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

BALCHED (4D5B1P2b) MICROWATERSHED

Sydhapur Hobli, Yadgir Taluk and District, Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project

The World Bank

ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

ICAR - NBSS & LUP

WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE

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

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

BALCHED (4D5B1P2b) MICROWATERSHED

Balichakra Hobli, Yadgir Taluk and District, Karnataka

Karnataka Watershed Development Project – II

Sujala-III

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ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING

WATERSHED DEVELOPMENT DEPARTMENT, GOVT. OF KARNATAKA, BANGALORE

PREFACE

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

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

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

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

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

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

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PART-A

LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

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

The present study covers an area of 613 ha in Balched microwatershed in Yadgir taluk and 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 about 93 per cent is covered by soils, 7 per cent by habitation and water bodies. The salient findings from the land resource inventory are summarized briefly below.

- *The soils belong to 11 soil series and 23 soil phases (management units) and 6 land management units.*
- *The length of crop growing period is 120-150 days starting from the 1st week of June to 4th week of October.*
- *From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- *Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 320 m grid interval.*
- *Land suitability for growing 26 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- *Entire land area of the microwatershed is suitable for agriculture.*
- *About 25 per cent soils are shallow (25-50 cm), 19 per cent are moderately shallow (50-75 cm), 8 per cent of the soils are moderately deep (75-100 cm) and about 41 per cent soils are deep (100-150 cm) to very deep (>150 cm) soils.*
- *About 24 per cent of the area has clayey soils, 30 per cent loamy soils and 38 per cent sandy soils at the surface.*
- *An area of about 79 per cent has non-gravelly and 14 per cent are gravelly.*
- *About 17 per cent of the area has soils that are very high (>200 mm/m) in available water capacity, 24 per cent medium (101-150 mm/m), 19 per cent low (51-100 mm/m) and about 33 per cent very low (<50 mm/m).*

- *An area of 90 per cent of the microwatershed has very gently sloping (1-3%) and about 3 per cent has gently sloping (3-5%) lands.*
- *About 71 per cent has soils that are moderately eroded (e2) and 22 per cent are severely eroded (e3) soils.*
- *An area of about 28 per cent is neutral (pH 6.5-7.3), 18 per cent is slightly alkaline (pH 7.3-7.8), 40 per cent soils that are moderately alkaline (pH 7.8 to 8.4), 7 per cent soils that are strongly alkaline (pH 8.4 – 9.0) and about <1 per cent are very strongly alkaline (pH>9.0) in soil reaction.*
- *The Electrical Conductivity (EC) of the soils are dominantly <2 dsm^{-1} indicating that the soils are non-saline.*
- *About 5 per cent is low (<0.5%), 52 per cent medium (0.5-0.75%) and 36 per cent high (>0.75%) in organic carbon.*
- *An area of 32 per cent has soils that are medium (23-57 kg/ha) and 61 per cent high (>57 kg/ha) in available phosphorus.*
- *About 25 per cent has low (<145 kg/ha), 63 per cent medium (145-337 kg/ha) and 6 per cent high (>337 kg/ha) in available potassium.*
- *Available sulphur is low (<10 ppm) in about 49 per cent area, medium (10-20 ppm) in 36 per cent and high (>20 ppm) in about 8 per cent area of the microwatershed.*
- *Available boron is low (<0.5 ppm) in 5 per cent, 79 per cent medium (0.5-1.0 ppm) and high (>1.0 ppm) in about 9 per cent area of the microwatershed.*
- *About 4 per cent area has soils that are deficient (<4.5 ppm) in available iron and 89 per cent sufficient (>4.5 ppm).*
- *Available manganese and copper are sufficient in all the soils of the microwatershed.*
- *Entire area of the microwatershed is deficient (<0.6 ppm) in available zinc.*
- *The land suitability for 26 major agricultural and horticultural crops grown in the microwatershed was assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price and finally the demand and supply position.*

Land suitability for various crops in the Balched microwatershed

Crop	***Suitability Area in ha (%)***			***Crop***	***Suitability Area in ha (%)***	
	Highly suitable (S1)	***Moderately suitable (S2)***			***Highly suitable (S1)***	***Moderately suitable (S2)***
Sorghum	*-*	*367 (60)*		*Sapota*	*1 (<1)*	*193 (31)*
Maize	*1 (<1)*	*264 (43)*		*Guava*	*1 (<1)*	*146 (24)*
Red gram	*-*	*249 (41)*		*Pomegranate*	*1 (<1)*	*248 (40)*
Bajra	*1 (<1)*	*413 (67)*		*Jackfruit*	*1 (<1)*	*146 (24)*
Ground nut	*1 (<1)*	*311 (51)*		*Jamun*	*1 (<1)*	*248 (40)*
Sunflower	*1 (<1)*	*248 (40)*		*Musambi*	*1 (<1)*	*248 (40)*
Cotton	*-*	*366 (60)*		*Lime*	*1 (<1)*	*248 (40)*
Bengalgram	*-*	*366 (60)*		*Cashew*	*1 (<1)*	*-*
Chilli	*1 (<1)*	*366 (60)*		*Custard apple*	*1 (<1)*	*413 (67)*
Tomato	*1 (<1)*	*264 (43)*		*Amla*	*1 (<1)*	*413 (67)*
Drumstick	*1 (<1)*	*295 (48)*		*Tamarind*	*1 (<1)*	*248 (40)*
Mulberry	*1 (<1)*	*193 (31)*		*Marigold*	*1 (<1)*	*366 (60)*
Mango	*1 (<1)*	*146 (24)*		*Chrysanthemum*	*1 (<1)*	*366 (60)*

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 9 identified LMUs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops that helps in maintaining the ecological balance in the microwatershed

- *Maintaining soil-health is vital for crop production and conserve soil and land resource base for maintaining ecological balance and to mitigate climate change. For this, several ameliorative measures have been suggested for these problematic soils like saline/alkali, highly eroded, sandy soils etc.,*
- *Soil and water conservation treatment plan has been prepared that would help in identifying the sites to be treated and also the type of structures required.*
- *As part of the greening programme, several tree species have been suggested to be planted in marginal and submarginal lands, field bunds and also in the hillocks, mounds and ridges. This would help in supplementing the farm income, provide fodder and fuel and generate lot of biomass which in turn would help in maintaining ecological balance and contribute to mitigating the climate change.*

Chapter 1

INTRODUCTION

Soil being a vital natural resource on whose proper use depends the life supporting systems of a country and the socioeconomic development of its people. Soils provide food, fodder, fibre and fuel for meeting the basic human and animal needs. With the ever increasing growth in human and animal population, the demand on soil for more food and fodder production is on the increase. The area available for agriculture is about 51 per cent of the total geographical area and more than 60 per cent of the people are still dependant on agriculture for their livelihood. However, the capacity of a soil to produce is limited and the limits to the production are set by its intrinsic characteristics, agro-climatic setting, and, use and management. There is, therefore, tremendous pressure on land and water resources, which is causing decline in soil-health and stagnation in productivity. The soils have been degrading at an estimated rate of one million hectares per year and ground water levels have been receding at an alarming rate resulting in decline in the ground water resource. Further, land degradation has emerged as a serious problem which has already affected about 38 lakh ha of cultivated area in the State. Soil erosion alone has degraded about 35 lakh ha. Almost all the uncultivated areas are facing various degrees of degradation, particularly soil erosion; salinity and alkalinity has emerged as a major problem in more than 3.5 lakh ha in the irrigated areas of the State. Nutrient depletion and declining factor productivity is common in both rainfed and irrigated areas. The degradation is continuing at an alarming rate and there appears to be no systematic effort among the stakeholders to contain this process. In recent times, an aberration of weather due to climate change phenomenon has added another dimension leading to unpredictable situation to be tackled by the farmers.

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

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

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

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

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

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

Chapter 2

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Balched micro-watershed is located in the northeastern part of Karnataka in Yadgir Taluk and District, Karnataka State (Fig. 2.1). It comprises parts of Balached, Sambara, Baddepalli and Balacheda villages. It lies between 16^0 33' and 16^0 35' north latitudes and 77^0 18' and 77^0 20' east longitudes and covers an area of 613 ha. It is about 36 km from Yadgir town and is surrounded by Sambara village on the northeast and Balached village on the east, north and southern side.

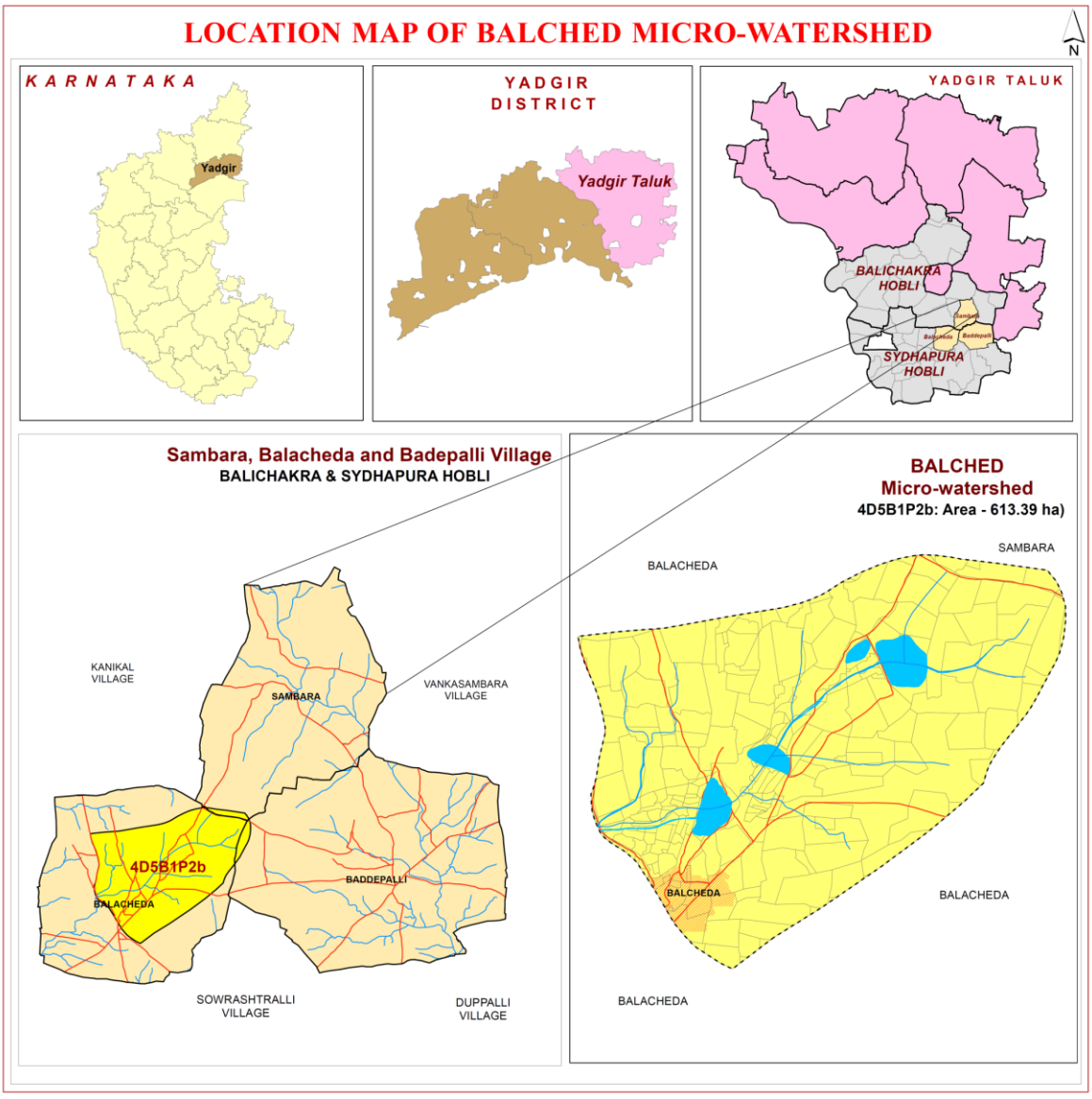


Fig.2.1 Location map of Balched Microwatershed

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 the village. The thickness of the alluvium generally is limited to less than a meter, except in river valleys where it is very deep extending to tens of meters. Such soils are transported and represent palaeo black soils originally formed at higher elevation, but now occupying river valleys.

Fig. 2.2 a Granite and granite gneiss rocks

Fig. 2.2 b Alluvium

2.3 Physiography

Physiographically, the area has been identified as granite gneiss and alluvial landscapes based on geology. The microwatershed area has been further divided into mounds/ridges, summits, very gently sloping uplands, plains and valleys based on slope and its relief features. The elevation ranges from 359-376 m above MSL.

2.4 Drainage

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

2.5 Climate

The Yadgir district lies in the northern plains of Karnataka and falls under semiarid tract of the state and is categorized as drought-prone with total annual rainfall of 866 mm (Table 2.1). Of the total rainfall, maximum of 652 mm is received during the south–west monsoon period from June to September, the north-east monsoon from October to early December contributes about 138 mm, and the remaining 76 mm during the rest of the year. The summer season starts during the middle of February and continues up to the first week of June. The period from December to the middle of February is the cold season. December is the coldest month with mean daily maximum and minimum temperatures being 29.5^0C and 10^0C respectively. During peak summer, temperature shoots up to 45^0C. Relative humidity varies from 26% in summer to 62% in winter. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo-Transpiration (PET) is 141 mm and varies from a low of 81 mm in December to 199 mm in the month of May. The PET is always higher than precipitation in all the months except July to end of September. Generally, the Length of crop Growing Period (LGP) is 120-150 days and starts from 1^{st} week of June to 4^{th} week of October.

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

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

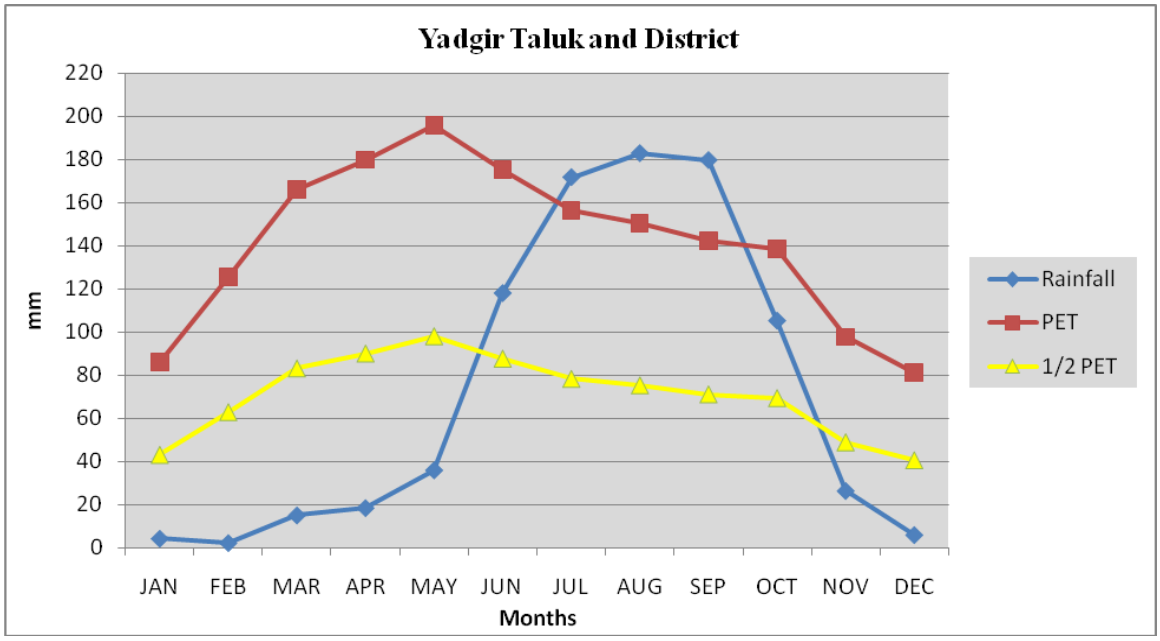


Fig 2.3 Rainfall distribution in Yadgir Taluk

2.6 Natural Vegetation

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

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

2.7 Land Utilization

About 72 per cent area (Table 2.2) in Yadgir taluk is cultivated at present. An area of about 2 per cent is permanently under pasture, 20 per cent under current fallows and 6 per cent under non-agricultural land and 5 per cent under currently barren. Forests occupy an area of about 7 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and bouldery areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, cotton, sunflower, groundnut, mango, pomegranate and marigold. The different crops and cropping systems adopted in the microwatershed is presented in the Figures 2.4 a & b. 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 Balched microwatershed is presented in Fig. 2.5. Simultaneously, enumeration of wells (bore wells and open wells) and other conservation structures in the microwatershed was made and their location in different survey numbers is marked on the cadastral map. Map showing the location of wells and soil conservation structures, and other water bodies in the microwatershed is given in Fig. 2.6.

Table 2.2 Land Utilization in Yadgir Taluk

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

Fig. 2.4 a. Different Crops and Cropping Systems in Balched Microwatershed

Fig. 2.4 b. Different Crops and Cropping Systems in Balched Microwatershed

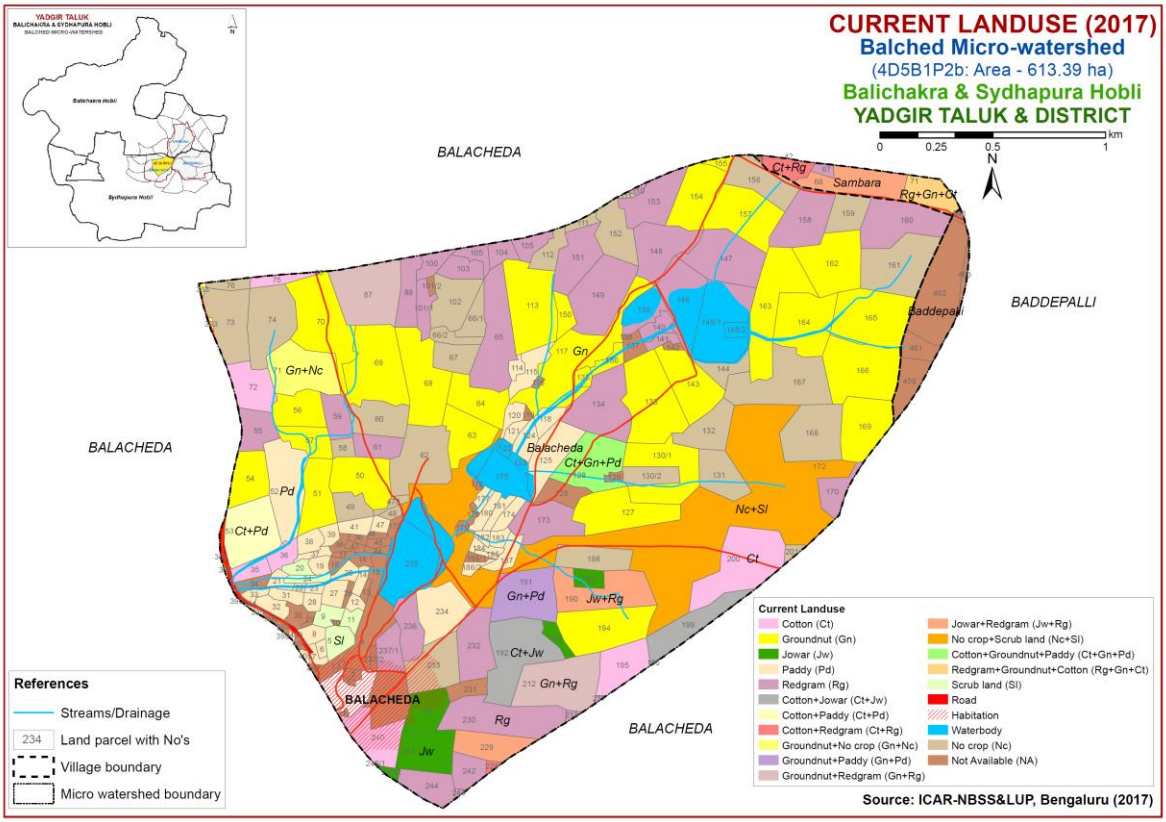


Fig. 2.5 Current Land Use map of Balched Microwatershed

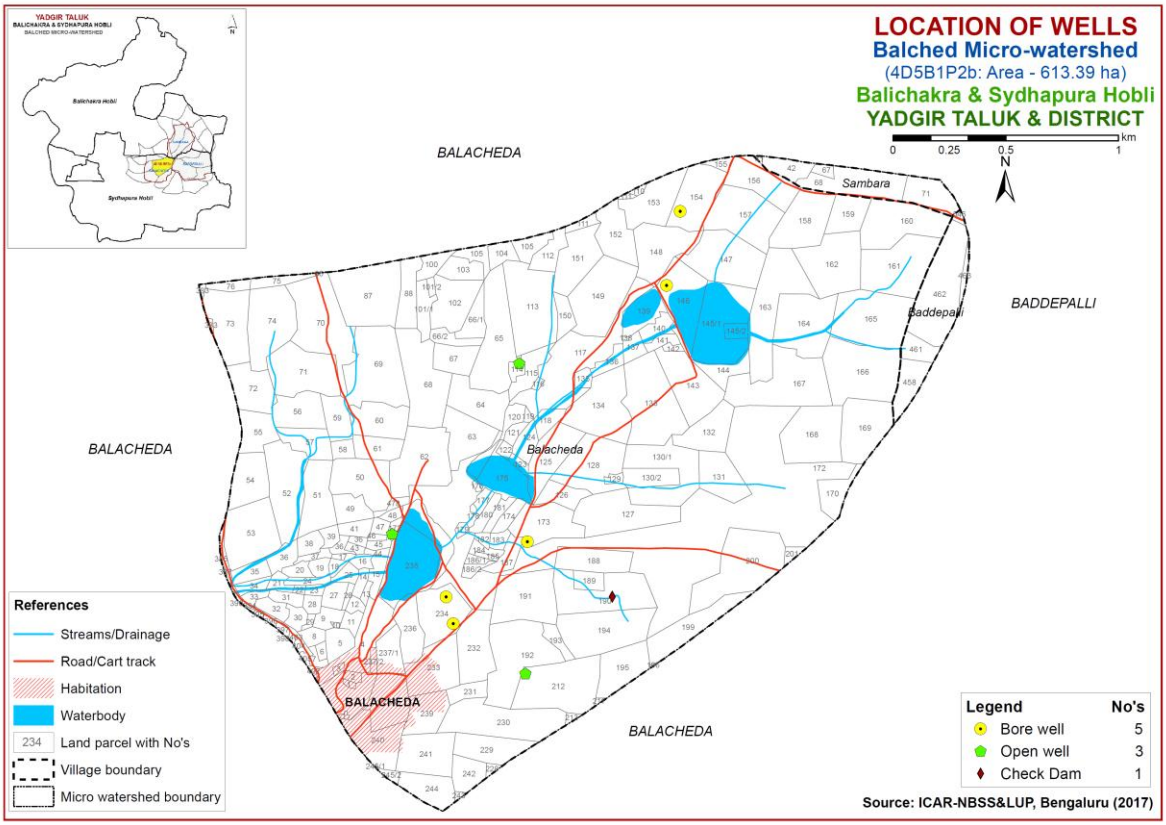


Fig. 2.6 Location of wells and conservation structures - Balched Microwatershed

Chapter 3

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly for a given level of management. This was achieved in Balched microwatershed by the detailed study of all the soil characteristics (depth, texture, colour, structure, consistence, coarse fragments, porosity, soil reaction, soil horizons etc.) and site (slope of the land, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing area extent and their geographic distribution on the microwatershed cadastral map. The detailed survey at 1:7920 scale was carried out in 613 ha area. The methodology followed for carrying out land resource inventory was as per the guidelines given in Soil Survey Manual (IARI, 1971; Soil Survey Staff, 2006; Natarajan *et al.,* 2015) which is briefly described below.

