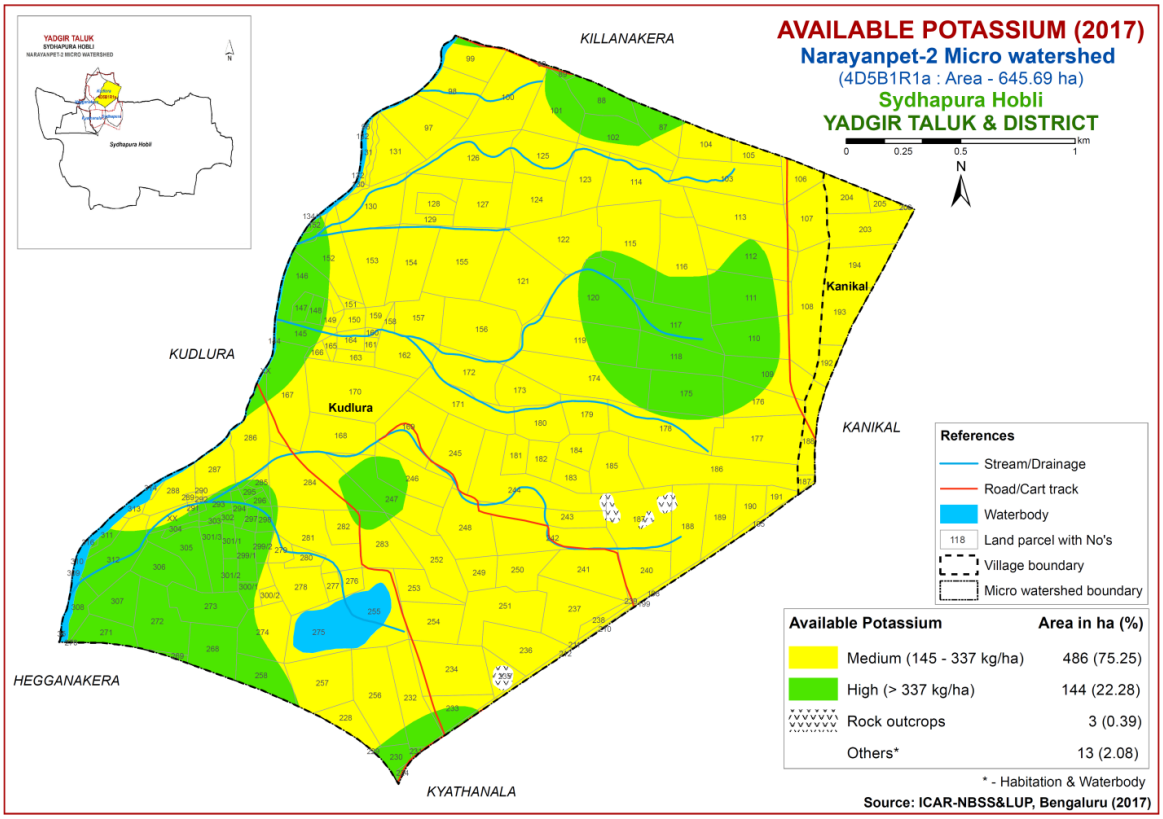


Fig.6.5 Soil Available Potassium map of Narayanapet-2 Microwatershed

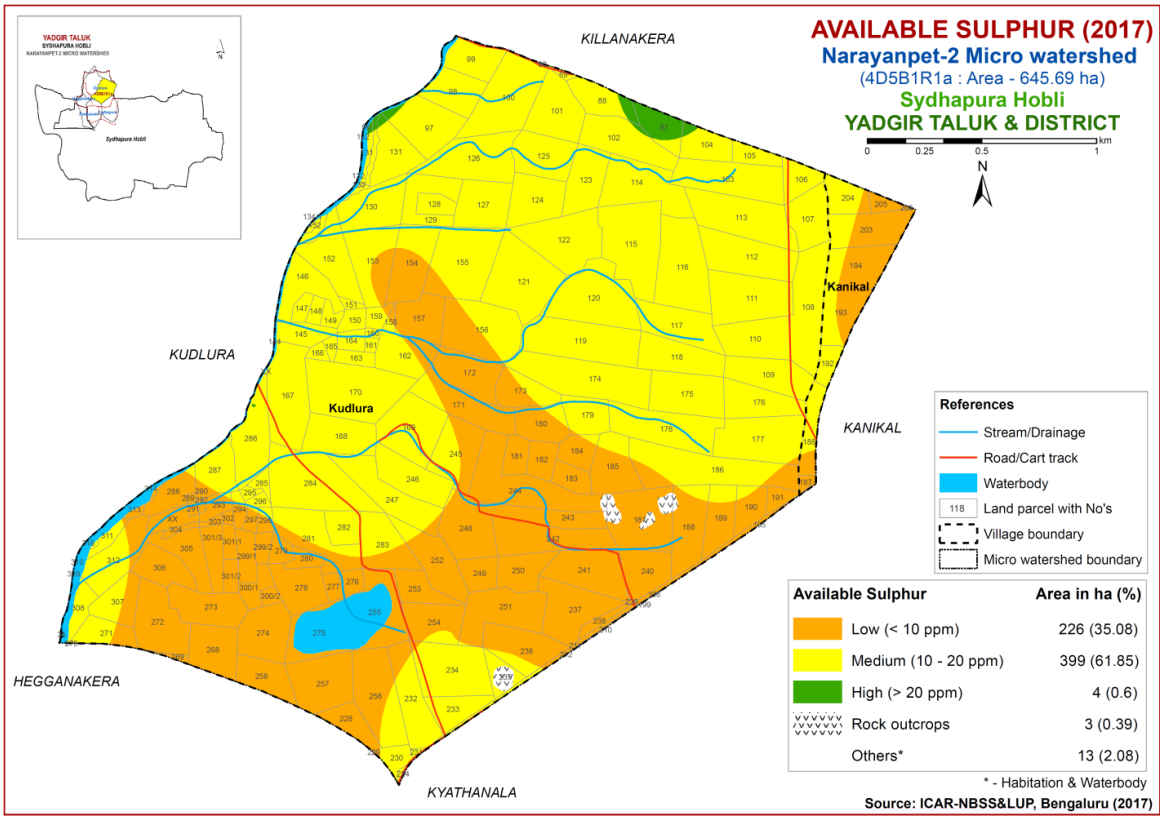


Fig.6.6 Soil Available Sulphur map of Narayanapet-2 Microwatershed

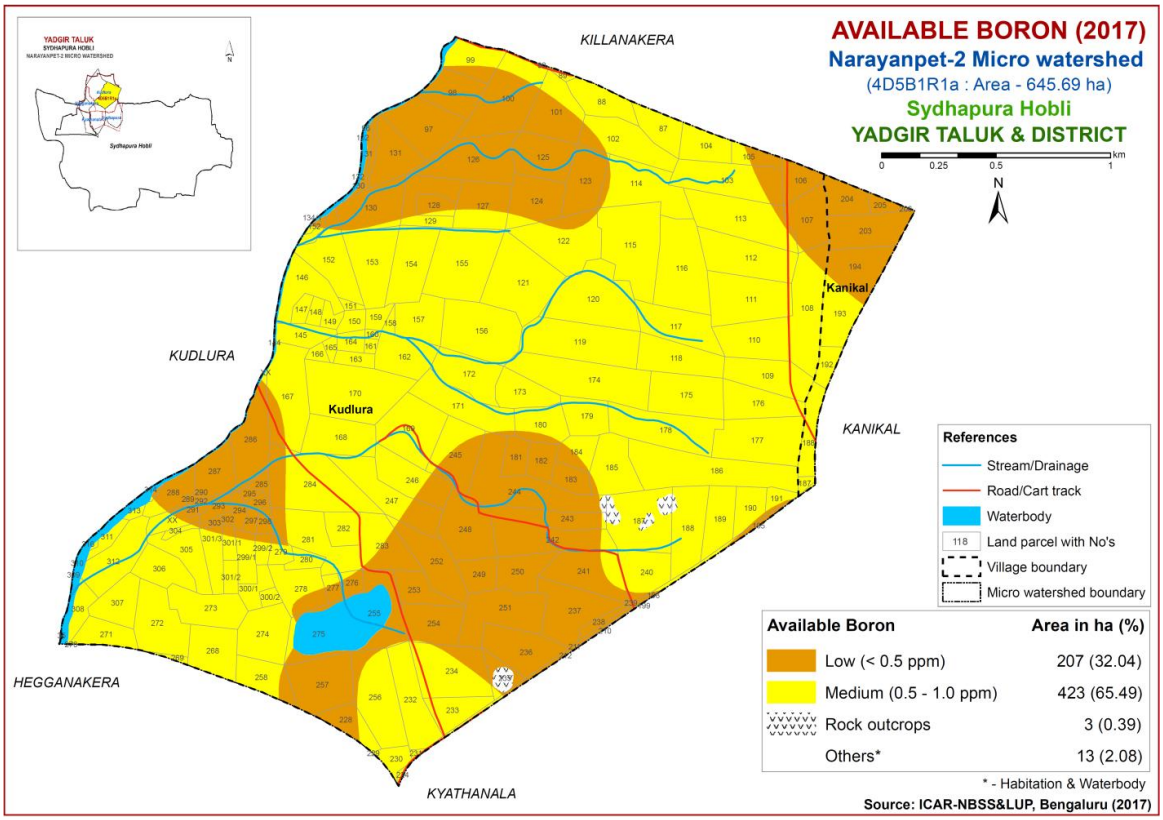


Fig.6.7 Soil Available Boron map of Narayanapet-2 Microwatershed

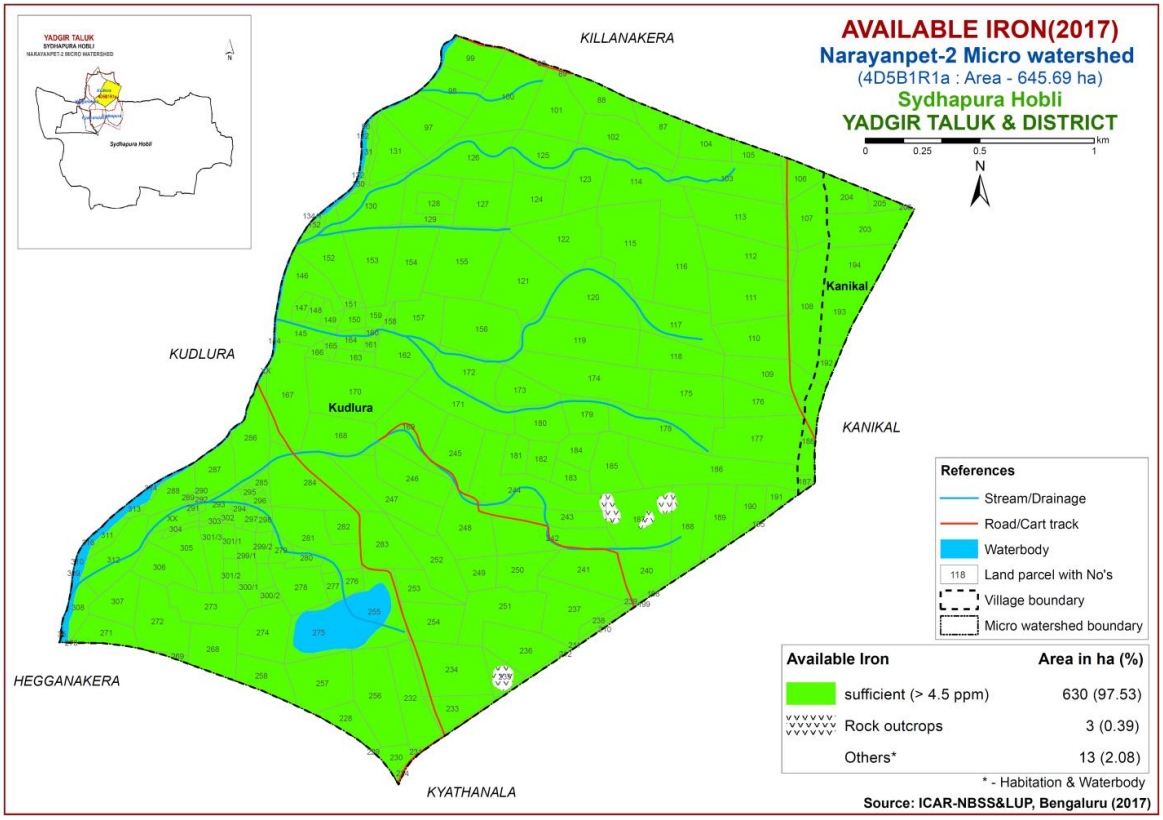


Fig.6.8 Soil Available Iron map of Narayanapet-2 Microwatershed

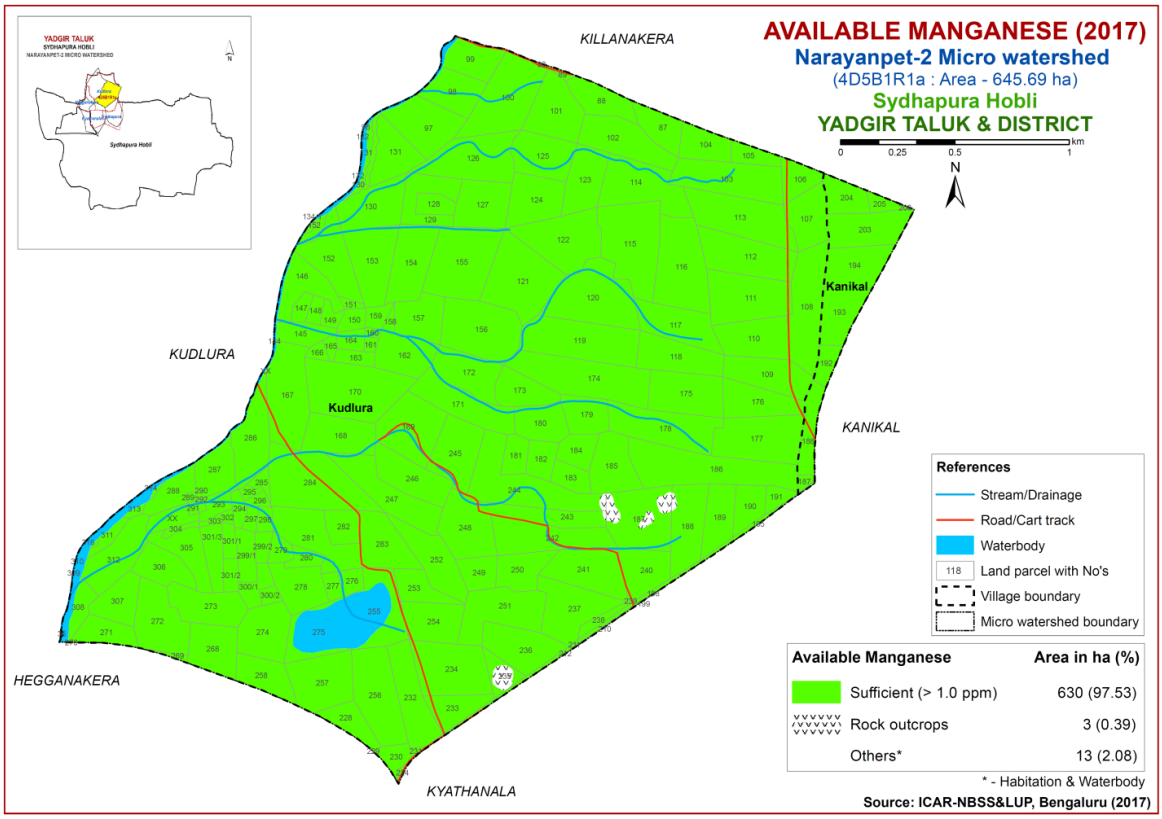


Fig.6.9 Soil Available Manganese map of Narayanapet-2 Microwatershed

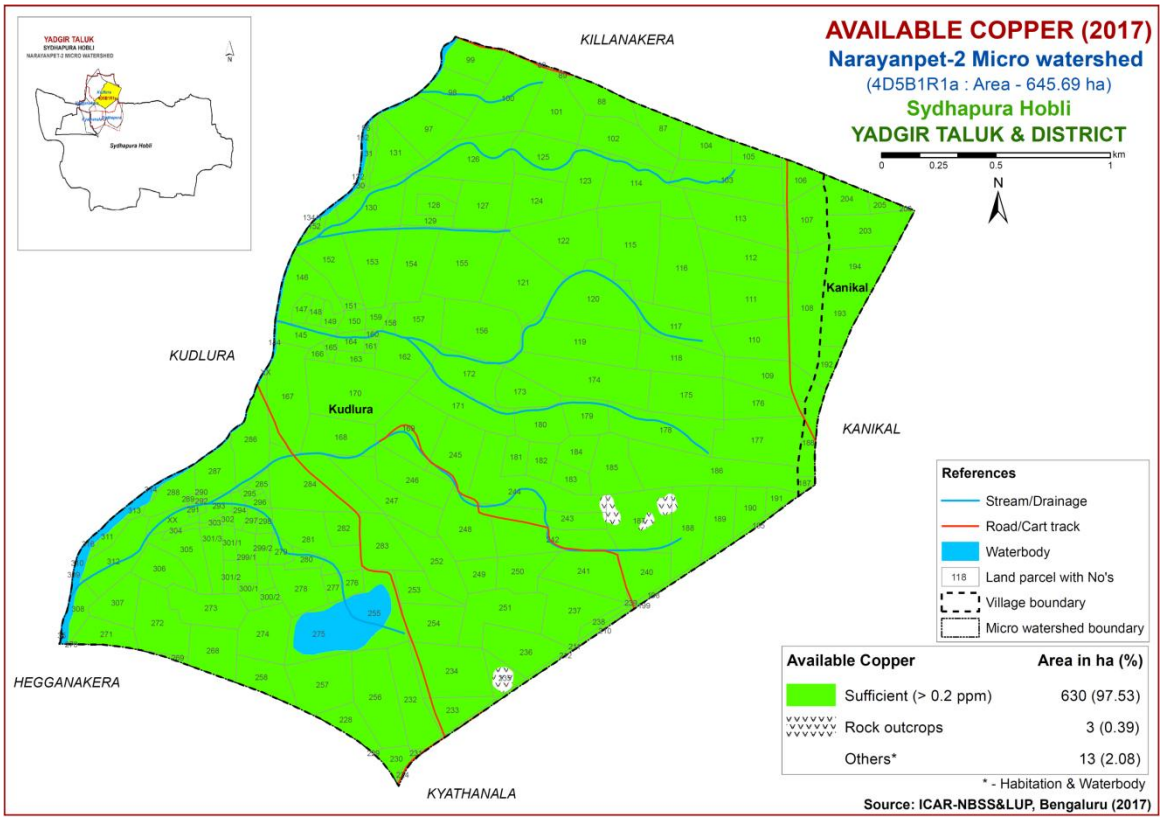


Fig.6.10 Soil Available Copper map of Narayanapet-2 Microwatershed

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in maximum area of 623 ha (97%) of the microwatershed and sufficient in small area of 6 ha (1%) area of the microwatershed occurring in southern part (Fig 6.11).

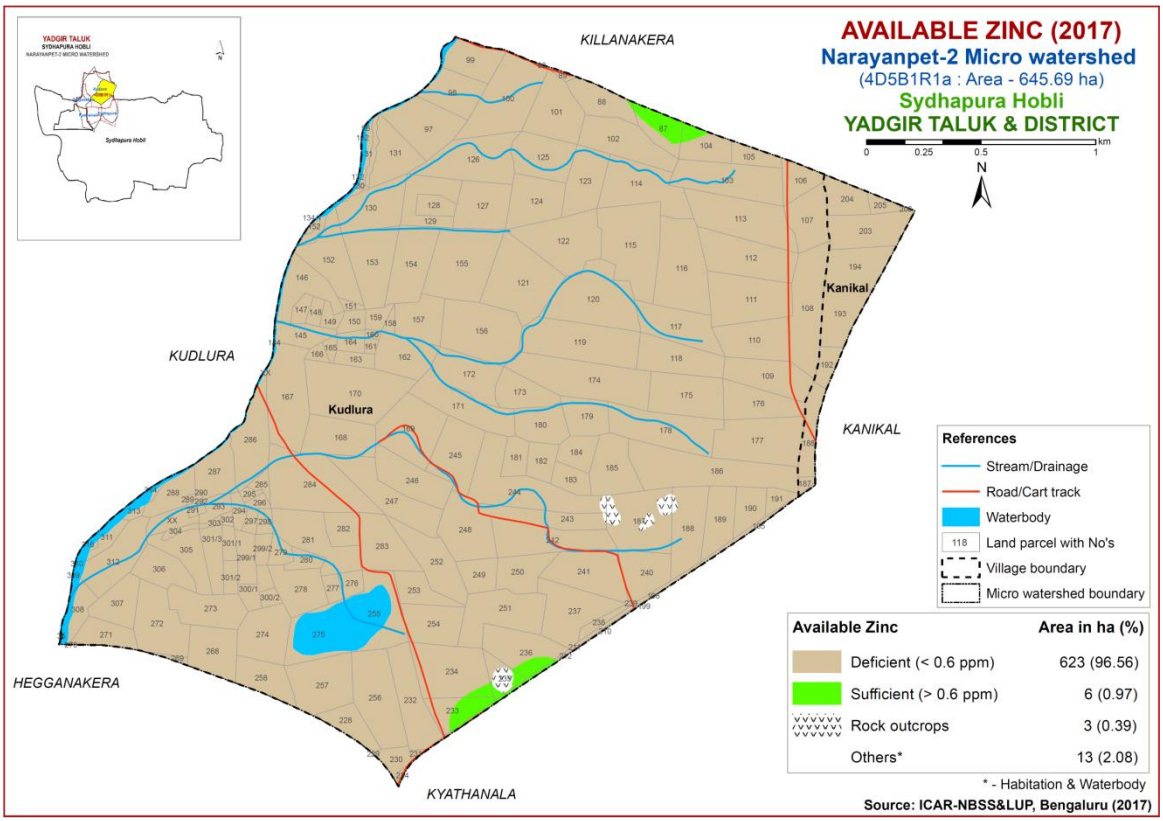


Fig.6.11 Soil Available Zinc map of Narayanapet-2 Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Narayanapet-2 microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The 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, 'w' for drainage and 'z' for calcareousness. These limitations are indicated as lower case letters to the Class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

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

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

Sorghum is one of the major crops grown in Karnataka in an area of 10.47 lakh ha in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad, Bellary, Chitradurga, Mysore and Tumakuru 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.

There are no highly suitable (Class S1) lands available for growing sorghum in the microwatershed. Maximum area of about 623 ha (97%) is moderately suitable (Class S2) for growing sorghum and are distributed in the major part of the microwatershed. They have minor limitations of texture, calcareousness, drainage and rooting depth. An area of about 7 ha (1%) is marginally suitable (Class S3) for growing sorghum and is distributed in the southern part of the microwatershed with moderate limitation rooting depth.

Table 7.1 Soil-Site Characteristics of Narayanapet-2 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drain-age Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm^{-1})	ESP (%)	CEC [Cmol (p^{+})kg^{-1}]	BS (%)
					Sur-face	Sub-surface	Surface (%)	Sub-surface (%)								
BDLhB2	866	150	WD	25-50	scl	sc	-	-	<50	1-3	moderate					
HSLiB2	866	150	MWD	75-100	sc	sl-scl	-	-	50-100	1-3	moderate					
GWDcB2	866	150	MWD	75-100	sl	sc-c	-	-	10-150	1-3	moderate					
MDGcB2	866	150	MWD	100-150	sl	sc-c	-	-	>200	1-3	moderate					
MDGiB2	866	150	MWD	100-150	sc	sc-c	-	-	>200	1-3	moderate					
RMPiB2	866	150	MWD	50-75	sc	sc-c	-	-	100-150	1-3	moderate					
RMPiB3	866	150	MWD	50-75	sc	sc-c	-	-	100-150	1-3	severe					
RHNcB2	866	150	MWD	75-100	sl	sc-c	-	-	100-150	1-3	moderate					
RHNmB2	866	150	MWD	75-100	c	sc-c	-	-	100-150	1-3	moderate					
KDRcB2	866	150	MWD	100-150	sl	sc-c	-	-	>200	1-3	moderate					
KDRiB2	866	150	MWD	100-150	sc	sc-c	-	-	>200	1-3	moderate					
KDRiB3	866	150	MWD	100-150	sc	sc-c	-	-	>200	1-3	severe					
KDRmB2	866	150	MWD	100-150	c	sc-c	-	-	>200	1-3	moderate					
SWRcB2	866	150	MWD	100-150	sl	c	-	-	>200	1-3	moderate					
HGNiB2	866	150	MWD	>150	sc	c	-	-	>200	1-3	moderate					
HGNiB3	866	150	MWD	>150	sc	c	-	-	>200	1-3	severe					
HGNmB2	866	150	MWD	>150	c	c	-	-	>200	1-3	moderate					
HGNmB3	866	150	MWD	>150	c	c	-	-	>200	1-3	severe					

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

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. Well drained	imperfect	Poorly/excessively	V. poorly
Soil reaction	pH	6.0-8.0	5.5-5.9,8.1-8.5	<5.5,8.6-9.0	>9.0
Surface soil texture	Class	C, cl, sicl, sc	l, sil, sic	Sl, ls	S, fragmental skeletal
Soil depth	Cm	100-75	50-75	30-50	<30
Gravel content	% vol.	5-15	15-30	30-60	>60
Salinity (EC)	dSm^{-1}	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

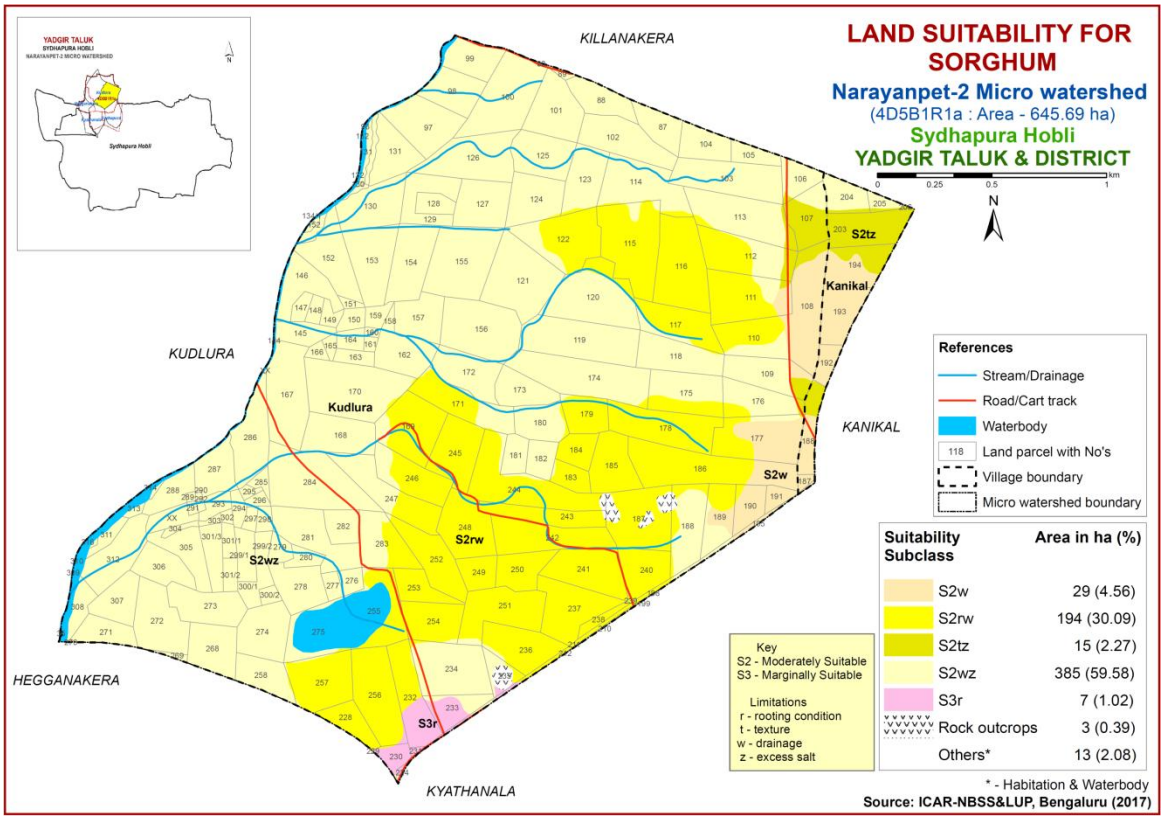


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Highly suitable (Class S1) and moderately suitable (Class S2) lands are not available for growing maize in the microwatershed. Marginally suitable lands (Class S3)

for growing maize occupy an entire area of 630 ha (98%) and occur in all parts of the microwatershed. They have moderate limitations of calcareousness, rooting depth, drainage and texture.