3.1 Base Maps

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

3.2 Image Interpretation for Physiography

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

Image Interpretation Legend for Physiography

G- Granite Gneiss Landscape

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

DSe Alluvial landscape

DSe 1 Summit

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

DSe 2 Very genetly sloping

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

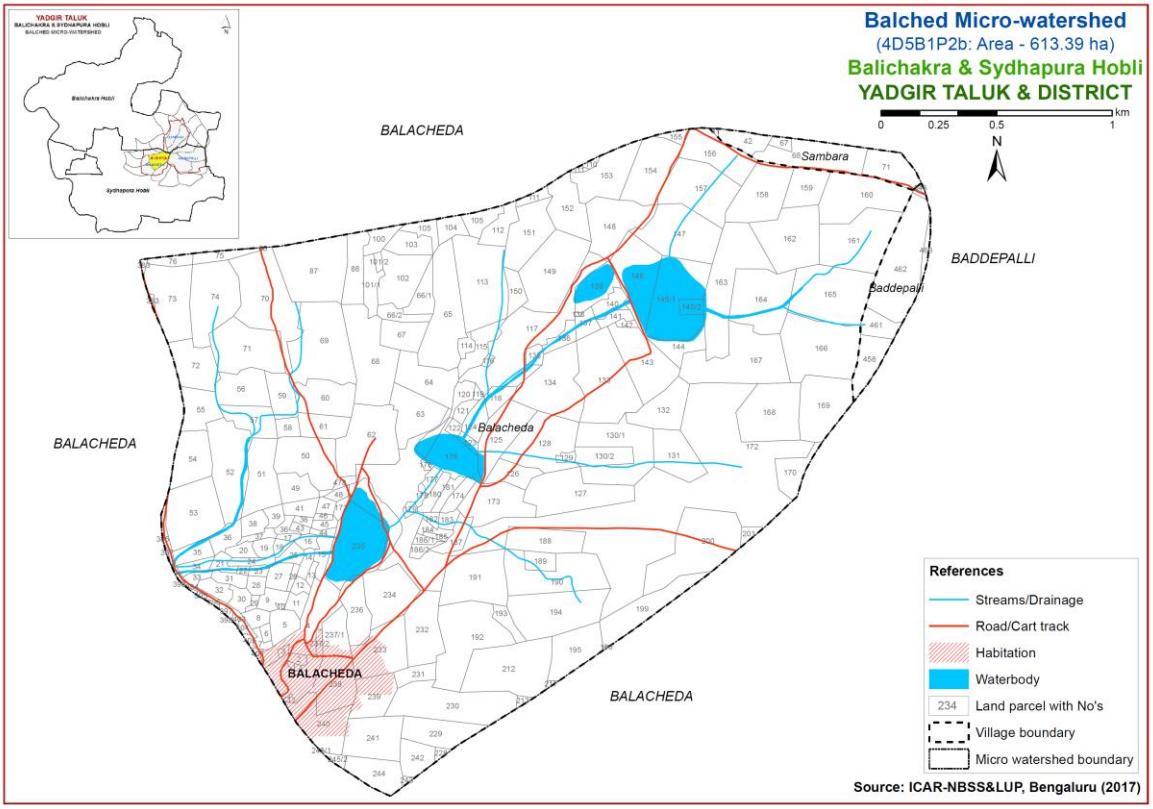


Fig 3.1 Scanned and Digitized Cadastral map of Balched Microwatershed

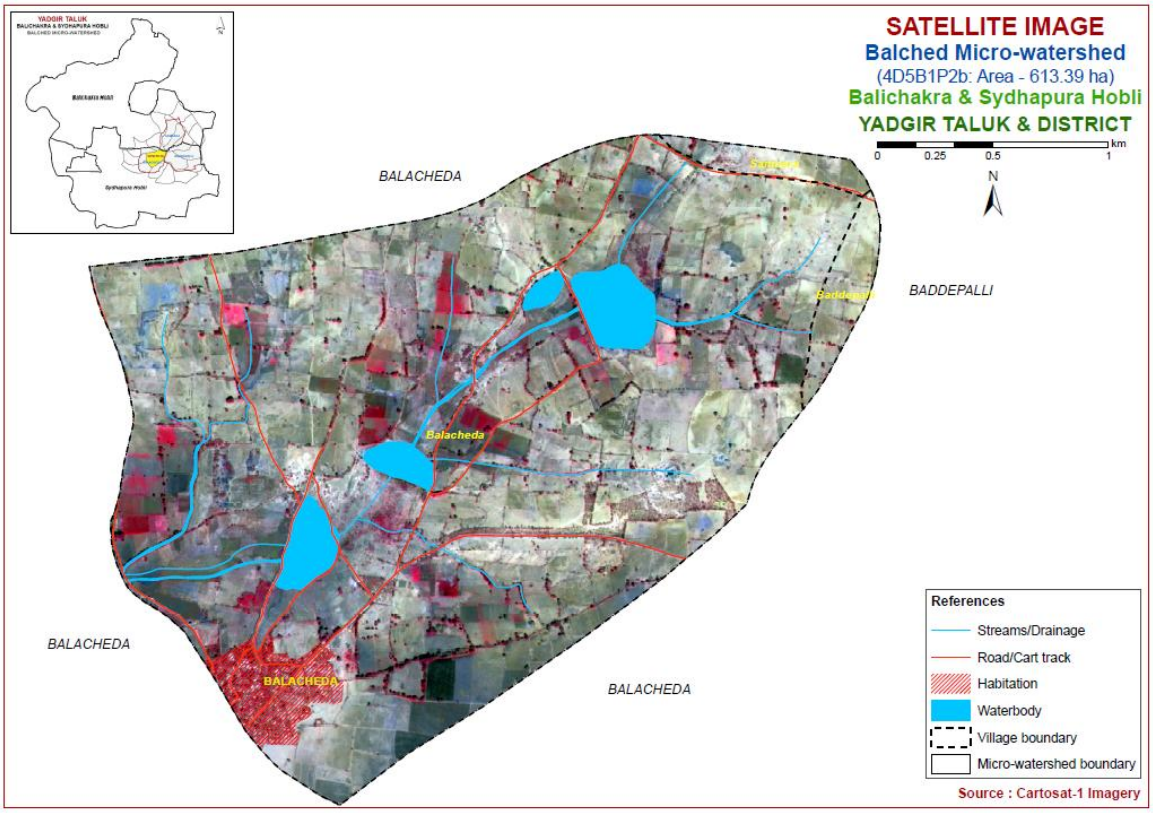


Fig.3.2 Satellite Image of Balched Microwatershed

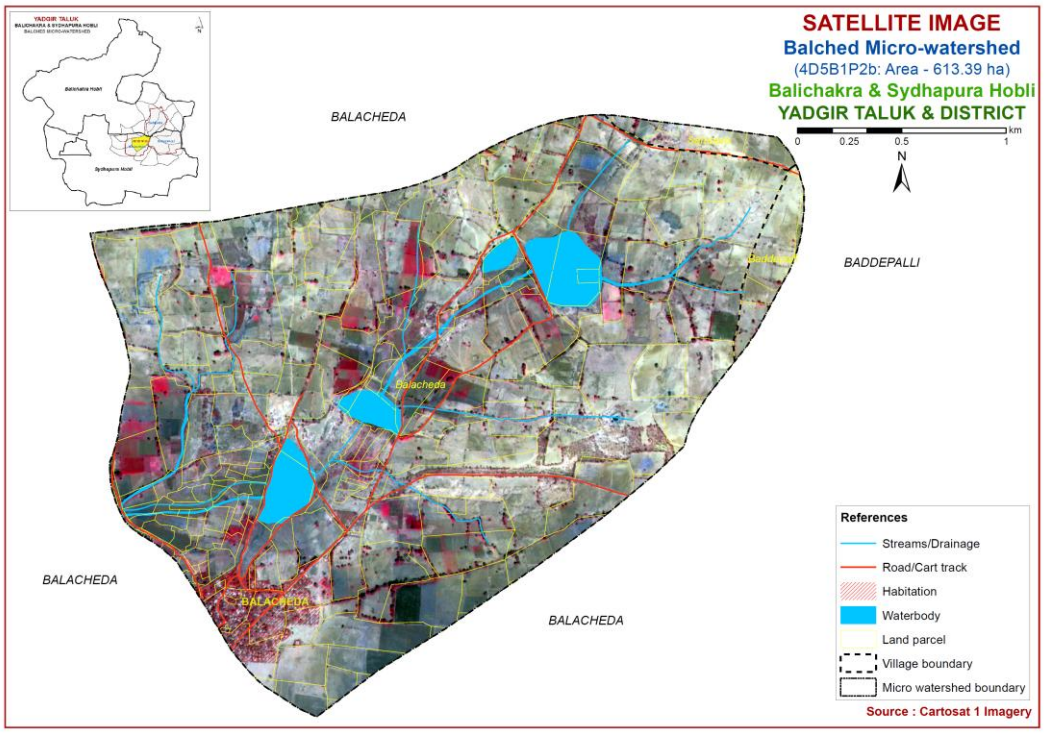


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Balched Microwatershed

3.3 Field Investigation

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

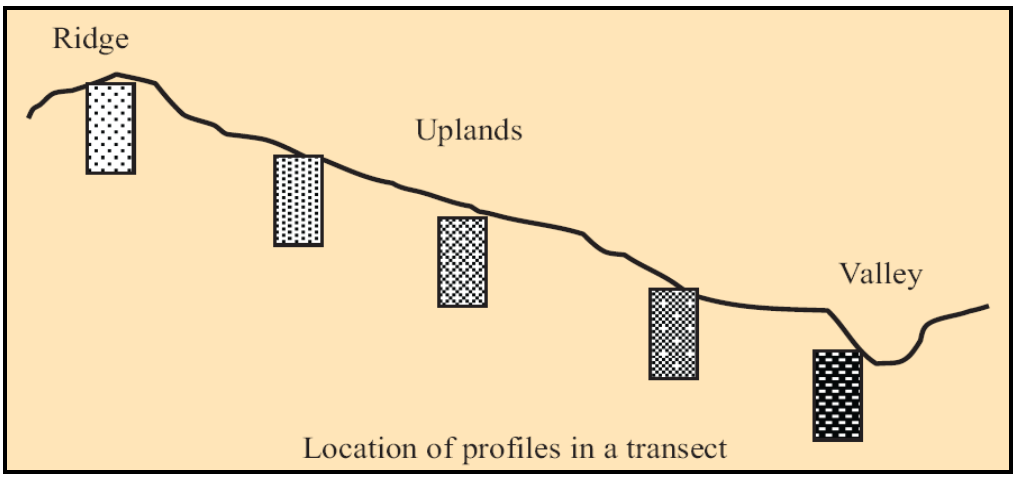


Fig: 3.4. Location of profiles in a transect

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

Based on the soil-site characteristics, the soils were grouped into different soil series (soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management). Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying soil series are given in Table 3.1. Based on the above characteristics, 11 soil series were identified in the Balched microwatershed.

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

SOILS OF GRANITE GNEISS LANDSCAPE							
Sl. No.	**Soil Series**	**Depth (cm)**	**Colour**	**Texture**	**Gravel (%)**	**Horizon sequence**	**Calcareousness**
1	Badiyala (BDL)	25-50	7.5YR 2.5/3, 2.5/2, 3/3, 10YR 3/4,4/3	sl	-	Ap-Bw	e
2	Vanakanahalli (VNK)	25-50	2.5YR 3/4	sc	-	Ap-Bt-Cr	-
3	Halagera (HLG)	50-75	10YR 3/2,4/4 7.5YR 4/3,4/2	scl	-	Ap-Bw	es
4	Duppali (DPL)	50-75	7.5YR 3/3 5YR 3/4	sc	-	Ap-Bt	-
5	Yalleri (YLR)	50-75	2.5YR 3/4,4/4 5YR 3/4, 7.5 YR4/4	c	15-35	Ap-Bt	-
6	Kalabelagundi (KBD)	75-100	2.5YR 4/4,3/4 5YR 4/2,4/3	g scl	35-60	Ap-Bt	-
7	Gondedagi (GDG)	100-150	5YR 4/2 7.5YR 4/2	scl	-	Ap-Bt	e
8	Annur (ANR)	100-150	10YR 4/3,4/1	c	-	Ap-Bw	es
9	Bomraldoddi (BMD)	>150	5YR 3/3,4/1,4/3,4/6	scl	-	Ap-Bt	e
10	Thumakur (TMK)	>150	10 YR 3/1,3/2, 3/3, 4/3	c	-	Ap-Bw	e
Soils of Alluvial Landscape							
11	Hegganakera (HGN)	>150	10 YR 4/2,4/1,3/1, 4/1	c	-	Ap-BA-Bss	e

3.4 Soil Mapping

The area under each soil series was further separated into 23 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 soil map (Fig. 3.5) in the form of symbols. During the survey many profile pits, few minipits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of minipits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 23 mapping units representing 11 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 23 soil phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Laboratory Characterization

Soil samples for each soil series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from farmer's fields (61 samples) for fertility status (major and micronutrients) at 320 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps for the 11 elements including pH and EC were generated for the microwatershed.

Table 3.2 Soil Map Unit description of Balched microwatershed

Soil Map unit No.	Soil Series	Soil phase	Soil Map Unit	Mapping Unit Description	Area in ha (%)
Soil 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, slightly calcareous sandy loam soils occurring on very gently to gently sloping uplands under cultivation			**63 (10.36)**
3		BDLbC3	Loamy sand surface, slope 3-5%, severe erosion		18 (2.98)
4		BDLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion		1 (0.15)
5		BDLiB2	Sandy clay surface, slope 1-3%, moderate erosion		44 (7.23)

	VNK	Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown, sandy clay red soils occurring on very gently to moderately sloping uplands under cultivation		**93 (15.12)**
9		VNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	74 (12.05)
10		VNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	19 (3.07)
	HLG	Halagera soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to dark yellowish brown and dark grayish brown, calcareous sandy clay loam black soils occurring on very gently sloping uplands under cultivation		**22 (3.64)**
14		HLGbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	11 (1.82)
16		HLGcB2	Sandy loam surface, slope 1-3%, moderate erosion	11 (1.82)
	DPL	Duppali soils are moderately shallow (50-75 cm), well drained, have dark brown to dark reddish brown, sandy clay red soils occurring on very gently sloping uplands under cultivation		62 (10.24)
25		DPLcB2	Sandy loam surface, slope 1-3%, moderate erosion	53 (8.69)
26		DPLiB2	Sandy clay surface, slope 1-3%, moderate erosion	9 (1.55)
	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, gravelly clay red soils occurring on very gently to gently sloping uplands under cultivation		33 (5.38)
27		YLRbB2	Loamy sand surface, slope 1-3%, moderate erosion	10 (1.6)
29		YLRbB2	Loamy sand surface, slope 1-3%, moderate erosion	23 (3.78)
	KBD	Kalabelagundi soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown and dark reddish gray, gravelly sandy clay loam red soils occurring on very gently sloping uplands under cultivation		47 (7.58)
39		KBDbB3	Loamy sand surface, slope 1-3%, severe erosion	47 (7.58)
	GDG	Gondedagi soils are deep (100-150 cm), well drained, have brown to dark reddish gray, slightly calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**146 (23.78)**
44		GDGbB2	Loamy sand surface, slope 1-3%, moderate erosion	72 (11.68)
45		GDGbB3g1	Loamy sand surface, slope 1-3%, severe erosion, gravelly (15-35%)	37 (6.02)
46		GDGiB2	Sandy clay surface, slope 1-3%, moderate erosion	37 (6.08)

	ANR	Annur soils are deep (100-150 cm), moderately well drained, have dark gray to brown, calcareous clayey soils occurring on very gently sloping uplands under cultivation		**26 (4.25)**
51		ANRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	13 (2.06)
52		ANRbB3	Loamy sand surface, slope 1-3%, severe erosion	8 (1.34)
54		ANRbB3	Loamy sand surface, slope 1-3%, severe erosion	5 (0.85)
	BMD	Bomraldoddi soils are very deep (>150 cm), well drained, have dark gray, reddish brown to dark reddish brown and yellowish red slightly calcareous, sandy clay loam red soils occurring on very gently sloping uplands under cultivation		**1 (0.23)**
64		BMDcB2	Sandy loam surface, slope 1-3%, moderate erosion	1 (0.23)
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have brown to very dark grayish brown, slightly calcareous clayey black soils occurring on nearly level to very gently sloping lowlands under cultivation		**48 (7.92)**
102		TMKbB3	Loamy sand surface, slope 1-3%, severe erosion	19 (3.12)
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	29 (4.8)
Soils of Alluvial Landscape				
	HGN	Hegganakera soils are very deep (>150 cm), moderately well drained, have dark gray to very dark grayish brown and brown, slightly calcareous black cracking clay soils occurring on very gently sloping plains under cultivation		**27 (4.47)**
92		HGNcB2	Sandy loam surface, slope 1-3%, moderate erosion	17 (2.84)
95		HGNmB2	Clay surface, slope 1-3%, moderate erosion	10 (1.63)
1000	Other	Habitation and Water bodies		**43 (7.03)**

3.6 Land Management Units (LMU's)

The 23 soil phases identified and mapped in the microwatershed were grouped into 9 Land Management Units (LMU's) for the purpose of preparing a Proposed Crop Plan for sustained development of the microwatershed. The database (soil phases) generated under LRI was utilized for identifying Land Management Units (LMU's) based on the management needs. One or more than one soil site characteristic having influence on the management have been chosen for identification and delineation of LMUs. For Balched microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LMUs. The Land Management Units are expected to behave similarly for a given level of management.

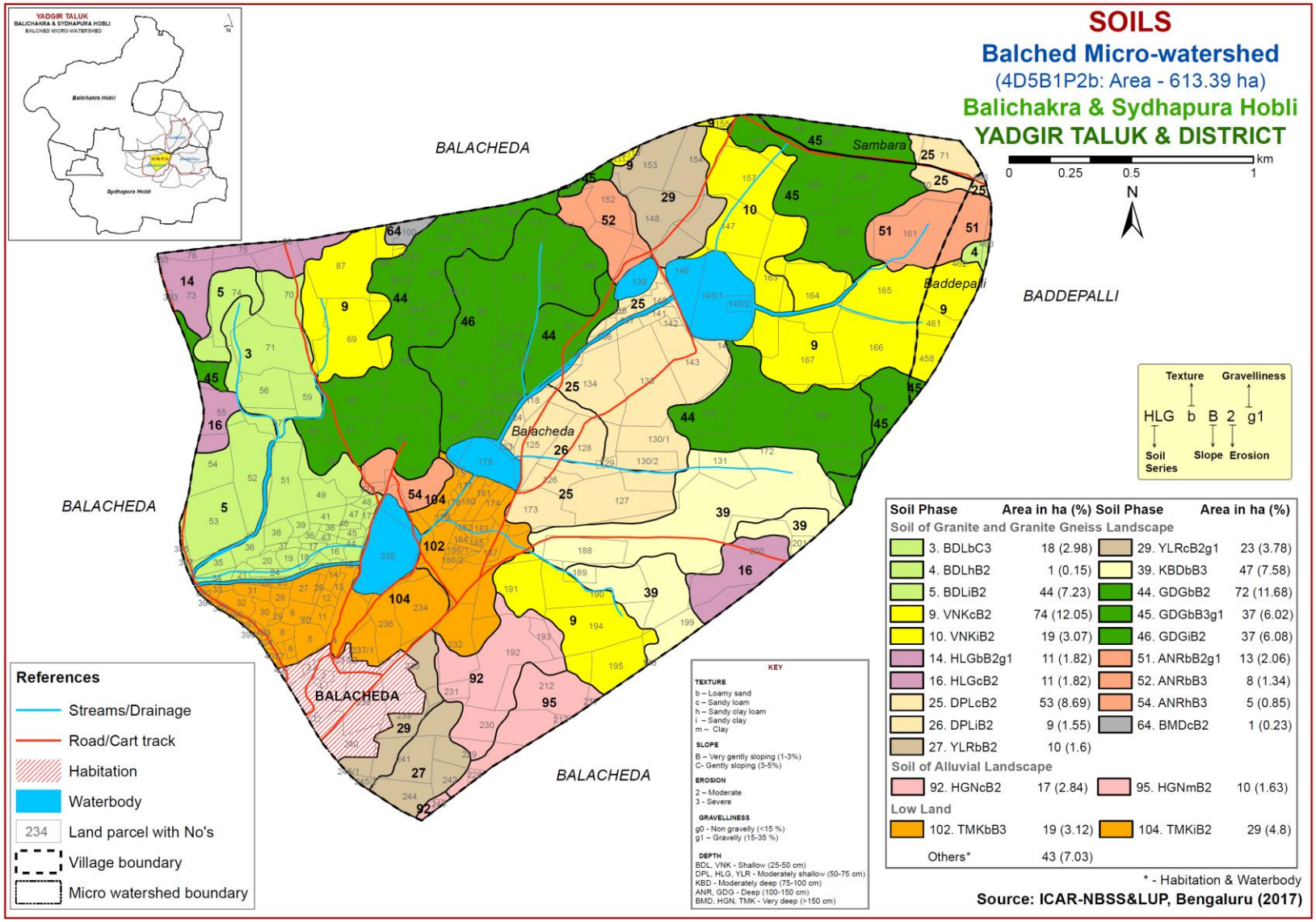


Fig 3.5 Soil phase or management units map of Balched Microwatershed

Chapter 4

THE SOILS

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

A brief description of each of the 11 soil series identified followed by 23 soil phases (management units) mapped (Fig. 3.4) are furnished below. The physical and chemical characteristics of soil series identified in Balched microwatershed are given in Table 4.1 along with soil classification. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristics that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of granite gneiss landscape

In this landscape, 10 soil series are identified and mapped. Of these, Gondedagi (GDG) series occupies a maximum area of 146 ha (24%) followed by Vanakanahalli (VNK) 93 ha (15%), Badiyala (BDL) 63 ha (10%), Duppali (DPL) 62 ha (10%), Kalabelagundi (KBD) 47 ha (8%), Yalleri (YLR) 33 ha (5%), Annur (ANR) 26 ha (4%), Halagera (HLG) 22 ha (4%) and other soil series occupy minor area of the microwatershed. The brief description of these series along with the soil phases identified and mapped is given below.