Table 7.3 Crop suitability criteria for Maize

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

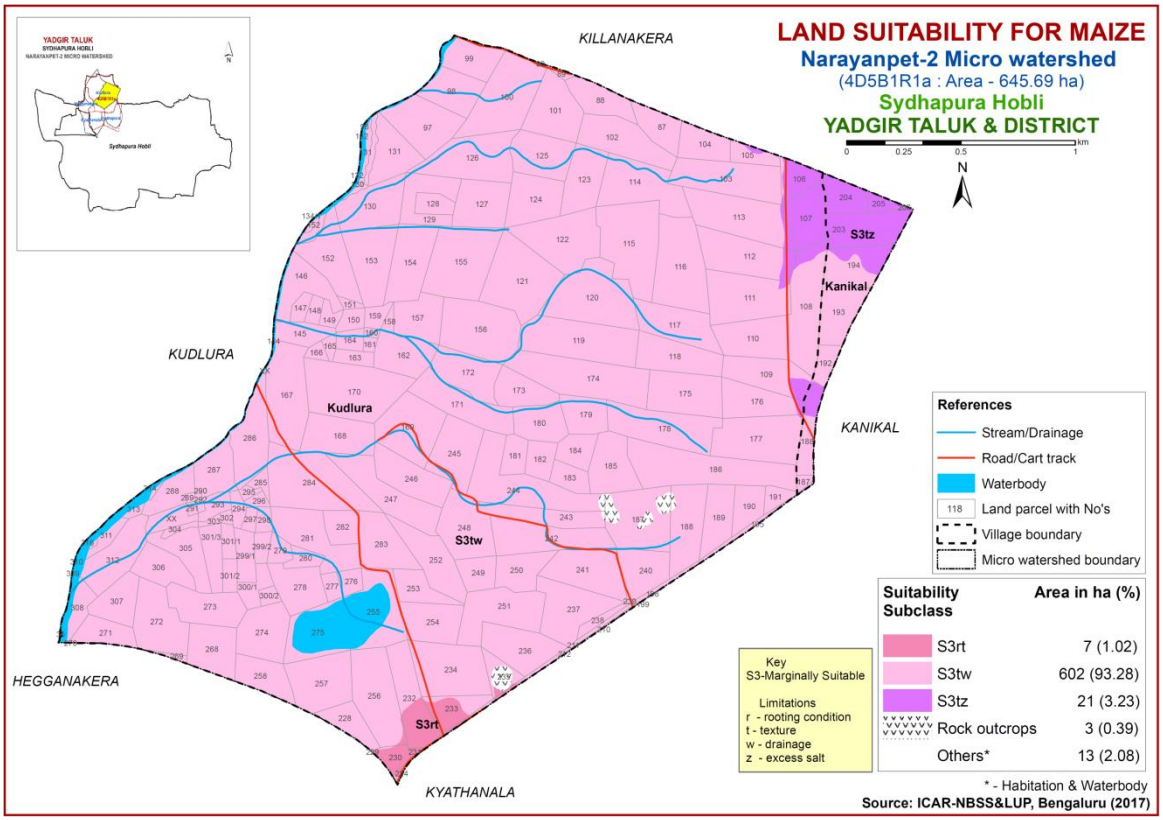


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for 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 (Table 7.4) were matched with the soil-site characteristics (Table 7.1) and a land suitability map

for growing bajra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

Table 7.4 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. Well 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

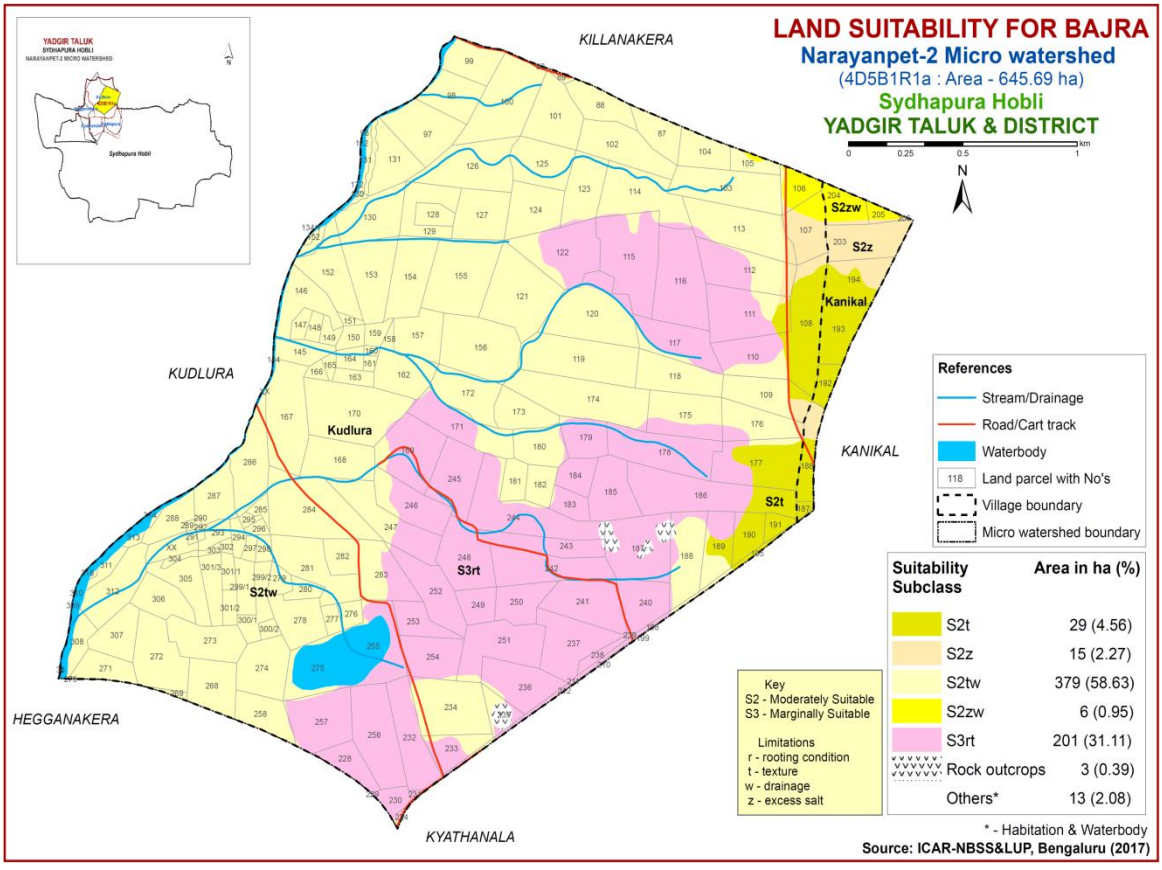


Fig. 7.3 Land Suitability map of Bajra

There are no highly (Class S1) suitable lands available for growing bajra in the microwatershed. Major area of about 429 ha (66%) is moderately suitable (Class S2) for growing bajra and are distributed in all parts of the microwatershed. They have minor limitations of texture, drainage and calcareousness. Marginally suitable lands (Class S3)

occupy an area of about 201 ha (31%) and distributed in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

7.4 Land Suitability for Groundnut (*Arachis hypogaea*)

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

No highly suitable (Class S1) lands are available for growing Groundnut in the microwatershed. Small area of about 15 ha (2%) is moderately suitable (Class S2) for groundnut and are distributed in the northeastern part of the microwatershed. They have minor limitations of calcareousness. Marginally suitable lands (Class S3) for growing groundnut occupy maximum area of about 615 ha (95%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, drainage, calcareousness and rooting depth.

Table 7.5 Crop 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 drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.0-8.0	8.1-8.5,5.5-5.9	>8.5,<5.5	
Surface soil texture	Class	l, cl, sil, sc, sicl	Sc, sic, c,	S, ls, sl c (>60%)	S, fragmental
Soil depth	Cm	>75	50-75	25-50	<25
Gravel content	% vol.	<35	35-50	>50	
$CaCO_3$ in root zone	%	high	Medium	low	
Salinity (EC)	dSm^{-1}	<2.0	2.0-4.0	4.0-8.0	
Sodicity (ESP)	%	<5	5-10	>10	

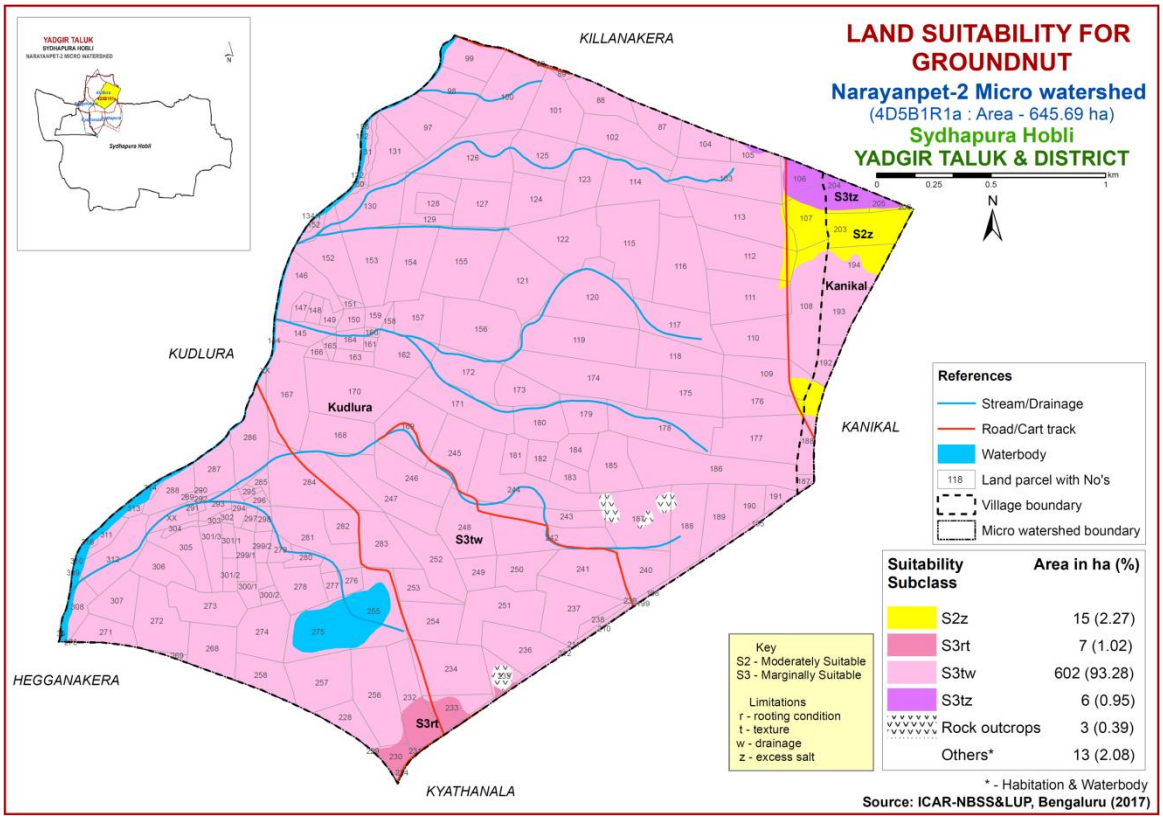


Fig. 7.4 Land Suitability map of Groundnut

7.5 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oil seed crop grown in an area of 4.1 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 are given in Figure 7.5.

Table 7.6 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 rained	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)	dS m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

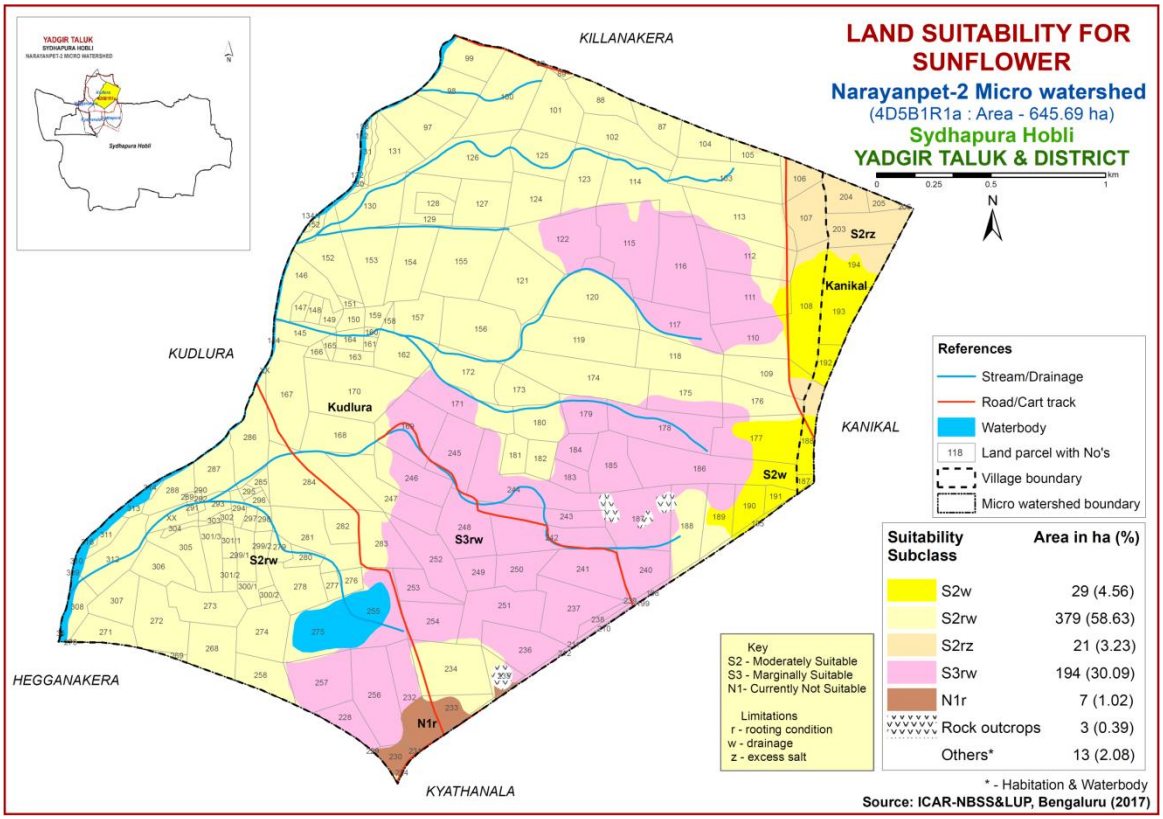


Fig. 7.5 Land Suitability map of Sunflower

No highly suitable (Class S1) lands available for growing sunflower in the microwatershed. Maximum area of about 429 ha (66%) is moderately suitable (Class S2) for sunflower and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands for sunflower are found to occur in an area of about 194 ha (30%) with moderate limitations of rooting depth and drainage and are distributed in the central, eastern, south-eastern and southern part of the microwatershed. An area of about 7 ha (1%) is not suitable (Class N) and are distributed in the southern part of the microwatershed with severe limitation of rooting depth.

7.6 Land suitability criteria for Red gram (*Cajanus Cajan)*

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

No highly suitable (Class S1) lands available for growing redgram in the microwatershed. Maximum area of about 429 ha (66%) is moderately suitable (Class S2) for growing redgram and are distributed in all parts of the microwatershed. They have minor limitations of rooting depth, texture, drainage and calcareousness. Marginally suitable lands (Class S3) for growing redgram occupy an area of about 201 ha (31%) and occur in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitations of rooting depth, texture and drainage.

Table 7.7 Land 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. 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
Sub Surface soil texture	Class	l,scl,sil,cl,sl	sicl,sic,c(m)	ls	
Soil depth	Cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	3-60	>60
Salinity (EC)	ds m^{-1}	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

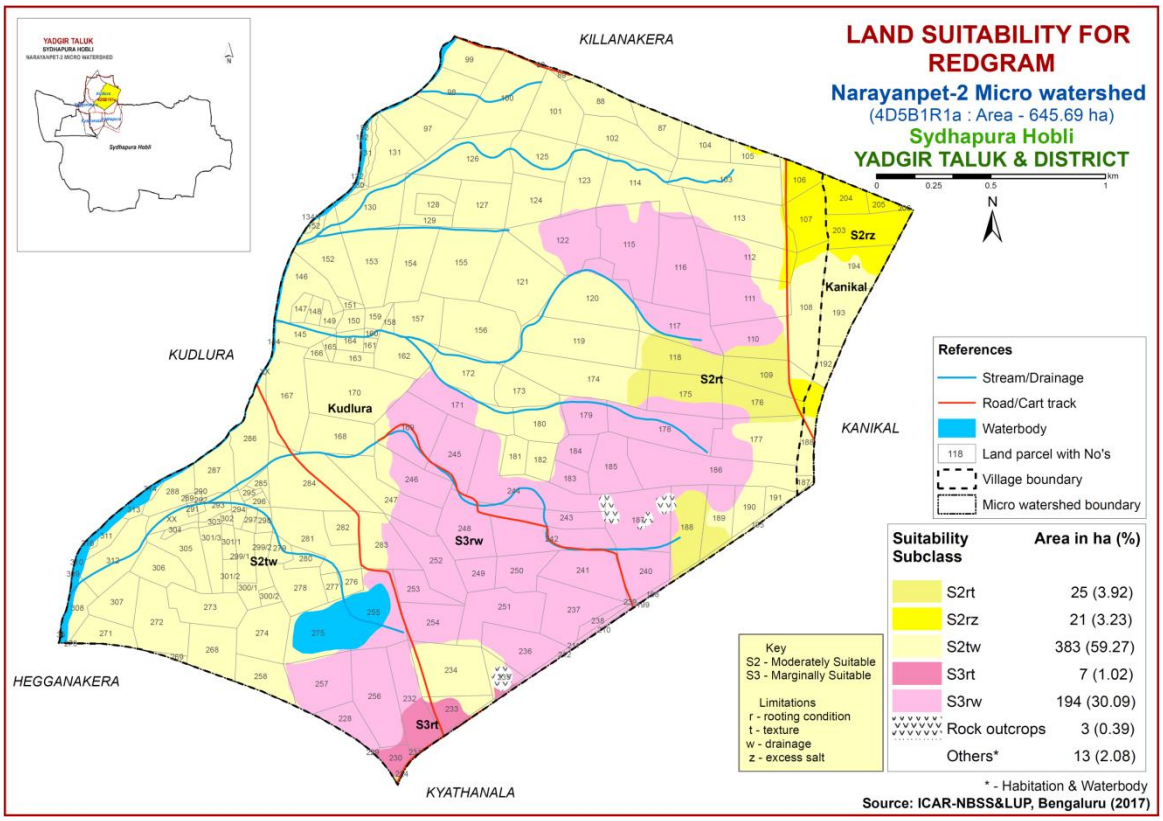


Fig. 7.6 Land Suitability map of Redgram

7.7 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 are given in Figure 7.7.

Table 7.8 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	

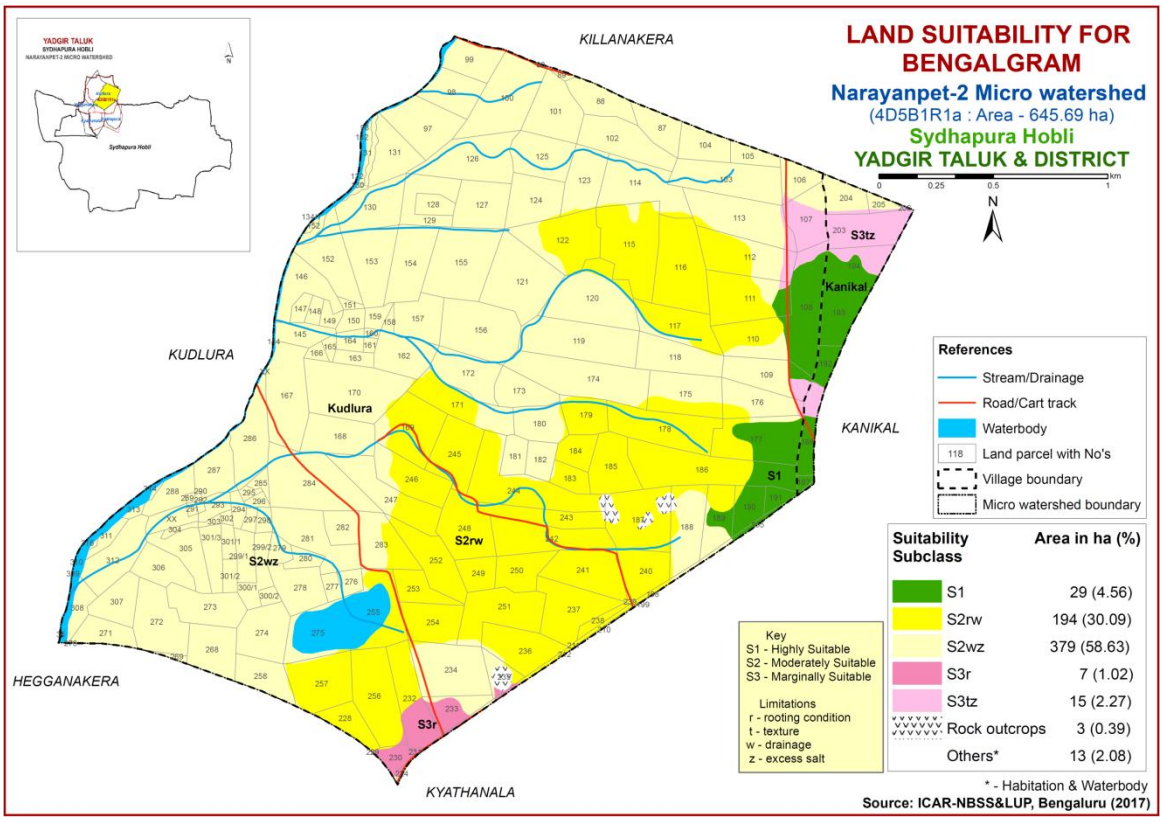


Fig. 7.7 Land Suitability map of Bengal gram.

Highly (Class S1) suitable lands for growing Bengalgram occur in small area of 29 ha (5%) and are distributed in the eastern part of the microwatershed. Major area of about 573 ha (89%) is moderately suitable (Class S2) for growing Bengal gram and are distributed in all parts of the microwatershed. They have minor limitations of drainage, calcareousness and rooting depth. Marginally suitable lands (Class S3) occupy an area of about 22 ha (3%) and are distributed in the northeastern, eastern and southern part of the

microwatershed. They have moderate limitations of rooting depth, calcareousness and texture.

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

Highly suitable (Class S1) lands available for growing cotton crop cover a small area of 29 ha (5%) and are distributed in the eastern and northeastern part of the microwatershed. Moderately suitable (Class S2) lands are found to occur in a maximum area of about 579 ha (90%). The soils have minor limitations of rooting depth, drainage and calcareousness. They are distributed in the major part of the microwatershed. Marginally suitable (Class S3) lands for cotton are found to occur in an area of about 22 ha (3%) with moderate limitations of rooting depth, texture and calcareousness and are distributed in the northeastern, eastern and southern part the microwatershed.

Table 7.9 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

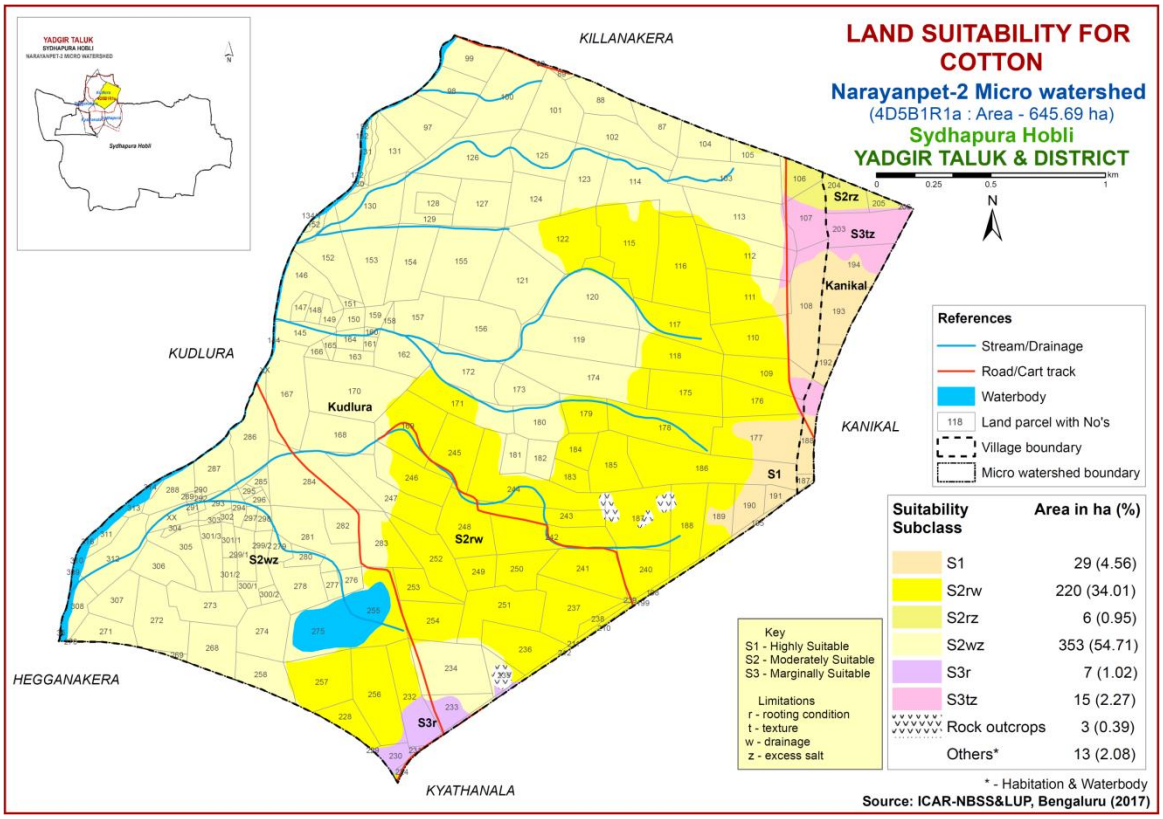


Fig. 7.8 Land Suitability map of Cotton

7.9 Land Suitability for Chilli (*Capsicum annuum)*

Chilli is one of the most important vegetable and spice crop grown in about 0.42 lakh ha in Karnataka state. The crop requirements for growing chilli (Table 7.10) were matched with the soil-site characteristics (Table 7.1) 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.

No highly (Class S1) suitable lands available for growing chilli in the microwatershed. Major area of about 429 ha (66%) is moderately suitable (Class S2) for growing chilli and are distributed in all parts of the microwatershed. They have minor limitations of texture, drainage and calcareousness. Marginally suitable lands (Class S3) occupy an area of about 201 ha (31%) and are distributed in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

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	V.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	

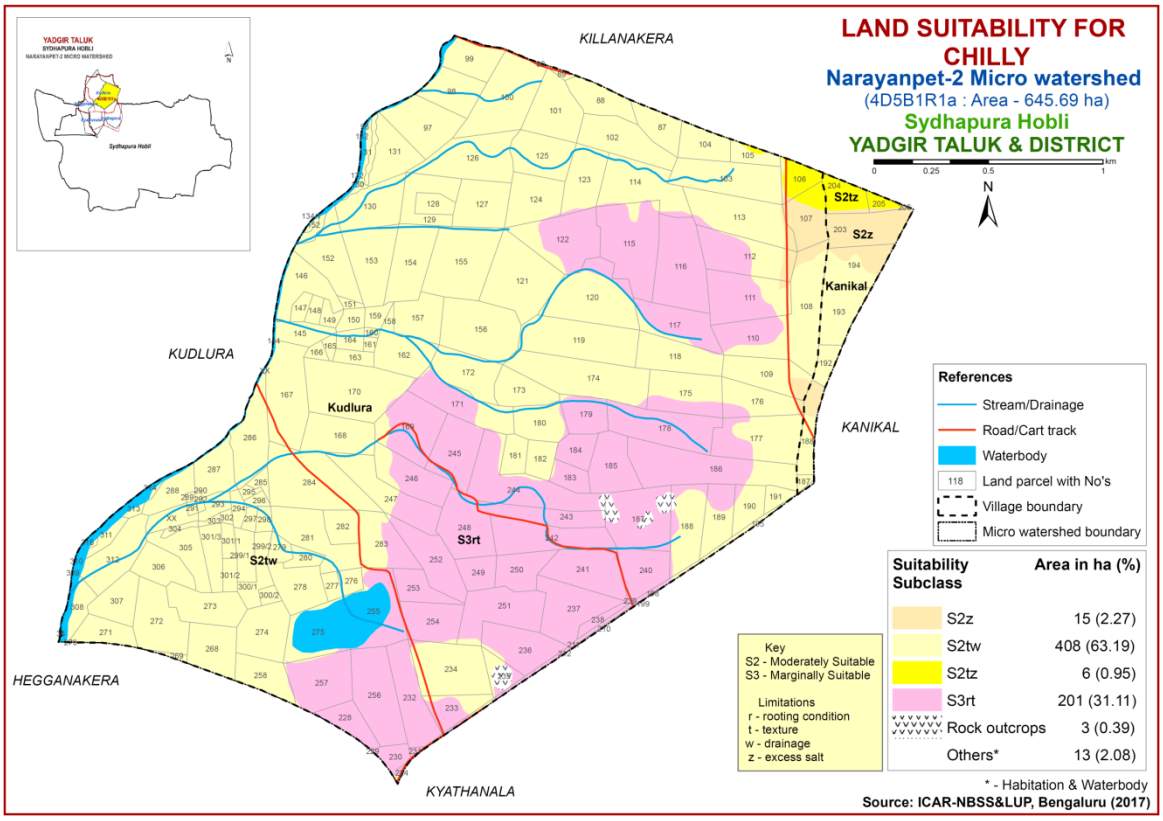


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Lycopersicon esculentum*)

Tomato is one of the most important vegetable crops grown in about 0.61 lakh ha covering almost all the district of the state. The crop requirements for growing tomato (Table 7.11) 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 is given in Figure 7.10.

No highly (Class S1) suitable lands available for growing tomato in the microwatershed. Small area of about 15 ha (2%) is moderately suitable (Class S2) for growing tomato and are distributed in the eastern and northeastern part of the microwatershed. They have minor limitation of calcareousness. Marginally suitable lands (Class S3) occupy major area of about 615 ha (92%) and are distributed in all parts of the microwatershed. They have moderate limitations of rooting depth, drainage, calcareousness and texture.

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	Mod.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	
Roting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel contet	%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

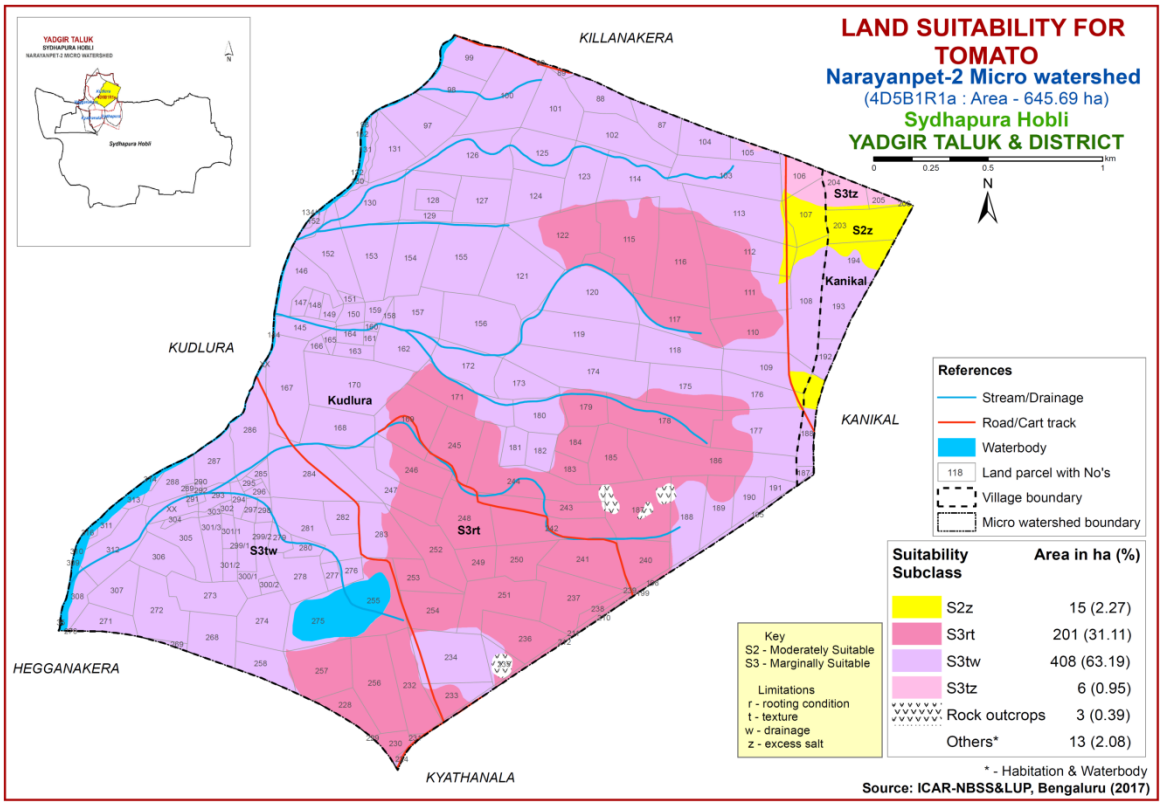


Fig 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera*)

Drumstick is one of the most important vegetable crops 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 are given in Figure 7.12.

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

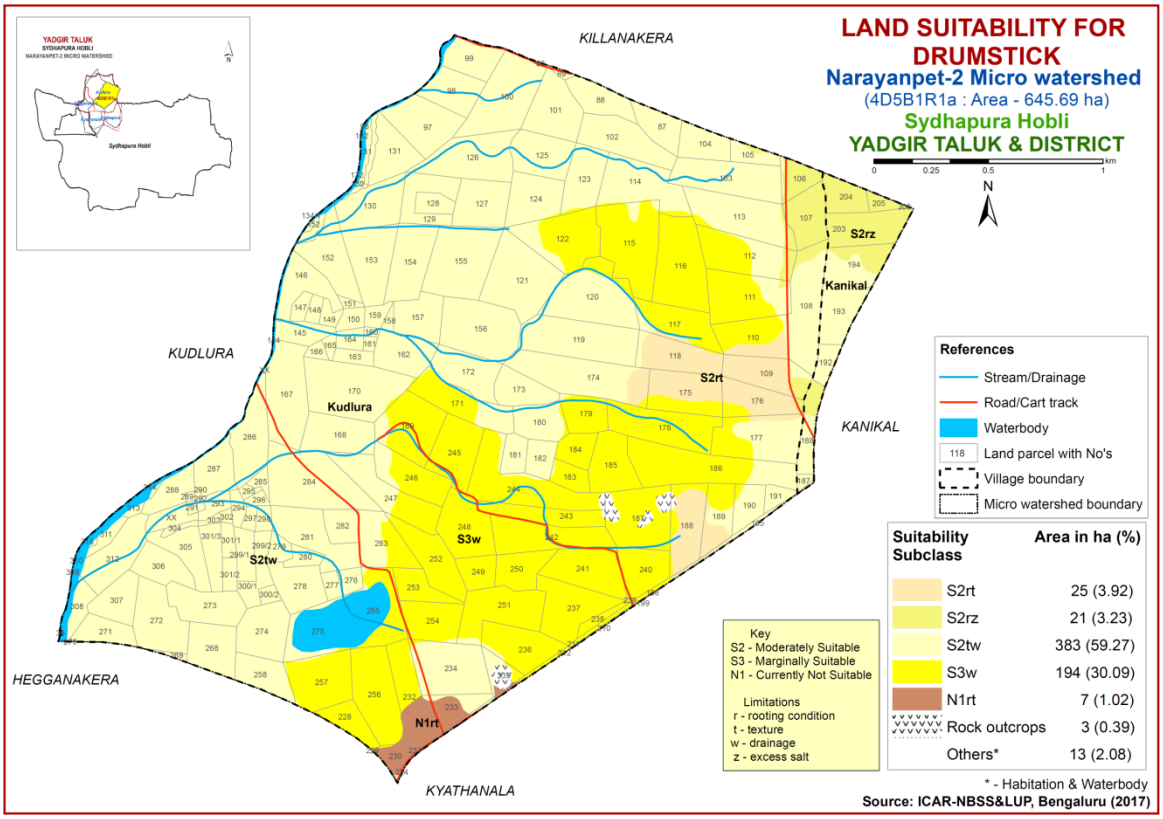


Fig 7.11 Land Suitability map of Drumstick

There are no highly (Class S1) suitable lands available for growing drumstick in the microwatershed. Major area of about 429 ha (66%) is moderately suitable (Class S2) for drumstick and is distributed in the major part of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and drainage. An area of about 194 ha (30%) is marginally suitable (Class S3) for growing drumstick and are distributed in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitation of drainage. An area of about 7 ha (1%) is not suitable (Class N) for growing drumstick and is distributed in the southern part of the microwatershed. They have severe limitations of rooting depth and texture.

7.12 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in an area of 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.13) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.12.

No highly suitable (Class S1) lands available for growing mango in the microwatershed. An area of about 29 ha (5%) is moderately suitable (Class S2) for growing mango and are distributed in the northeastern and eastern part of the microwatershed. They have minor limitation of rooting depth.

Table 7.13 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	V.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	8.6-9.04.0-4.9	>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	

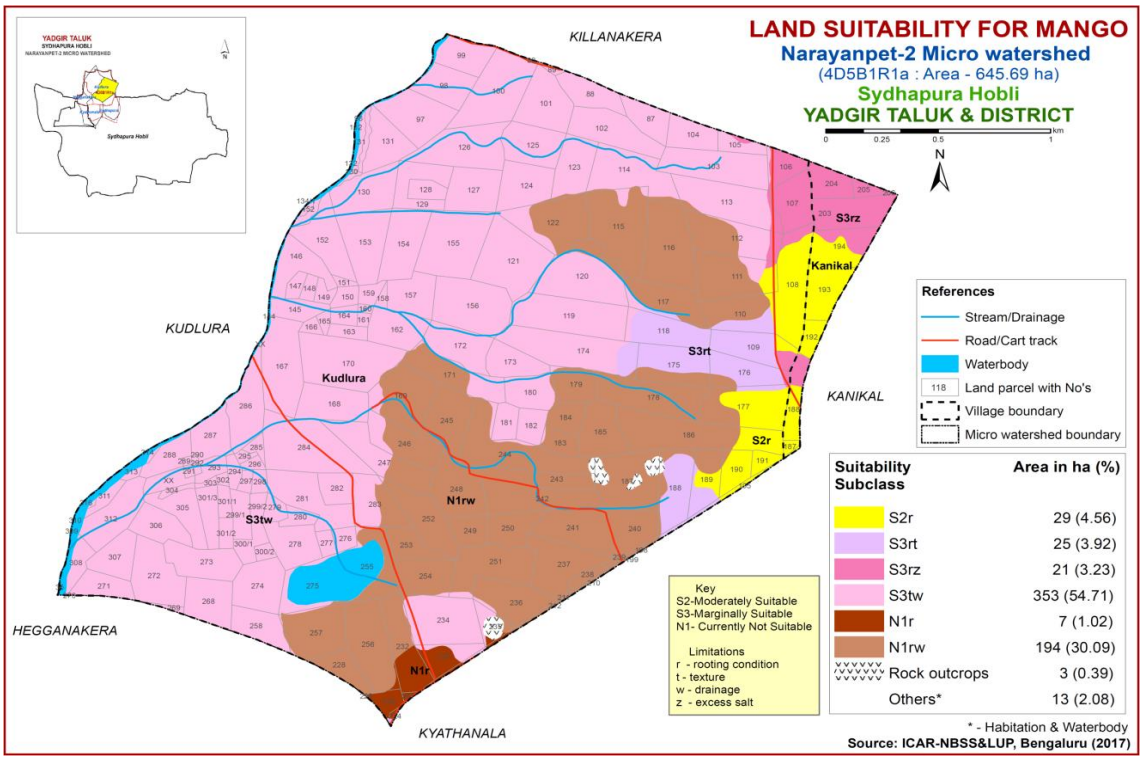


Fig. 7.12 Land Suitability map of Mango

Maximum area of 399 ha (62%) is marginally suitable (Class S3) for growing mango with moderate limitations of drainage, texture, calcareousness and rooting depth and are distributed in all parts of the microwatershed. An area of about 201 ha (31%) is not suitable (Class N) for growing mango and occur in the central, eastern, south-eastern

and southern part of the microwatershed with severe limitations of rooting depth and drainage.

7.13 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of 0.06 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) for growing guava were matched with the soil-site characteristics (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 7.13.

No highly suitable (Class S1) lands available for growing guava in the microwatershed. An area of about 15 ha (2%) is moderately suitable (Class S2) for growing guava and are distributed in the northeastern and eastern part of the microwatershed and have minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands cover maximum area of about 608 ha (94%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and drainage. An area of about 7 ha (1%) is not suitable (N) for growing guava and occur in the southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.14 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

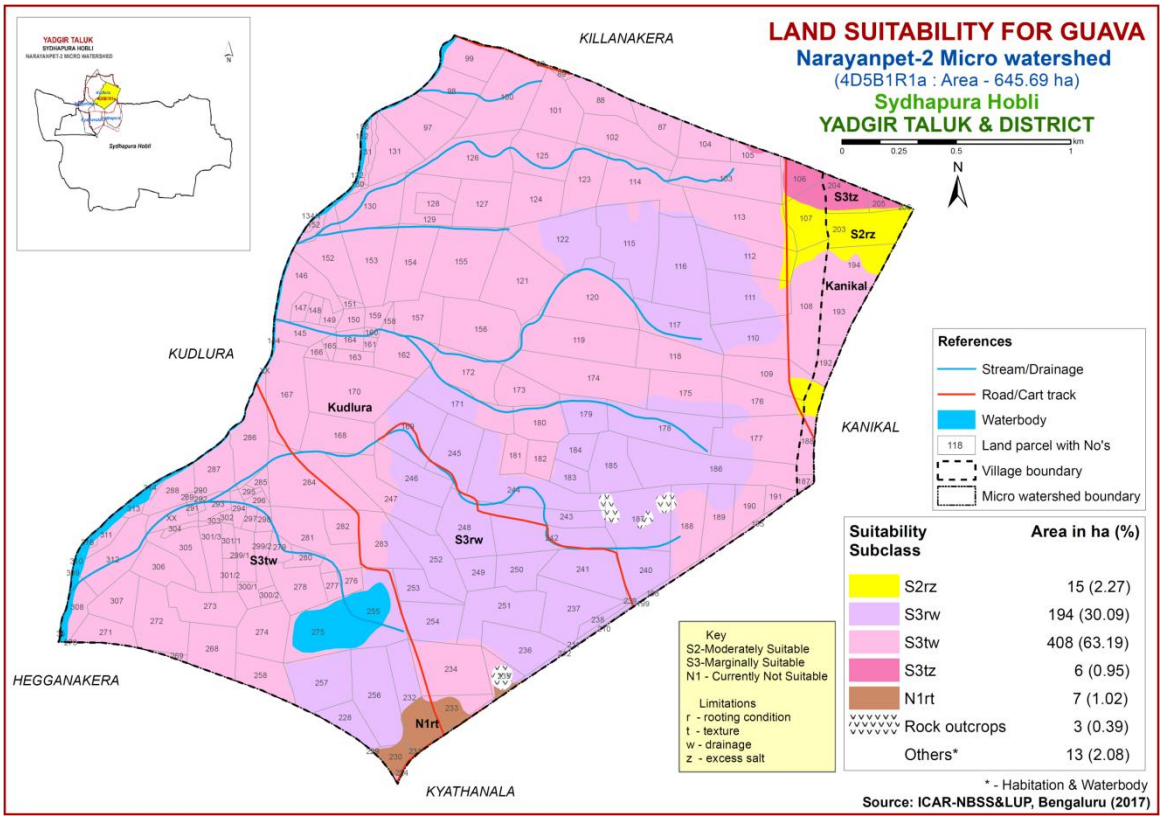


Fig. 7.13 Land Suitability map of Guava

7.14 Land suitability for Sapota (*Manilkara zapota*)

Sapota is one of the most important fruit crop grown in an area of 29373 ha in almost all the districts of the State. The crop requirements (Table 7.15) for growing sapota were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sapota was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.14.

No highly suitable (Class S1) lands available for growing Sapota in the microwatershed. An area of about 15 ha (2%) is moderately suitable (Class S2) and are distributed in the northeastern and eastern part of the microwatershed. They have minor limitations of calcareousness and rooting depth. Maximum area of about 608 ha (95%) is marginally suitable (Class S3) for growing sapota and are distributed in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, calcareousness and drainage. An area of about 7 ha (1%) is not suitable (Class N) for growing sapota and occur in the southern part of the microwatershed with severe limitation of rooting depth.

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	Mod. 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

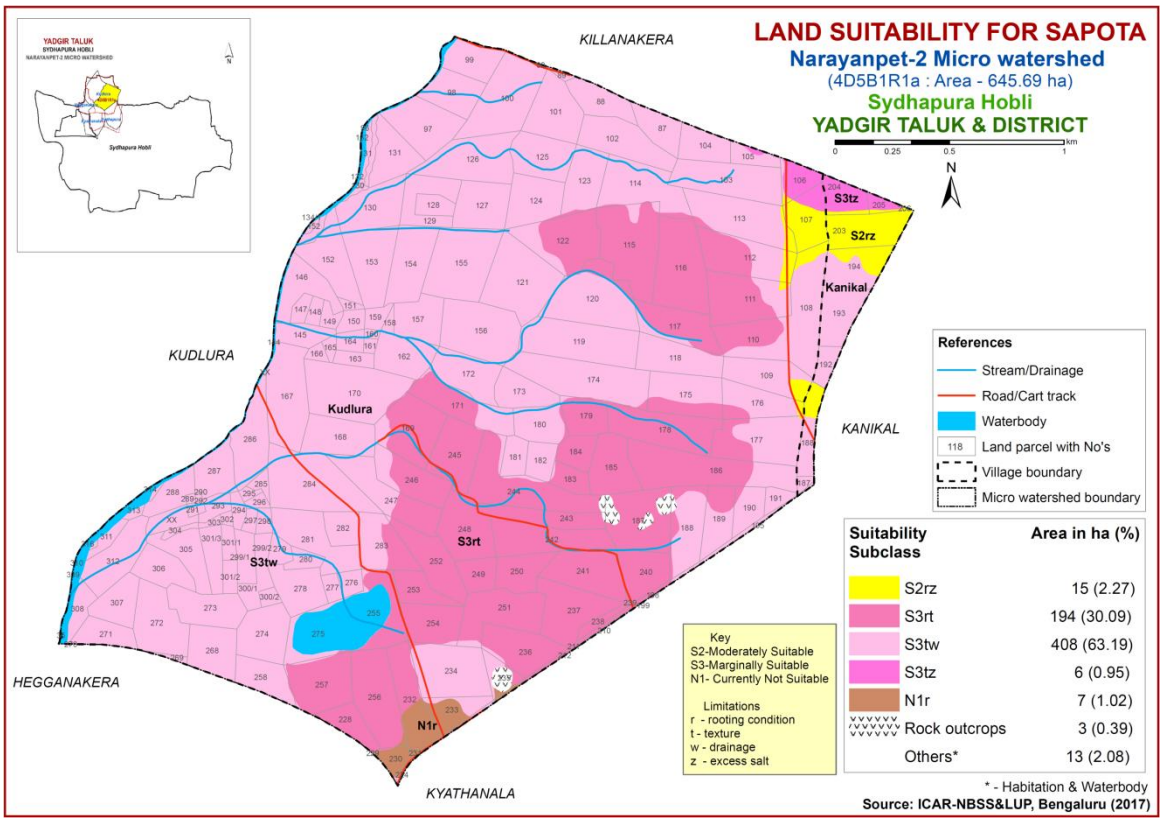


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the most important fruit crop commercially grown in about 18488 ha in Karnataka, 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 are given in Figure 7.15.

No highly (Class S1) suitable lands available for growing pomegranate in the microwatershed. Major area of about 429 ha (66%) is moderately suitable (Class S2) for growing pomegranate and is distributed in all parts of the microwatershed. They have minor limitations of rooting depth, texture, calcareousness and drainage. An area of about 194 ha (30%) is marginally suitable (Class S3) for growing pomegranate and are distributed in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and drainage. An area of about 7 ha (1%) is not suitable (Class N) for growing pomegranate and is distributed in the southern part of the microwatershed with severe limitation of rooting depth.

Table 7.16 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		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	

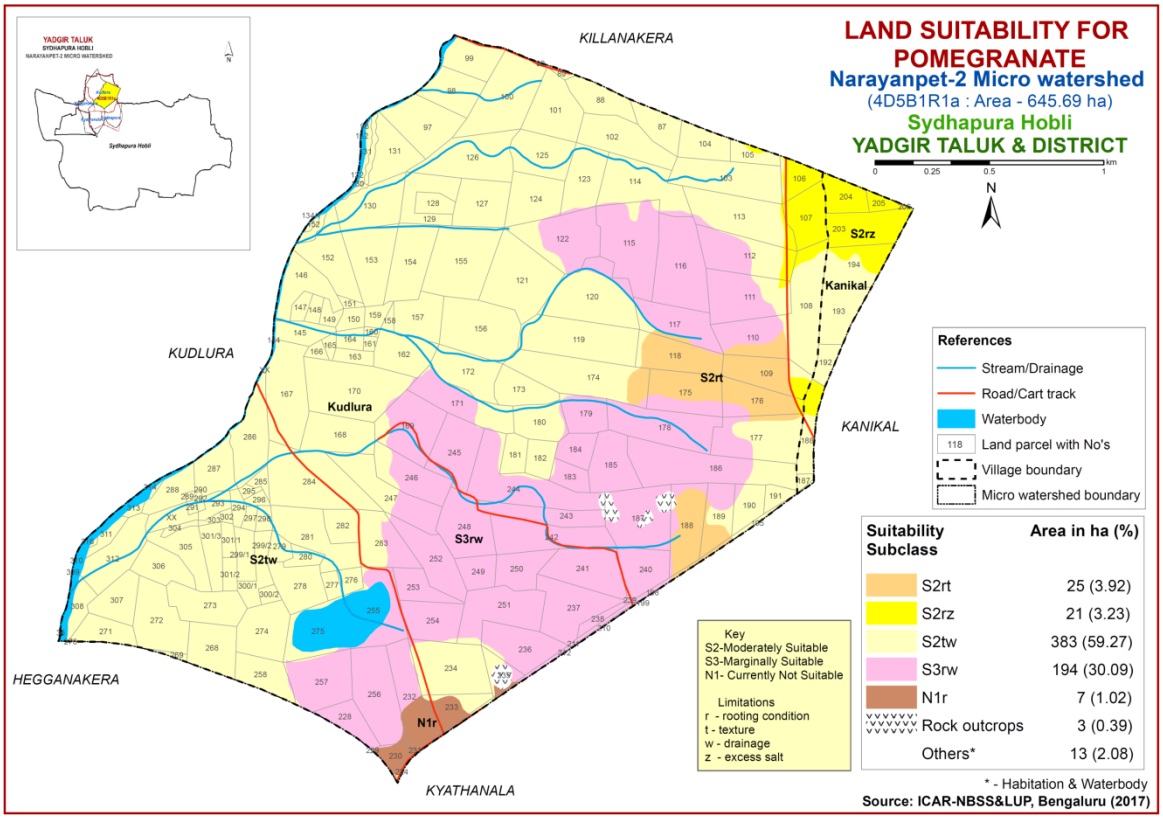


Fig 7.15 Land Suitability map of Pomegranate

7.16 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the important fruit crop grown in an area of 3446 ha in almost all the districts of the State. The crop requirements for growing musambi (Table 7.17) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

Table 7.17 Crop suitability criteria for Musambi

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. 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
Rooting conditions	Soil depth	Cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Erosion	Slope	%	<3	3-5	5-10	

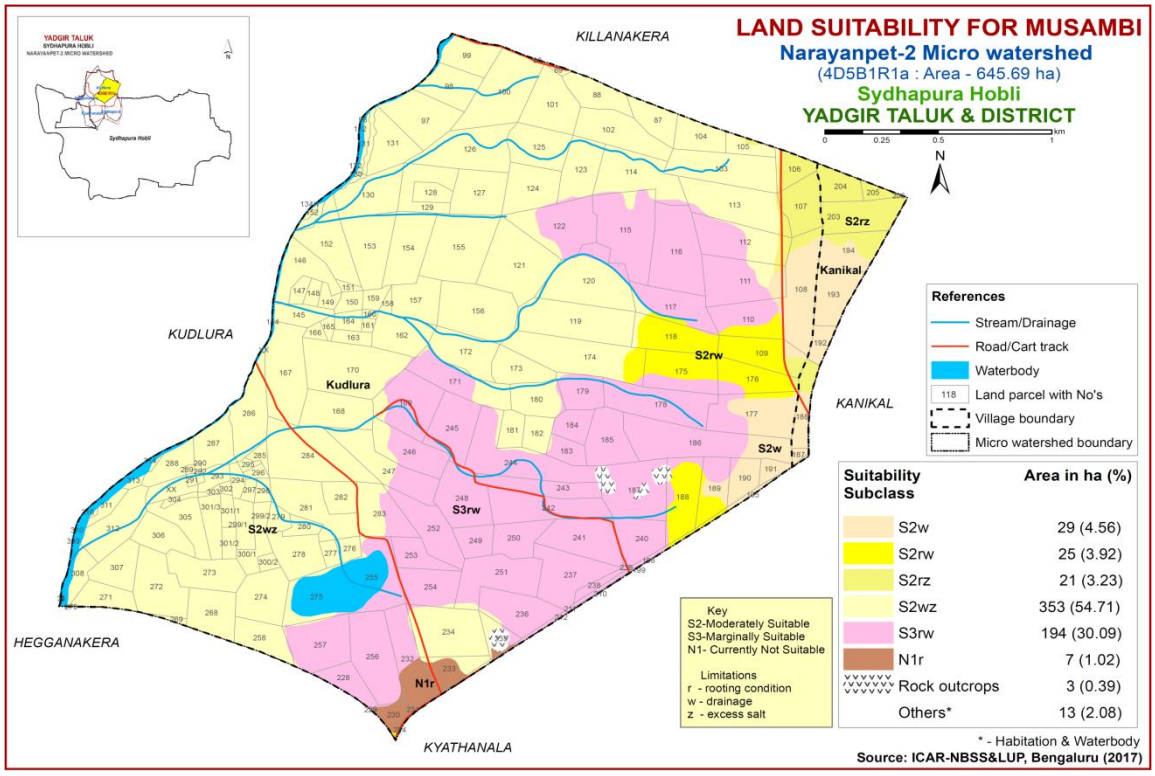


Fig. 7.16 Land Suitability map of Musambi

No highly suitable (Class S1) lands available for growing Musambi in the microwatershed. Major area of about 428 ha (66%) is moderately suitable (Class S2) for growing Musambi and are distributed in all parts of the microwatershed. They have minor limitations of drainage, calcareousness and rooting depth. Marginally suitable (Class S3) lands occupy an area of about 194 ha (30%) and are distributed in the central, eastern, south-eastern and southern part of the microwatershed. They have moderate limitations of rooting depth and drainage. An area of about 7 ha (1%) is not suitable (Class N) and are distributed in the southern part of the microwatershed with severe limitation of rooting depth.

7.17 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 0.11 lakh ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.18) 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 geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7. 17.

No highly suitable (Class S1) lands available for growing Lime in the microwatershed. Major area of about 428 ha (66%) is moderately suitable (Class S2) for growing lime and are distributed in all parts of the microwatershed. They have minor limitations of drainage, calcareousness and rooting depth.