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

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

Landscape and soil profile characteristics of Badiyala (BDL) Series

4.1.2 Vanakanahalli (VNK) Series: Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown sandy clay red soils. They have developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Vanakanahalli series has been classified as a member of the fine, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 25 to 49 cm. The thickness of A horizon ranges from 7 to 16 cm. Its colour is in 2.5 YR and 5 YR with value 3 and chroma 2 to 4. The texture is sandy loam to sandy clay loam and sandy clay. The thickness of B horizon ranges from 20 to 40 cm. Its colour is in 2.5 YR and 5 YR hue with value 3 to 4 and chroma 3 to 4. Its texture is sandy clay. Two phases were identified and mapped.

Landscape and soil profile characteristics of Vanakanahalli (VNK) Series

4.1.3 Halagera (HLG) Series: Halagera soils are moderately shallow (50-75 cm), well drained, have very dark grayish brown to dark yellowish brown, calcareous sandy clay

loam soils. They are developed from weathered granite gneiss and occur on very gently sloping uplands under cultivation. The Halagera series has been classified as a member of the fine-loamy, mixed, (calcareous) isohyperthermic family of Typic Haplustepts.

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

Landscape and soil profile characteristics of Halagera (HLG) Series

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

The thickness of the solum ranges from 51-75 cm. Thickness of A horizon ranges from 8 to 15 cm. Its colour is in hue 10 YR with value 4 and chroma 3 to 6. The texture varies from loamy sand to sandy clay. The thickness of B horizon ranges from 55 to 65 cm. Its colour is in 7.5 YR and 5 YR hue with value 3 to 4 and chroma 2 to 4. The texture is sandy clay. The available water capacity is low (51-100 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Duppali (DPL) Series

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

The thickness of the solum ranges from 50 to 74 cm. The thickness of A horizon ranges from 10 to 13 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 2 to 4. The texture is sandy loam, loamy sand, and sandy clay loam. The thickness of B horizon ranges from 45 to 64 cm. Its colour is in 10 YR, 7.5 YR and 5 YR hue with value 2 to 4 and chroma 2 to 4. Its texture is clay with gravel content of 15-35 per cent. The available water capacity is low (51-100 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Yalleri (YLR) Series

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

The thickness of the solum ranges from 75 to 98 cm. The thickness of A horizon ranges from 10 to 19 cm. Its colour is in hue 5 YR and 7.5 YR with value 3 to 4 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 70 to 84 cm. Its colour is in hue 5 YR and 2.5YR with value 3 to 4 and chroma 2 to 4. Its texture is sandy clay loam to sandy clay with gravel content of 35-60 per cent. The available water capacity is very low (<50 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Kalabelagundi (KBD) Series

4.1.7 Gondedagi (GDG) Series: Gondedagi soils are deep (100-150 cm), well drained, have dark reddish gray to dark brown, slightly calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Gondedagi series has been classified as a member of the fine-loamy, mixed, isohyperthermic family of Typic Haplustalfs.

The thickness of the solum ranges from 105 to 148 cm. The thickness of A horizon ranges from 9 to 17 cm. Its colour is in 7.5 YR and 5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam to sandy clay. The thickness of B horizon ranges from 108 to 135 cm. Its colour is in 5 YR and 7.5 YR hue with value 2 to 4 and chroma 2 to 4. The texture is sandy clay loam and is slightly calcareous. The available water capacity is medium (101-150 mm/m). Three phases were identified and mapped.

Landscape and soil profile characteristics of Gondedagi (GDG) Series

4.1.8 Annur (ANR) Series: Annur soils are deep (100-150 cm), moderately well drained, have dark gray to dark brown, calcareous clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands under cultivation. The Annur series has been classified as a member of the fine, mixed, (calcareous), isohyperthermic family of Typic Haplustepts.

The thickness of the solum ranges from 102 to 148 cm. The thickness of A-horizon ranges from 9 to 17 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 2 to 4. The texture ranges from loamy sand to sandy clay loam and sandy clay and are calcareous. The thickness of B horizon ranges from 102 to 135 cm. Its colour is in 10 YR hue with value 3 to 5 and chroma 1 to 6. Texture is sandy clay loam to sandy clay and clay and is calcareous. The available water capacity is very high (>200 mm/m). Two phases were identified and mapped.

Landscape and soil profile characteristics of Anur (ANR) Series

4.1.9 Bomraldoddi (BMD) Series: Bomraldoddi soils are very deep (>150 cm), well drained, have dark reddish brown to dark grey, reddish brown, dark brown and yellowish red, slightly calcareous sandy clay loam soils. They are developed from weathered granite gneiss and occur on nearly level to very gently sloping uplands under cultivation.

The thickness of the solum is more than 150 cm. The thickness of A horizon ranges from 11 to 17 cm. Its colour is in 5 YR hue with value 3 to 4 and chroma 1 to 5. Texture varies from sandy loam to sandy clay loam. The thickness of B horizon is more than 150 cm. Its colour is in hue 5 YR with value 4 and chroma 1 to 6. Texture varies from sandy clay loam to sandy clay and is slightly calcareous. The available water capacity is high (151-200 mm/m). Only one phase was identified.

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

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

Landscape and soil profile characteristics of Thumakur (TMK) Series

4.2 Soils of Alluvial landscape

In this landscape, only one soil series has been identified and mapped. The Hegganakera (HGN) series covers 27 ha (4%) in the microwatershed. The brief description of soil series along with the soil phases identified and mapped is given below.

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

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 10 YR hue 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 and is slightly calcareous. The available water capacity is very high (>200 mm/m). Only one phase was identified and mapped.

Landscape and soil profile characteristics of Hegganakera (HGN) Series

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

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

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

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

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

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

Contd…

Soil Series: Vanakanahalli (VNK) **Pedon:** R-15

Location: $16^0$43'49.5"N $77^0$17'17.9"E, Yaleri village, Balichakra hobli, Yadgiri taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	82.61	8.09	9.30	6.77	8.59	21.13	34.58	11.53	-	ls	8.85	3.53
18-50	Bt	54.51	8.73	36.77	4.93	6.18	14.15	20.75	8.49	-	sc	18.88	11.63

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	5.37	-	-	0.11	0.60	0.00	2.96	1.45	0.13	0.14	4.68	6.27	0.67	75	2.22
18-50	4.71	-	-	0.05	0.81	0.00	5.56	2.24	0.10	0.05	7.95	13.31	0.36	60	0.38

Contd…

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

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

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine-loamy, mixed, (calcareous), isohyperthermic Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-8	Ap	81.02	8.42	10.56	10.41	24.08	18.98	19.08	8.47	<15	ls	9.10	4.79
8-22	Bw1	61.00	11.50	27.50	8.29	9.35	21.89	14.35	7.12	<15	scl	16.91	12.28
22-53	Bw2	61.41	13.80	24.79	15.98	15.67	12.62	11.78	5.36	15-35	scl	17.08	11.26

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-8	8.49	-	-	0.185	0.30	2.99	-	-	0.24	0.06	-	8.80	0.83	100	0.69
8-22	8.57	-	-	0.116	0.45	4.03	-	-	0.11	0.02	-	19.50	0.71	100	0.12
22-53	8.70	-	-	0.113	0.27	7.67	-	-	0.11	0.05	-	15.50	0.63	100	0.33

Contd…

Soil Series: Duppali (DPL) **Pedon:** R-4

Location: $16^0$37'45.8"N $77^0$18'93.2"E, Neelahalli village, Balichakra hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coars (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-7	Ap	85.28	5.38	9.34	13.40	26.09	19.90	20.51	5.38	-	ls	9.30	4.92
7-39	Bt1	48.50	7.08	44.42	16.85	10.41	10.94	6.97	3.33	-	sc	21.31	16.82
39-65	Bt2	50.95	5.29	43.76	23.57	10.36	8.77	5.50	2.75	-	sc	21.99	17.50

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-7	6.92	-	-	0.122	0.92	0.00	4.73	1.61	0.19	0.01	6.54	7.10	0.76	92	0.09
7-39	7.00	-	-	0.060	0.62	0.00	13.57	4.78	0.12	0.40	18.87	19.30	0.43	98	2.06
39-65	6.87	-	-	0.072	0.41	0.00	13.69	4.57	0.19	0.65	19.10	19.90	0.45	96	3.25

Contd…

Soil Series: Yalleri (YLR) **Pedon:** R-16

Location: $16^0$32'54.3"N $77^0$22'71.2"E, Duppalli village, Sydhapura hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-5	Ap	81.69	5.44	12.87	6.10	8.65	33.88	21.57	11.50	-	sl	8.60	3.37
5-34	Bt1	38.78	6.73	54.49	3.38	9.91	12.42	8.93	4.14	-	c	25.33	15.82
34-75	Bt2	40.35	2.90	56.75	12.91	6.83	10.30	7.48	2.82	35-60	c	24.49	16.20

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-5	6.91	-	-	0.069	0.70	0.00	5.29	1.37	0.28	0.03	6.96	6.90	0.54	100	0.45
5-34	7.05	-	-	0.053	0.62	0.00	16.43	3.89	0.26	0.09	20.67	21.60	0.40	96	0.42
34-75	7.25	-	-	0.058	0.59	0.00	15.22	3.46	0.25	0.14	19.06	19.90	0.35	96	0.69

Contd…

Soil Series: Kalabelagundi (KBD) **Pedon:** R-13

Location: $16^0$43'78.3"n $77^0$13'71.4"E, Halagera village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Loamy-skeletal, mixed, isohyperthermic Typic Haplustalfs

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-11	Ap	72.35	5.19	22.46	7.19	14.29	19.01	25.28	6.58	15	scl	15.12	8.16
11-35	Bt1	73.20	5.81	20.99	13.66	18.67	16.79	17.62	6.47	20	scl	11.58	7.29
35-64	Bt2	51.68	7.30	41.03	29.41	8.00	4.86	5.62	3.78	40	sc	19.86	14.24
64-89	BC	64.35	3.51	32.15	21.84	12.03	14.87	10.23	5.38	40	scl	16.72	10.36

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-11	7.84	-	-	0.604	0.88	0.52	8.69	2.17	0.44	0.49	11.78	11.50	0.51	102	4.27
11-35	5.57	-	-	0.181	0.68	0.00	6.40	1.63	0.18	0.14	8.36	9.10	0.43	92	1.57
35-64	7.42	-	-	0.098	0.44	1.05	15.82	2.34	0.12	0.76	19.04	19.60	0.48	97	3.90
64-89	6.66	-	-	0.165	0.56	0.65	10.45	4.00	0.09	0.43	14.97	15.10	0.47	99	2.86

Contd…

Soil Series: Gondedagi (GDG) **Pedon:** R-6

Location: $16^0$34' 42.6"N $77^0$20'00.1"E, Balached, Sydhapura hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-17	Ap	84.15	7.67	8.18	19.72	24.39	20.33	12.80	6.91	-	ls	5.83	3.37
17-55	Bt1	62.36	11.26	26.38	19.71	16.58	11.89	7.82	6.36	-	scl	14.94	9.18
55-115	Bt2	57.78	13.38	28.84	21.84	12.54	9.61	7.63	6.17	-	scl	17.93	9.86

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-17	5.57	-	-	0.25	0.60	0.00	3.45	0.92	0.14	0.01	4.52	5.83	0.71	78	0.22
17-55	6.20	-	-	0.04	0.57	0.00	9.79	1.58	0.07	0.05	11.49	14.96	0.57	77	0.31
55-115	8.32	-	-	0.14	0.45	6.24	-	-	0.08	0.05	-	15.84	0.55	100	0.34

Contd…

Soil Series: Anur (ANR) **Pedon:** R-15

Location: $16^0$32'45.0"N $77^0$23'57.4"E, Duppalli village, Sydhapura hobli, Yadgir taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-18	Ap	64.60	13.44	21.96	7.33	10.42	18.68	20.12	8.05	<15	scl	16.59	7.96
18-49	Bw1	56.66	12.19	31.15	4.73	9.80	18.66	17.02	6.45	-	scl	33.38	13.51
49-95	Bw2	39.94	17.81	42.25	3.09	3.30	15.44	10.65	7.45	<15	c	44.68	25.23
95-123	Bw3	30.65	17.58	51.77	1.50	5.57	10.18	9.65	3.75	<15	c	54.94	32.07

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-18	10.17	-	-	0.365	0.48	6.11	-	-	0.25	3.52	-	19.90	0.91	100	17.70
18-49	10.32	-	-	1.38	0.30	6.76	-	-	0.21	16.03	-	24.60	0.79	100	65.17
49-95	10.08	-	-	2.55	0.17	6.11	-	-	0.33	21.49	-	32.60	0.77	100	65.91
95-123	9.92	-	-	2.56	0.12	7.93	-	-	0.51	26.03	-	36.00	0.70	100	72.30

Contd…

Soil Series: Hegganakera (HGN) **Pedon:** R-12

Location: $16^0$46'19.9"N $77^0$04'34.0"E, Thumakura village, Yadgir hobli, Yadgir taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bengaluru **Classification:** Fine, smectitic, isohyperthermic Typic Haplusterts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand								
		Sand (2.0-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.0-1.0)	Coarse (1.0-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			1/3 Bar	15 Bar
0-8	Ap	20.20	25.22	54.58	2.32	2.76	3.53	8.17	3.42	-	c	42.47	25.59
8-24	BA	21.18	21.70	57.12	2.07	3.28	4.69	7.31	3.82	-	c	41.88	24.67
24-50	Bss1	18.76	21.67	59.57	1.20	2.51	3.93	7.09	4.03	-	c	40.46	23.34
50-86	Bss2	16.74	22.24	61.02	0.88	1.53	4.27	6.02	4.05	-	c	42.18	24.76
86-146	Bss3	18.64	20.20	61.16	2.30	2.41	3.73	6.36	3.84	-	c	40.03	28.61
146-170	Bss4	16.08	19.33	64.59	0.88	2.75	3.41	5.95	3.08	-	c	40.28	29.90

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	$CaCO_3$	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	$CaCl_2$	M KCl	dS m^{-1}	%	%	cmol kg^{-1}							%	%
0-8	8.77	-	-	1.33	1.16	8.19	-	-	1.10	5.21	-	36.23	0.66	100	14.38
8-24	8.93	-	-	1.11	0.64	5.46	-	-	0.87	4.23	-	35.50	0.62	100	11.93
24-50	8.85	-	-	0.984	0.32	3.38	-	-	0.71	3.78	-	36.69	0.62	100	10.30
50-86	8.54	-	-	0.562	0.24	3.38	-	-	0.58	3.07	-	39.16	0.64	100	7.84
86-146	8.45	-	-	0.526	0.24	3.38	-	-	0.62	2.82	-	38.52	0.63	100	7.31
146-170	8.64	-	-	0.517	0.20	4.29	-	-	0.60	2.99	-	36.87	0.57	100	8.12

Contd…

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

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

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

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

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

Chapter 5

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The 23 soil map units identified in the Balched microwatershed are grouped under three land capability class and five land capability subclass (Fig. 5.1).

Entire are of the microwatershed is suitable for agriculture. An area of 298 ha (49%) is good cultivable lands (Class II) that have minor limitations and require moderate conservation practices and are distributed in the major part of the microwatershed. Moderately good cultivable lands (Class III) cover an area of 254 ha (41%) and are distributed in the northern, northeastern, eastern, central, western and southwestern part of the microwatershed with moderate problems of soil that require special conservation practices. An area of about 18 ha (3%) is fairly good lands (Class IV) that have very severe limitations that reduce the choice of crops or that require very careful management and are distributed in the northwestern part of the microwatershed.

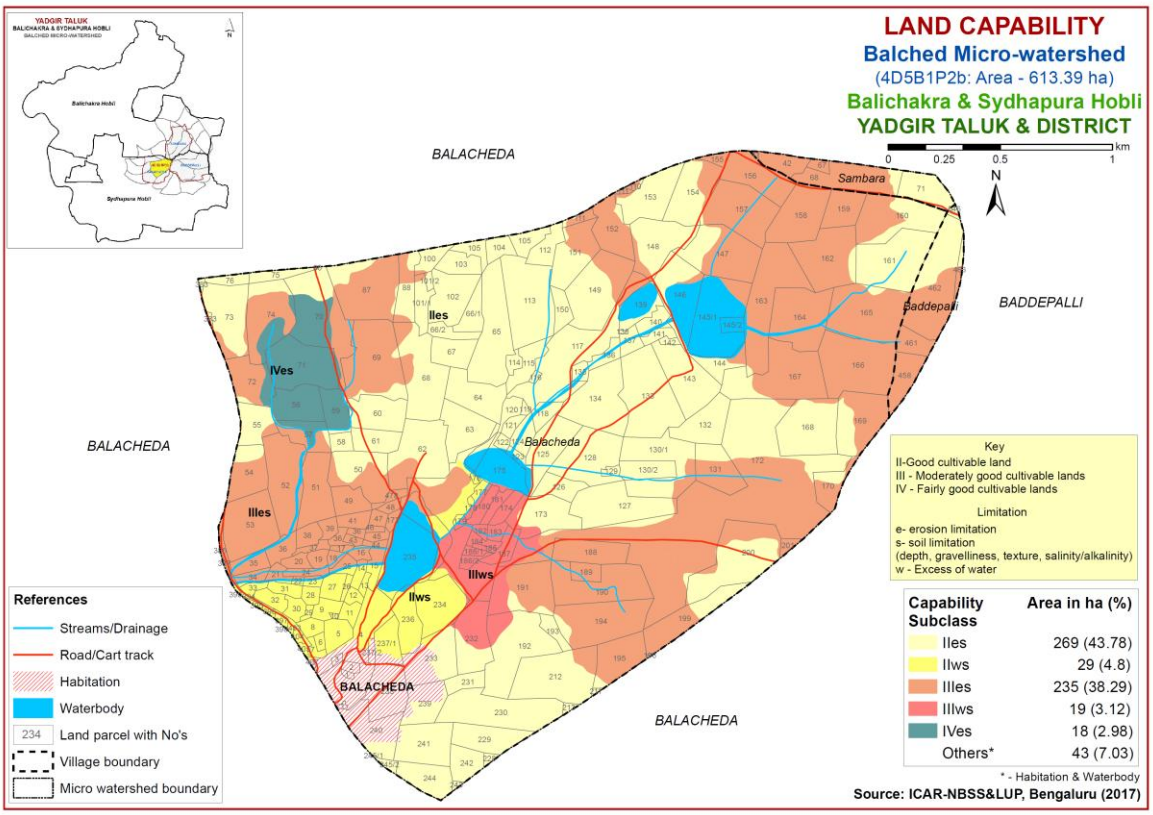


Fig. 5.1 Land Capability map of Balched Microwatershed

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 shown in Figure 5.2.

Shallow (25-50 cm) soils occupy an area of 156 ha (25%) and are distributed in the northeastern, western, northwestern and southern part of the microwatershed. An area of 118 ha (19%) is moderately shallow (50-75 cm) and are distributed in the central, northern, northwestern, southern, eastern and northeastern part of the microwatershed. Moderately deep soils (75-100 cm) occur in an area of 47 ha (8%) and are distributed in the eastern part of the microwatershed. Deep (100-150 cm) to very deep (>150 cm) soils cover an area of 249 ha (41%) and are distributed in the major part of the microwatershed.

The most problem lands with an area of about 156 ha (25%) having shallow (25-50 cm) rooting depth. They are suitable for growing short duration agricultural crops but well suited for pasture, forestry or other recreational purposes. The most productive lands covering about 249 ha (41%) with respect to soil rooting depth where all climatically adapted annual and perennial crops can be grown are deep (100-150 cm) to very deep (>150 cm) occurring in the major part of the microwatershed.

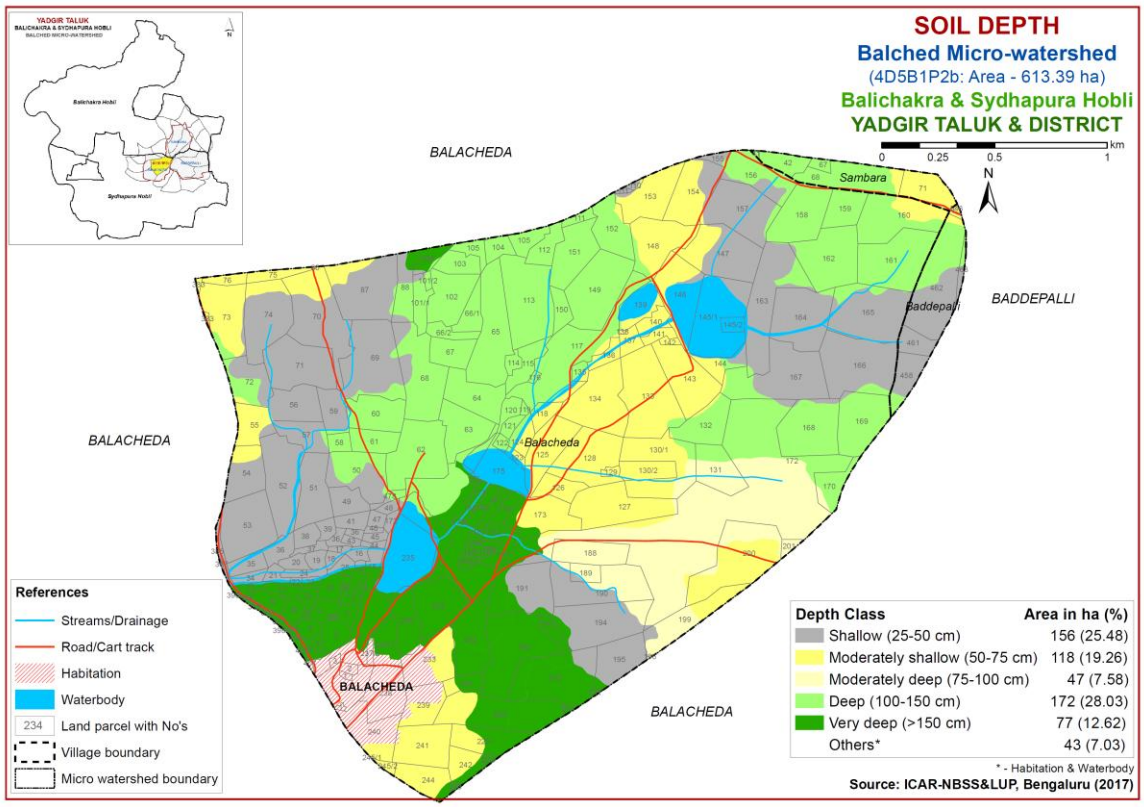


Fig. 5.2 Soil Depth map of Balched Microwatershed

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.