Table 7.18 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	Temperature in growing season	^0C	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 34calcareous	Upto 5	5-10	>10
Rooting conditions	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	

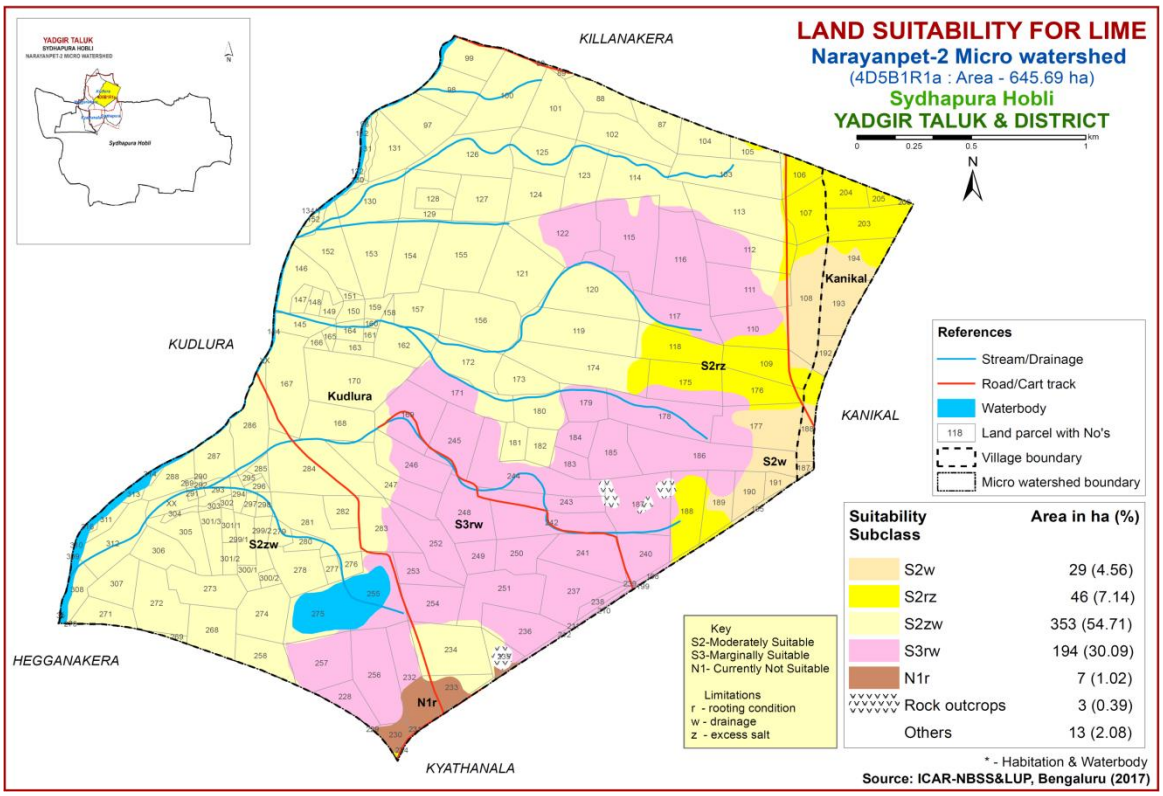


Fig. 7.17 Land Suitability map of Lime

Marginally suitable (Class S3) lands occupy an area of about 194 ha (30%) and are distributed in the central, eastern, southern and south-eastern part of the microwatershed. They have moderate limitations of rooting depth and drainage. An area of about 7 ha (1%) is not suitable (Class N) and is distributed in the southern part of the microwatershed with severe limitation of rooting depth.

7.18 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the medicinal fruit crop grown in almost all the districts of the State. The crop requirements for growing amla (Table 7.19) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated.

Table 7.19 Land 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

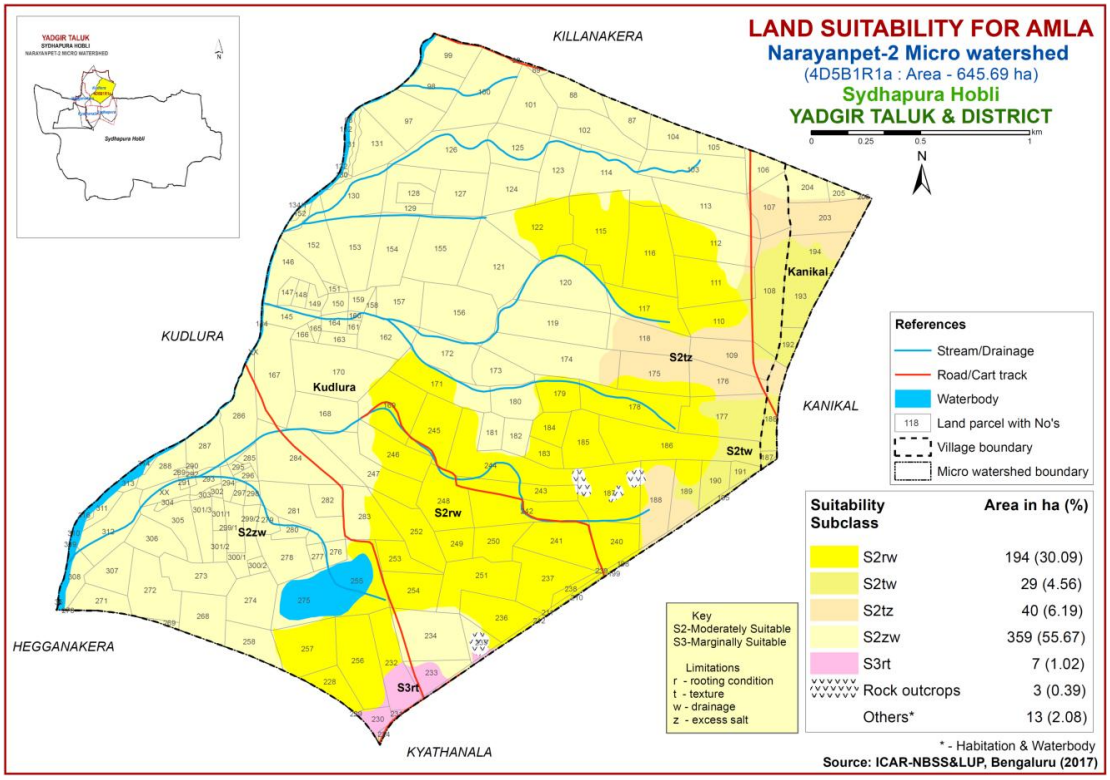


Fig. 7.18 Land Suitability map of Amla

The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.18.

No highly suitable (Class S1) lands available for growing Amla in the microwatershed. Maximum area of about 622 ha (97%) has soils that are moderately suitable (Class S2) for growing Amla with minor limitations of drainage, texture, calcareousness and rooting depth and are distributed in the major part of the

microwatershed. Small area of 7 ha (1%) is marginally suitable (Class S3) with moderate limitations of rooting depth and texture and is distributed in the southern part of the microwatershed.

7.19 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important plantation nut crop grown in an area of 0.7 lakh ha in almost all the districts of the State. 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 geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.19.

Entire area in the microwatershed is not suitable (Class N) for growing of cashew as they have severe limitations of rooting depth, texture, calcareousness and drainage.

Table 7.20 Land 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	sc, c (red), scl, cl,	-	ls, sl	c (black)
	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	

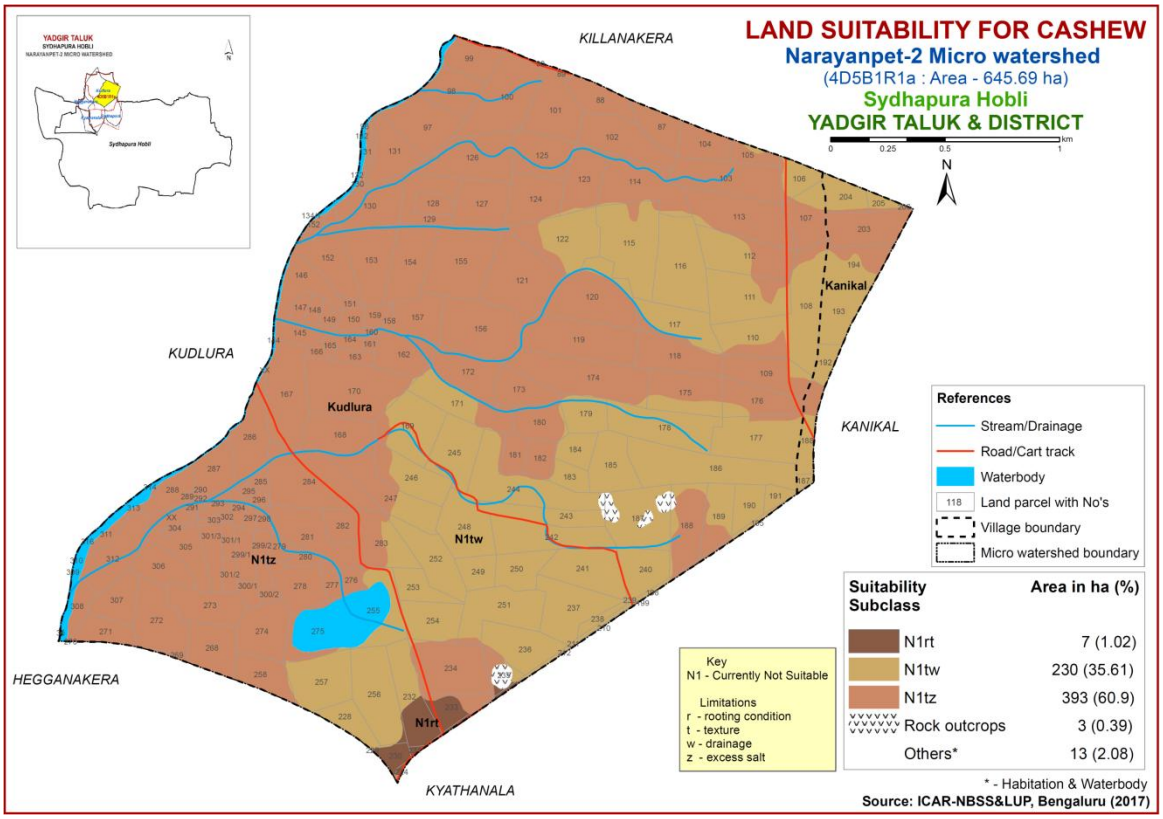


Fig. 7.19 Land Suitability map of Cashew

7. 20 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in an area of 5368 ha in almost all the districts of the State. The crop requirements for growing jackfruit (Table 7.21) 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 are given in Figure 7.20.

Table 7.21 Land 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	V. 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	-

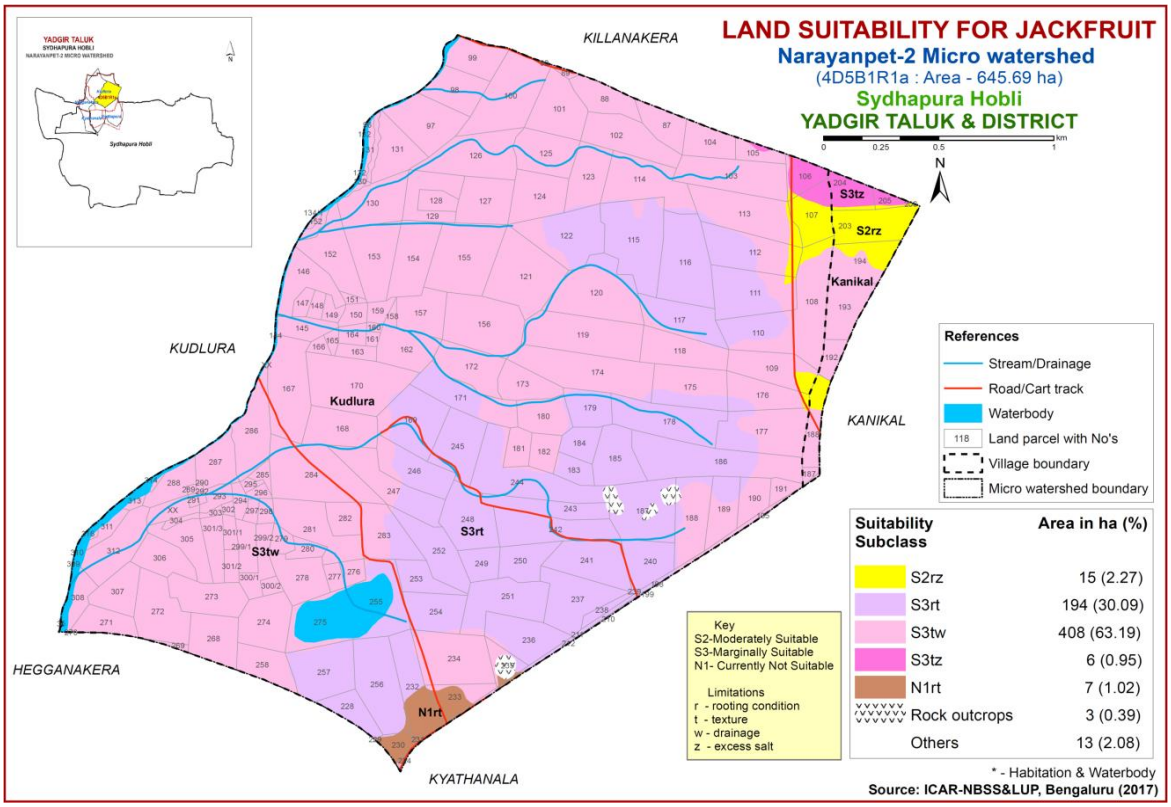


Fig. 7.20 Land Suitability map of Jackfruit

No highly suitable (Class S1) lands available for growing Jackfruit in the microwatershed. Moderately suitable (Class S2) lands occupy a small area of 15 ha (2%) and are distributed in the northeastern and eastern part of the microwatershed with minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands for growing Jackfruit occupy maximum area of about 608 ha (94%) and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, drainage, texture and calcareousness. An area of about 7 ha (1%) is not suitable (Class N) and are distributed in the southern part of the microwatershed with severe limitations of rooting depth and texture.

7.21 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is an important fruit crop grown in almost all the districts of the State. The crop requirements for growing jamun (Table 22) 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 7.21.

No highly suitable (Class S1) lands available for growing Jamun in the microwatershed. Maximum area of about 383 ha (59%) is moderately suitable (Class S2) for growing Jamun and are distributed in all parts of the microwatershed. They have minor limitations of texture and drainage. An area of about 240 ha (37%) is marginally suitable (Class S3) for growing Jamun and are distributed in the northeastern, eastern, central, south-eastern and southern part of the microwatershed. They have moderate limitations of drainage, texture, calcareousness and rooting depth. An area of about 7 ha

(1%) is not suitable (N) and is distributed in the southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.22 Land 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

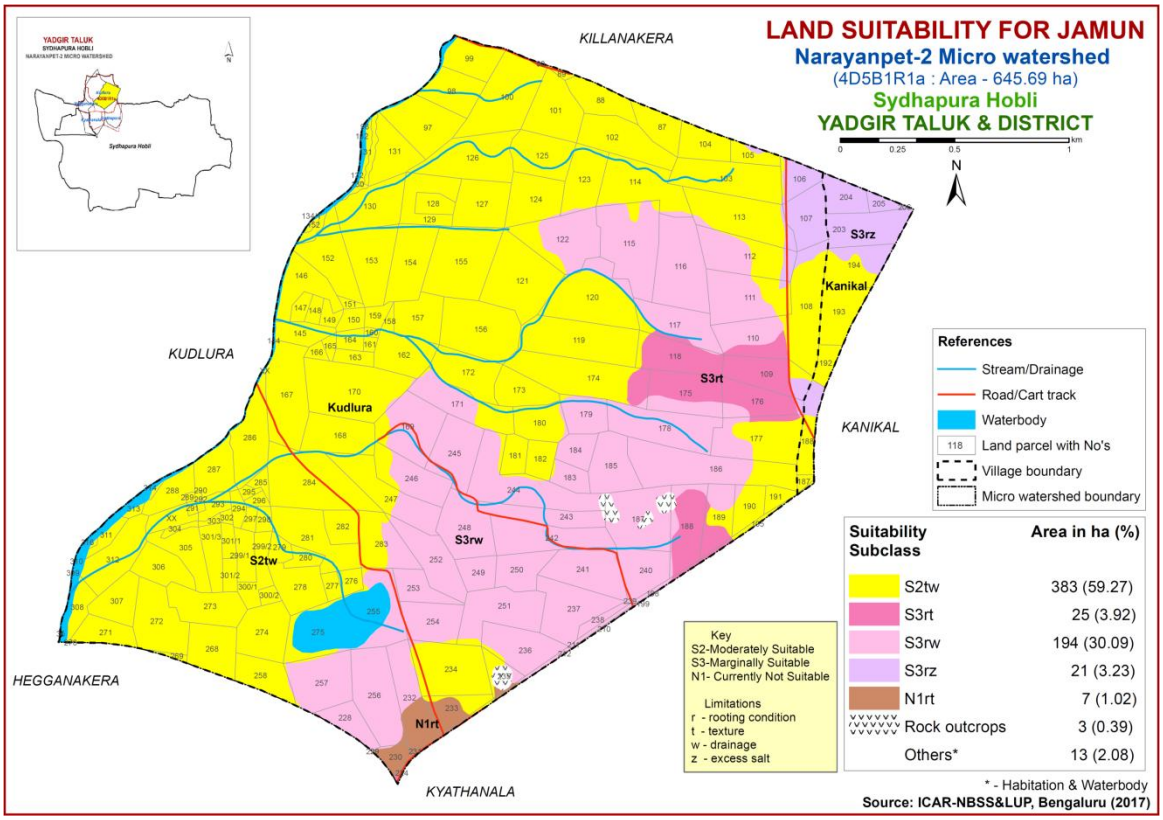


Fig. 7.21 Land Suitability map of Jamun

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

Custard apple is one of the most important fruit crop grown in almost all the districts of the State. The crop requirements for growing custard apple (Table7.23) 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 geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

Table 7.23 Land 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	

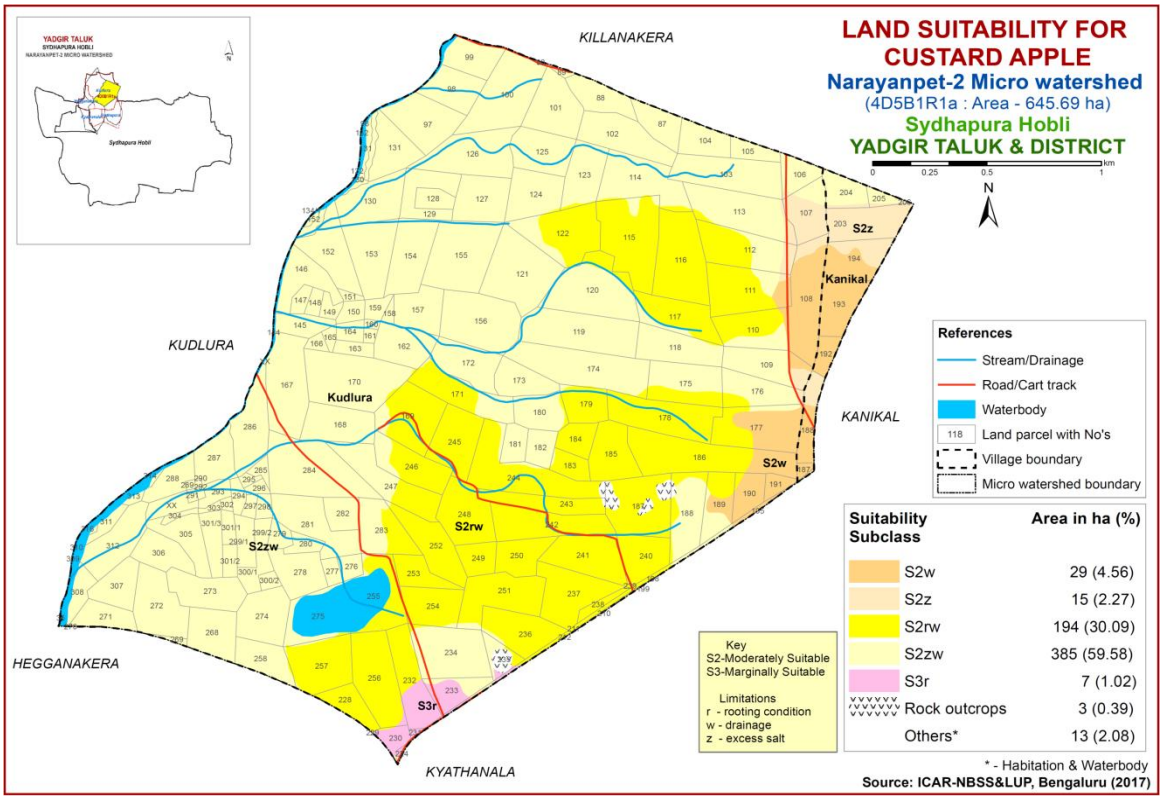


Fig. 7.22 Land Suitability map of Custard Apple

No highly suitable (Class S1) lands are available for growing custard apple in the microwatershed. Maximum area of about 623 ha (97%) has soils that are moderately suitable (Class S2) for growing custard apple with minor limitations of drainage, calcareousness and rooting depth and are distributed in all parts of the microwatershed. An area of about 7 ha (1%) is marginally suitable (Class S3) for growing custard apple and is distributed in the southern part of the microwatershed with moderate limitation of rooting depth.

7.23 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is the most important spice crop grown in almost all the districts of the state. The crop requirements for growing tamarind (Table 7.24) were matched with the

soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Fig. 7.23.

Table 7.24 Land 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

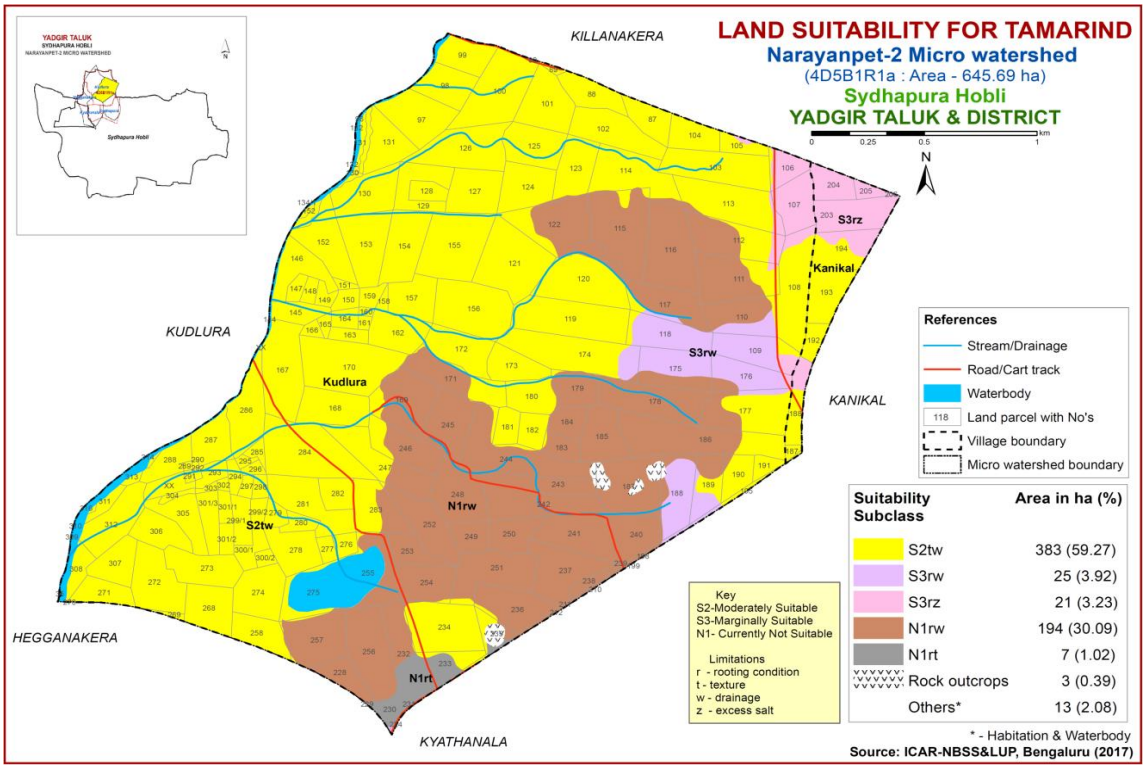


Fig. 7.23 Land Suitability map of Tamarind

No highly suitable (Class S1) lands are available for growing Tamarind in the microwatershed. Maximum area of about 383 ha (59%) is moderately suitable (Class S2) for growing Tamarind and are distributed in the major part of the microwatershed. They have minor limitations of texture and drainage. Marginally suitable (Class S3) lands for growing Tamarind occupy an area of about 46 ha (7%) and are distributed in the central, northeastern and eastern part of the microwatershed. They have moderate limitations of rooting depth, drainage and calcareousness. An area of about 201 ha (31%) is not suitable (Class N) for growing Tamarind and occur in the central, eastern, south-eastern and southern part of the microwatershed with severe limitations of rooting depth, texture and drainage.

7.24 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is an important leaf crop grown for rearing silkworms in about 1.6 lakh ha area in all the districts of the state. The crop requirements for growing mulberry (Table 7.25) 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 7.24.

No highly (Class S1) suitable lands available for growing mulberry in the microwatershed. Moderately (Class S2) suitable lands occur in 15 ha (2%) and are distributed in the eastern and northeastern part of the microwatershed with minor limitations of rooting depth and calcareousness. Major area of about 608 ha (94%) is marginally suitable (Class S3) for growing mulberry and are distributed in all parts of the microwatershed. They have moderate limitations of texture, drainage, calcareousness and rooting depth. Not suitable lands (Class N) occupy an area of about 7 ha (1%) and distributed in the southern part of the microwatershed. They have severe limitations of rooting depth and texture.

Table 7.25 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

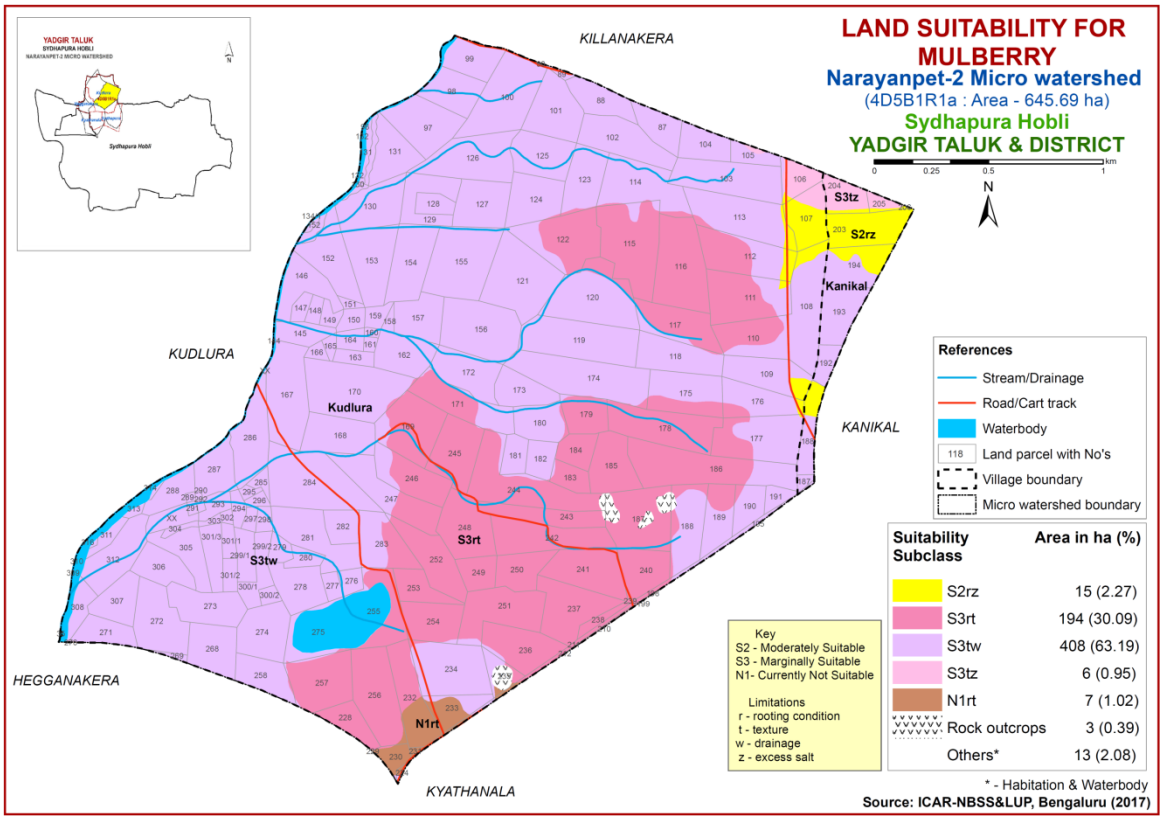


Fig 7.24 Land Suitability map of Mulberry

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 (Table 7.26) for growing marigold were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.25.