Maximum area of about 149 ha (24%) has clayey soils at the surface and are distributed in the western, northern, central, southern and northeastern part of the microwatershed. Sandy soils occupy an area of about 234 ha (38%) and are distributed in

the major part of the microwatershed. Loamy soils occupy an area of about 186 ha (30%) and are distributed in all parts of the microwatershed.

The most productive lands 149 ha (24%) with respect to surface soil texture are the clay soils that have high potential for soil-water retention and availability, and nutrient retention and availability, but have problems of drainage, infiltration, workability and other physical problems as compared to loamy soils. The other productive lands (30%) are loamy soils which also have high potential for soil-water retention and nutrient availability but have no drainage or other physical problems. The problematic lands are sandy soils (38%) that have less run-off and less soil moisture, less capillary rise and less evaporation losses, but are amenable to good soil tilth and are ideal for root and tuber crops.

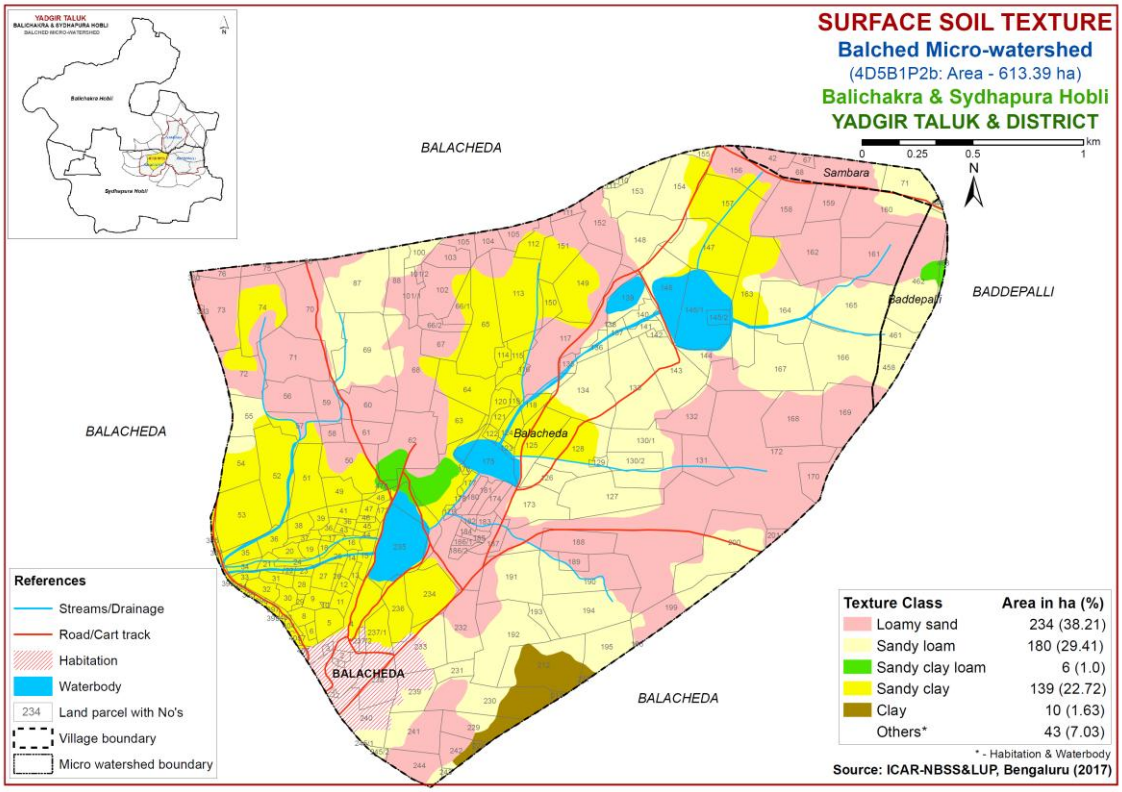


Fig. 5.3 Surface Soil Texture map of Balched Microwatershed

5.4 Soil Gravelliness

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

An area of 486 ha (79%) has soils that are non gravelly (<15%) and are distributed in the major part of the microwatershed. An area of 84 ha (14%) is gravelly (15-35%) and is distributed in the eastern and central part of the microwatershed.

The most productive lands with respect to gravelliness are found to be 79 per cent. They are non gravelly (<15%) and have potential for growing all annual and perennial crops. The problem soils that are gravelly (15-35%) cover 84 ha where only short or medium duration crops can be grown.

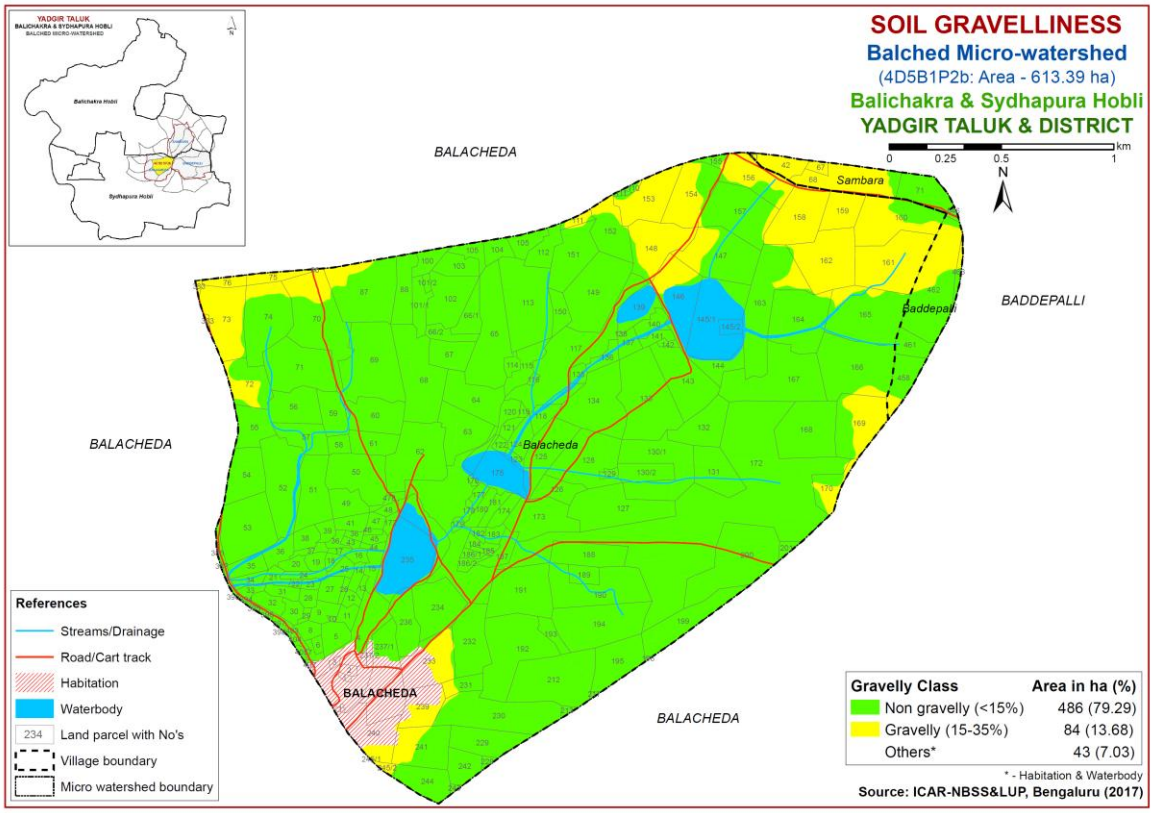


Fig. 5.4 Soil Gravelliness map of Balched Microwatershed

5.5 Available Water Capacity

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

Major area of about 203 ha (33%) has soils that are very low (<50 mm/m) in available water capacity and are distributed in the northeastern, northwestern and southeastern part of the microwatershed. An area of about 118 ha (19%) has soils that are

low (51-100 mm/m) in available water capacity and are distributed in the northwestern, central, southern, northeastern and southeastern part of the microwatershed. An area of 147 ha (24%) in the microwatershed has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the major part of the microwatershed. The available water capacity is very high in an area of 102 ha (17%) and are distributed in the northern, northeastern, southern and western part of the microwatershed.

Maximum area of 203 ha (33%) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only the short or medium duration crops can be grown and the probability of crop failure is very high. These areas are best put to other alternative uses. The potential soils with respect to AWC cover about 102 ha that have very high AWC, where all climatically adapted long duration crops can be grown.

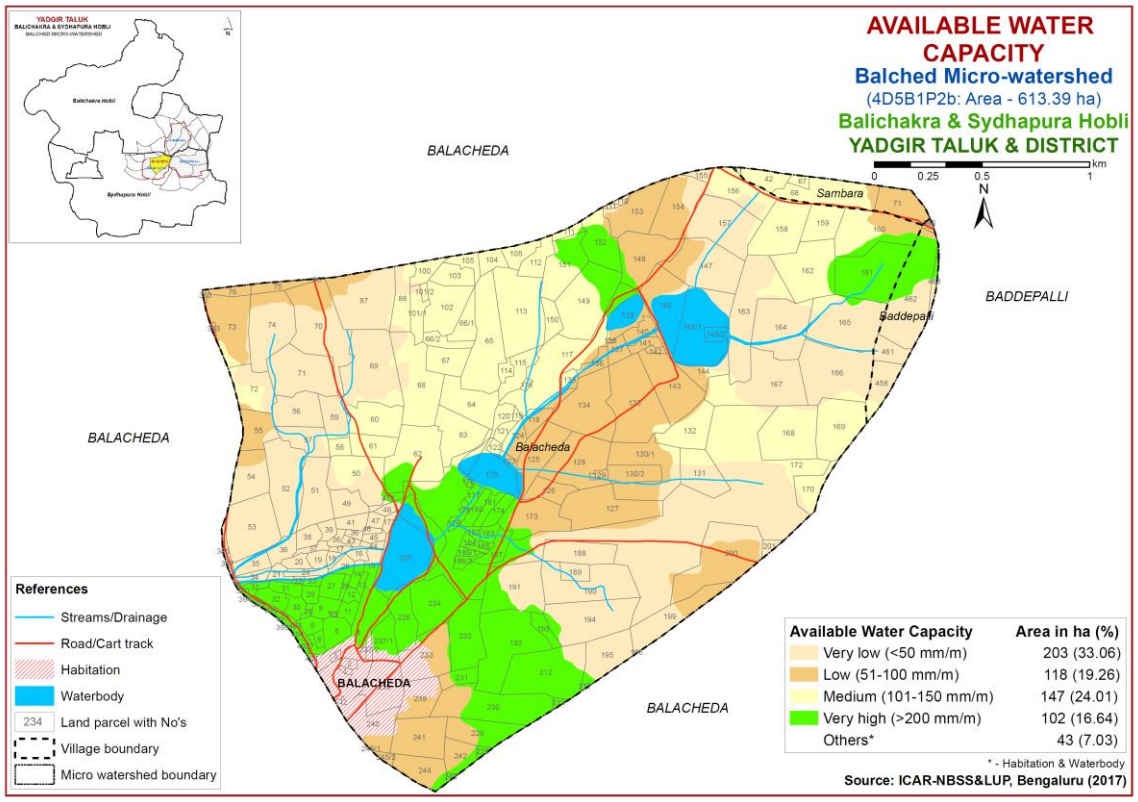


Fig. 5.5 Soil Available Water Capacity map of Balched Microwatershed

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 four slope classes and a slope map was generated. The area extent and their geographical distribution in the microwatershed is shown in Figure 5.6.

Maximum area in the microwatershed falls under very gently sloping (1-3%) lands. It covers an area of about 552 ha (90%) and is distributed in all parts of the microwatershed. Gently sloping (3-5%) soils cover an area of 18 ha (3%) and are distributed in the northwestern part of the microwatershed.

In all these lands, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

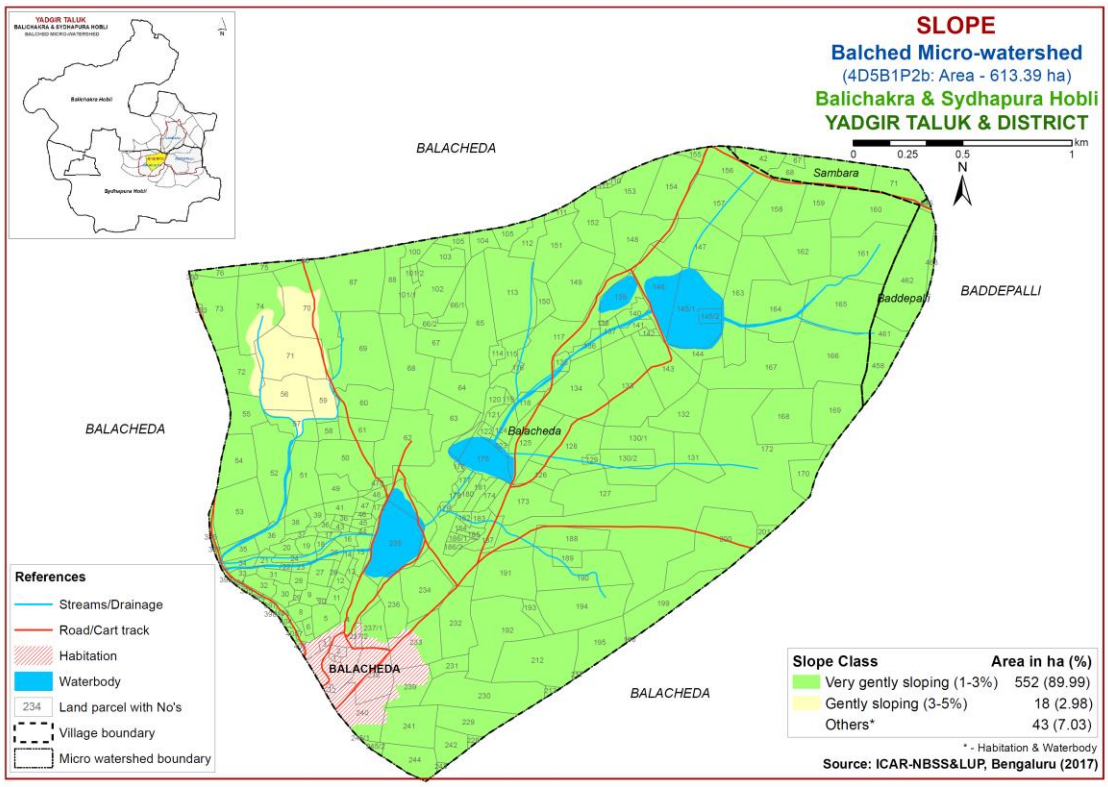


Fig. 5.6 Soil Slope map of Balched Microwatershed

5.7 Soil Erosion

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

Soils that are moderately eroded (e2 class) cover an area of 436 ha (71%) of the microwatershed. An area of about 134 ha (22%) in the microwatershed is under severe erosion (e3 class). Entire area of the microwatershed need soil and water conservation and other land development measures for restoring the soil health.

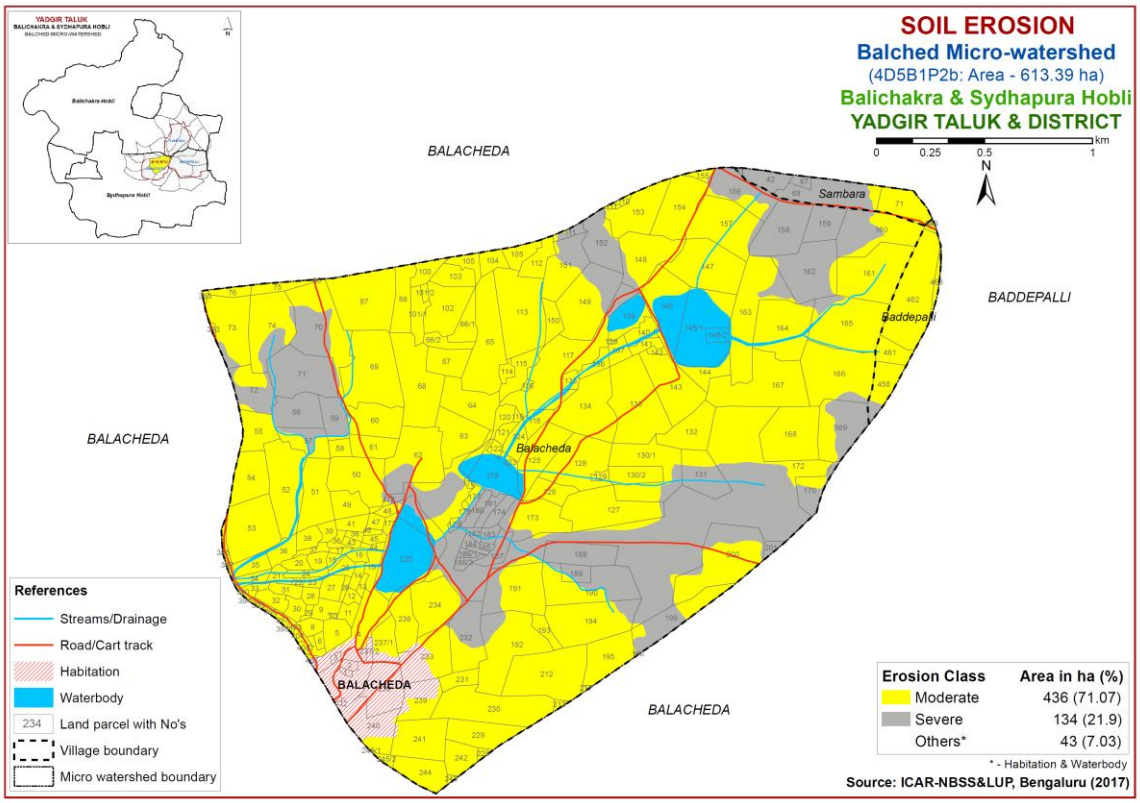


Fig. 5.7 Soil Erosion map of Balched Microwatershed

Chapter 6

FERTILITY STATUS

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

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

6.1 Soil Reaction (pH)

The soil fertility analysis of the Balched microwatershed for soil reaction (pH) showed that a negligible area of 0.024 ha (<1%) is very strongly alkaline (pH >9.0) and is distributed in the southern part of the microwatershed. An area of 43 ha (7%) is strongly alkaline (pH 8.4-9.0) and is distributed in the central, southern, western and northeastern part of the microwatershed. Maximum area of 243 ha (40%) is moderately alkaline (pH 7.8-8.4) in reaction and is distributed in the major part of the microwatershed (Fig. 6.1). Slightly alkaline (pH 7.3-7.8) is around 113 ha (18%) area and is distributed in the northern, central, northwestern and northeastern part of the microwatershed. An area of about 171 ha (28%) is neutral (pH 6.5-7.3) and is distributed in the central, eastern, northeastern, northern and northwestern part of the microwatershed. Thus, major soils in the microwatershed are alkaline in reaction.

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

The soil organic carbon content (Fig. 6.3) of the soils in the microwatershed is high (>0.75%) in an area of 224 ha (36%) and are distributed in the northeastern, eastern, southern and southwestern part of the microwatershed. Medium (0.5-0.75%) in organic carbon content cover an area of 316 ha (52%) and is distributed in the major part of the microwatershed. An area of 30 ha (5%) is low (<0.5%) and are distributed in the northwestern part of the microwatershed.

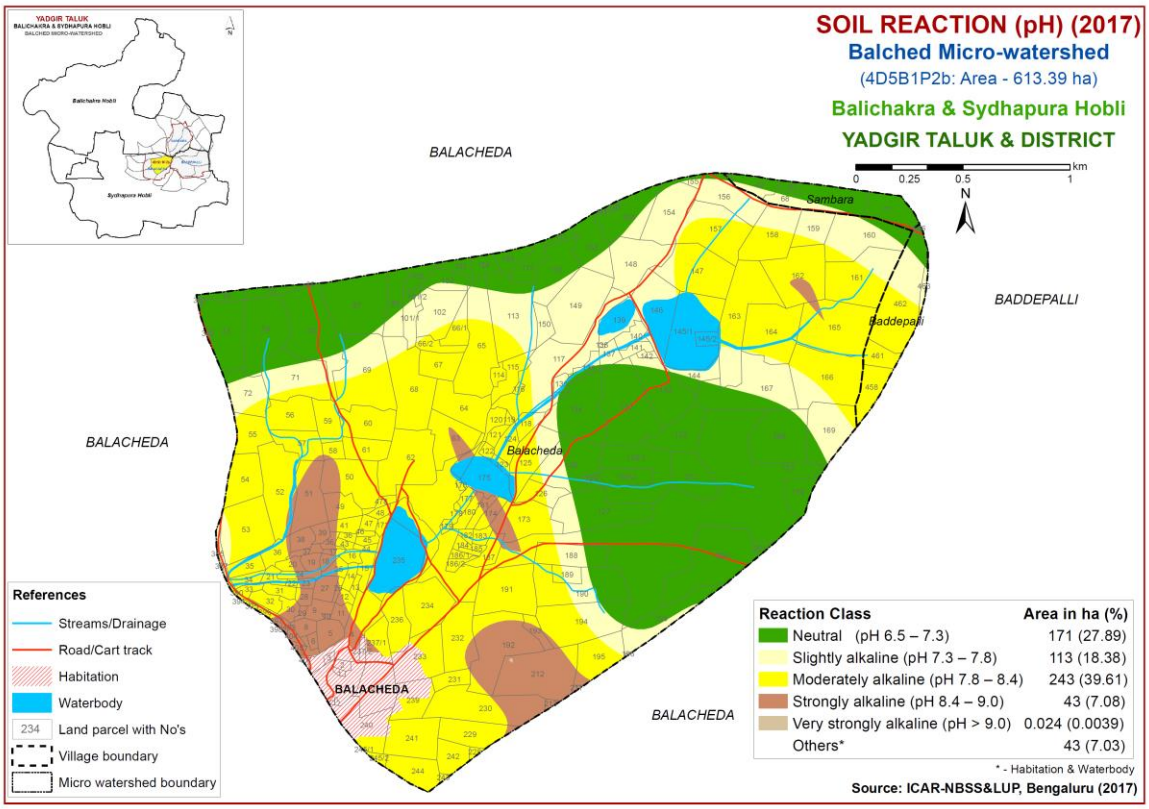


Fig.6.1 Soil Reaction (pH) map of Balched Microwatershed

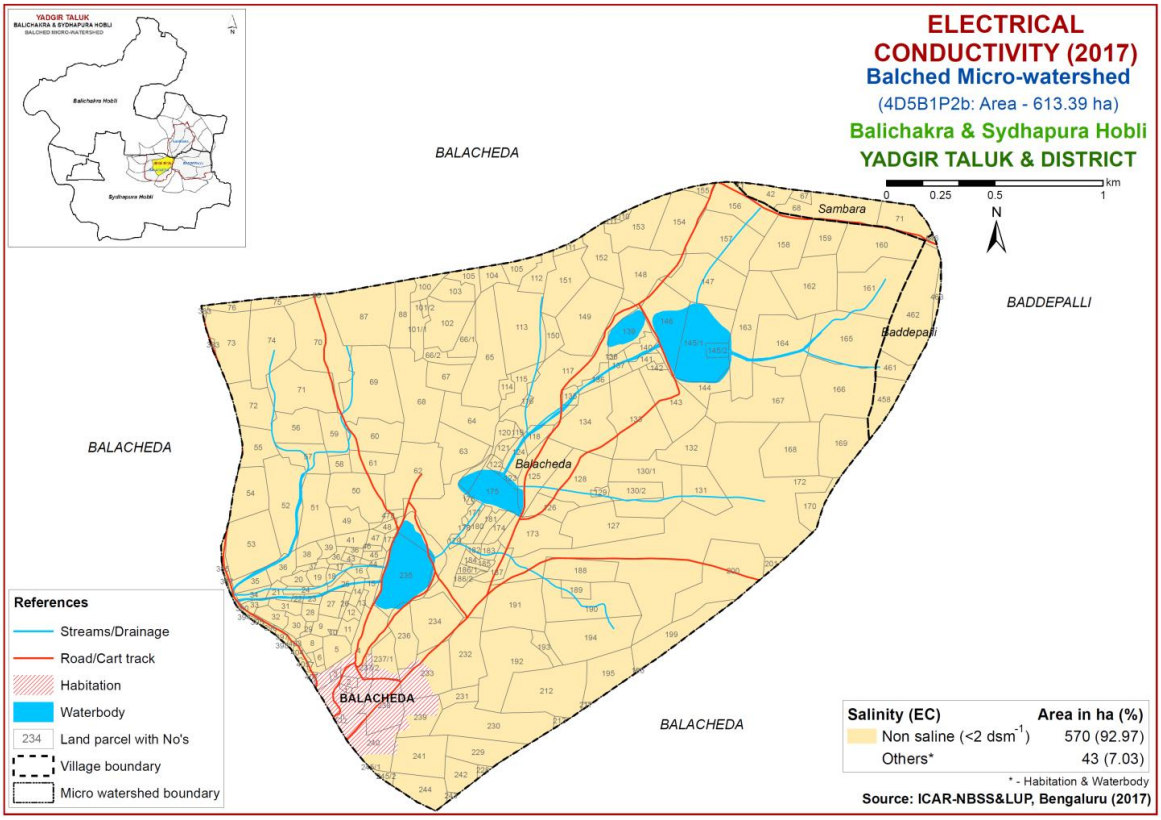


Fig.6.2 Electrical Conductivity (EC) map of Balched Microwatershed

6.4 Available Phosphorus

The soil fertility analysis revealed that available phosphorus (Fig. 6.4) is medium (23-57 kg/ha) in an area of 199 ha (32%) and is distributed in the northeastern, southern and northwestern part of the microwatershed. Maximum area of about 372 ha (61%) is high (>57 kg/ha) in available phosphorus and is distributed in the major part of the microwatershed. There is an urgent need to increase the dose of phosphorous in soils that are low and medium for all the crops by 25 per cent over the recommended dose to realize better crop performance.

6.5 Available Potassium

Available potassium content (Fig. 6.5) is low (<145 kg/ha) in area of 152 ha (25%) and are distributed in the central and northeastern part of the microwatershed. Maximum area of about 384 ha (63%) is medium (145-337 kg/ha) and is distributed in the major part of the microwatershed. High available potassium (>337 kg/ha) content cover a small area of 34 ha (6%) and is distributed in the southern and western part of the microwatershed.

6.6 Available Sulphur

Soils that are high in available sulphur content (>20 ppm) occur in a small area of 48 (8%) and is distributed in the central and western part of the microwatershed. Medium (10-20 ppm) in an area of about 219 ha (36%) and is distributed in the northeastern, central, western and southern part of the microwatershed. Available sulphur is low (<10 ppm) in a maximum area of 303 ha (49%) and is distributed in the major part of the microwatershed (Fig. 6.6). The areas that are low and medium in available sulphur need to be applied with magnesium sulphate or gypsum or factomphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected.

6.7 Available Boron

Available boron content (Fig. 6.7) is low (<0.5 ppm) in a small area of 30 ha (5%) and is distributed in the western and southern part of the microwatershed. Maximum area of about 486 ha (79%) is medium (0.5-1.0 ppm) and is distributed in all parts of microwatershed. An area of about 54 ha (9%) is high (>1.0 ppm) in available boron and are distributed in the western, central and northeastern part of microwatershed.

6.8 Available Iron

Available iron content is sufficient (>4.5 ppm) in maximum area of about 545 ha (89%) and is distributed in the major part of the microwatershed. It is deficient (<4.5 ppm) in an area of about 26 ha (4%) and is distributed in the northeastern part of the microwatershed (Fig. 6.8).

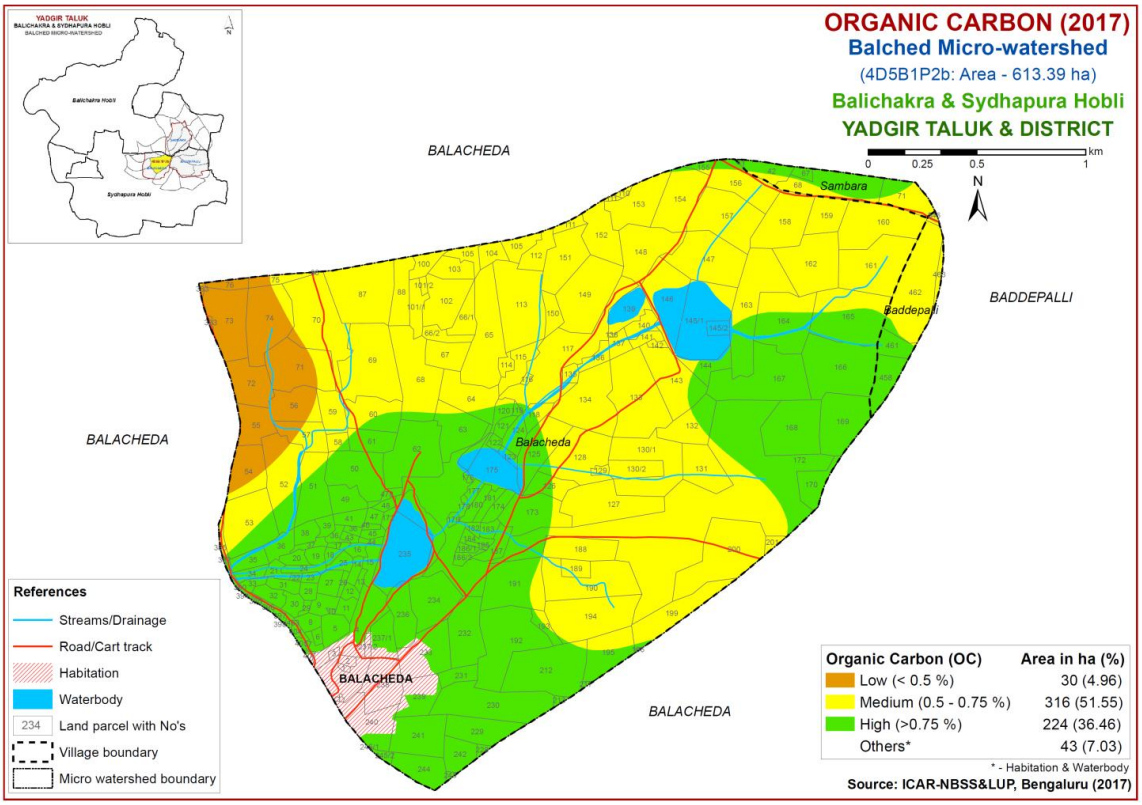


Fig.6.3 Soil Organic Carbon map of Balched Microwatershed

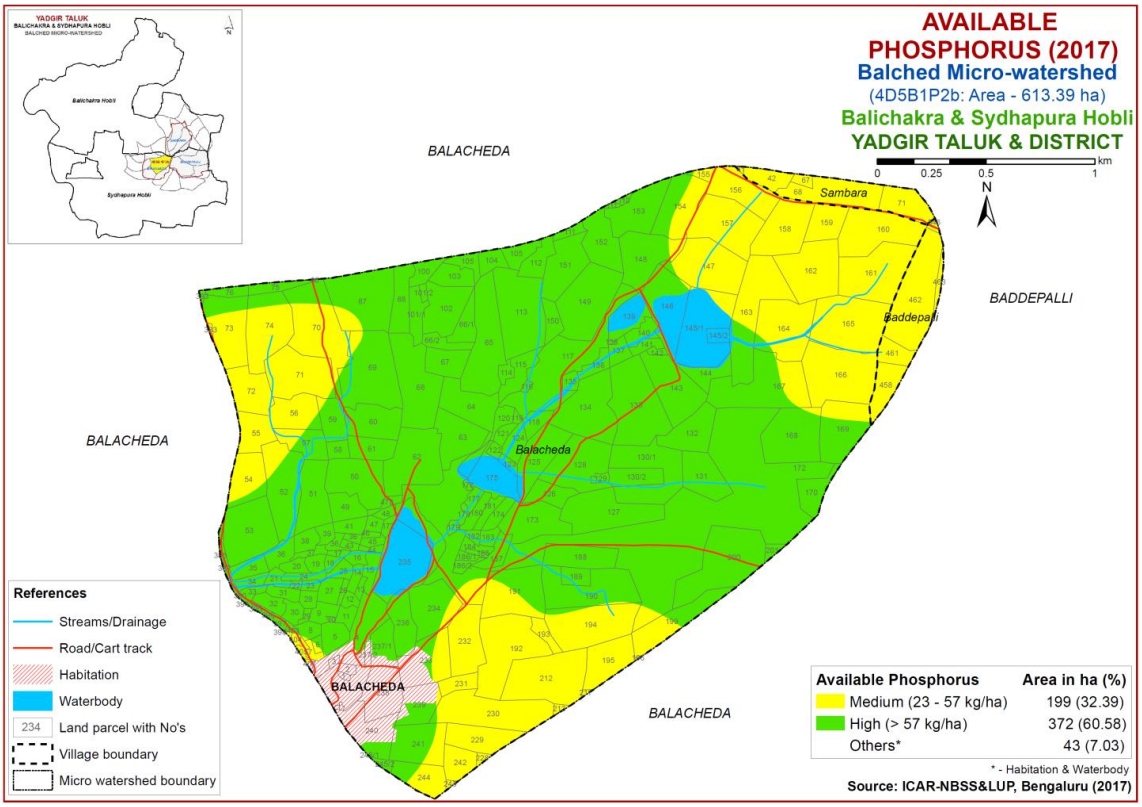


Fig.6.4 Soil available Phosphorus map of Balched Microwatershed

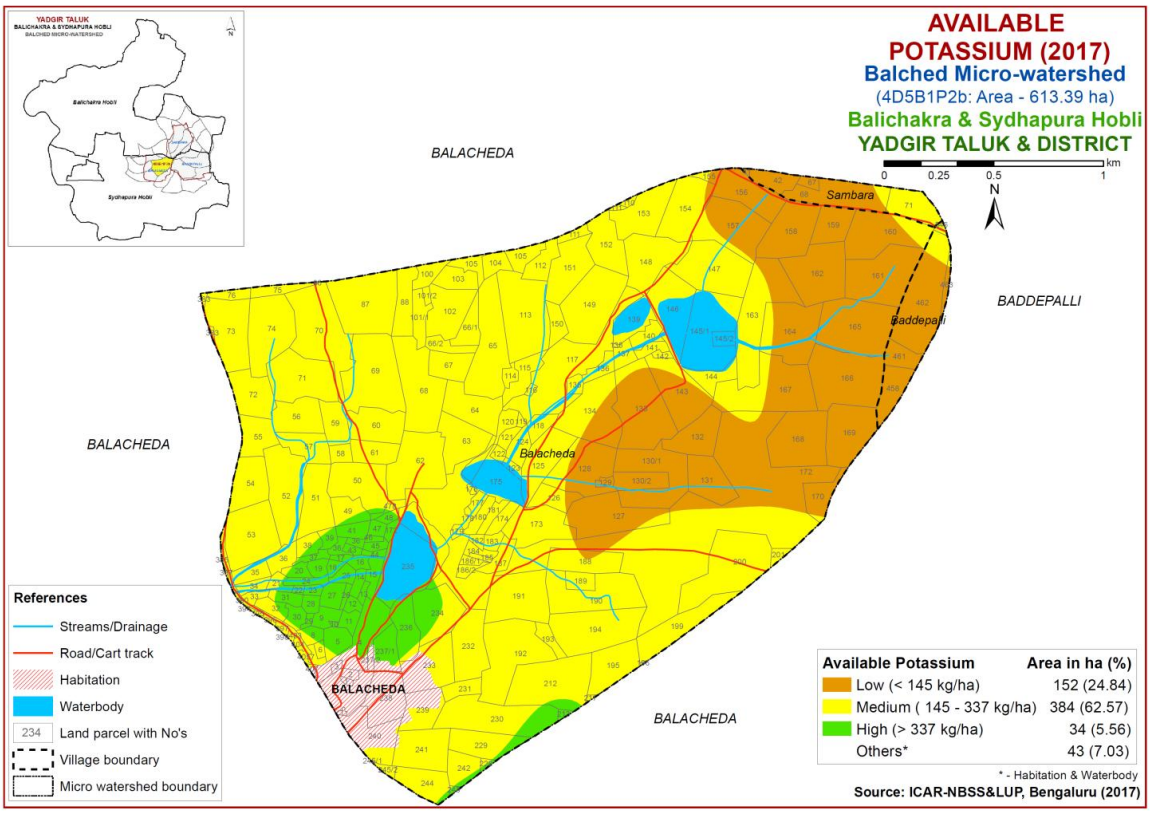


Fig. 6.5 Soil available Potassium map of Balched Microwatershed

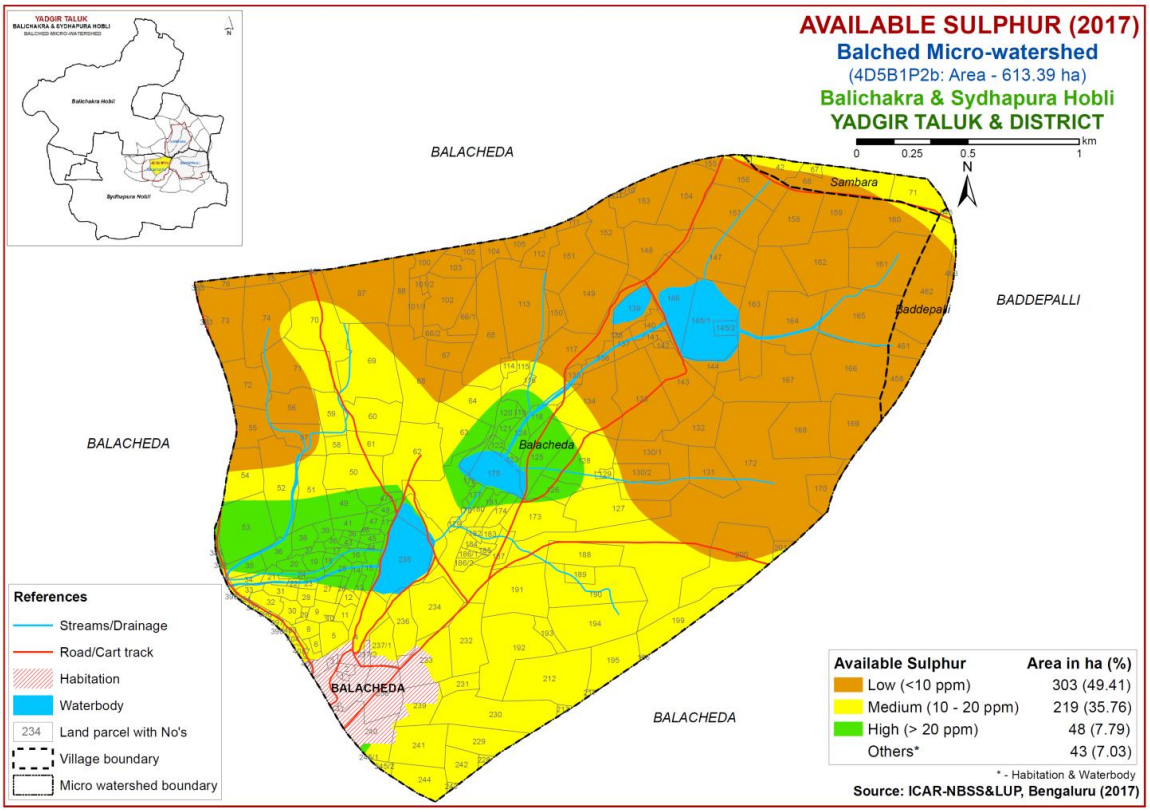


Fig. 6.6 Soil available Sulphur map of Balched Microwatershed

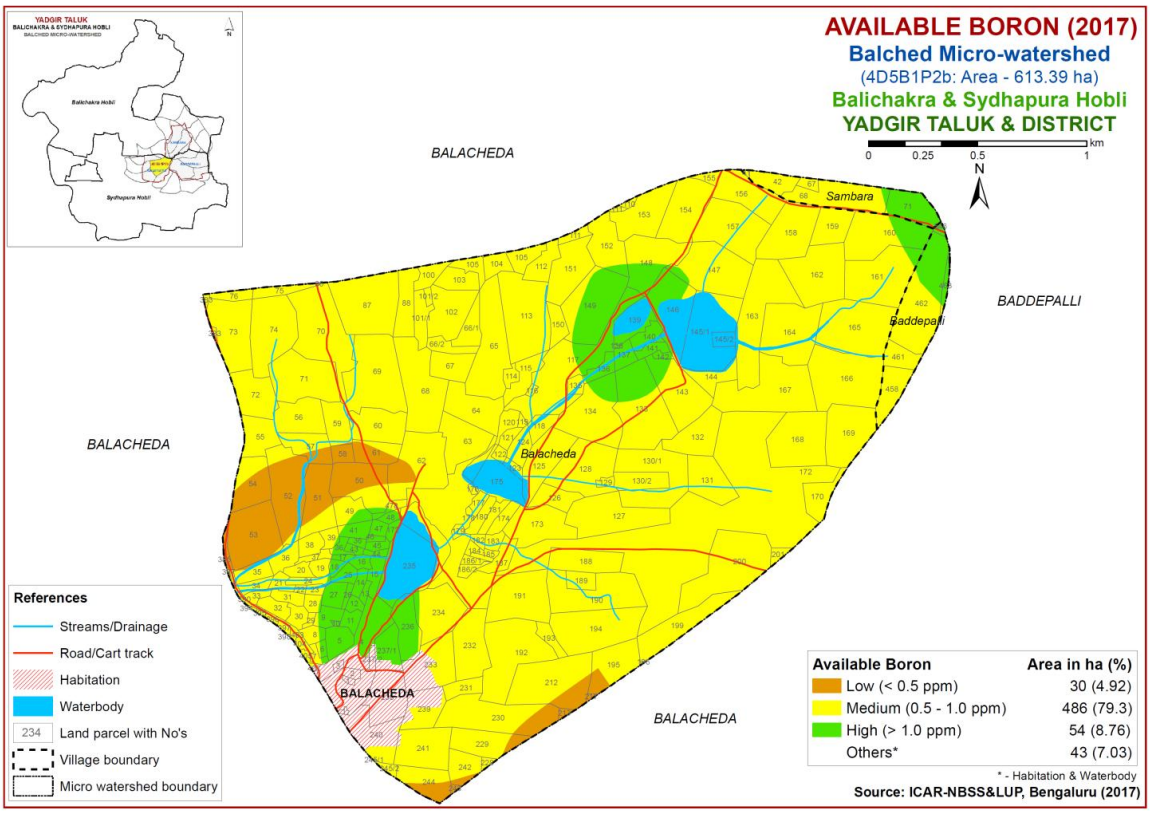


Fig. 6.7 Soil available Boron map of Balched Microwatershed

6.9 Available Manganese

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

6.10 Available Copper

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

6.11 Available Zinc

Available zinc content is deficient (<0.6 ppm) in the entire area of the microwatershed (Fig 6.11).