No highly suitable (Class S1) lands available for growing Marigold in the microwatershed. Maximum area of about 623 ha (97%) is moderately suitable (Class S2) for growing Marigold and are distributed in the major part of the microwatershed. They have minor limitations of texture, drainage, rooting depth and calcareousness. Marginally suitable (Class S3) lands for growing Marigold occupy an area of about 7 ha (1%) and are distributed in the southern part of the microwatershed. They have moderate limitations of texture and 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		18-23	17-15 24-35	35-40 10-14	>40 <10
Soil aeration	Soil drainage	Class	Well drained	Mod.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	-

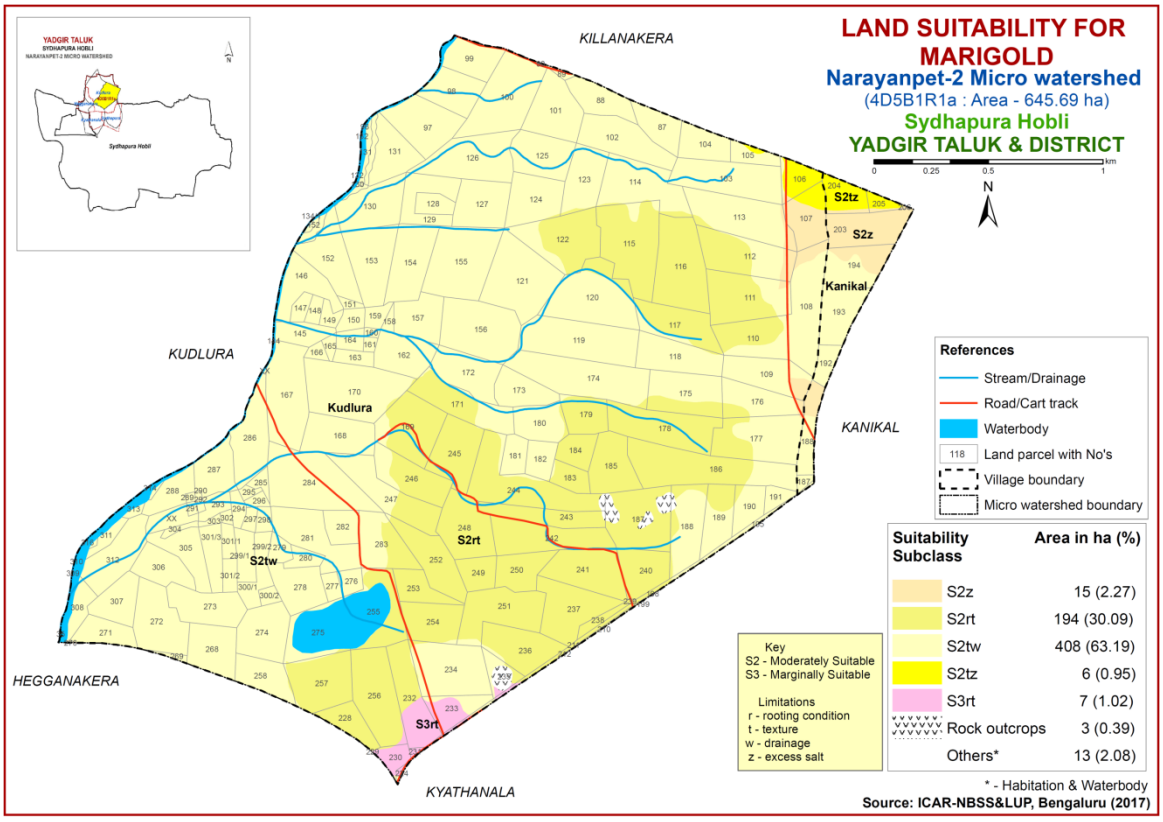


Fig. 7.25 Land Suitability map of Marigold

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 (Table 7.27) for growing chrysanthemum were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their

geographical distribution of different suitability subclasses in the microwatershed are 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		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	

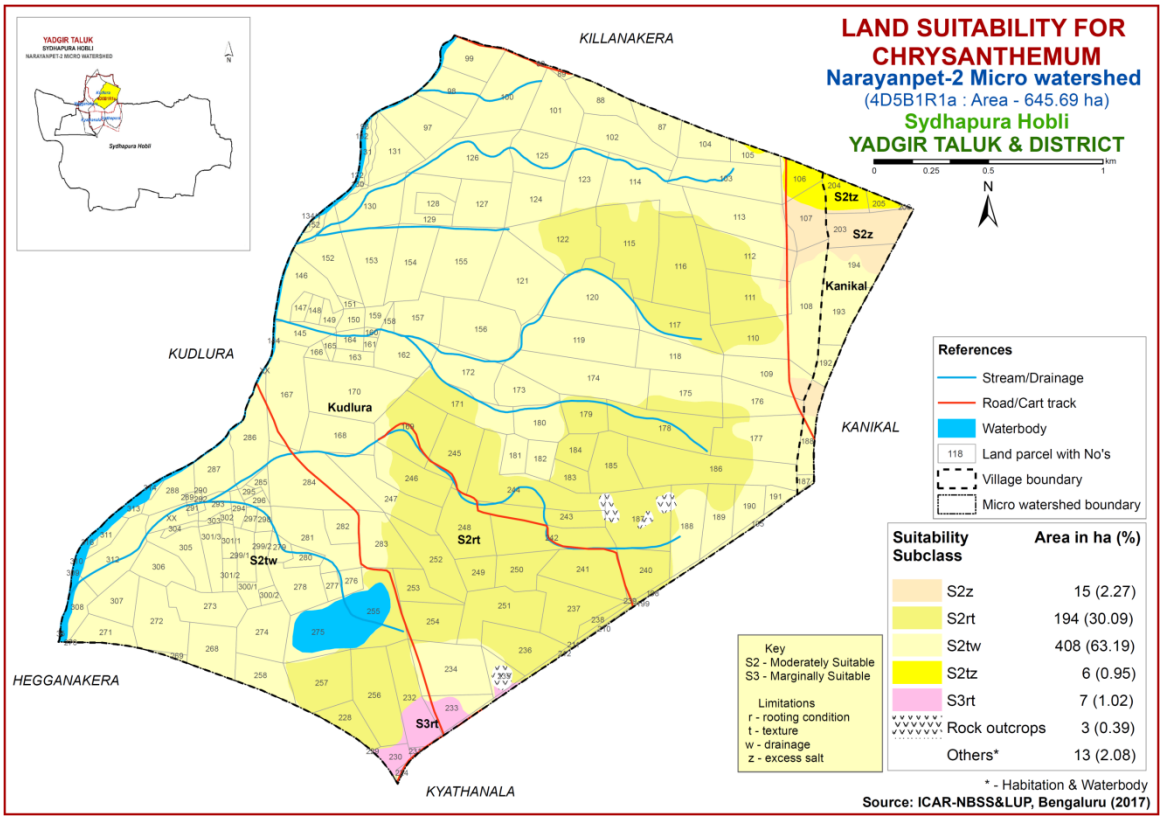


Fig. 7.26 Land Suitability map of Chrysanthemum

No highly suitable (Class S1) lands available for growing Chrysanthemum in the microwatershed. Maximum area of about 623 ha (97%) is moderately suitable (Class S2) for growing Chrysanthemum and are distributed in the major part of the microwatershed.

They have minor limitations of texture, rooting depth, calcareousness and drainage. Marginally suitable (Class S3) lands for growing Chrysanthemum occupy an area of about 7 ha (1%) and are distributed in the southern part of the microwatershed. They have moderate limitations of rooting depth and texture.

7.27 Land Management Unit (LMUs)

The 19 soil map units identified in Narayanapet-2 microwatershed have been grouped into 3 Land Management Unit (LMU's) for the purpose of preparing a Proposed Crop Plan. Land Management Unit are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Unit map (Fig. 7.28) has been generated. These Land Management Unit are expected to behave similarly for a given level of management.

The map units that have been grouped into 3 Land Management Unit along with brief description of soil and site characteristics are given below.

LMU NO.	Soil map units	Soil and site characteristics
1	77. RHNcB2, 79.RHNmB2 84. KDRcB2, 87.KDRiB2 88.KDRiB3, 89.KDRmB2 90. SWRcB2, 93. HGNiB2 94.HGNiB3, 95.HGNmB2 96. HGNmB3, 33. HSLiB2 34. GWDcB2, 57.MDGcB2 58. MDGiB2	Moderately deep to very deep soils (75 to >150 cm), 1-3 % slopes, non gravelly (<15%), moderate to severe erosion.
2	71. RMPiB2 72. RMPiB3	Moderately shallow soils (50-75 cm), 1-3 % slopes, non gravelly (<15%) moderate to severe erosion.
3	4. BDLhB2	Shallow soils (25-50 cm), 1-3% slopes, non gravelly (<15%), moderate erosion.

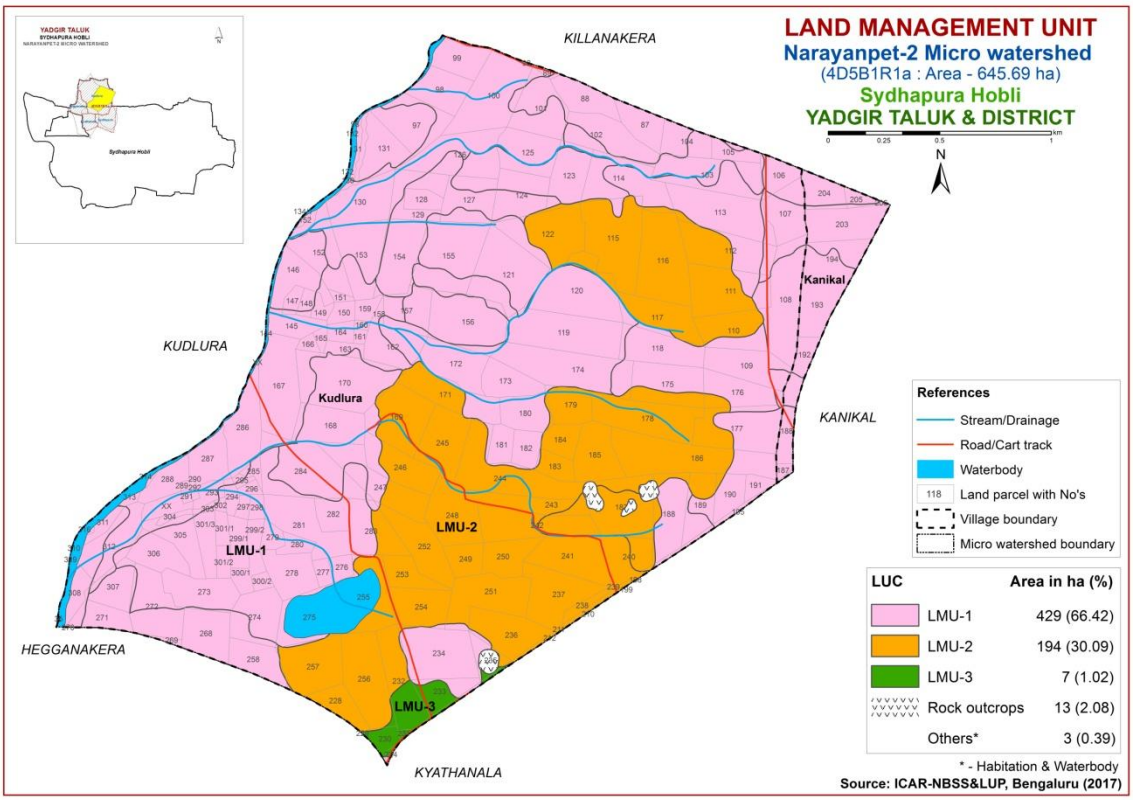


Fig. 7.28 Land Management Unit Map- Narayanapet-2 Microwatershed

7.28 Proposed Crop Plan for Narayanapet-2 Microwatershed

After assessing the land suitability for the 26 crops, the proposed crop plan has been prepared for the 3 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 below in Table 7.29.

Table 7.29 Proposed Crop Plan for Narayanapet-2 Microwatershed

LMU No	Mapping Units	Survey Number	Soil Characteristics	Field Crops	Horticulture Crops	Suitable Interventions
LMU 1	77. RHNcB2 79.RHNmB2 84. KDRcB2 87.KDRiB2 88.KDRiB3 89.KDRmB2 90. SWRcB2 93. HGNiB2 94.HGNiB3 95.HGNmB2 96. HGNmB3 33. HSLiB2 34. GWDcB2 57.MDGcB2 58. MDGiB2	**Kanikal:**187,188,192,193,194,203,204,205,206 **Kudlura:**87,88,89,90,97,98,99,100,101,102,103,104,105,106,107,108,109,113,114,118,119,120,121,123,124,125,126,127,128,129,130,131,145,146,147,148,149,150,151,152,153,154,155,156,157,158,159,160,161,162,163,164,165,166,167,168,170,172,173,174,175,176,177,180,181,182,188,189,190,191,193,195,234,247,258,268,269,270,271,272,273,274,276,277,278,279,280,281,282,283,284,285,286,287,288,289,290,291,292,293,294,295,296,297,298,299/1,299/2,300/1,300/2,301/1,301/2,301/3,302,303,304,305,306,307,308,311,312	Moderately deep to very deep soils (75 to >150 cm), 1-3 % slopes, non gravelly (<15%), moderate to severe erosion.	Sunflower, Sorghum, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Jamun, Tamarind, Lime, Musambi, Amla, Custard apple, **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Bio-fertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
LMU 2	71. RMPiB2 72. RMPiB3	**Kudlura:** 110,111,112,115,116,117,122,169,171,178,179,183,184,185,186,187,198,199,210,211,212,228,232,236,237,238,239,240,241,242,243,244,245,246,248,249,250,251,252,253,254,256,257	Moderately shallow soils (50-75 cm), 1-3 % slopes, non gravelly (<15%) moderate to severe erosion.	Sorghum, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables:** Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Bio-fertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
LMU 3	4. BDLhB2 (Shallow, black clay soils)	**Kudlura:**224,229,230,231,233	Shallow soils (25-50 cm), 1-3% slopes, non gravelly (<15%), moderate erosion.	Bengal gram, Linseed, Safflower, Coriander	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope, drip irrigation and mulching is recommended

Chapter 8

SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Narayanapet-2 Microwatershed

- The soil phases identified in the microwatershed belonged to the soil series of KDR 216 ha (33%), RMP 195 ha (30%), HGN 84 ha (13%), SWR 54 ha (8%), MDG 29 ha (4%), RHN 25 ha (4%), HSL 15 ha (2%), BDL 7 ha (1%) and GWD 6 ha (1%).
- As per land capability classification entire area of the microwatershed falls under arable land category (Class II & III). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, about 125 ha (19%) is neutral (pH 6.5 -7.3), 501 ha (78%) area is slightly to moderately alkaline (pH 7.3-8.4) and 5 ha (1%) is strongly alkaline (pH 8.4 - 9.0).

❖ **Soil Health Management**

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

Acid soils

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

Liming materials:

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

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

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. Entire area of about 630 ha is suffering from moderate to severe erosion. These areas need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning (Saturation Plan) in IWMP is focusing on preparation of

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

In this connection, how various outputs of Sujala-III are of use in addressing these objectives of Net Planning (Saturation 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, raddish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, and Karnataka can be adopted.
- **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Narayanapet-2 microwatershed.
- **Organic Carbon:** The OC content (an index of available Nitrogen) is high in (>0.75%) in about 135 ha (21%), medium (0.5-0.75%) in 236 ha (37%) area and low (<0.5%) in 259 ha (40%). The areas that are medium and low in OC needs to be further improved by

applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.

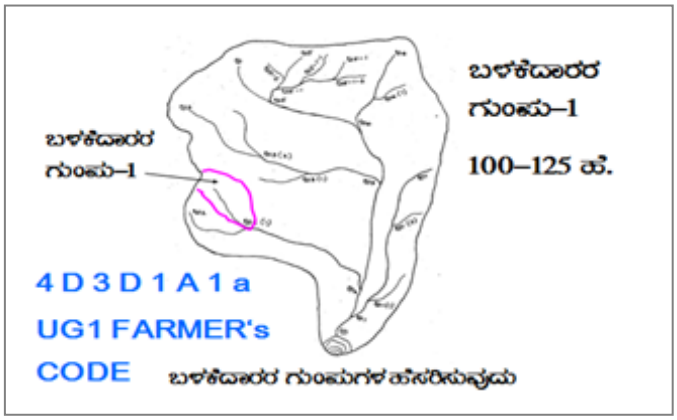
- **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 495 ha area where OC is low to medium (<0.5 - 0.75%). For example, for rainfed maize, recommended level is 50 kg N per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.
- **Available Phosphorus**: Available Phosphorus is low (<23 kg/ha) in an area of 85 ha (13%) and medium (23-57 kg/ha) in 448 ha (69%) of the microwatershed. In 97 ha (15%) area, the available phosphorus is high (>57 kg/ha). For all the crops, 25% additional P needs to be applied where available P is low and medium.
- **Available Potassium:** Available potassium is medium (145-337 kg/ha) in maximum area of 486 ha (75%) of the microwatershed and an area of about 144 ha (22%) is high (>337 kg/ha) in available potassium. All the plots, where available potassium is low and medium, for all the crops, additional 25 % potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops, it is high in 4 ha (1%), medium in 399 ha (62%) and low in 226 ha (35%). Low and medium 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.
- **Available Boron:** An area of 207 ha (32%) is low and 423 ha (65%) is medium. For these areas, application of sodium borate @ 10 kg/ha as soil application or 0.2 % borax as foliar spray is recommended.
- **Available Iron:** Entire area in the microwatershed is sufficient in available iron.
- **Available Zinc:** Almost entire area of about 623 ha (97%) of the microwatershed is deficient in available zinc content. Application of zinc sulphate @25 kg/ha is to be recommended for these areas and about 6 ha (1%) area is sufficient in available zinc content.
- **Soil Alkalinity:** The microwatershed has 506 ha (78%) area with soils that are slightly to very strongly alkaline. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc, are recommended.
- **Land Suitability for various crops:** Areas that are highly, moderately and marginally suitable 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 the 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 Narayanapet-2 microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

- Soil depth
- Surface soil texture
- Available water capacity
- Soil slope
- Soil gravelliness
- Land capability
- Present land use and land cover
- Crop suitability
- Rainfall
- Hydrology
- Water Resources
- Socio-economic data



- Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
- Cadastral map (1:7920 scale)
- Satellite imagery (1:7920 scale)

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

Steps for Survey and Preparation of Treatment Plan

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

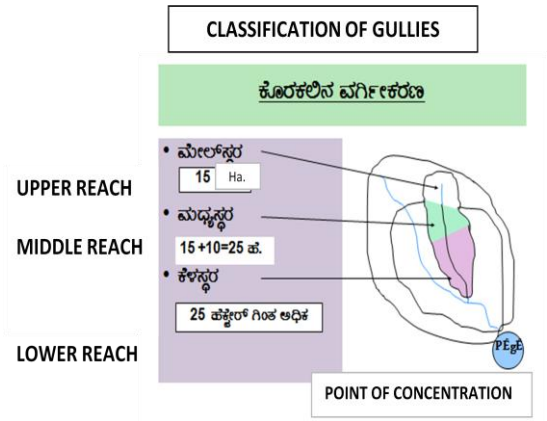
- Naming of user groups and farmers
- Identification of arable and non arable lands
- Identification of drainage lines and gullies
- Identification of non treatable areas
- Identification of priority areas in the arable lands
- Treatment plan for arable lands
- Location of water harvesting and recharge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

9.1 Treatment Plan

The treatment plan recommended for arable lands is briefly described below

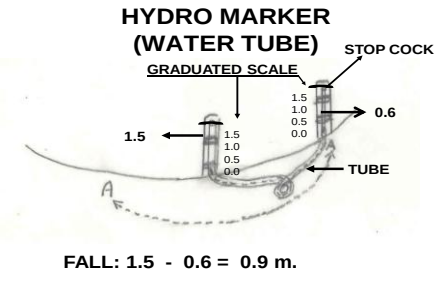
9.1.1 Arable Land Treatment

A. BUNDING

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

Measurement of Land Slope

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



FALL: 1.5 - 0.6 = 0.9 m.

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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

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

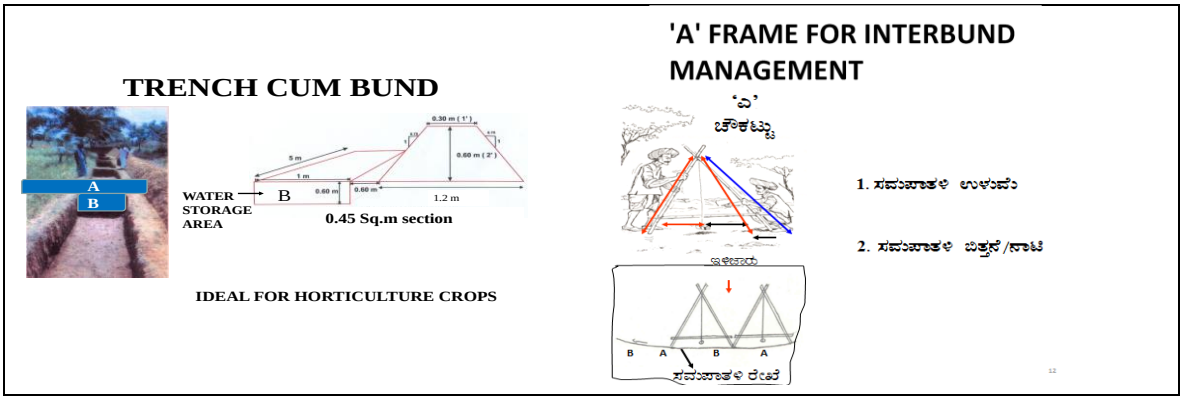
Recommended Bund Section

Top width (m)	Base width (m)	Height (m)	Side slope (Z:1;H:V)	Cross section (sq m)	Soil Texture	Remarks
0.3	0.9	0.3	01:01	0.18	Sandy loam	Vegetative bund
0.3	1.2	0.3	1.5:1	0.225	Sandy clay	
0.3	1.2	0.5	0.9:1	0.375	Red gravelly soils	
0.3	1.2	0.6	0.75:1	0.45		
0.3	1.5	0.6	01:01	0.54	Red sandy loam	
0.3	2.1	0.6	1.5:1	0.72	Very shallow 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

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas/ hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff from 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 different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. Entire area of about 630 ha needs Graded bunding.

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

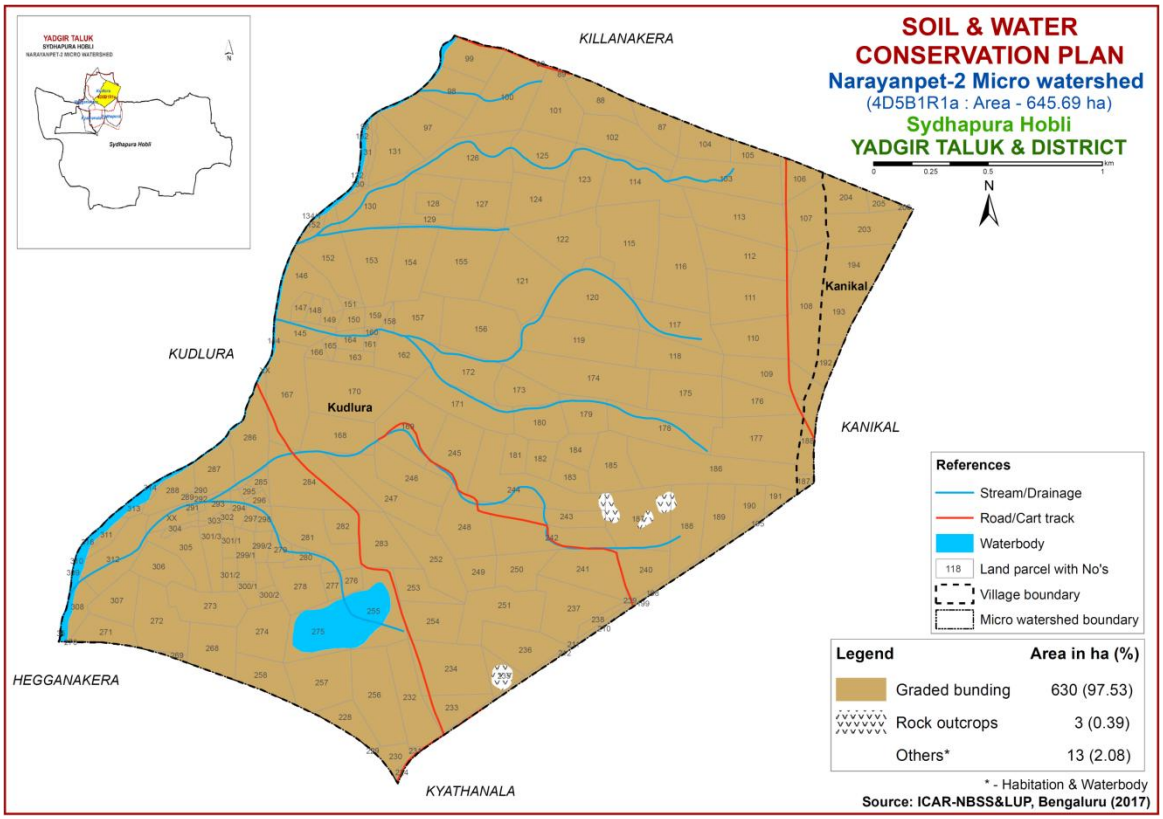


Fig. 9.1 Soil and Water Conservation Plan map of Narayanapet-2 Microwatershed

9.3 Greening of Microwatershed

As part of the greening programme in the watersheds, it is envisaged to plant a variety of horticultural and other tree plants that are edible, economical and produce lot of biomass which helps to restore the ecological balance in the watersheds. The lands that are suitable for greening programme are non-arable lands (land capability classes V, VI VII and VIII) and also the lands that are not suitable or marginally suitable 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 dugout soil on the lower side of the slope in order to harness the flowing water and facilitate weathering of soil in the pit. Exposure of soil in the pit also prevents spread of pests and diseases due to scorching sun rays. The pits should be filled with mixture of soil and organic manure during the second week of April and keep ready with sufficiently tall seedlings produced either in poly bags or in root trainer nurseries so that planting can be done during the 2nd or 3rd week of April depending on the rainfall.

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like 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-2 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
Hegganakera	35	0.02	Waterbody	Others	Others	Others	Others	Others	Others	Others	Jowar (Jw)	Not Available	Others	Others
Kanikal	187	0.38	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kanikal	188	2.68	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kanikal	192	1.4	MDGiB2	LMU-1	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
Kanikal	193	4.1	MDGiB2	LMU-1	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
Kanikal	194	4.44	MDGiB2	LMU-1	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
Kanikal	203	4.96	HSLiB2	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kanikal	204	2.59	GWDcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kanikal	205	0.87	GWDcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kanikal	206	0.05	HSLiB2	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	87	2.8	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy (Gn+Pd)	Not Available	IIes	Graded bunding
Kudlura	88	3.28	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy (Gn+Pd)	Not Available	IIes	Graded bunding
Kudlura	89	0.29	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	Graded bunding
Kudlura	90	0.04	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Waterbody	Not Available	IIIes	Graded bunding
Kudlura	96	0.08	Waterbody	Others	Others	Others	Others	Others	Others	Others	Paddy (Pd)	Not Available	Others	Others
Kudlura	97	5.66	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	98	3.88	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy+No crop (Pd+Nc)	Not Available	IIIes	Graded bunding
Kudlura	99	3.61	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	100	8.03	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	101	5.32	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	102	5.62	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Kudlura	103	6.82	KDRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	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
Kudlura	104	2.93	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	105	1.59	KDRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+No crop (Rg+Nc)	Not Available	IIes	Graded bunding
Kudlura	106	2.25	GWDcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+No crop (Rg+Nc)	Not Available	IIes	Graded bunding
Kudlura	107	3.99	HSLiB2	LMU-1	Moderately deep (75-100 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	108	7.25	MDGiB2	LMU-1	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
Kudlura	109	4.94	RHNcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	110	5.06	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	111	7	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	1 Bore Well	IIes	Graded bunding
Kudlura	112	6.53	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Kudlura	113	7.65	KDRiB2	LMU-1	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
Kudlura	114	6.77	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+No crop (Rg+Nc)	Not Available	IIes	Graded bunding
Kudlura	115	8.92	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	116	8.26	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	117	5.07	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+No crop (Rg+Nc)	Not Available	IIes	Graded bunding
Kudlura	118	4.92	RHNcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	119	8.31	KDRiB2	LMU-1	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
Kudlura	120	8.54	KDRiB2	LMU-1	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
Kudlura	121	8.34	HGNiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+No crop (Jw+Nc)	Not Available	IIes	Graded bunding
Kudlura	122	7.05	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	123	4.38	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	124	4.67	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	125	4.69	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	126	6.97	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	127	4.65	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	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
Kudlura	128	1.43	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	129	3.67	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	130	5.19	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	131	4.89	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	132	0.05	Waterbody	Others	Others	Others	Others	Others	Others	Others	Paddy (Pd)	Not Available	Others	Others
Kudlura	134 /1	0.03	Waterbody	Others	Others	Others	Others	Others	Others	Others	Paddy (Pd)	Not Available	Others	Others
Kudlura	144	0.01	Waterbody	Others	Others	Others	Others	Others	Others	Others	Jowar (Jw)	Not Available	Others	Others
Kudlura	145	2.2	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	146	4.11	HGNmB3	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	Graded bunding
Kudlura	147	0.82	HGNmB3	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Jowar (Jw)	Not Available	IIIes	Graded bunding
Kudlura	148	0.72	HGNmB3	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Jowar (Jw)	Not Available	IIIes	Graded bunding
Kudlura	149	0.77	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	150	1.01	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	151	0.35	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	152	5.38	HGNmB3	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Redgram+No crop (Rg+Nc)	Not Available	IIIes	Graded bunding
Kudlura	153	5.8	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	154	5.52	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+No crop (Jw+Nc)	Not Available	IIes	Graded bunding
Kudlura	155	8.39	HGNiB2	LMU-1	Very deep (>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
Kudlura	156	7.81	HGNiB2	LMU-1	Very deep (>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
Kudlura	157	3.79	HGNiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	158	0.4	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	159	0.96	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	160	0.27	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	161	0.36	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	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
Kudlura	162	4.08	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	163	1.08	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	164	1.05	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	165	0.49	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	166	0.57	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	167	7.49	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	168	4.83	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	169	6.48	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	1 Check Dam	IIes	Graded bunding
Kudlura	170	9.45	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	171	5.48	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	172	4.65	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	1 Check Dam	IIes	Graded bunding
Kudlura	173	3.27	KDRiB2	LMU-1	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
Kudlura	174	9.11	KDRiB2	LMU-1	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
Kudlura	175	5.8	RHNcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	176	4.29	RHNcB2	LMU-1	Moderately deep (75-100 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	177	7.23	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	178	6.99	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	179	3.07	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	180	3.43	KDRiB2	LMU-1	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
Kudlura	181	1.74	KDRiB2	LMU-1	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
Kudlura	182	1.96	KDRiB2	LMU-1	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
Kudlura	183	1.76	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	184	2.16	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	185	4.61	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	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
Kudlura	186	10.03	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	187	7.26	RMPiB3	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	188	5.33	RHNmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	189	3.53	RHNmB2	LMU-1	Moderately deep (75-100 cm)	Clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	190	2.38	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	191	1.01	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	193	0	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	195	0	MDGcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	198	0.02	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	199	0.04	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	210	0.16	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	211	0.01	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	212	0.02	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	224	0.01	BDLhB2	LMU-3	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Kudlura	228	2.53	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	229	0	BDLhB2	LMU-3	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	230	1.36	BDLhB2	LMU-3	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	231	0.18	BDLhB2	LMU-3	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Kudlura	232	5.37	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	233	2.83	BDLhB2	LMU-3	Shallow (25-50 cm)	Sandy clay loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Kudlura	234	7.13	KDRiB2	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram+No crop (Rg+Nc)	Not Available	IIes	Graded bunding
Kudlura	235	1.84	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	No crop (Nc)	Not Available	Rock outcrops	Rock outcrops
Kudlura	236	5.04	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	237	5.98	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 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
Kudlura	238	0.8	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	239	0.05	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	240	3.84	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+No crop (Ct+Nc)	Not Available	IIes	Graded bunding
Kudlura	241	5.73	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	242	6.1	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	243	3.63	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	244	8.72	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+No crop (Ct+Nc)	Not Available	IIes	Graded bunding
Kudlura	245	5.27	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	1 Check Dam	IIes	Graded bunding
Kudlura	246	4.75	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	247	5.98	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Groundnut (Gn)	1 Bore Well	IIIes	Graded bunding
Kudlura	248	5.58	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	Graded bunding
Kudlura	249	2.22	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	250	3.31	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	251	6.45	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	252	4.95	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	253	2.59	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	254	4.21	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	255	7.34	Waterbody	Others	Others	Others	Others	Others	Others	Others	No crop (Nc)	Not Available	Others	Others
Kudlura	256	7.21	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	257	6.05	RMPiB2	LMU-2	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Kudlura	258	3.42	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	268	4.33	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	269	0.3	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	270	0.02	HGNiB3	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	Graded bunding

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Kudlura	271	2.64	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	272	5.77	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	273	4.64	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	274	4.86	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	275	5.83	Waterbody	Others	Others	Others	Others	Others	Others	Others	No crop (Nc)	Not Available	Others	Others
Kudlura	276	1.04	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	277	0.84	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	278	3.99	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	279	1.07	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	280	1.11	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	281	5.77	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Kudlura	282	2.17	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	283	4.68	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	Graded bunding
Kudlura	284	9.57	KDRiB3	LMU-1	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Kudlura	285	0.65	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	286	5.32	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	287	3.42	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	288	2.69	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Kudlura	289	0.17	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	290	0.11	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	291	0.24	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	292	0.18	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	293	1.19	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	294	0.87	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	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
Kudlura	295	0.38	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	296	0.51	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	297	0.58	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	298	0.73	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	299/1	1.88	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	299/2	0.9	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	300/1	1.62	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	300/2	0.6	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	301/1	0.9	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	301/2	0.93	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	301/3	2.24	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	302	0.29	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	303	0.29	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	304	0.42	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Kudlura	305	3.44	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Kudlura	306	3.32	SWRcB2	LMU-1	Deep (100-150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	307	3.3	HGNmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Kudlura	308	2.47	HGNiB3	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIes	Graded bunding
Kudlura	309	0.02	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Kudlura	310	0.09	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Kudlura	311	1.42	HGNiB3	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIes	Graded bunding
Kudlura	312	5.15	KDRmB2	LMU-1	Deep (100-150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Kudlura	313	0.72	Waterbody	Others	Others	Others	Others	Others	Others	Others	No crop (Nc)	Not Available	Others	Others
Kudlura	314	0.05	Waterbody	Others	Others	Others	Others	Others	Others	Others	No crop (Nc)	Not Available	Others	Others
Kudlura	316	0.14	Waterbody	Others	Others	Others	Others	Others	Others	Others	Jowar (Jw)	Not Available	Others	Others

Appendix II

Narayanpet-2 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
Hegganakera	35	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kanikal	187	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	188	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	192	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	194	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	203	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	204	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	205	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kanikal	206	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	87	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	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)
Kudlura	88	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	89	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	90	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	96	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	97	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	98	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	99	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	100	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	101	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	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)
Kudlura	102	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	103	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	104	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	105	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	106	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	107	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	108	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	109	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	110	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	111	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	112	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	113	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	114	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	115	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	116	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	117	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	118	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	119	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	120	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	121	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	122	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	123	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	124	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	125	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	126	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	127	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	128	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	129	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	130	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	131	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	132	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	134/1	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	144	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	145	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	146	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	147	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	148	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	149	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	150	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	151	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	152	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	153	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	154	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	155	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	156	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	157	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	158	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	159	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	160	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	161	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	162	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	163	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	164	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	165	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	166	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	167	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	168	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	169	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	170	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	171	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	172	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	173	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	174	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	175	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	176	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	177	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	178	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	179	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	180	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	181	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	182	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	183	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	184	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	185	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	186	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	187	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	188	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	189	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	190	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	191	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	193	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	195	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	198	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	199	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	210	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	211	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	212	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	224	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	228	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	229	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	230	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	231	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	232	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	233	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Sufficient (> 0.6 ppm)
Kudlura	234	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	235	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kudlura	236	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	237	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	238	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	239	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	240	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	241	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	242	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	243	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	244	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	245	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	246	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	247	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	248	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	249	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	250	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	251	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	252	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	253	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	254	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	255	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	256	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	257	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	258	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	268	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	269	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	270	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	271	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	272	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	273	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	274	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	275	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	276	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	277	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	278	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	279	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	280	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	281	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	282	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	283	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	284	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	285	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	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)
Kudlura	286	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Low (< 23 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	287	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	288	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	289	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	290	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	291	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	292	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	293	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	294	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)

Village	Survey No.	Soil Reaction	Salinity	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Kudlura	295	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	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)
Kudlura	296	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	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)
Kudlura	297	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	298	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	299/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	299/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	300/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	300/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	301/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	301/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	301/3	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	302	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	303	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Low (< 0.5 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	304	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	305	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	306	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Low (< 10 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	307	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	308	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	309	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	310	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	311	Others	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	312	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (> 1.0 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2 ppm)	Deficient (< 0.6 ppm)
Kudlura	313	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	314	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	316	Others	Others	Others*	Others	Others	Others	Others	Others	Others	Others	Others

Appendix III

Narayanpet-2 Microwatershed
Soil Suitability Information

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Heggan akera	35	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
Kanikal	187	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kanikal	188	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kanikal	192	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kanikal	193	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kanikal	194	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kanikal	203	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2z	S2z	S2rz	S2rz
Kanikal	204	S3rz	S3tz	S3tz	S2wz	S3tz	S2rz	S3rz	S2rz	S2wz	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Kanikal	205	S3rz	S3tz	S3tz	S2wz	S3tz	S2rz	S3rz	S2rz	S2wz	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Kanikal	206	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2rz	S2rz
Kudlura	87	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	88	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	89	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	90	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	96	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Kudlura	97	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	98	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	99	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	100	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	101	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	102	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	103	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	104	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	105	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	106	S3rz	S3tz	S3tz	S2wz	S3tz	S2rz	S3rz	S2rz	S2wz	S2rz	S2rz	S2zw	S3tz	S2zw	N1tw	S3rz	S2rz	S3tz	S2tz	S3tz	S2tz	S2tz	S2rz	S2zw	S2rz	S3tz
Kudlura	107	S3rz	S3tz	S2rz	S2tz	S2rz	S3tz	S3rz	S2rz	S3tz	S2rz	S2rz	S2tz	S2rz	S2z	N1tz	S3rz	S2rz	S2z	S2z	S2z	S2z	S2z	S2rz	S2z	S2rz	S2rz

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Kudlura	108	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	109	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw
Kudlura	110	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	111	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	112	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	113	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	114	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	115	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	116	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	117	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	118	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw
Kudlura	119	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	120	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	121	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	122	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	123	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	124	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	125	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	126	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	127	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	128	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	129	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	130	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	131	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	132	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
Kudlura	134/1	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
Kudlura	144	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
Kudlura	145	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	146	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Kudlura	147	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	148	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	149	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	150	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	151	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	152	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	153	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	154	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	155	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	156	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	157	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	158	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	159	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	160	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	161	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	162	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	163	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	164	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	165	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	166	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	167	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	168	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	169	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	170	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	171	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	172	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	173	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	174	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	175	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw
Kudlura	176	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Kudlura	177	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	178	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	179	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	180	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	181	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	182	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	183	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	184	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	185	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	186	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	187	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	188	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw
Kudlura	189	S3rt	S3tw	S3tw	S2wz	S3tw	S2rw	S3rw	S2rz	S2wz	S2rw	S2rt	S2tz	S3tw	S2zw	N1tz	S3rt	S2rw	S3tw	S2tw	S3tw	S2tw	S2tw	S2rt	S2tw	S2rt	S3tw
Kudlura	190	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	191	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	193	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	195	S2r	S3tw	S3tw	S2w	S3tw	S1	S2tw	S2w	S1	S2w	S2tw	S2tw	S3tw	S2w	N1tw	S2tw	S2w	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2t	S2tw	S3tw
Kudlura	198	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	199	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	210	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	211	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	212	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	224	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
Kudlura	228	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	229	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
Kudlura	230	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
Kudlura	231	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
Kudlura	232	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	233	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
Kudlura	234	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Kudlura	235	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops	Rock outcrops
Kudlura	236	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	237	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	238	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	239	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	240	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	241	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	242	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	243	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	244	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	245	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	246	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	247	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	248	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	249	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	250	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	251	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	252	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	253	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	254	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	255	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
Kudlura	256	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	257	N1rw	S3tw	S3rt	S2rw	S3rw	S2rw	N1rw	S3rw	S2rw	S3rw	S3rw	S2rw	S3rt	S2rw	N1tw	S3rw	S3rw	S3tw	S3rt	S3rt	S2rt	S2rt	S3rw	S3rt	S3w	S3rt
Kudlura	258	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	268	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	269	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	270	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	271	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	272	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw

Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Kudlura	273	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	274	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	275	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
Kudlura	276	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	277	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	278	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	285	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	287	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	288	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	291	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	292	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	294	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	295	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	296	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	297	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	298	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	299/1	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	299/2	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Village	Survey No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengal gram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
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Kudlura	301/1	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	301/2	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	301/3	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	303	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
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Kudlura	305	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	306	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	307	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	308	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	309	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
Kudlura	310	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
Kudlura	311	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	312	S3tw	S3tw	S3tw	S2wz	S3tw	S2wz	S2tw	S2zw	S2wz	S2rw	S2tw	S2zw	S3tw	S2zw	N1tz	S2tw	S2wz	S3tw	S2tw	S3tw	S2tw	S2tw	S2tw	S2tw	S2tw	S3tw
Kudlura	313	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
Kudlura	314	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
Kudlura	316	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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Chapter 1

EXECUTIVE SUMMARY

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

Methodology: *Narayanapet-2 micro-watershed (Yadgir taluk and district) is located in between $16^0$34' – $16^0$36' North latitudes and 77^0 14' – $76^0$16' East longitudes, covering an area of about 645.69 ha, bounded by Kanikal, Kudlura, Hegganakera and Kyathanala villages with length of growing period (LGP) 120-150 days. We used soil resource map as basis for sampling farm households to test the hypothesis that soil quality influence crop selection, and conservation investment of farm households. The level of technology adoption and productivity gaps and livelihood patterns were analyses. The cost of soil degradation and ecosystem services were quantified.*

Results: *The socio-economic outputs for the Narayanpet-2 micro-watershed in Yadgir taluk and district are presented here.*

Social Indicators;

- *Male and female ratio is 43.9 to 56.1 per cent to the total sample population.*
- *Younger age group 18 to 50 of population is around 43.9 per cent to the total population.*
- *Literacy population is around 54.9 per cent.*
- *Social groups belong to other backward caste (OBC) are around 62.5 per cent.*
- *Fire wood is the source of energy for a cooking around 93.8 per cent sample households.*
- *About 12.5 per cent of households have a yashaswini health card.*
- *About 12.5 per cent farm households having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 87.5 per cent.*
- *Swach bharath program providing closed toilet facilities around 25 per cent of sample households.*
- *Women participation in decisions making are around 75 per cent of households were found.*

Economic Indicators;

- *The average land holding is 2.21 ha indicates that majority of farm households are belong to marginal and small farmers. The account for dry land of 31.16 ha among the total cultivated land among the sample households.*

- *Agriculture is the main occupation is only 6.10 per cent and agriculture is the main and non agriculture labour is subsidiary occupation for 40.24 per cent of sample households.*
- *The average value of domestic assets is around Rs.14679 per household. Mobile and television are popular media mass communication.*
- *The average value of farm assets is around Rs.12142 per household, about 20.0 per cent of sample farmers are owing plough.*
- *The average value of livestock is around Rs.43333 per household; about 26.32 per cent of household are having livestock.*
- *The average per capita food consumption is around 1168.2 grams (2557.1 kilo calories) against national institute of nutrition recommendation at 827 gram. Around 94 per cent of sample households are consuming more than the NIN recommendation.*
- *The annual average income is around Rs.55121 per household. About 93.8 per cent of farm households are below poverty line.*
- *The per capita monthly average expenditure is around Rs.4689.*

Environmental Indicators-Ecosystem Services;

- *The value of ecosystem service helps to support investment to decision on soil and water conservation and in promoting sustainable land use.*
- *The average value of ecosystem service for food grain production is around Rs. Rs.9659/ ha/year. Per hectare food grain production services is maximum in cotton (Rs.15372) followed by green gram (Rs.12705), red gram (Rs.8639) and sorghum (Rs. 1920).*
- *The average value of ecosystem service for fodder production is around Rs.1646/ ha/year in sorghum.*
- *The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The value of per hectare water used and value of water was maximum in cotton (Rs.63129) followed by green gram (Rs.56859), red gram (Rs.48518) and sorghum (Rs. 37643).*

Economic Land Evaluation;

- *The major cropping pattern is redgram (51.2%) followed by cotton (36.7 %), green gram (6.0 %) and sorghum (6.0 %).*
- *The total cost of cultivation and benefit cost ratio (BCR) in study area for cotton ranges between Rs.73340/ha in medium farmers (with BCR of 1.01) and Rs.28595/ha in semi medium farmers (with BCR of 1.42).*
- *In redgram the cost of cultivation range between Rs.45689/ha in medium farmers (with BCR of 1.12) and Rs.29530/ha in small farmers (with BCR of 1.34),*

- *In sorghum the cost of cultivation is Rs.17480/ha in small farmers (with BCR of 1.20) and*
- *In greengram the cost of cultivation is Rs.23522/ha in small farmers (with BCR of 1.54).*
- *The land management practices reported by the farmers are crop rotation, tillage practices, fertilizer application and use of farm yard manure (FYM). Due to higher wages farmer are following labour saving strategies is not prating soil and water conservation measures. Less ownership of livestock limiting application of FYM.*
- *It was observed soil quality influences on the type and intensity of land use. More fertilizer applications in deeper soils to maximize returns.*

Suggestions;

- *Involving farmers is watershed planning helps in strengthing institutional participation.*
- *The per capita food consumption and monthly income is very low. Diversifying income generation activities from crop and livestock production in order to reduce risk related to drought and market prices.*
- *Majority of farmers reported that they are not getting timely support/extension services from the concerned development departments.*
- *By strengthing agricultural extension for providing timely advice improved technology there is scope to increase in net income of farm households.*
- *By adopting recommended package of practices by following the soil test fertiliser recommendation, there is scope to increase yield in cotton (33.5 %), redgram (22.8 to 29.2 %), greengram (3.6 %) and sorghum (56.0 %).*

Chapter 2

INTRODUCTION

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

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

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

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

Objectives of the study

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

Chapter 3

METHODOLOGY

Study area

Narayanapet-2 micro-watershed is located in North-eastern Dry Zone of Karnataka (Figure 1): The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane. It's represented Agro Ecological Sub Region (AESR) 6.2 with LGP 120-150 days.

Narayanapet-2 micro-watershed (Yadgir taluk and district) is located in between $16^0$34' – $16^0$36' North latitudes and 77^0 14' – $76^0$16' East longitudes, covering an area of about 645.69 ha, bounded by Kanikal, Kudlura, Hegganakera and Kyathanala villages.

Sampling Procedure:

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

Sources of data and analysis:

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

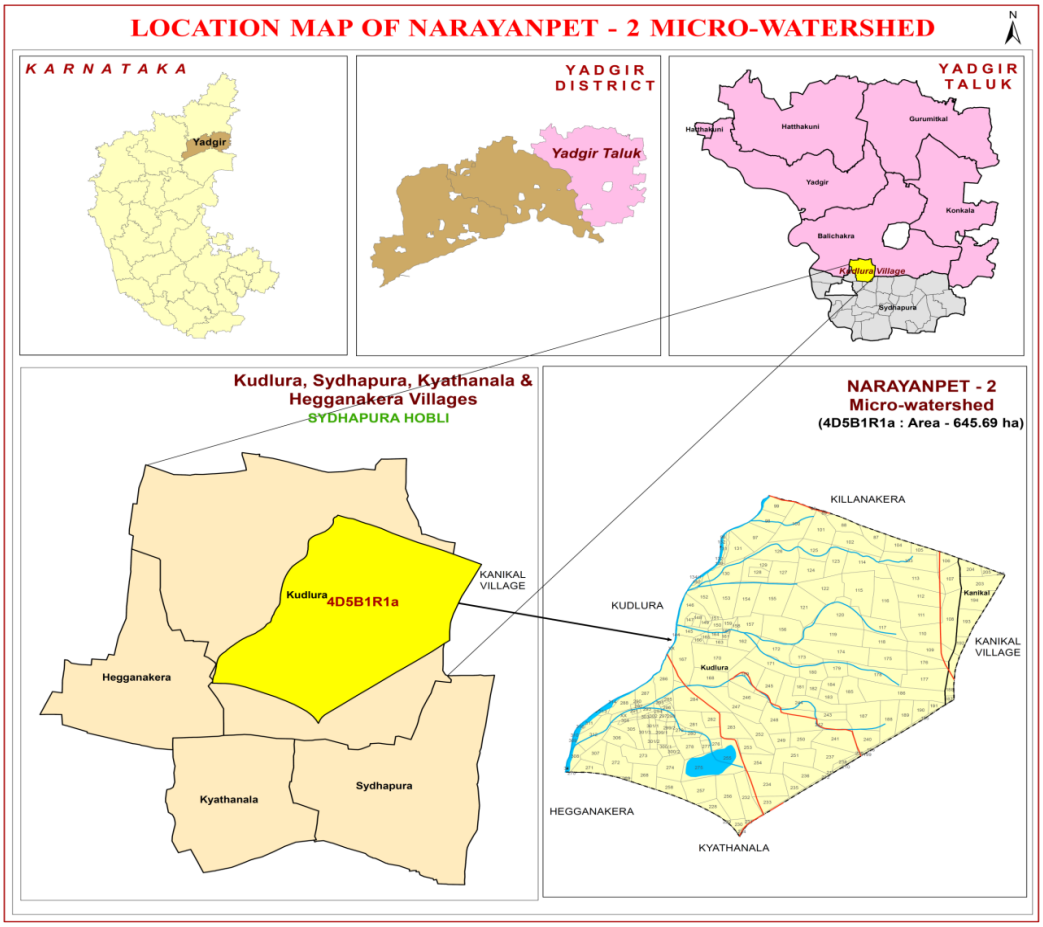
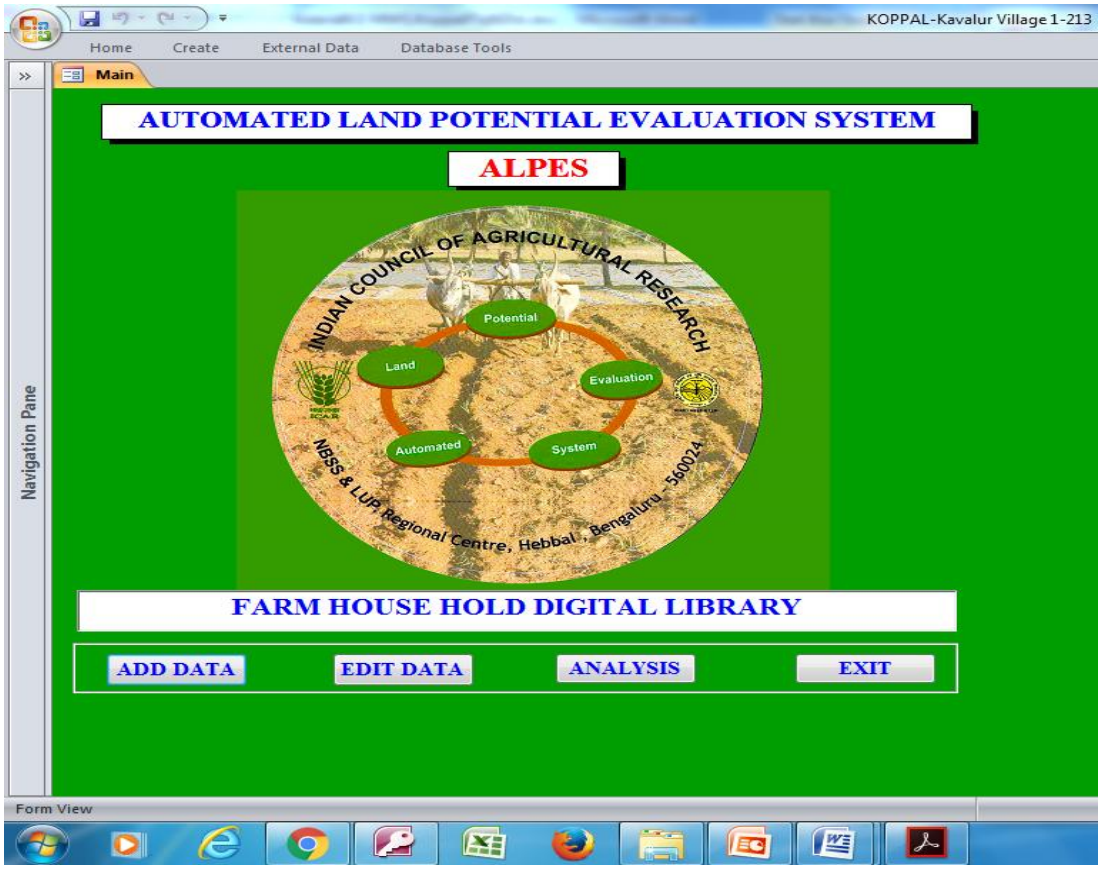


Figure 1: Location of study area

Steps followed in socio-economic assessment

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



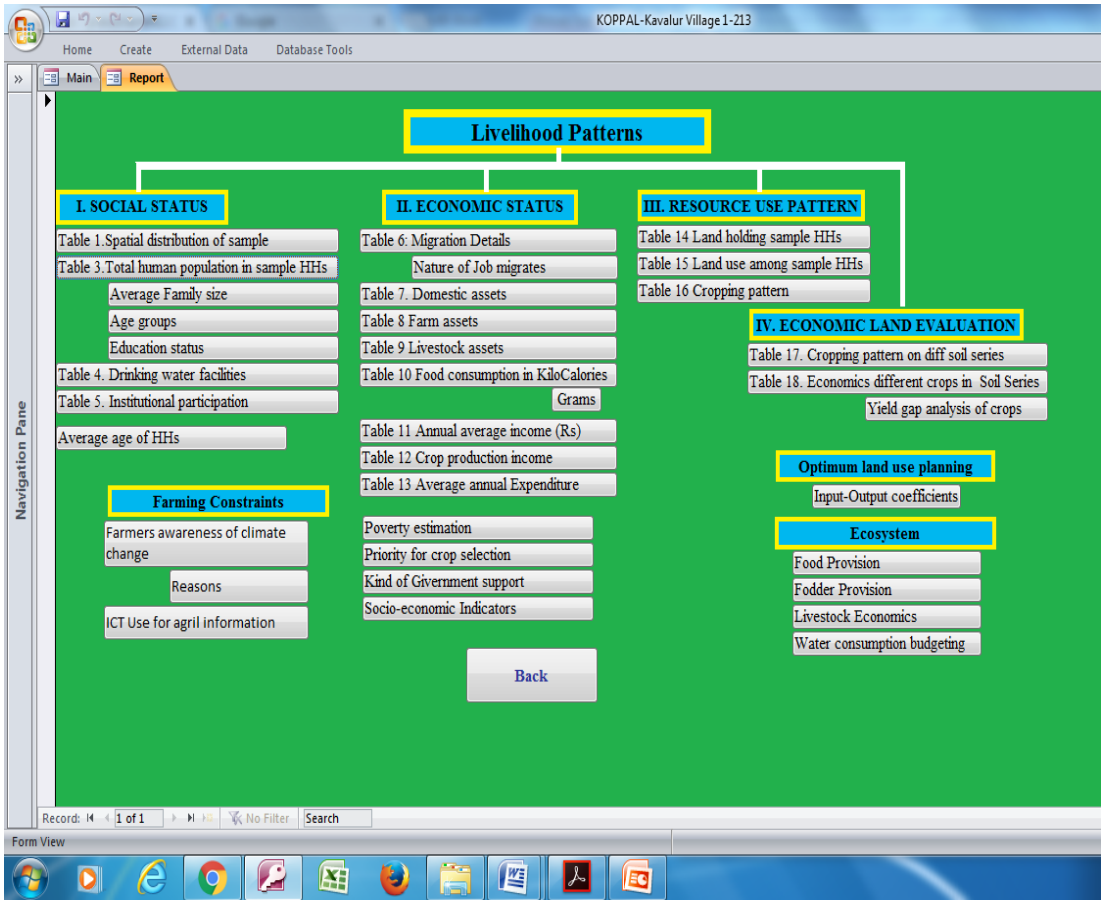


Figure 2: ALPES FRAMEWORK

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

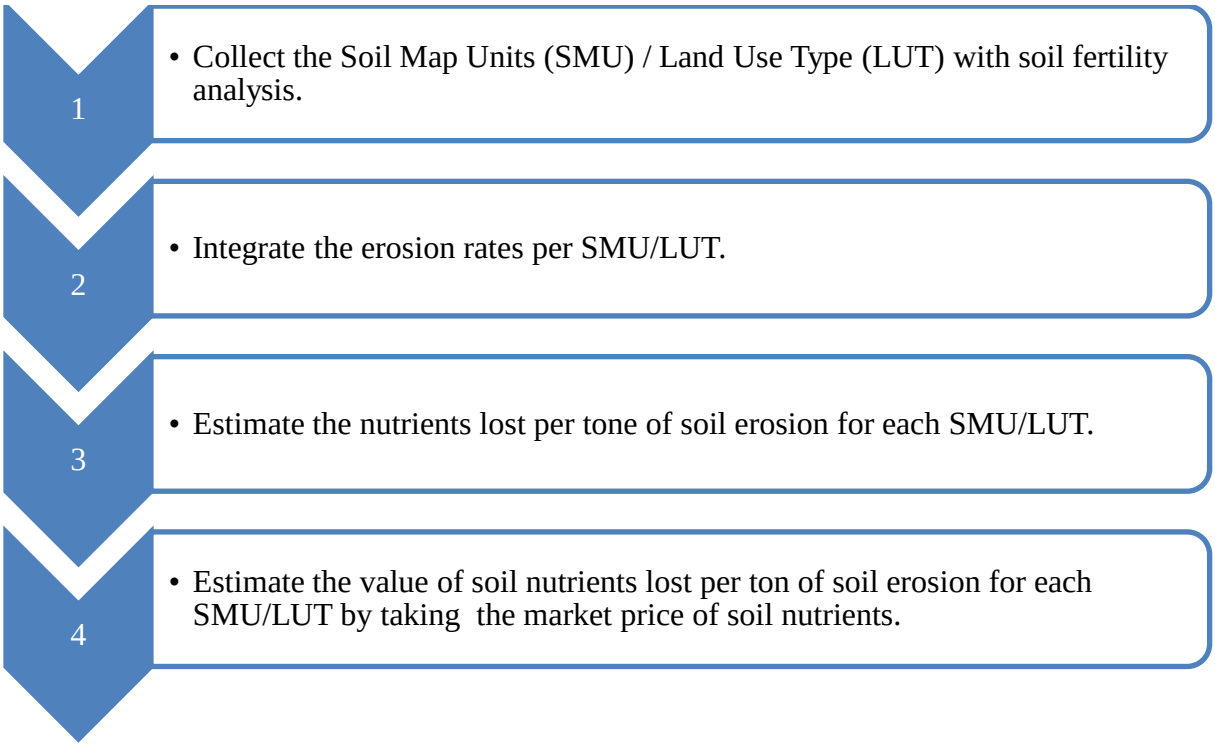
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total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

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

Economic Valuation of Soil ecosystem services:

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

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



Chapter 4

RESULTS AND DISCUSSIONS

The demographic information shows that the household population dynamics encompasses the socioeconomic status of the farmer. For a rural family, the household size should be optimal to earn a comfortable livelihood through farm and non-farm wage earning. The total number of population in watershed area was 154, out of which 43.9 per cent were males and 56.1 per cent females. Average family size of the households is 5.13 among the sample population.