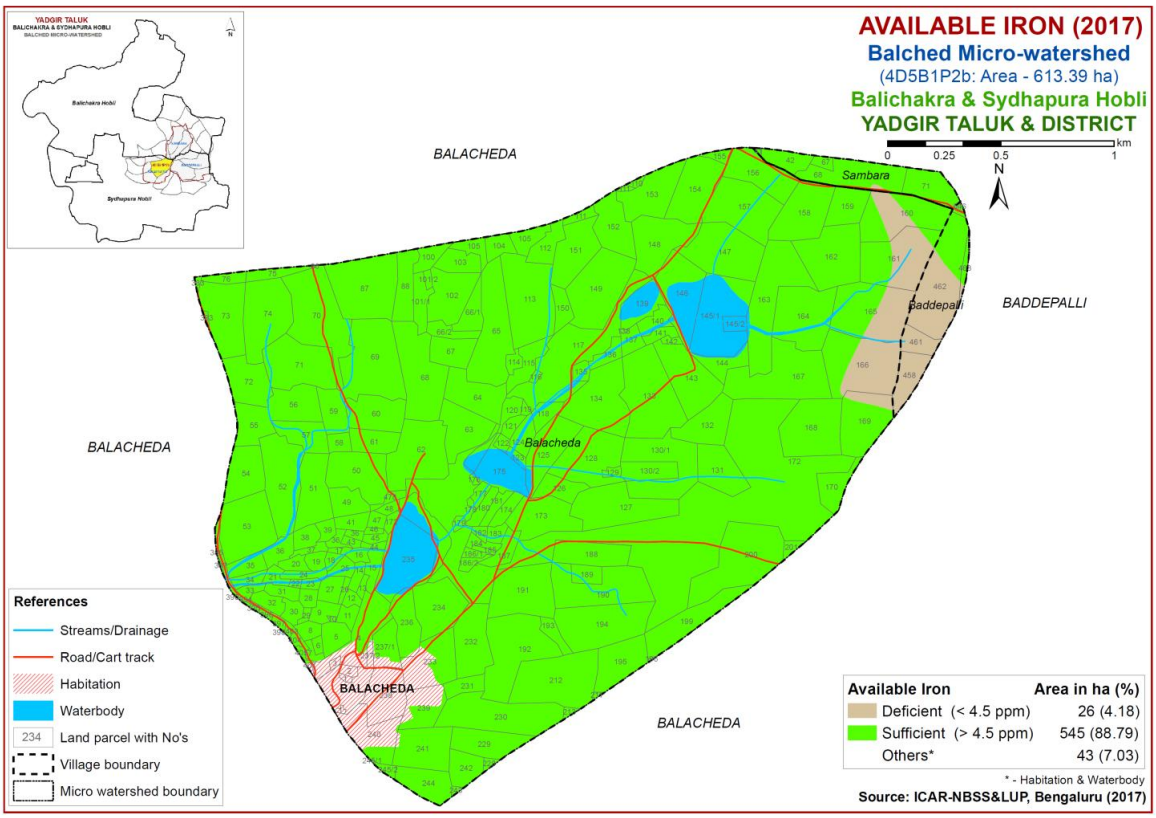


Fig. 6.8 Soil available Iron map of Balched Microwatershed

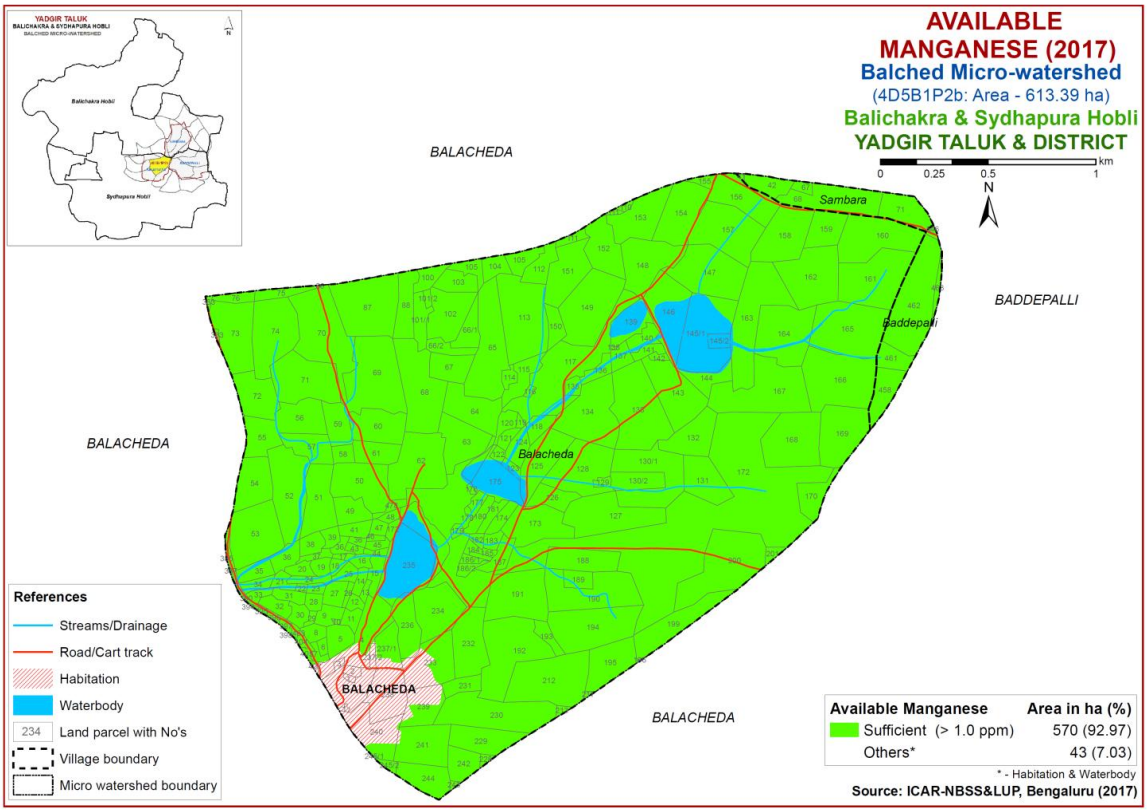


Fig. 6.9 Soil available Manganese map of Balched Microwatershed

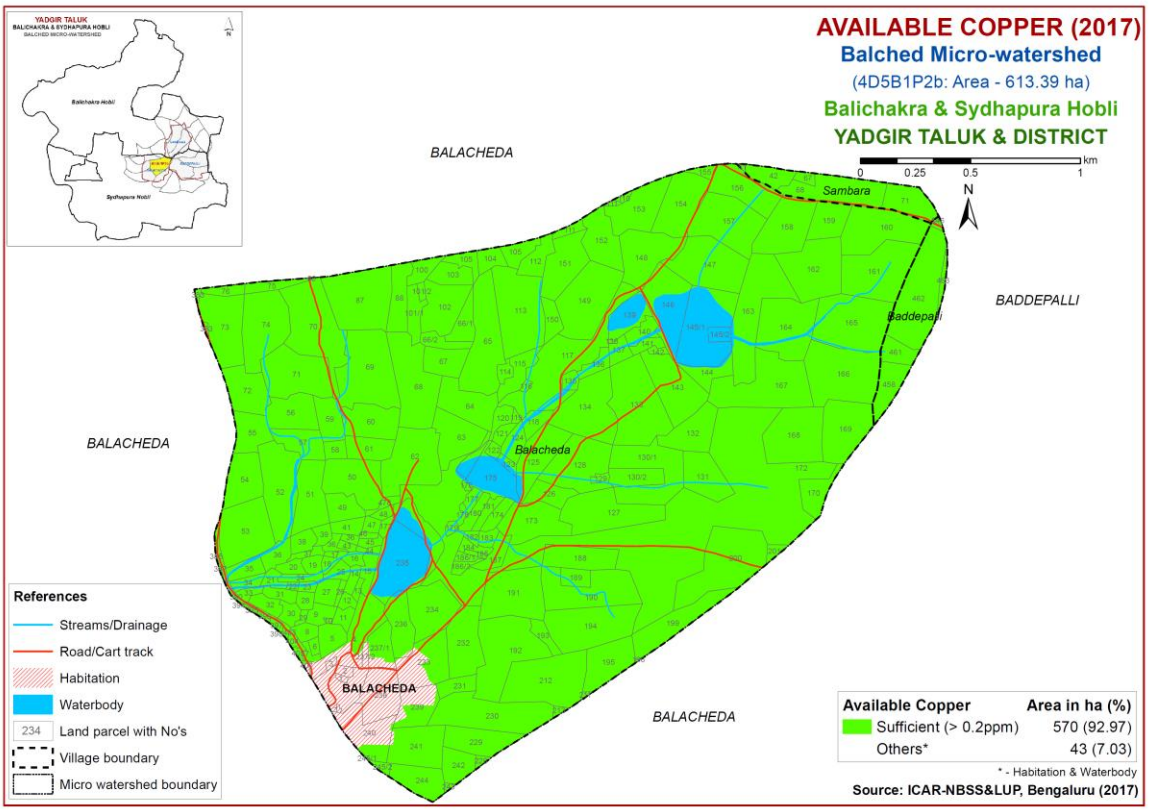


Fig. 6.10 Soil available Copper map of Balched Microwatershed

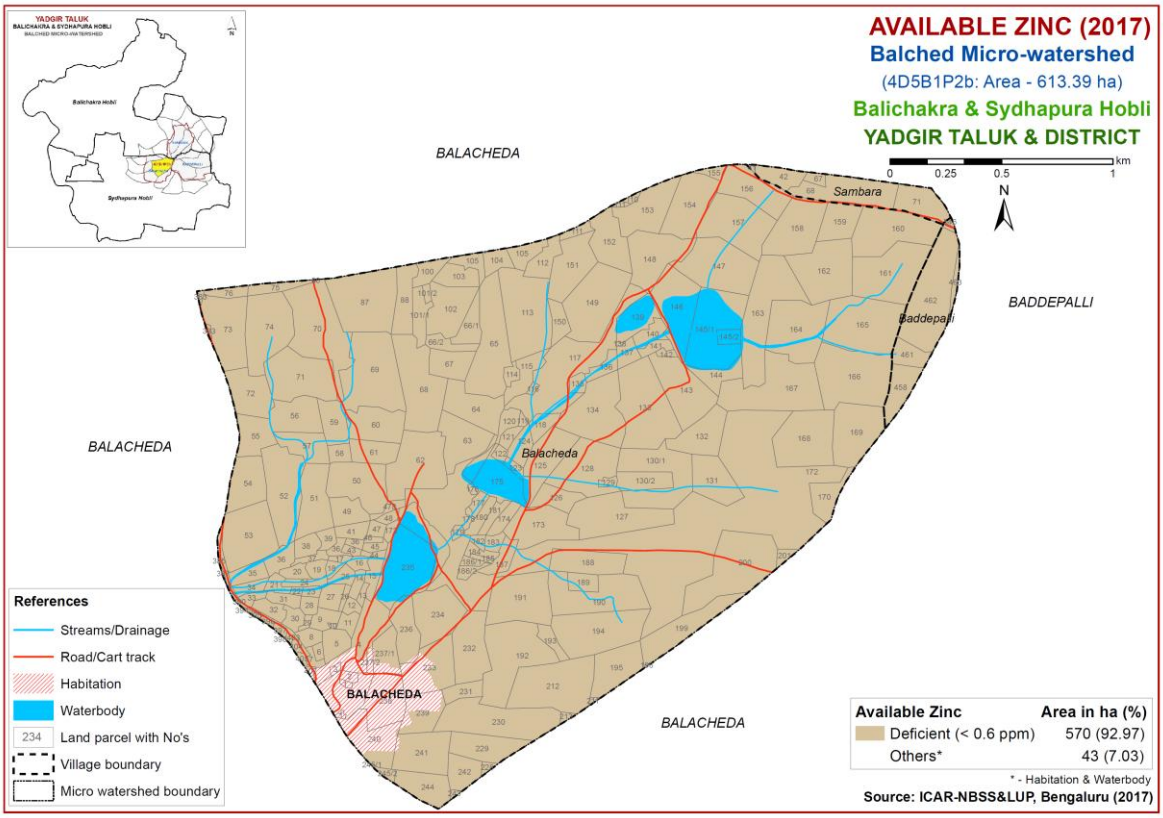


Fig. 6.11 Soil available Zinc map of Balched Microwatershed

Chapter 7

LAND SUITABILITY FOR MAJOR CROPS

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

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Table 7.1 Soil-Site Characteristics of Balched Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC	ESP	CEC [Cmol (p^+) kg^{-1}]	BS (%)
					Surf-ace	Sub-surface	Sur-face (%)	Sub-surface (%)								
BDLbC3	866	120-150	WD	25-50	ls	sl	-	-	<50	3-5	severe	6.20	0.07	0.20	4.20	93
BDLhB2	866	120-150	WD	25-50	scl	sl	-	-	<50	1-3	moderate	6.20	0.07	0.20	4.20	93
BDLiB2	866	120-150	WD	25-50	sc	sl	-	-	<50	1-3	moderate	6.20	0.07	0.20	4.20	93
VNKcB2	866	120-150	WD	25-50	sl	sc	-	-	<50	1-3	moderate	5.37	0.11	2.22	6.27	75
VNKiB2	866	120-150	WD	25-50	sc	sc	-	-	<50	1-3	moderate	5.37	0.11	2.22	6.27	75
HLGbB2g1	866	120-150	MWD	50-75	ls	scl	15-35	-	51-100	1-3	moderate	8.49	0.18	0.69	8.80	100
HLGcB2	866	120-150	MWD	50-75	sl	scl	-	-	51-100	1-3	moderate	8.49	0.18	0.69	8.80	100
DPLcB2	866	120-150	WD	50-75	sl	sc	-	-	51-100	1-3	moderate	6.92	0.12	0.09	7.10	92
DPLiB2	866	120-150	WD	50-75	sc	sc	-	-	51-100	1-3	moderate	6.92	0.12	0.09	7.10	92
YLRbB2	866	120-150	WD	50-75	ls	c	-	15-35	51-100	1-3	moderate	6.91	0.69	0.45	6.90	100
YLRcB2g1	866	120-150	WD	50-75	sl	c	15-35	15-35	51-100	1-3	moderate	6.91	0.69	0.45	6.90	100
KBDbB3	866	120-150	WD	75-100	ls	g scl	-	35-60	<50	1-3	severe	7.84	0.60	4.27	11.50	102
GDGbB2	866	120-150	WD	100-150	ls	scl	-	-	101-150	1-3	moderate	5.57	0.25	0.22	5.83	78
GDGbB3g1	866	120-150	WD	100-150	ls	scl	15-35	-	101-150	1-3	severe	5.57	0.25	0.22	5.83	78
GDGiB2	866	120-150	WD	100-150	sc	scl	-	-	101-150	1-3	moderate	5.57	0.25	0.22	5.83	78
ANRbB2g1	866	120-150	MWD	100-150	ls	c	15-35	-	>200	1-3	moderate	10.17	0.36	17.70	19.90	100
ANRbB3	866	120-150	MWD	100-150	ls	c	-	-	>200	1-3	severe	10.17	0.36	17.70	19.90	100
ANRhB3	866	120-150	MWD	100-150	scl	c	-	-	>200	1-3	severe	10.17	0.36	17.70	19.90	100
BMDcB2	866	120-150	WD	>150	sl	scl	-	-	151-200	1-3	moderate	-	-	-	-	-
TMKbB3	866	120-150	MWD	>150	ls	c	-	-	>200	1-3	severe	9.60	0.35	16.57	21.83	100
TMKiB2	866	120-150	MWD	>150	sc	c	-	-	>200	1-3	moderate	9.60	0.35	16.57	21.83	100
HGNcB2	866	120-150	MWD	>150	sl	c	-	-	>200	1-3	moderate	8.77	1.33	14.38	36.23	100
HGNmB2	866	120-150	MWD	>150	c	c	-	-	>200	1-3	moderate	8.77	1.33	14.38	36.23	100

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

There are no highly suitable (Class S1) lands for growing sorghum in the microwatershed. Maximum area of about 367 ha (60%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of drainage, calcareousness, gravelliness and rooting condition. Marginally suitable lands (Class S3) occupy an area of 203 ha (33%) and are distributed in the western, northwestern, southeastern and northeastern part of the microwatershed. They have moderate limitations of gravelliness and rooting condition.

Table 7.2 Crop suitability criteria for Sorghum

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

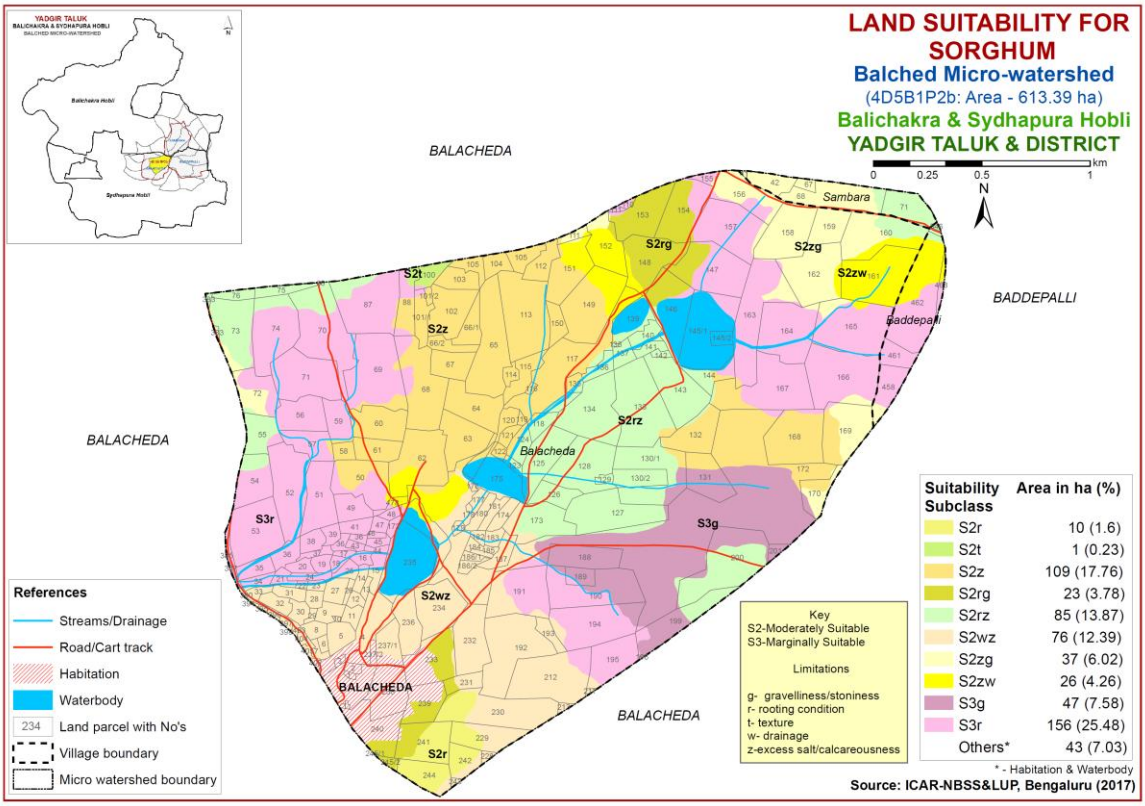


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

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

Table 7.3 Crop suitability criteria for Maize

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

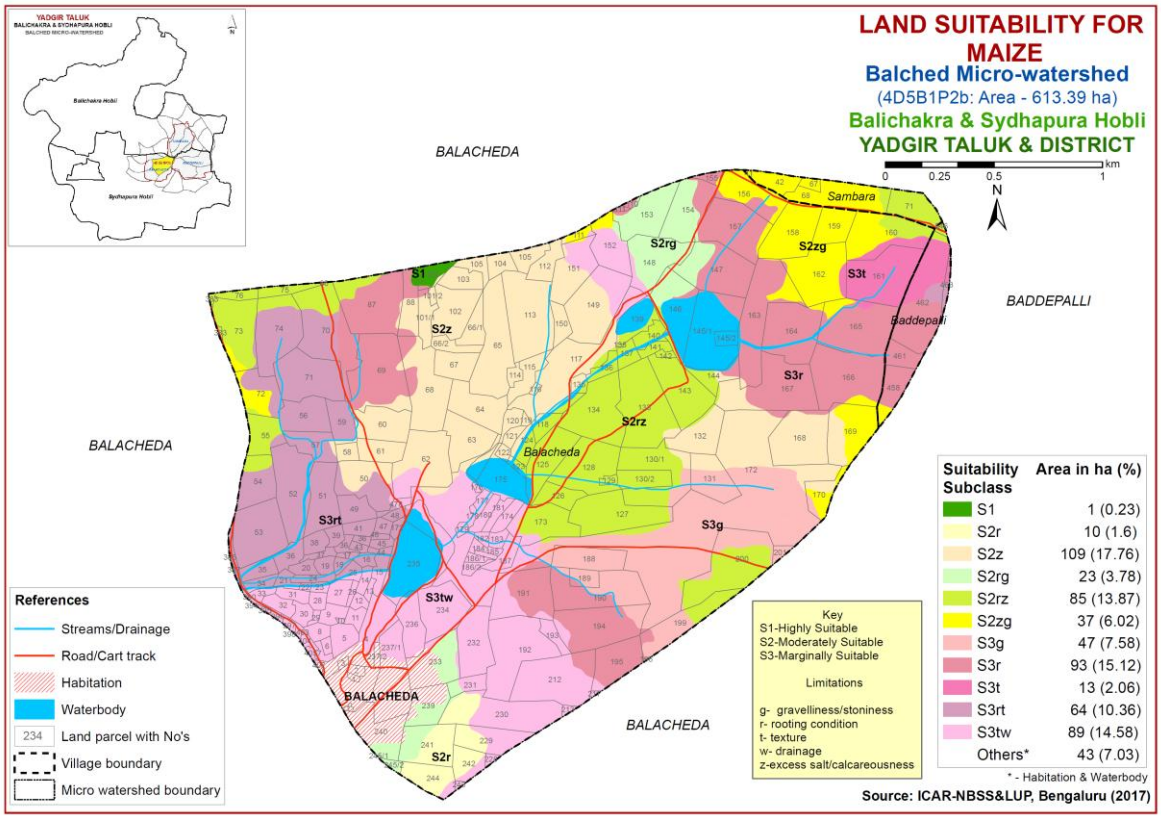


Fig. 7.2 Land Suitability map of Maize

In Balched microwatershed, the highly (Class S1) suitable lands for growing maize occur a minor area of 1 ha (<1%) and are distributed in the northern part of the microwatershed. An area of about 264 ha (43%) is moderately suitable (Class S2) for growing maize and are distributed in the southern, central, eastern, northeastern, northern and northwestern part of the microwatershed. They have minor limitations of calcareousness, gravelliness and rooting depth. Marginally suitable lands (Class S3) occupy maximum area of 306 ha (50%) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, drainage, rooting condition and calcareousness.

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

Red gram is one of the major pulse crop grown in an area of 7.28 lakh ha mainly in northern Karnataka in Bijapur, Kalaburgi, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing red gram (Table 7.4) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing red gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.3.

There are no lands that are highly (Class S1) suitable for growing redgram in Balched microwatershed. Maximum area of about 249 ha (41%) is moderately suitable (Class S2) for red gram and is distributed in all parts of the microwatershed. They have minor limitations of texture, gravelliness, calcareousness and drainage. An area of about 322 ha (52%) is marginally suitable (Class S3) for growing red gram and are distributed in the major of the microwatershed. They have moderate limitations of rooting condition, gravelliness, texture and calcareousness.

Table 7.4 Crop suitability criteria for Red gram

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

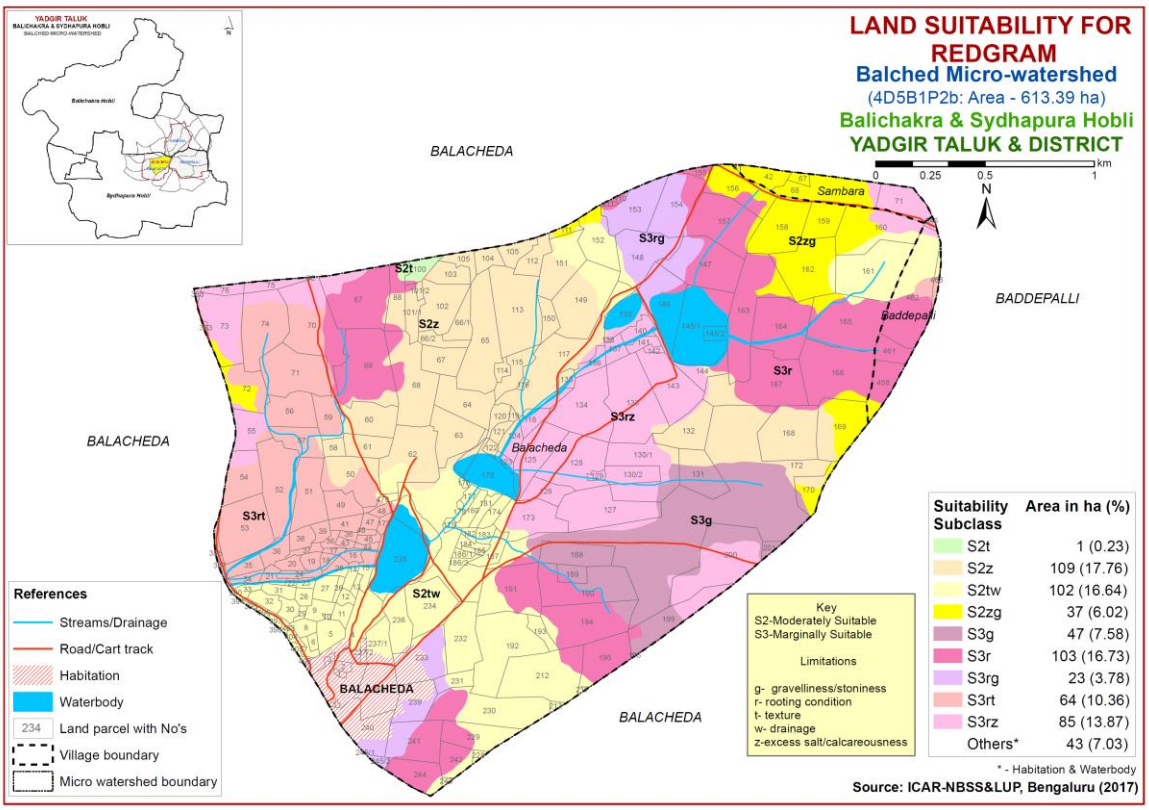


Fig. 7.3 Land Suitability map of Red gram

7.4 Land Suitability for Bajra (*Pennisetum glaucum)*

Bajra is one of the most important millet crop grown in an area of 2.34 lakh ha in the northern districts of Karnataka State. The crop requirements for growing bajra (Table 7.5) 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 is given in Figure 7.4.