Table 1: Human population among sample households in Narayanpet-2 Microwatershed

Particulars	MF(34)		SF(51)		SMF(53)		MDF(17)		ALL (154)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Male	17	50.0	21	40.7	21	39.3	9	55.6	68	43.9
Female	17	50.0	30	59.3	32	60.7	8	44.4	86	56.1
Total human population	34	100	51	100	53	100	17	100	154	100
Average family size	4.50		6.75		4.67		4.50		5.13	

Age is an important factor, which affects the potential employment and mobility status of respondents. The data on age wise distribution of farmers in the sample households indicated that majority of the farmers are coming under the age group of 0 to18 years (39.0 %) followed by 30 to 50 years (24.4 %), 18 to 30 years (19.5 %) and more than 50 years (17.1 %). Hence, in the study area in general, the respondents were of young and middle age, indicating there by that the households had almost settled with whatever livelihood options they were practicing and sample respondents were young by age who could venture into various options of livelihood sources (Table 2).

Table 2: Age groups among the sample population in Narayanpet-2 micro-watershed

Particulars	MF(34)		SF(51)		SMF(53)		MDF(17)		ALL (154)	
	No.	%	No.	%	No.	%	No.	%	No.	%
0 to 18 years	15	44.4	23	44.4	21	39.3	2	11.1	60	39.0
18 to 30 years	6	16.7	13	25.9	11	21.4	0	0.0	30	19.5
30 to 50 years	11	33.3	8	14.8	11	21.4	8	44.4	38	24.4
>50 years	2	5.6	8	14.8	9	17.9	8	44.4	26	17.1
Grand total	34	100.0	51	100.0	53	100.0	17	100.0	154	100.0
Average age	26.67		25.41		29.43		46.44		29.37	

Data on literacy (Table 3) indicated that 45.1 per cent of respondents were illiterate and 54.9 per cent literate with highest of primary school education (23.2 %) followed by the middle school education (17.1 %), high school education (8.5 %), senior secondary education (2.4 %), graduates (2.4 %) and technical (1.2 %) among the sample population.

The ethnic groups among the sample farm households found to be 62.5 per cent belonging to other backward castes (OBC) followed by 31.3 per cent belong to scheduled caste (SC) and 6.25 per cent belonging to general caste among the sample population (Table 4 and Figure 3).

Table 3: Education status among the sample population in Narayanpet-2 micro-watershed

Particulars	MF(34)		SF(51)		SMF(53)		MDF(17)		ALL (154)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterates	11	33.3	21	40.7	23	42.9	15	88.9	69	45.1
Literates	23	66.7	30	59.3	30	57.1	2	11.1	85	54.9
Primary School (<5 class)	8	22.2	17	33.3	11	21.4	0	0.0	36	23.2
Middle School (6- 8 class)	8	22.2	8	14.8	11	21.4	0	0.0	26	17.1
High School (9- 10 class)	6	16.7	4	7.4	2	3.6	2	11.1	13	8.5
Senior secondary	0	0.0	2	3.7	2	3.6	0	0.0	4	2.4
Graduate	0	0.0	0	0.0	4	7.1	0	0.0	4	2.4
Technical	2	5.6	0	0.0	0	0.0	0	0.0	2	1.2
Grand Total	34	100	51	100	53	100	17	100	154	100

Table 4: Social groups among sample households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
SC	0	0	7	100	2	16.7	0	0	9	31.3
OBC	8	100	0	0	7	66.7	4	100	19	62.5
General	0	0	0	0	2	16.7	0	0	2	6.25
Grand total	8	100	7	100	11	100	4	100	30	100

Among 93.8 per cent of sample households are using fire wood as source of fuel for cooking. Among the entire sample farmers are having electricity connection. About 12.5 per cent are sample households having health cards. Only 12.5 per cent of having MNREGA job cards for employment generation. About 87.5per cent of farm households are having ration cards for taking food grains from public distribution system. About 25 per cent of farm households are having toilet facilities (Table 5).

Table 5: Basic needs of sample households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Types of fuel use for cooking										
Fire wood	8	100	7	100	9	83.3	4	100	28	93.8
Fire wood & Gas	0	0	0	0	2	16.7	0	0	2	6.25
Energy supply for home										
Electricity	8	100	7	100	11	100	4	100	30	100
Health Card										
Yes	0	0	2	25	0	0	2	50	4	12.5
No	8	100	5	75	11	100	2	50	26	87.5
NREGA										
Yes	0	0	2	25	2	16.7	0	0	4	12.5
No	8	100	5	75	9	83.3	4	100	26	87.5
Ration Card										
Yes	8	100	7	100	7	66.7	4	100	26	87.5
No	0	0	0	0	4	33.3	0	0	4	12.5
Household with toilet										
Yes	0	0	2	25	4	33.3	2	50	8	25
No	8	100	5	75	7	66.7	2	50	23	75
Drinking Water										
Tube Well	8	100	7	100	11	100	4	100	30	100

The data collected on the source of drinking water in the study area is presented in Table 5. Among the entire sample respondents are having tube well source for water supply for domestic purpose with share of 100 percent.

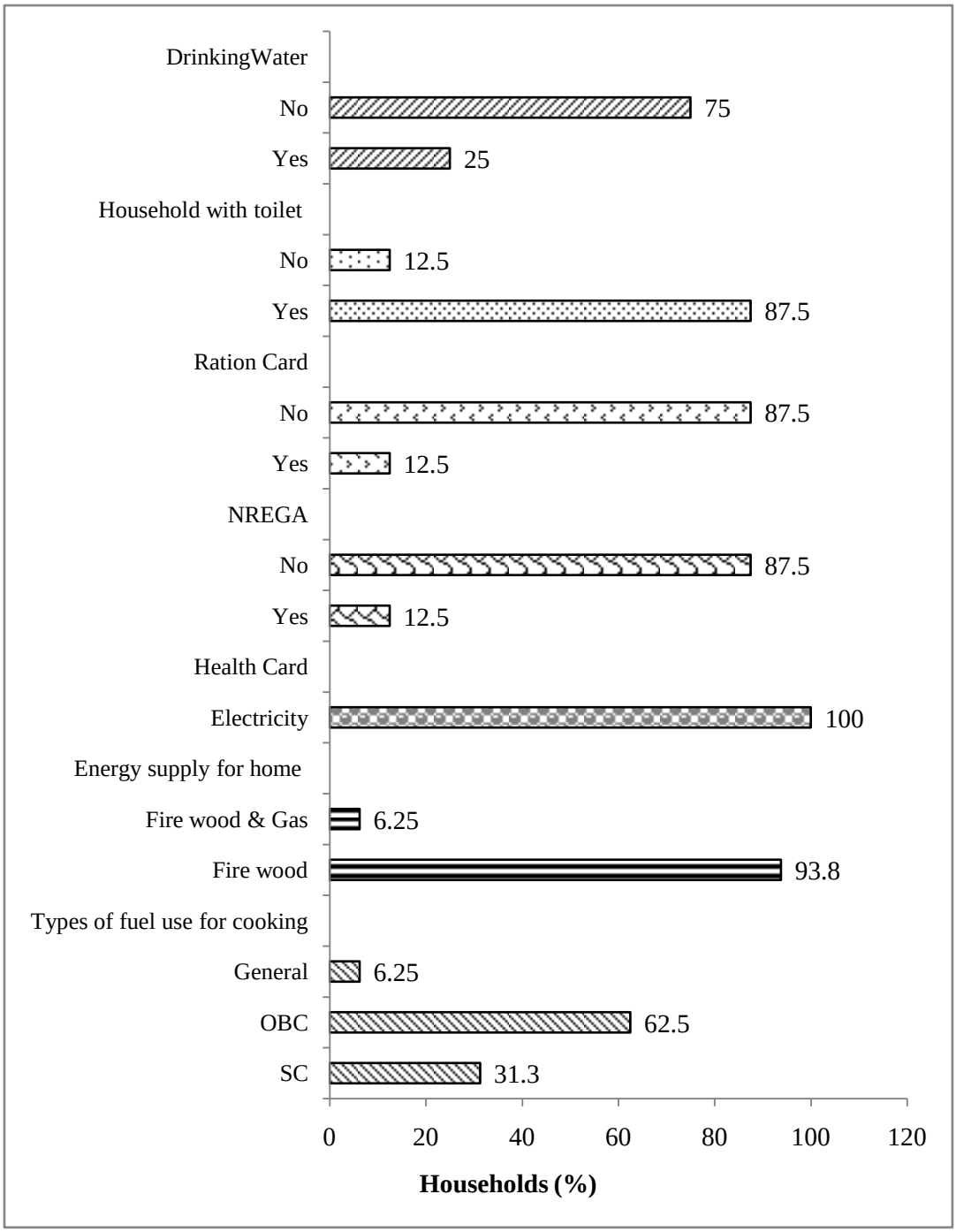


Figure 3: Basic needs of sample households in Narayanpet-2 Microwatershed

The occupational pattern (Table 6) among sample households shows that agriculture is the main occupation is around 6.10 per cent and agriculture is a main and non agriculture labour is subsidiary occupations around 40.24 per cent of population.

Agriculture labour is the main occupation and non agriculture is subsidiary occupations around 1.22 per cent of population and 32.93 per cent of sample population is studying.

Table 6: Occupational pattern in sample population in Narayanpet-2 Microwatershed

Occupation		MF(34)		SF(51)		SMF(53)		MDF(17)		ALL (154)	
Main	**Subsidiary**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Agriculture	Agriculture	2	5.6	4	7.41	4	7.14	0	0.0	9	6.10
	Agriculture Labour	2	5.6	21	40.74	8	14.29	0	0.0	30	19.51
	Non Agriculture Labour	17	50.0	8	14.81	23	42.9	15	88.9	62	40.24
Agriculture Labour	Non Agriculture Labour	0	0.0	0	0.0	2	3.57	0	0.0	2	1.22
Studying		13	38.9	19	37.04	17	32.14	2	11.11	51	32.93
Grand Total		34	100	51	100	53	100	17	100	154	100
Family labour availability		**Man days/month**									
Male		30	60	56	44	36	51	50	56	44	49
Female		20	40	72	56	34	49	40	44	46	51
Total		50	100	128	100	69	100	90	100	90	100

The important assets especially with reference to domestic assets were analyzed and are given in Table 7 and Figure 4. The important domestic assets possessed by all categories of farmers are television (100 %) followed by mobile phones (87.5 %), mixer/grinder (62.5 %), motorcycle (6.25%), landline Phone (6.25 %) and refrigerator (6.25 %). The average value of domestic assets is around Rs. 14679 per households.

Table 7: Domestic assets among the sample households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Landline Phone	0	0	2	25	0	0.0	0	0	2	6.25
Mixer/grinder	6	75	2	25	7	66.7	4	100	19	62.5
Mobile Phone	8	100	4	50	11	100.0	4	100	26	87.5
Motorcycle	0	0	2	25	0	0.0	0	0	2	6.25
Refrigerator	0	0	0	0	2	16.7	0	0	2	6.25
Tv	8	100	7	100	11	100.0	4	100	30	100

Average value of durable assets

The data regarding the average value of durable assets owned by the households in Narayanpet-2 micro watershed is presented in Table 10. The results shows that the average value of landline Phone was Rs.5000, television was Rs. 8533, mixer grinder was Rs. 3900, motor cycle was Rs. 50000, mobile phone was Rs. 5643 and Refrigerator was Rs.15000.

Table 8: Average value of durable asset of Narayanpet-2 micro-watershed

(Rupees)

Particulars	MF(8)	SF(7)	SMF(11)	MDF(4)	ALL (30)
Landline Phone	0	5000	0	0	5000
Mixer/grinder	8333	2000	2000	2000	3900
Mobile Phone	5000	7500	5667	5000	5643
Motorcycle	0	50000	0	0	50000
Refrigerator	0	0	15000		15000
Television	10000	8667	7000	10000	8533
Average value	7778	14633	7417	5667	14679

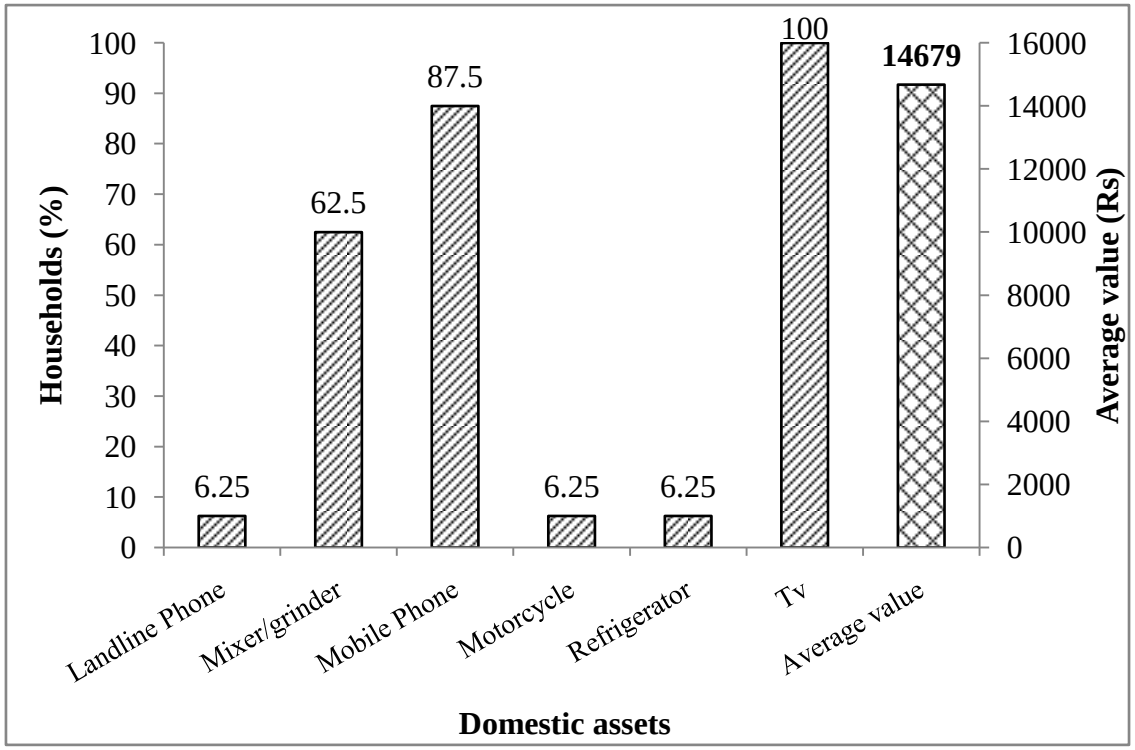


Figure 4: Domestic assets among the sample households in Narayanpet-2 Microwatershed

The most popularly owned farm equipments were sickles, plough, cattle shed; pump sets, chaff cutter, bullock cart, sprayer and thresher. Plough and sickle were commonly present in all the sampled farmers; these were primary implements in agriculture. The per cent of households owned bullock cart (20.0 %), plough (20.0 %), sprayer (10.0 %) and harvester (3.3 %) was found highest among the sample farmers. the average value of farm assets is around Rs. 12142 per households (Table 9 and Figure 5).

Table 9: Farm assets among samples households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Bullock cart	2	25.0	0	0	3	27.3	1	25.0	6	20.0
Harvester	1	12.5	0	0	0	0.0	0	0.0	1	3.3
Plough	2	25.0	0	0	3	27.3	1	25.0	6	20.0
Sprayer	1	12.5	0	0	1	9.1	1	25.0	3	10.0

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Narayanpet-2 micro watershed is presented in Table 10. The results show that the average value of bullocks cart was Rs. 33167, the average value of harvester was Rs.7000, the average value of plough was Rs.6667 and the average value of sprayer was Rs.1733.

Table 10: Average value of farm implements owned by households in Narayanpet-2 micro watershed (Rupees)

Particulars	MF(8)	SF(7)	SMF(11)	MDF(4)	ALL (30)
Bullock cart	3000	0	48250	48250	33167
Harvester	7000	0	0	0	7000
Plough	5000	0	7500	7500	6667
Sprayer	2000	0	1600	1600	1733
Average Value	4250	0	19117	19117	12142

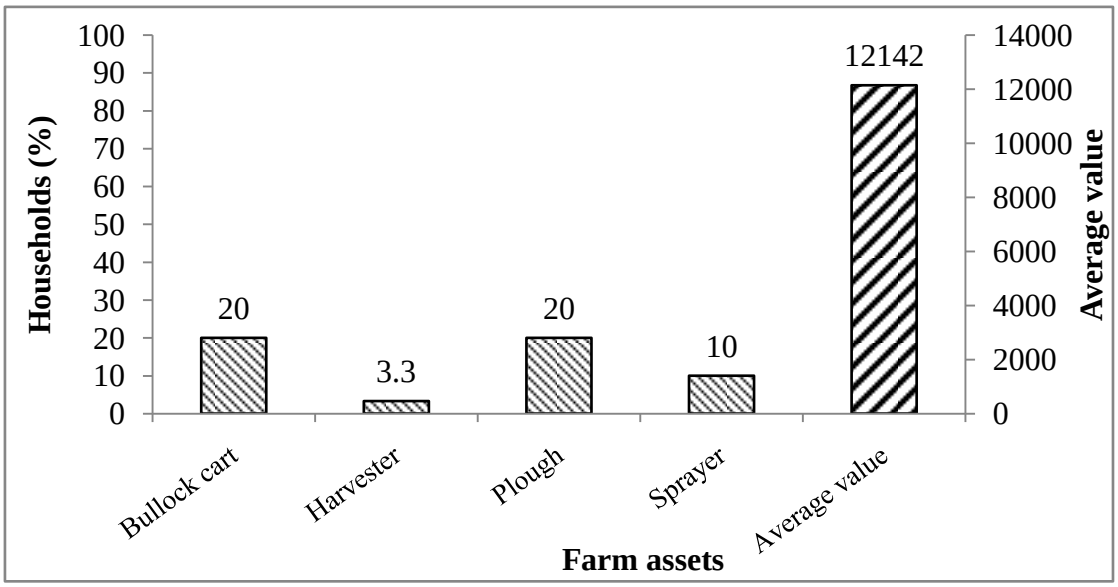


Figure 5: Farm assets among samples households in Narayanpet-2 Microwatershed

Livestock is an integral component of the conventional farming systems (Table 11 and Figure 6). The highest livestock population is local dry cow were around 6.7 per cent followed by local milching cow (6.7 %) and bullocks (3.3 %).The average livestock value was Rs. 43333 per households.

Table 11: Livestock assets among sample households in Narayanpet-2 micro-watershed

Livestock	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	0	0	0	%	No.	%
Local Dry Cow	2	25.0	0	0	0	0	0	0	2	6.7
Local Milching Cow	2	25.0	0	0	0	0	0	0	2	6.7
Bullocks	1	12.5	0	0	0	0	0	0	1	3.3
No Livestock	3	37.5	7	100	11	100	4	100	26	86.7

Average value of livestock: The data regarding the average value of farm Implements owned by the households in Narayanpet-2 micro watershed is presented in Table 12. The

results show that the average value of local dry cow was Rs.15000, the average value of local milching cow was Rs. 15000 and the average value of bullocks was Rs.100000.

Table 12: Average value of livestock owned by households in Narayanpet-2 micro watershed

Particulars	MF(8)	SF(7)	SMF(11)	MDF(4)	ALL (30)
Local Dry Cow	15000	0	0	0	15000
Local Milching Cow	15000	0	0	0	15000
Bullocks	100000	0	0	0	100000
Average value	43333	0	0	0	43333

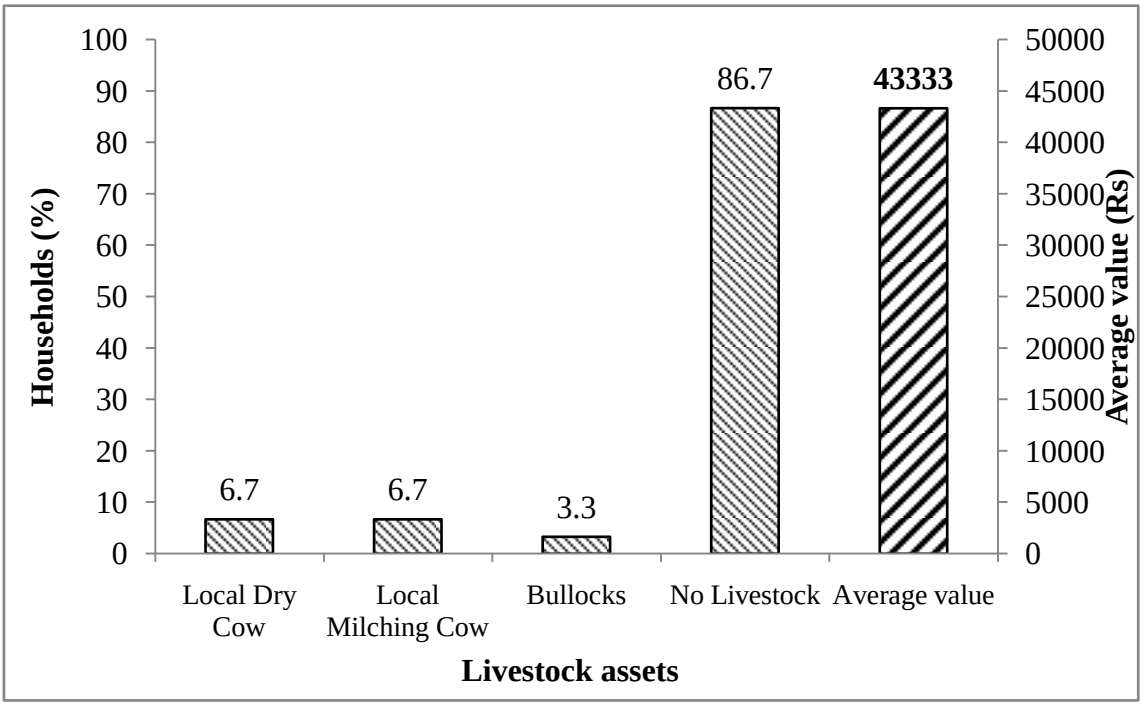


Figure 6: Livestock assets among sample households in Narayanpet-2 Microwatershed

Average milk produced in sample households is 563 litters/ annum. Among the farm households, sorghum is the main crops for domestic food and fodder for animals. About 1667 kg /ha of average fodder is available per season for the livestock feeding (Table 13).

Table 13: Milk produced and fodder availability of sample households in Narayanpet-2 Microwatershed

Particulars	MF(8)	SF(7)	SMF(11)	MDF(4)	ALL (30)
Name of the livestock				**Ltr./Lactation/animal**	
Local Milching Cow	563	0	0	0	563
Average value (Rs).	***563***	***0***		***0***	***563***
Fodder produces				**Fodder yield (kg/ha)**	
Sorghum	0	1667	0	0	1667
Average fodder availability	***0***	***1667***	***0***	***0***	***1667***
Livestock having households (%)	71.43	0.0	0.0	0.0	26.32
Livestock population (Numbers)	10	0	0	0	10

A woman participation in decision making is in this micro-watershed is presented in Table 14. About 6.25 per cent women participating in local organization activities and 81.25 per cent women earning for her family requirement and 75 per cent of women taking decision in her family and agriculture related activities.

Table 14: Women empowerment of sample households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Women participation in local organization activities										
Yes	0	0	2	25	0	0	0	0	2	6.25
No	8	100	5	75	11	100	4	100	28	93.75
Women participation in Elected Panchayth										
Yes	0	0	0	0	0	0	0	0	0	0
No	8	100	7	100	11	100	4	100	30	100
Women earning for her family requirement										
Yes	8	100	5	75	7	66.7	4	100	24	81.25
No	0	0	2	25	4	33.3	0	0	6	18.75
Women taking decision in her family and agriculture related activities										
Yes	6	75	5	75	7	66.7	4	100	23	75
No	2	25	2	25	4	33.3	0	0	8	25
Grand Total	8	100	7	100	11	100	4	100	30	100

The food intake in terms of kilo calorie (kcal) per person per day was calculated and presented in the (Table 15 and Figure 7). More quantity of cereals is consumed by sample farmers which accounted for 1692.1 kcal per person. The other important food items consumed was pulses 35.7 kcal followed by cooking oil 236.0 kcal, milk 70.9 kcal, vegetables 46.1kcal, egg 429.7 kcal and meat 46.5 kcal. In the sampled households farmers were consuming more (2557.1kcal) than NIN- recommended food requirement (2250 kcal).

Table 15: Per capita daily consumption of food among the sample households in Narayanpet-2 Microwatershed

Particulars	NIN recommendation (gram/per day/person/)	Present level of consumption (gram/per day/person)	Kilo calories / day/person
Cereals	396	497.7	1692.1
Pulses	43	10.4	35.7
Milk	200	109.1	70.9
Vegetables	143	192.1	46.1
Cooking Oil	31	41.4	236.0
Egg	0.48	286.5	429.7
Meat	14.2	31.0	46.5
Total	**827.68**	1168.2	2557.1
Threshold of NIN recommendation		**827***	**2250***
Below NIN		6	19
Above NIN		94	81

Note: * day/person

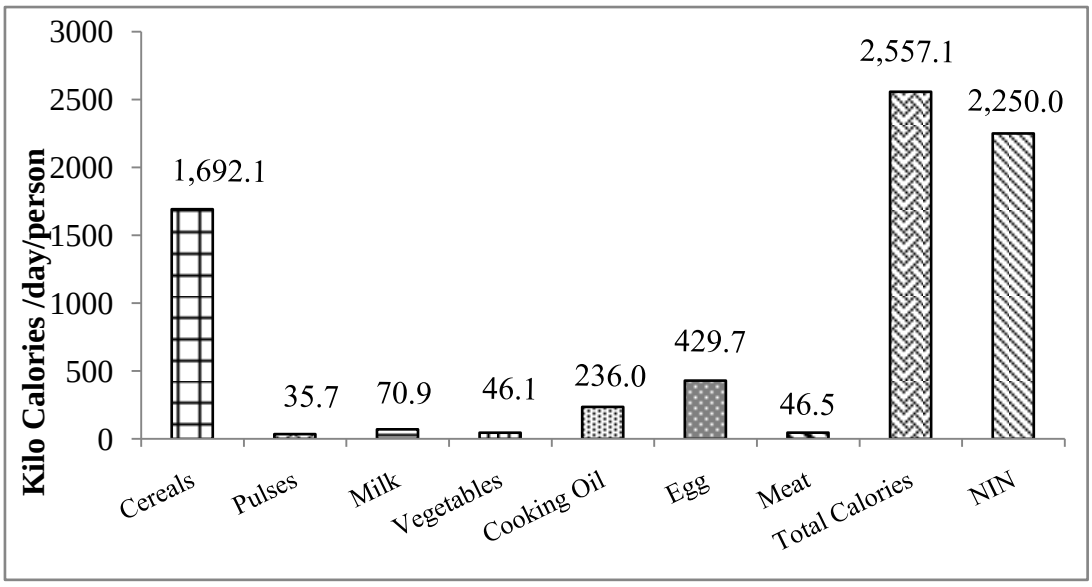


Figure 7: Per capita daily consumption of food among the sample households in Narayanpet-2 Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs. 55121. Major source of income to the farmers in the study area is from livestock (Rs.42944) followed by crop production (Rs. 12177). The monthly per capita income is Rs. 896, which is less than the threshold monthly income of Rs.975 for considering below poverty line. Due to the fact that erratic rainfall and shortage of water, farmers are diverting from crop production activities to enable the household for a comfortable livelihood. The incomes from the other aforesaid sources are very meagre (Table 16).

Table 16: Annual average income of HHs from various sources in Narayanpet-2 Microwatershed

Particulars	MF (8)*	SF (7)*	SMF (10)*	MDF (4)*	ALL (30)*
Nonfarm income	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Livestock income	42944 (50)	0 (0)	0 (0)	0 (0)	42944 (12.5)
Crop Production	7270 (100)	15918 (100)	15492 (100)	4562 (100)	12177 (100)
Total Income (Rs)	50214	15918	15492	4562	55121
Average monthly per capita income (Rs)	930	197	277	84	896
Thresholds for poverty level (Rs 975 per month/person)					
% of households Above poverty line	25.0	0.0	0.0	0.0	6.3
% of households below poverty line	75.0	100.0	100.0	100.0	93.8

* Figure in the parenthesis indicates %of households

The average annual expenditure of farm households indicated that farmers in the study area spend highest on food (Rs. 60495) followed by education, clothing, social function and health. Now a day's education is most important among all of us. In today's

competitive world, education is a necessity for man after food, clothing, and shelter. It is the only fundamental way by which a desired change in the society can happen. The average per capita monthly expenditure is around Rs. 4689 and about 93.8 per cent of farm households are below poverty line (Table 17 and Figure 8).

Table 17: Average annual expenditure of sample HHs in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(4)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Food	58515	31.5	65010	27.5	56990	12.8	65940	50.4	60495	21.0
Education	1000	0.5	2750	1.2	251333	56.6	0	0.0	95188	33.0
Clothing	6253	3.4	13750	5.8	14667	3.3	5000	3.8	11126	3.9
Social functions	100000	53.8	125000	52.9	100000	22.5	50001	38.2	100000	34.7
Health	20000	10.8	30000	12.7	20833	4.7	10000	7.6	21563	7.5
Total	185768	100	236510	100	443823	100	130941	100	288371	100
Monthly per capita	3440		2920		7925		2425		4689	

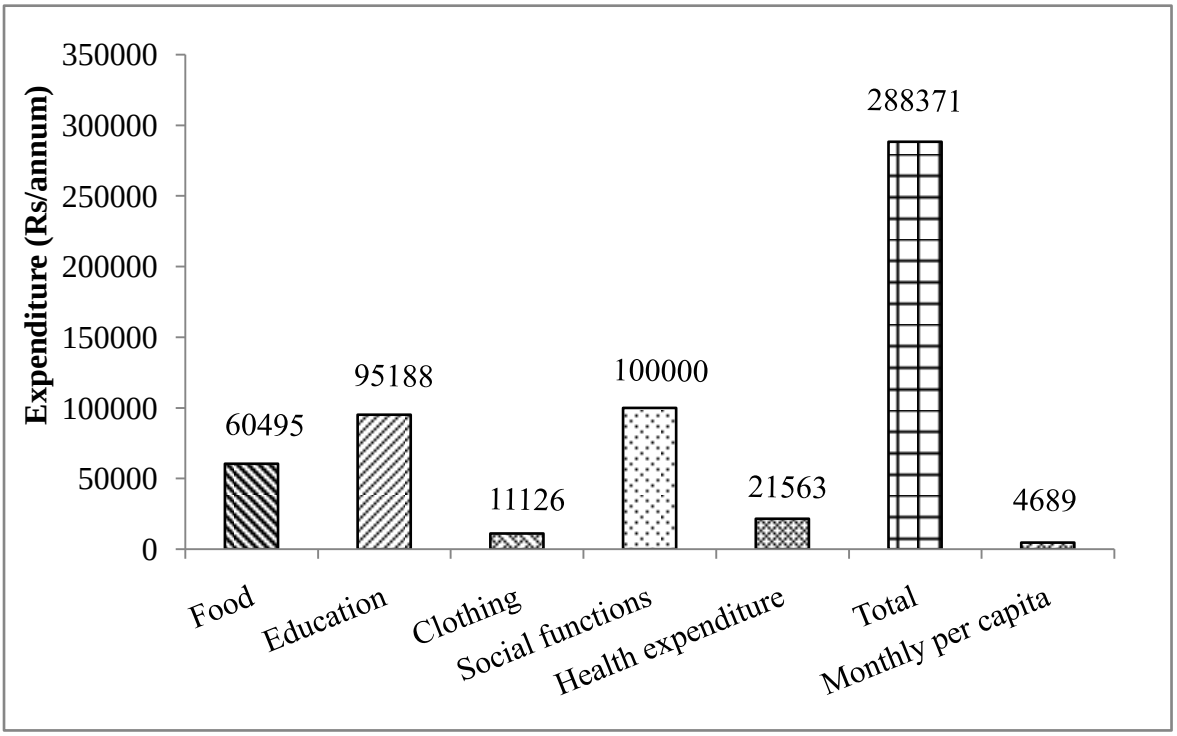


Figure 8: Average annual expenditure of sample HHs in Narayanpet-2 Microwatershed

Land holding: Total sample households are 30 and total area cultivated by them is 66.00ha. The average land holding of sample HHs is 2.20 ha. the large number of households is (11) belong to semi medium group with an average holding size of 2.80 ha followed by marginal farmers (8) with an average holding size of 0.59 ha, small farmers (7) with an average land holding is 1.48 ha and medium size groups (4) with an average land holding is 11.58 ha (Table 18).

Table 18: Distribution of land holding among the sample households in Narayanpet-2 micro-watershed

Size groups	Particulars	Value
Marginal Farmers	Total sample HHs in number	8
	Total land holding (ha)	4.43
	Avg of Total land holding (ha)	0.59
Small Farmers	Total sample HHs in number	7
	Total land holding (ha)	10.33
	Avg of Total land holding (ha)	1.48
Semi-Medium Farmers	Total sample HHs in number	11
	Total land holding (ha)	31.55
	Avg of Total land holding (ha)	2.80
Medium Farmers	Total sample HHs in number	4
	Total land holding (ha)	43.42
	Avg of Total land holding (ha)	11.58
Total sample households	Total sample HHs in number	30
	Total land holding (ha)	66.00
	Avg of Total land holding (ha)	2.20

Land use: The total land holding in the Narayanpet-2 micro-watershed is 31.16 ha it's a dry land condition, 32.56 ha fallow land and only 2.27 ha land is irrigated land (Table 19). The average land holding per household is worked out to be 2.21 ha.

Table 19: Land use among samples households in Narayanpet-2 Microwatershed

Particulars	MF(8)		SF(7)		SMF(11)		MDF(2)		ALL (30)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Irrigated land	0.00	0.0	2.27	22.0	0.00	0.0	0.00	0.0	2.27	3.4
Dry land	4.43	100.0	8.06	78.0	14.13	44.8	10.02	23.1	31.16	47.2
Fallow land	0.00	0.0	0.00	0.0	17.42	55.2	33.40	76.9	32.56	49.3
Total land	4.4	100.0	10.3	100.0	31.5	100.0	43.4	100.0	66.0	100.0
Average of land area	0.59		1.48		3.75		11.58		2.21	

In the micro-watershed, the prevalent present land uses under perennial plants are neem trees (83.9 %) followed by teak (7.1 %), tamarind (5.4 %) and mango (3.6 %) (Table 20).

Table 20: Number of trees/plants covered in sample farm households in Narayanpet-2 Microwatershed

Plants	MF(8)		SF(7)		SMF(11)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mango	1	9.1	1	12.5	0	0.0	0	0.0	2	3.6
Neem trees	4	36.4	7	87.5	26	96.3	10	100	47	83.9
Tamarind	2	18.2	0	0.0	1	3.7	0	0.0	3	5.4
Teak	4	36.4	0	0.0	0	0.0	0	0.0	4	7.1
Grand Total	11	100	8	100	27	100	10	100	56	100

The land use decisions are usually based on experience of farmers, tradition, expected profit, personal preferences, resources and social requirements. The present dominant crops grown in dry lands in the study area were by red gram (51.2 %) followed by cotton (36.7 %) and green gram (6.0 %) which are taken during Kharif season and sorghum (6.0 %) under with rabi season, respectively. The cropping intensity was 106.38 per cent (Table 21 and Figure 9).

Table 21: Present cropping pattern and cropping intensity in Narayanpet-2 Microwatershed

Crops/Season	MF(4)		SF(12)		SMF(12)		MDF(4)		ALL (35)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Kharif	***4.43***	***100.0***	***8.75***	***84.7***	***14.13***	***100.0***	***10.02***	***100.0***	***31.42***	***94.0***
Red gram	2.16	48.7	7.17	69.5	3.87	27.4	6.68	66.7	17.12	51.2
Cotton	2.27	51.3	0.00	0.0	10.27	72.6	3.34	33.3	12.28	36.7
Green gram	0.0	0.0	1.58	15.3	0.0	0.0	0.0	0.0	2.02	6.0
Rabi	***0.0***	***0.0***	***1.58***	***15.3***	***0.0***	***0.0***	***0.0***	***0.0***	***2.02***	***6.0***
Sorghum	0.0	0.0	1.58	15.3	0.0	0.0	0.0	0.0	2.02	6.0
Total	***4***	***100***	***10***	***100***	***14***	***100***	***10***	***100***	***33***	***100***

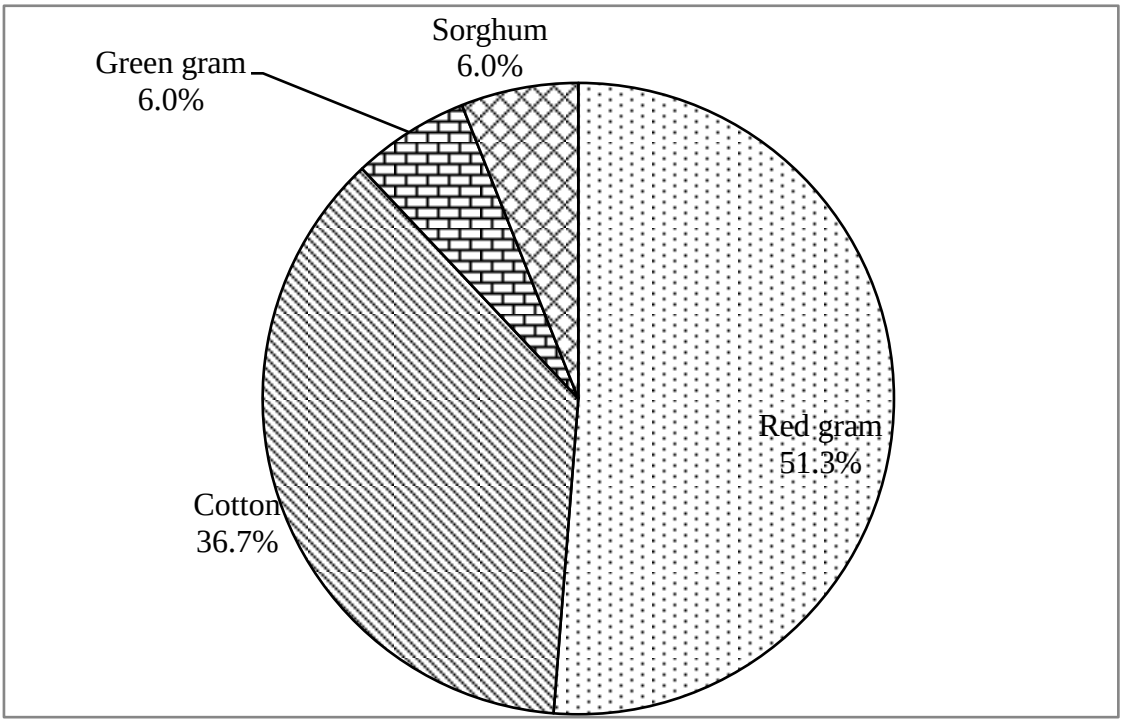


Figure 9: Present cropping pattern in Narayanpet-2 Microwatershed

Economic land evaluation

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

In Narayanpet-2 micro-watershed, 9 soil series are identified and mapped (Table 22). The distribution of major soil series are Hegganakera covering an area around 239 ha (42.03 %) followed by Kudlura 79.34 ha (14.02 %), Rachanalli 60 ha (10.59 %), Sowrashtrahalli 72 ha (12.64 %), Gudalagunta 43 ha (7.54 %), Balched 37 ha (6.48 %), Halagera 11 (1.93 %), Yalleri 5 ha (0.89 %), and Kyathanala 1ha (0.25 %).

Table 22: Distribution of soil series in Narayanpet-2 Microwatershed

Soil No	Soil Series	Mapping Unit Description	Area in Ha (%)
Soil of Granite and Granite Gneiss Landscape			
1	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 to sandy clay alluvial soils occurring on very gently sloping uplands under cultivation	11 (1.93)
2	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, gravelly sandy clay red soils occurring on very gently to gently sloping uplands under cultivation	5 (0.89)
Soil of Alluvial Landscape			
3	GDL	Gudalagunta soils are shallow (25-50 cm), well drained, have very dark gray, calcareous sandy clay to clay alluvial soils occurring on very gently sloping uplands under cultivation	43 (7.54)
4	KYT	Kyathanala soils are shallow (25-50 cm), well drained, have brown to strong brown and reddish to dark reddish brown, sandy clay loam to sandy clay alluvial soils occurring on very gently sloping uplands under cultivation	1 (0.25)
5	BLD	Balched soils are moderately shallow (50-75 cm), moderately well drained, have very dark gray to very dark grayish brown, calcareous alluvial clay soils occurring on very gently sloping uplands under cultivation	37 (6.48)
6	RHN	Rachanalli soils are moderately deep (75-100 cm), moderately well drained, have brown to very dark grayish brown, sandy clay to calcareous alluvial clay soils occurring on very gently sloping uplands under cultivation	60 (10.59)
7	KDR	Kudlura soils are deep (100-150 cm), moderately well drained, have dark gray to very dark grayish brown, calcareous sandy clay to clay alluvial soils occurring on nearly level to very gently sloping uplands under cultivation	79.34 (14.02)
8	SWR	Sowrashtrahalli soils are deep (100-150 cm), moderately well drained, have dark gray to very dark grayish brown, calcareous black cracking clay soils occurring on very gently sloping uplands under cultivation	72 (12.67)
9	HGN	Hegganakera soils are very deep (>150 cm), moderately well drained, have dark gray to very dark grayish brown and brown, calcareous black cracking clay soils occurring on very gently sloping uplands under cultivation	239 (42.03)

Present cropping pattern on different soil series are given in Table 23. Crops grown on marginal farmers are cotton and redgram. Greengram, red gram and sorghum at small farmers are grown. Cotton and redgram are grown at semi medium farmers. Cotton and redgram at medium farmers are grow.

Table 23: Cropping pattern on major soil series in Narayanpet-2 micro-watershed

(Area in per cent)

Size groups	Crops	Dry land -Kharif season	Grand total
Marginal Farmers	Cotton	51.3	51.3
	Redgram	48.7	48.7
Small Farmers	Greengram	18.4	18.4
	Redgram	63.2	63.2
	Sorghum	18.4	18.4
Semi-Medium Farmers	Cotton	72.6	72.6
	Redgram	27.4	27.4
Medium Farmers	Cotton	33.3	33.3
	Redgram	66.7	66.7

Land is used for agricultural use for growing cereals, pulse, oilseeds and commercial crops. The soil/ land potential are measures in terms of physical yield and net income. The alternative land use options for each micro-watershed are given below (Table 24).

Table 24: Alternative land use options for different size group of farmers (Benefit Cost Ratio) in Narayanpet-2 Microwatershed.

Crops	MF(8)	SF(7)	SMF(11)	MDF(2)	ALL (30)
Cotton	1.41		1.42	1.01	1.35
Greengram		1.54			1.54
Redgram	1.13	1.34	1.38	1.12	1.27
Sorghum		1.20			1.20

The productivity of different crops grown in Narayanpet-2 micro-watershed under potential yield of the crops is given in Table 25.

The data on cost of cultivation and benefit cost ratio (BCR) of different crops is given in Table 25. The total cost of cultivation in study area for cotton ranges between Rs.73340/ha in medium farmers (with BCR of 1.01) and Rs.28595/ha in semi medium (with BCR of 1.42), redgram range between Rs.45689/ha in medium farmers (with BCR of 1.12) and Rs.29530/ha in small farmers (with BCR of 1.34), sorghum the cost of cultivation is Rs.17480/ha in small farmers (with BCR of 1.20) and greengram the cost of cultivation is Rs.23522/ha in small farmers (with BCR of 1.54).

Table 25: Economic land evaluation and bridging yield gap for different crops in Narayanpet-2 micro-watershed

Particulars	Marginal Farmers		Small Farmers			Semi-Medium Farmers		Medium Farmers	
	Cotton	Redgram	Greengram	Redgram	Sorghum	Cotton	Redgram	Cotton	Redgram
Total cost (Rs/ha)	55336	39511	23522	29530	17840	28595	29909	73340	45689
Gross Return (Rs/ha)	79040	44744	36227	40138	21407	40792	41620	74100	50944
Net returns (Rs/ha)	23704	5232	12705	10608	3567	12197	11711	760	5255
BCR	1.41	1.13	1.54	1.34	1.20	1.42	1.38	1.01	1.12
Farmers Practices (FP)									
FYM (t/ha)	3.1	4.4	1.7	2.9	0.0	2.8	2.5	5.0	6.3
Nitrogen (kg/ha)	16.9	7.5	60.8	2.5	60.8	37.6	3.8	22.5	5.6
Phosphorus (kg/ha)	43.1	19.2	57.5	6.4	57.5	47.4	9.6	57.5	14.4
Potash (kg/ha)	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0
Grain (Qtl/ha)	20.0	9.5	8.3	8.7	12.5	11.5	8.8	25.0	9.4
Price of Yield (Rs/Qtl)	4000	4700	4400	4633	1600	3900	4800	3000	5500
Soil test based fertilizer Recommendation (STBR)									
FYM (t/ha)	12.4	7.4	7.4	7.4	7.4	12.4	7.4	12.4	7.4
Nitrogen (kg/ha)	148.2	24.7	18.5	24.7	81.5	148.2	24.7	148.2	24.7
Phosphorus (kg/ha)	74.1	49.4	37.1	49.4	56.8	74.1	49.4	74.1	49.4
Potash (kg/ha)	74.1	24.7	37.1	24.7	39.5	74.1	24.7	74.1	24.7
Grain (Qtl/ha)	17.3	12.4	8.6	12.4	28.4	17.3	12.4	17.3	12.4
% of Adoption/yield gap (STBR-FP) / (STBR)									
FYM (%)	74.7	41.3	77.5	61.5	100.0	77.0	66.3	59.5	15.7
Nitrogen (%)	88.6	69.6	-228.4	89.9	25.4	74.7	84.8	84.8	77.2
Phosphorus (%)	41.8	61.2	-55.2	87.1	-1.2	36.1	80.6	22.4	70.9
Potash (%)	100.0	100.0	100.0	100.0	100.0	93.1	100.0	100.0	100.0
Grain (%)	-15.7	22.8	3.6	29.2	56.0	33.5	29.1	-44.6	24.1
Value of yield and Fertilizer (Rs)									
Additional Cost (Rs/ha)	13646	5089	5077	7211	8418	13392	7407	11071	3424
Additional Benefits (Rs/ha)	-10840	13221	1371	16734	25448	22568	17280	-23130	16363
Net change income (Rs/ha)	-24486	8132	-3706	9524	17030	9176	9873	-34201	12939

The data on FYM, Nitrogen, Phosphorus and Potash application by the farmers to different crops and recommended FYM for different crops is given in Table 25. There is a huge gap between FYM application by farmers and recommended FYM in all the crops across the soils. There is a larger yield gap in crops grown across different soil series. Adequate knowledge about recommended package of practices is the pre-requisite for their use in cultivation of crops. It is a fact that, recommended practices are major contributing factors to yield. Inadequate knowledge about recommended practices leads to their improper adoption. Strengthening of extension services by concerned agency is required to increase adoption of recommended cultivation practices and ultimately reducing the gap. By adopting soil-test fertiliser recommendation, there is scope to increase yield and income to a maximum of Rs. 17030 in sorghum and a minimum of Rs. 8132 in red gram cultivation.

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

The average value of ecosystem service for food grain production is around Rs.9659/ ha/year (Table 26 and Figure 10). Per hectare food grain production services is maximum in cotton (Rs.15372) followed by green gram (Rs.12705), red gram (Rs.8639) and sorghum (Rs. 1920).

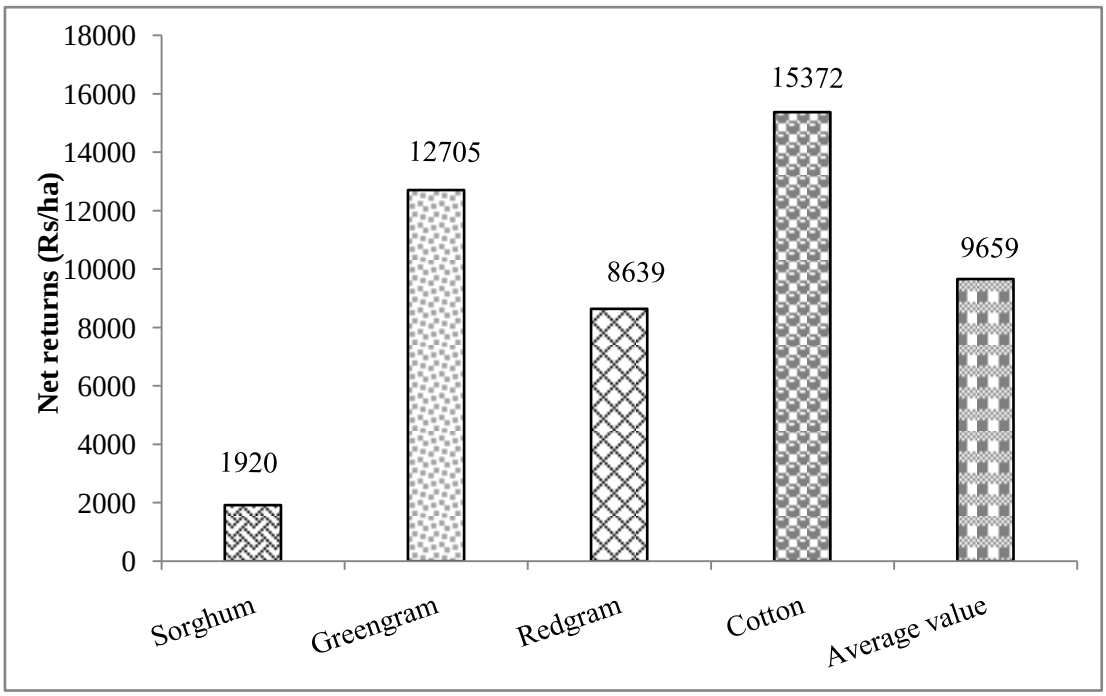


Figure 10: Ecosystem services of food production in Narayanpet-2 Microwatershed

Table 26: Ecosystem services of food grain production in Narayanpet-2 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs/ha)	Cost of Cultivation (Rs/ha)	Net returns (Rs/ha)
Cereals	Sorghum	2.2	12.4	1600	19760	17840	1920
Pulses	Greengram	2.2	8.2	4400	36227	23522	12705
	Redgram	15.9	8.9	4800	42779	34140	8639
Commercial crops	Cotton	13.1	15.7	3800	59541	44169	15372
Average value		33.4	11.3	3650	39577	29918	9659

The average value of ecosystem service for fodder production is around Rs.1646/ ha/year (Table 27) in sorghum.

Table 27: Ecosystem services of fodder production in Narayanpet-2 Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Net Returns (Rs/ha)
Cereals	Sorghum	1.21	1.6	1000	1646
Average Value		1.21	1.6	1000	1646

The water demand for production of different crops was worked out in arriving at the ecosystem services of water support to crop growth. The data on water requirement for producing one quintal of grain is considered for estimating the total value of water required for crop production. The value of per hector water used was maximum (Table 28 and Figure 11) in cotton (Rs.63129) followed by green gram (Rs.56859), red gram (Rs.48518) and sorghum (Rs. 37643).

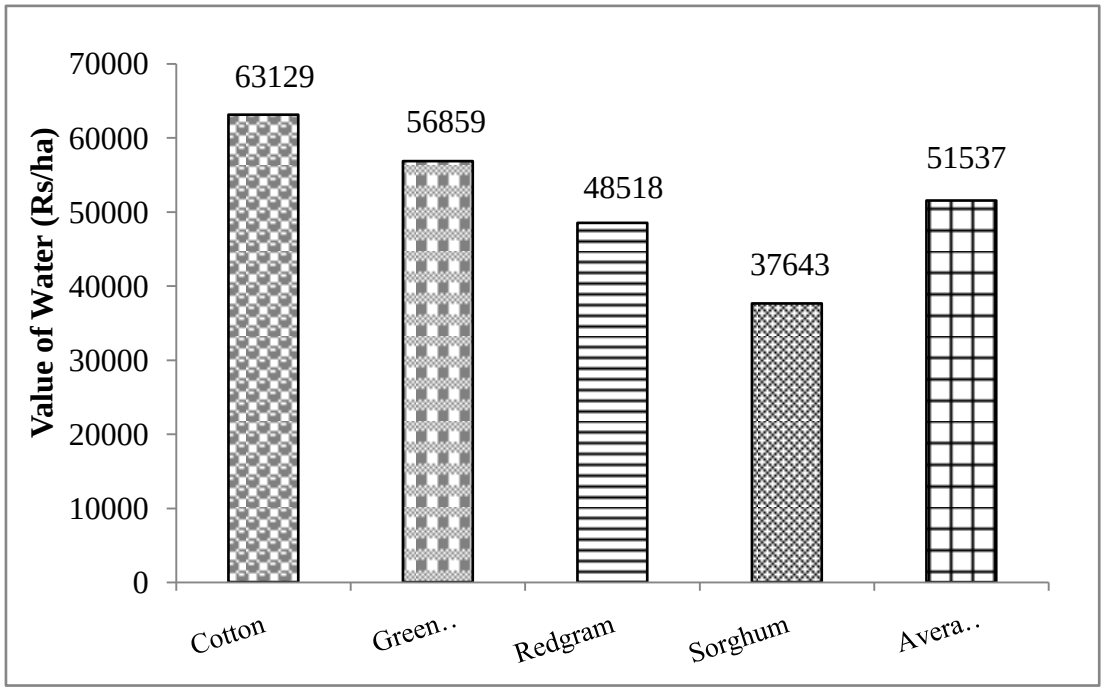


Figure 11: Ecosystem services of water supply in Narayanpet-2 Microwatershed

Table 28: Ecosystem services of water supply in Narayanpet-2 Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Cotton	15.7	6313	63129	403
Greengram	8.2	5686	56859	691
Redgram	8.9	4852	48518	544
Sorghum	12.4	3764	37643	305
Average value	11.3	5154	51537	486

The main constraints in farming is climate change particularly decline in rainfall and increasing temperature. Farmers reported that they are not getting timely support/extension services from the concerned development department (Table 29).

Table 29: Farming constraints related land resources of sample households in Narayanpet-2 Microwatershed

Particulars	Per cent
Farmers awareness of climate change	
Yes	0
No	100
Perception on climate change	
Decrease in rainfall	0.0
Increase in temperature	0.0
Availability agricultural technology information	
Yes	6
No	94

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