Table 7.5 Crop suitability criteria for Bajra

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

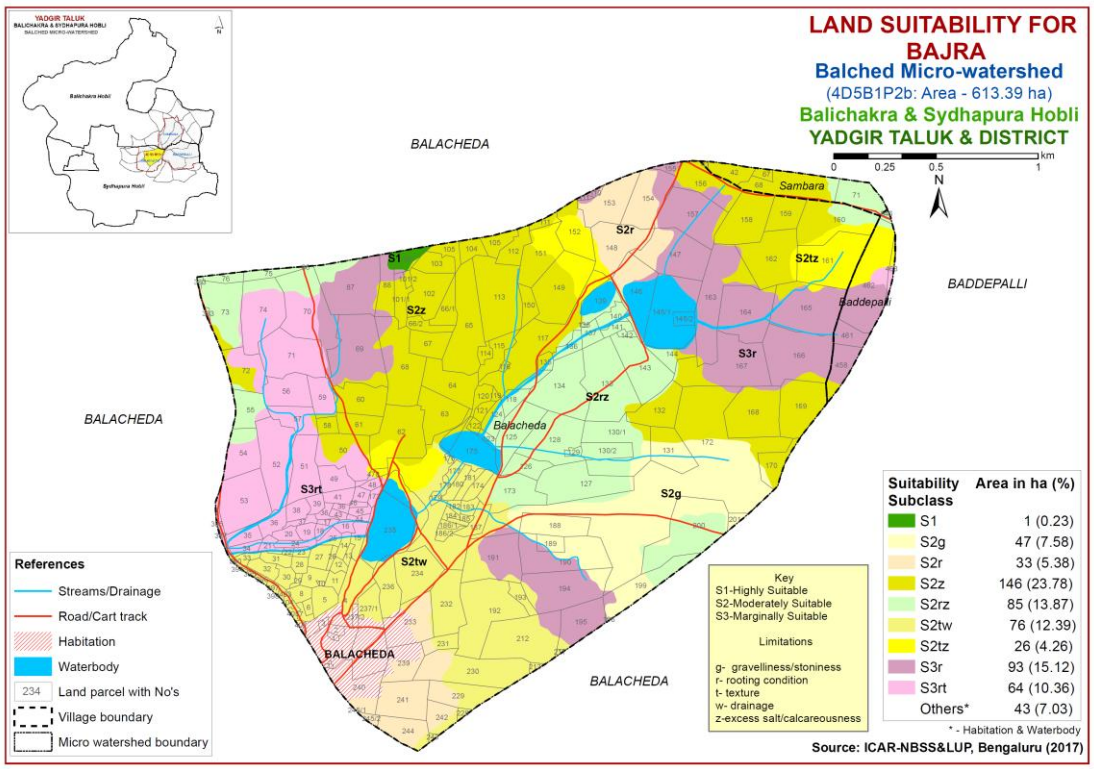


Fig. 7.4 Land Suitability map of Bajra

In Balched microwatershed, the lands that are highly (Class S1) suitable for growing bajra occur in a minor area of about 1 ha (<1%) and are distributed in the northern part of the microwatershed. Maximum area of about 413 ha (67%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of drainage, texture, calcareousness and rooting condition. Marginally suitable lands (Class S3) occur in an area of 157 ha (25%) and are distributed in the western, northwestern, northeastern and southeastern part of the microwatershed. They have moderate limitations of texture and rooting condition.

7.5 Land suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in almost all the districts of the State. The crop requirements for growing groundnut (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.5.

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing groundnut in the microwatershed. Moderately suitable (Class S2) lands cover an area of 311 ha (51%) and occur in the major part of the microwatershed. They have minor limitations of calcareousness, texture, gravelliness and rooting condition. The marginally suitable (Class S3) lands cover an area of about 258 ha (42%) and occur in the southern, western, northern and northeastern part of the microwatershed. They have moderate limitations of texture, rooting condition and drainage.

Table 7.6 Land suitability criteria for Groundnut

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

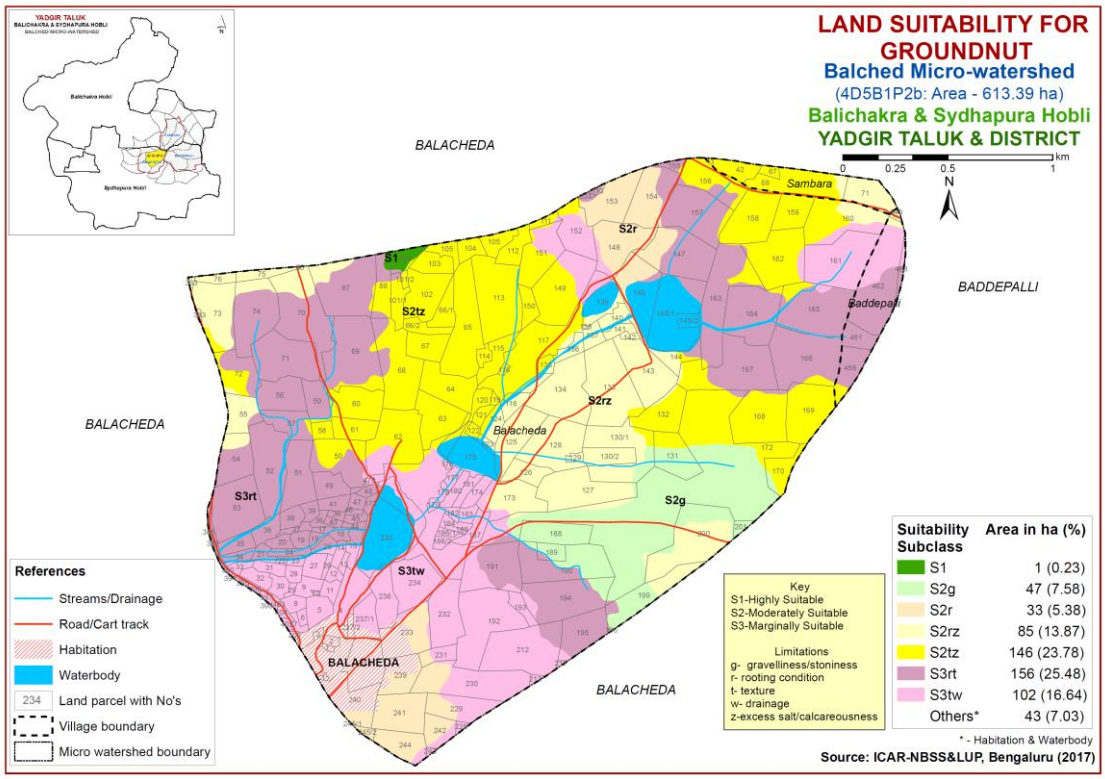


Fig. 7.5 Land Suitability map of Groundnut

7.6 Land Suitability for Sunflower (*Helianthus annus*)

Sunflower is one of the most important oilseed crop grown in an area of 3.56 lakh ha in the State in all the districts. The crop requirements for growing sunflower (Table 7.7) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing sunflower was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.6.

Table 7.7 Crop suitability criteria for Sunflower

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

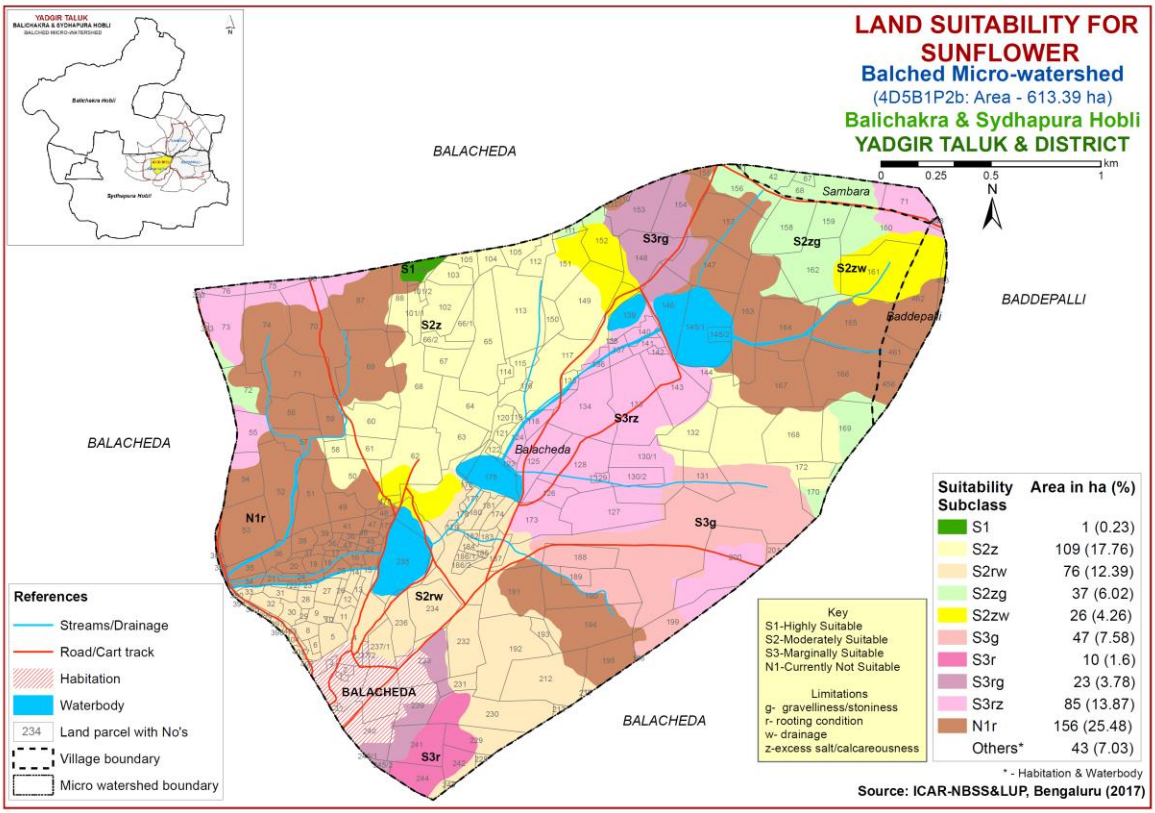


Fig. 7.6 Land Suitability map of Sunflower

A minor area of about 1 ha (<1%) is highly (Class S1) suitable for growing sunflower in the microwatershed. Maximum area of about 248 ha (40%) is moderately suitable (Class S2) and is distributed in the northern, southern, eastern and northeastern part of the microwatershed. They have minor limitations of rooting condition, gravelliness, calcareousness and drainage. An area of about 165 ha (27%) is marginally suitable (Class S3) and are distributed in the northeastern, eastern, central, southern and northwestern part of the microwatershed. They have moderate limitations of rooting

condition, gravelliness and calcareousness. An area of 156 ha (25%) is currently not suitable (Class N1) for growing sunflower and are distributed in the southeastern, northeastern, western and northwestern part of the microwatershed with severe limitation of rooting condition.

7.7 Land Suitability for Cotton (*Gossypium hirsutum*)

Cotton is one of the most important fibre crop grown in the state in about 8.75 lakh ha area in Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga and Chamarajnagar districts. The crop requirements for growing cotton (Table 7.8) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing cotton was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.7.

There are no highly (Class S1) suitable lands for growing cotton in the microwatershed. Maximum area of about 366 ha (60%) is moderately suitable (Class S2) for growing cotton and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, drainage, calcareousness and rooting condition. Marginally suitable (Class S3) lands occur in an area of 204 ha (33%) and are distributed in the northeastern, western, northwestern and eastern part of the microwatershed with moderate limitations of texture, gravelliness and rooting condition.

Table 7.8 Crop suitability criteria for Cotton

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

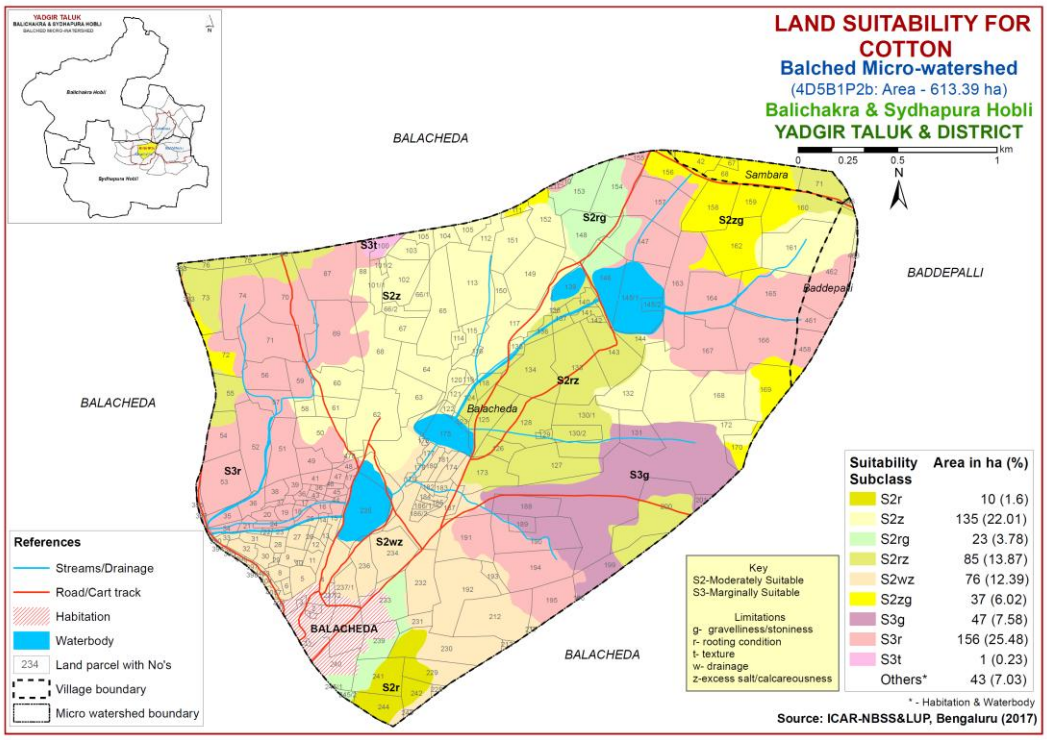


Fig. 7.7 Land Suitability map of Cotton

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

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

Table 7.9 Crop suitability criteria for Bengal gram

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

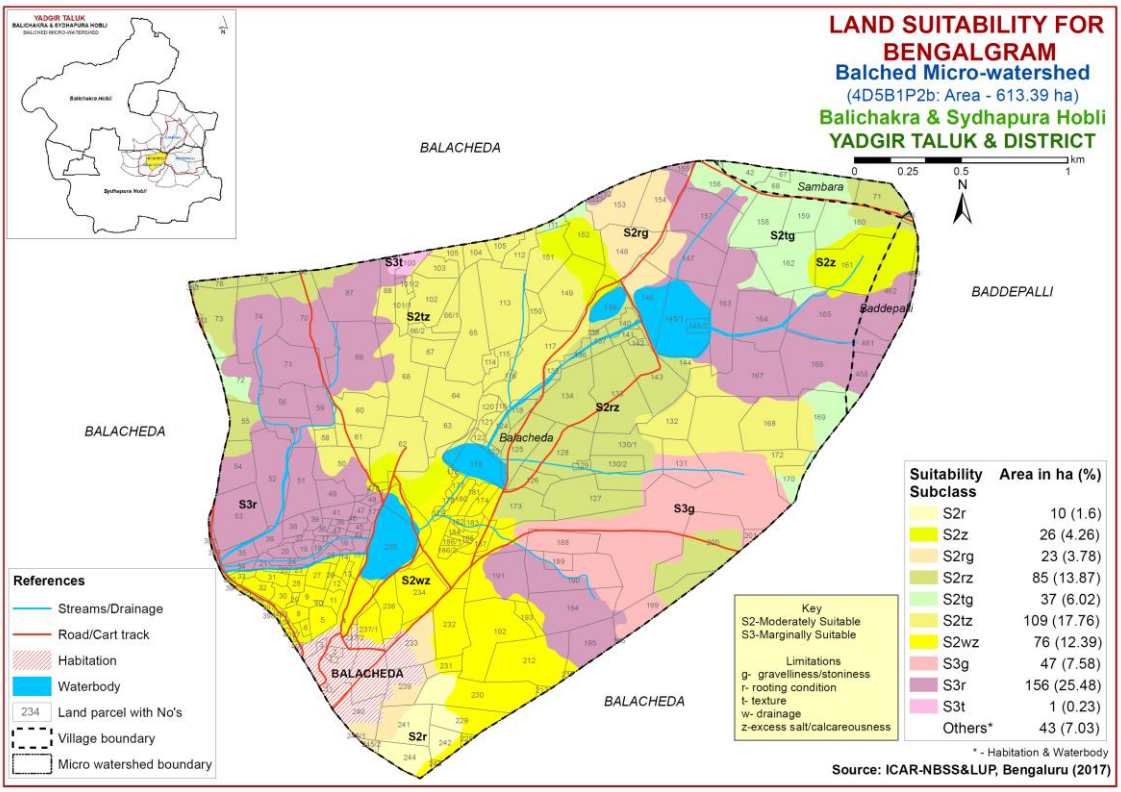


Fig. 7.8 Land Suitability map of Bengal gram

There are no highly (Class S1) suitable lands for growing bengal gram in the microwatershed. Maximum area of about 366 ha (60%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, texture, calcareousness, drainage and rooting condition. Marginally suitable (Class S3) lands occur in an area of 204 ha (33%) and are distributed in the northeastern, eastern, western and northwestern part of the microwatershed with moderate limitations of texture, gravelliness and calcareousness.

7.9 Land Suitability for Chilli (*Capsicum annuum)*

Chilli is one of the most important fruit and spice crop grown in about 0.42 lakh ha in Karnataka State. The crop requirements for growing chilli (Table 7.10) 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.

A minor area of 1 ha (<1%) is highly (Class S1) suitable for growing chilli in the microwatershed. Maximum area of about 366 ha (60%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of drainage, texture, calcareousness, gravelliness and rooting condition. Marginally suitable lands (Class S3) occur in an area of about 204 ha (33%) and are distributed in the northeastern, eastern, western and northwestern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness 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	Very poorly drained
Soil reaction	pH	6.5-7.8, 6.0-7.0	7.8-8.4	8.4-9.0, 5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl, sc, sic,c(m/k)	c(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	%vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

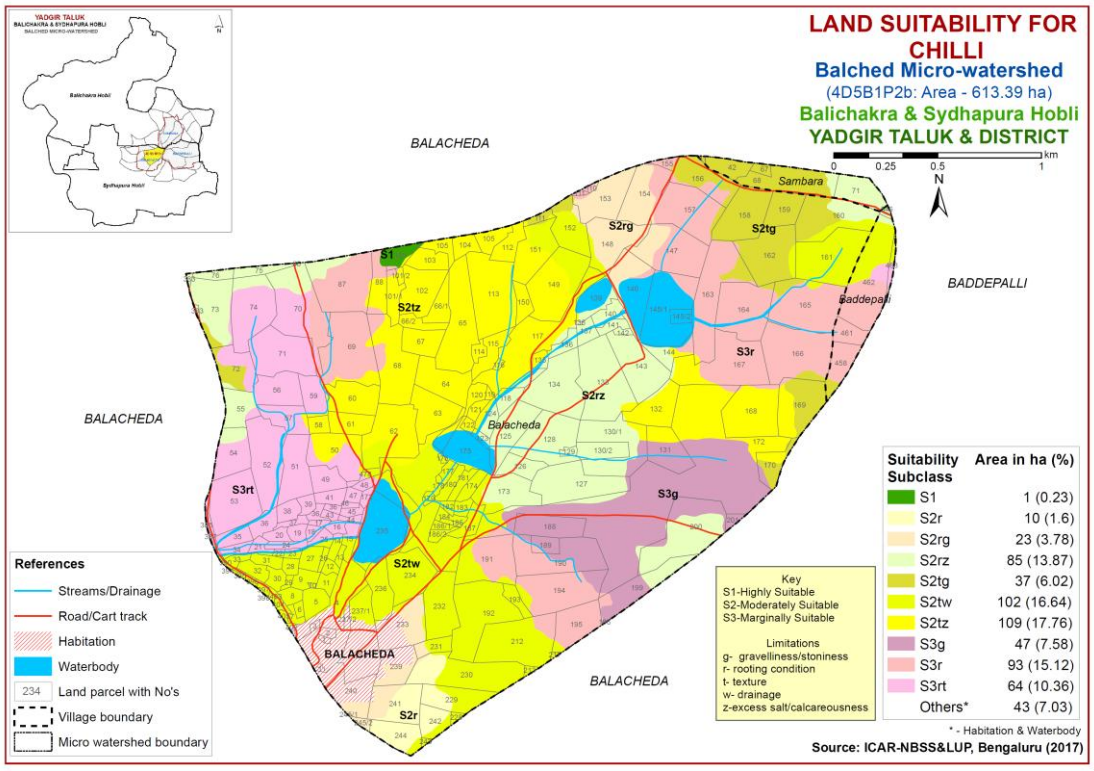


Fig 7.9 Land Suitability map of Chilli

7.10 Land Suitability for Tomato (*Lycopersicon esculentum*)

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

Table 7.11 Crop suitability criteria for Tomato

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

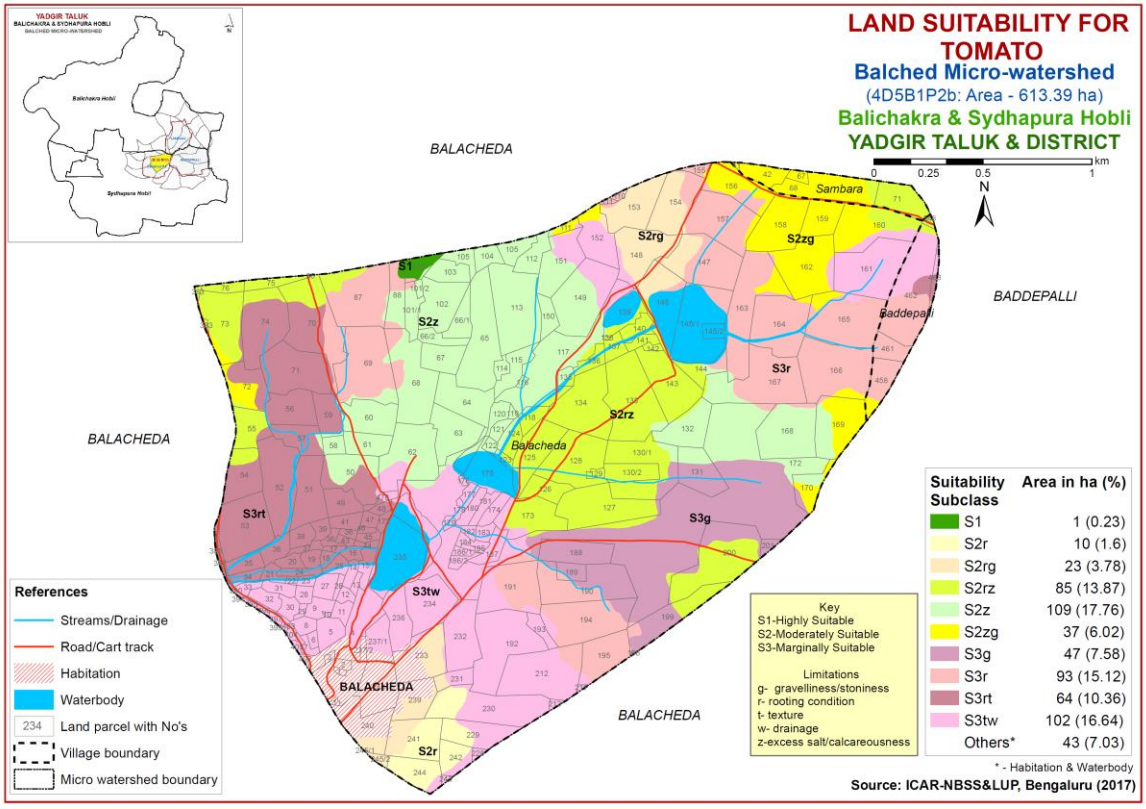


Fig 7.10 Land Suitability map of Tomato

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing tomato and are distributed in the northern part of the microwatershed. The moderately suitable (Class S2) lands cover an area of about 264 ha (43%) and occur in the southern, eastern,

northeastern, central, northern and northwestern part of the microwatershed. They have minor limitations of calcareousness, gravelliness and rooting condition. The marginally suitable (Class S3) lands cover a maximum area of about 306 ha (50%) and occur in the major part of the microwatershed. They have moderate limitations of texture, rooting condition, gravelliness and drainage.

7.11 Land Suitability for Drumstick (*Moringa oleifera*)

Drumstick is one of the most important vegetable crop grown in about 2403 ha in the State. The crop requirements for growing drumstick (Table 7.12) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing drumstick was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.11.

Highly (Class S1) suitable lands occur in a minor area of about 1 ha (<1%) for growing drumstick in the microwatershed. Maximum area of about 295 ha (48%) is moderately suitable (Class S2) for drumstick and are distributed in the major part of the microwatershed. They have minor limitations of gravelliness, texture, calcareousness and drainage. An area of about 118 ha (19%) is marginally suitable (Class S3) for growing drumstick and are distributed in the central, southern, eastern, northeastern and northwestern part of the microwatershed. They have moderate limitations of rooting condition and calcareousness. Not suitable (Class N1) lands occupy an area of about 157 ha (25%) for drumstick and are distributed in the western, northwestern, southeastern and northeastern part of the microwatershed.

Table 7.12 Crop suitability criteria for Drumstick

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

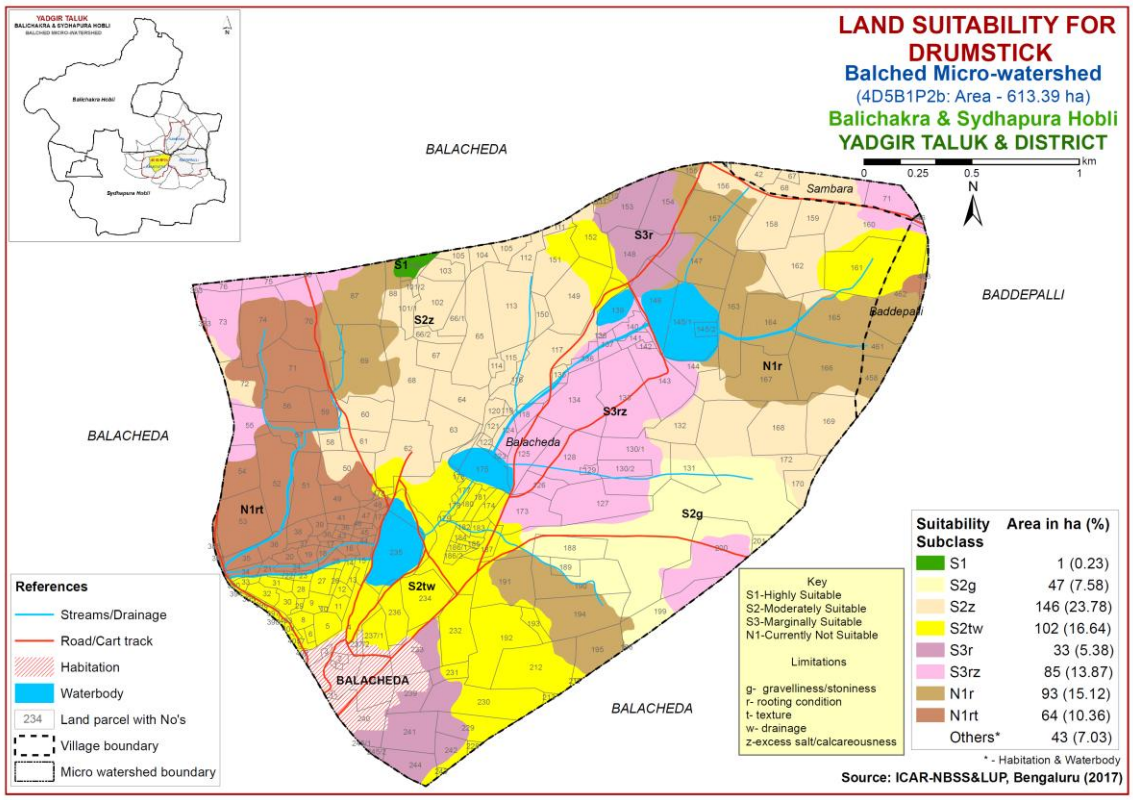


Fig 7.11 Land Suitability map of Drumstick

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the important leaf crop grown for rearing silk worm in about 1,66,000 ha area in all the districts of the state. The crop requirements for growing mulberry (Table 7.13) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mulberry was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.12.

An area of about 1 ha (<1%) is highly (Class S1) suitable for growing mulberry in the microwatershed. An area of about 193 ha (31%) is moderately suitable (Class S2) and are distributed in the eastern, northeastern, northern and northwestern part of the microwatershed. They have minor limitations of gravelliness and calcareousness. Marginally suitable lands (Class S3) occur in an area of 220 ha (36%) and are distributed in the major part of the microwatershed. They have moderate limitations of rooting condition, calcareousness and drainage. Not suitable (Class N1) lands occupy an area of about 157 ha (25%) for mulberry and are distributed in the western, northwestern, southeastern and northeastern part of the microwatershed.

Table 7.13 Crop suitability criteria for Mulberry

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

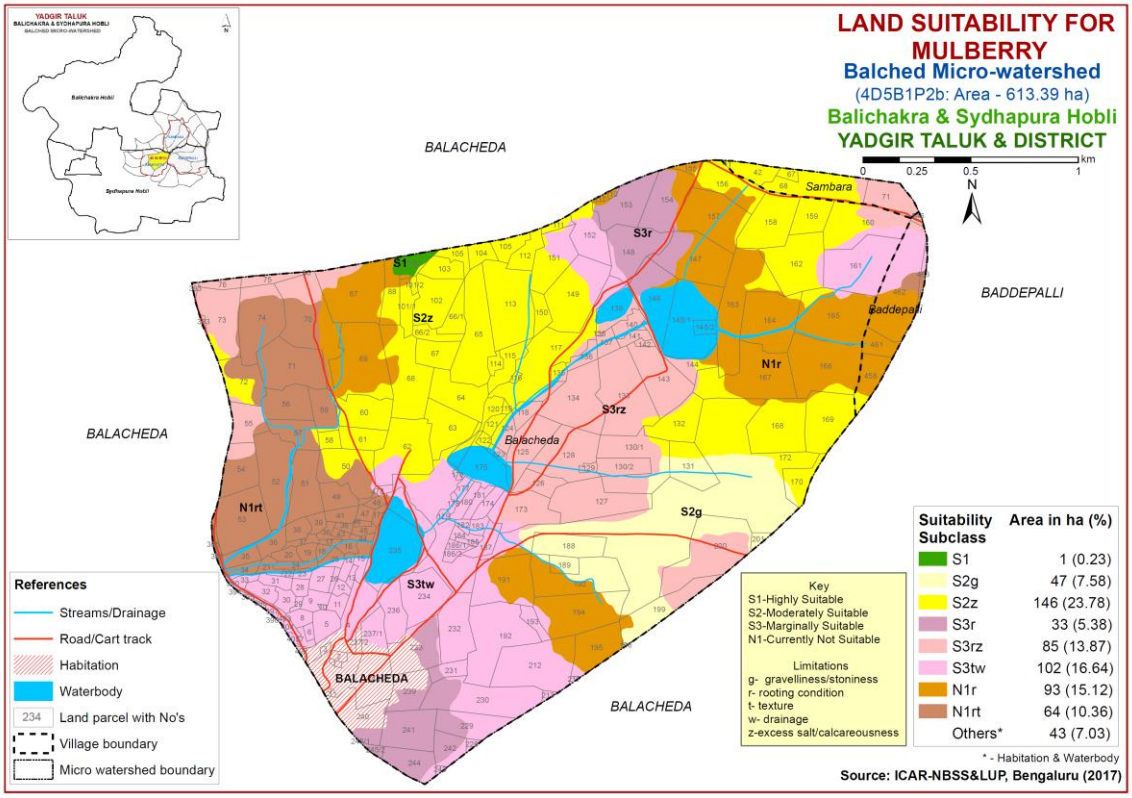


Fig 7.12 Land Suitability map of Mulberry

7.13 Land Suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 173080 ha in all the districts of the State. The crop requirements for growing mango (Table 7.14) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.13.

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing mango in the microwatershed. Moderately suitable (Class S2) lands occupy 146 ha (24%) and are distributed in the northern, northwestern, eastern and northeastern part of the microwatershed. They have minor limitations of rooting condition and calcareousness. An

area of about 149 ha (24%) is marginally suitable (Class S3) and are distributed in the northern, northeastern, southern, southwestern and eastern part of the microwatershed. They have moderate limitations of texture, drainage, calcareousness, gravelliness and rooting condition. Not suitable lands (Class N1) occupy an area of 274 ha (45%) and are distributed in all parts of the microwatershed. They have severe limitations of rooting condition and calcareousness.

Table 7.14 Crop suitability criteria for Mango

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

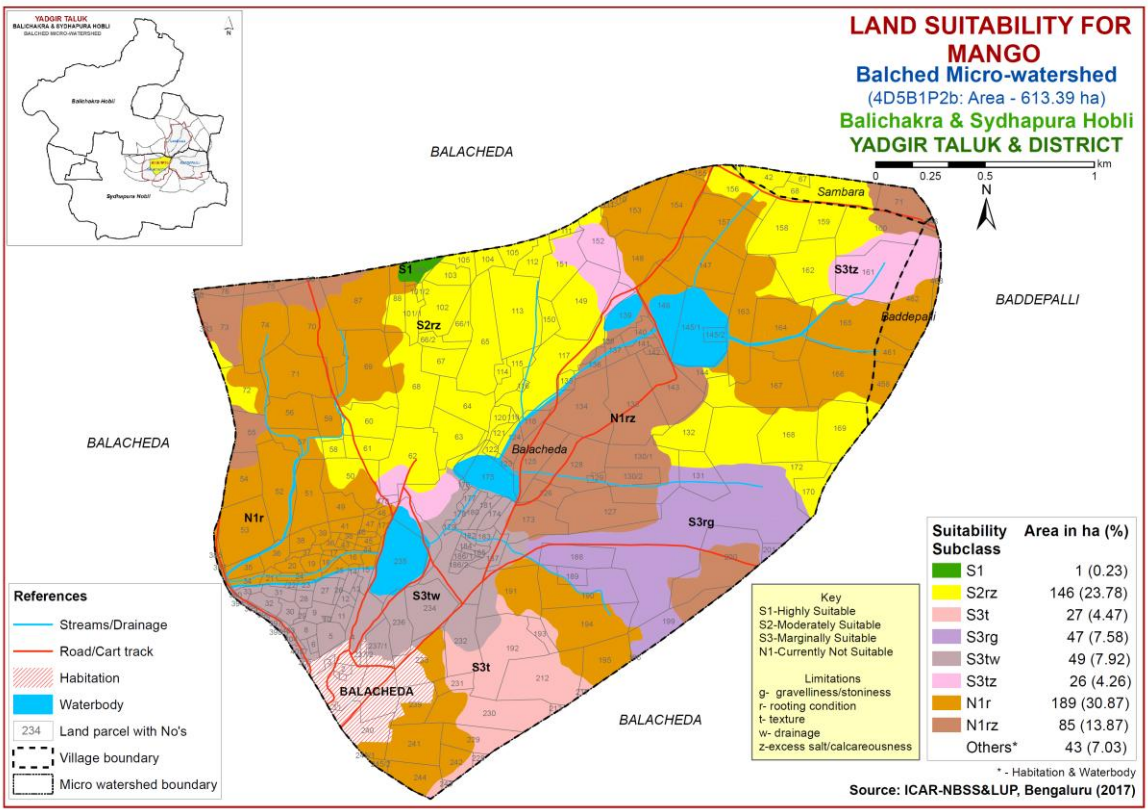


Fig. 7.13 Land Suitability map of Mango

7.14 Land Suitability for Sapota (*Manilkara zapota*)

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

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing sapota in the microwatershed. Moderately (Class S2) suitable lands occur in an area of 193 ha (31%) and are distributed in the northern, northwestern, northeastern and eastern part of the microwatershed. They have minor limitations of gravelliness and calcareousness. Maximum area of about 267 ha (43%) is marginally suitable (Class S3) for sapota and are distributed in the major part of the microwatershed. They have moderate limitations of texture, drainage, calcareousness and rooting depth. An area of about 156 ha (25%) is currently not suitable (Class N1) and are distributed in the southeastern, western, northwestern and northeastern part of the microwatershed.

Table 7.15 Crop suitability criteria for Sapota

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable (S3)	Not suitable(N)
Climate	Temperature in growing season	^{0} C	28-32	33-36 24-27	37-42 20-23	>42 <18
Soil moisture	Growing period	Days	>150	120-150	90-120	<120
Soil aeration	Soil drainage	class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availabiliy	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

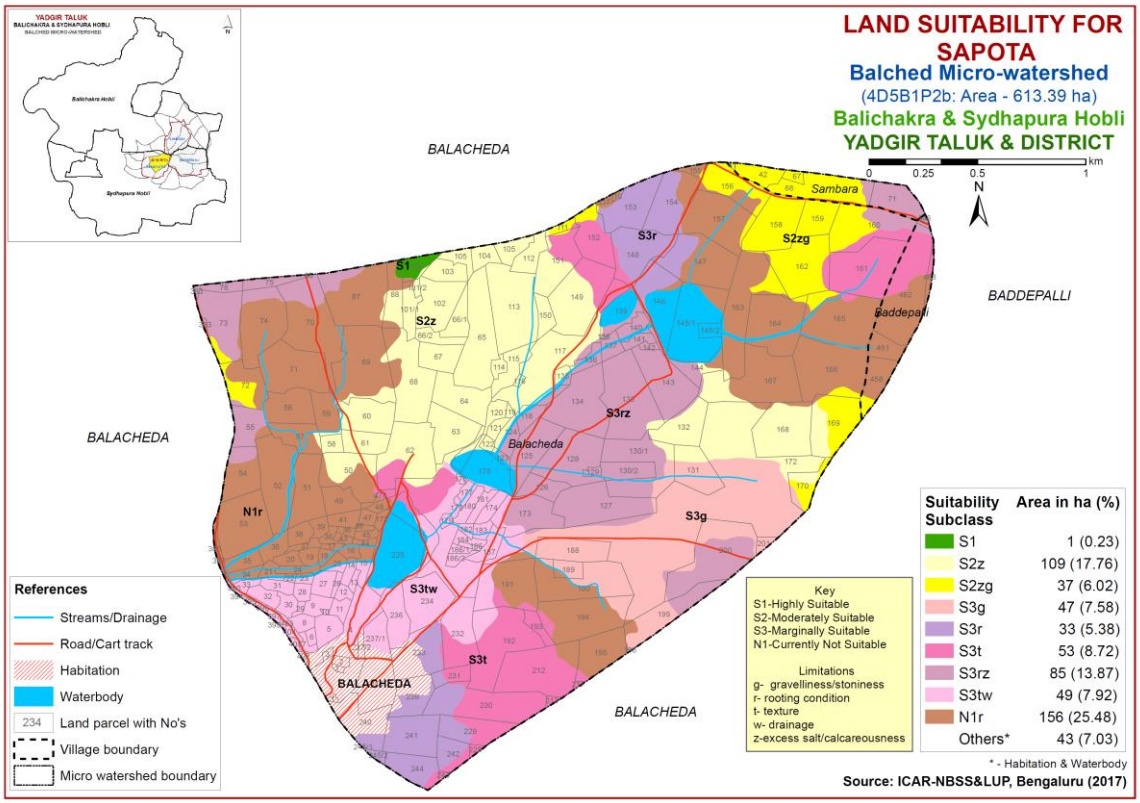


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in about 6558 ha in the State is Raichur, Dharwad, Belgaum, Kalaburgi, Bijapur, Bidar, Bellary, Chitradurga, Bangalore, Kolar, Chikkaballapur and Chamarajnagar districts. The crop requirements for growing guava (Table 7.16) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.15.

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing guava in the microwatershed. Moderately suitable (Class S2) lands occupy 146 ha (24%) and are distributed in the northern, northwestern, northeastern and eastern part of the microwatershed. They have minor limitations of texture and calcareousness. Maximum area of about 267 ha (43%) is marginally suitable (Class S3) and are distributed in the northern, northeastern, northwestern, central, eastern and southern part of the microwatershed. They have moderate limitations of texture, drainage, calcareousness, gravelliness and rooting depth. Not suitable (Class N1) lands occur in an area of about 157 ha (25%) and are distributed in the western, northwestern, southern and northeastern part of the microwaterhsed. They have severe limitations of rooting condition and texture.

Table 7.16 Crop suitability criteria for Guava

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

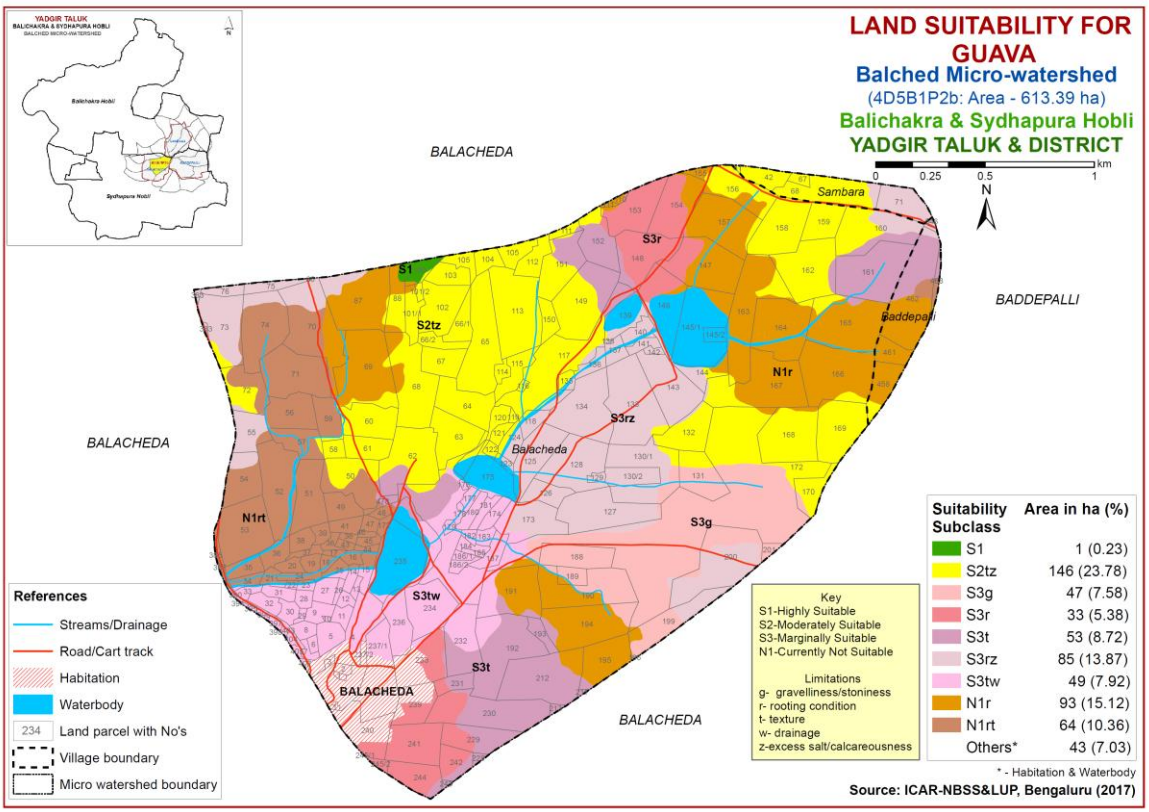


Fig 7.15 Land Suitability map of Guava

7.16 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the most important fruit crop commercially grown in about 18488 ha in karnataka in an area of about 0.16 lakh ha mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The crop requirements for growing pomegranate (Table 7.17) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing pomegranate was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.16.

Highly (Class S1) suitable lands of about 1 ha (<1%) is available for growing pomegranate in the microwatershed. An area of about 248 ha (40%) is moderately suitable (Class S2) for pomegranate and are distributed in the eastern, northeastern, northern and southern part of the microwatershed. They have minor limitations of texture, calcareousness and drainage. An area of about 165 ha (27%) is marginally suitable (Class S3) and are distributed in the central, eastern, southern, northwestern and northeastern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness and calcareousness. Not suitable lands (Class N1) occur in an area of 156 ha (25%) and are distributed in the western, northwestern, eastern and northeastern part of the microwatershed. They have severe limitation of rooting condition.

Table 7.17 Crop suitability criteria for Pomegranate

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

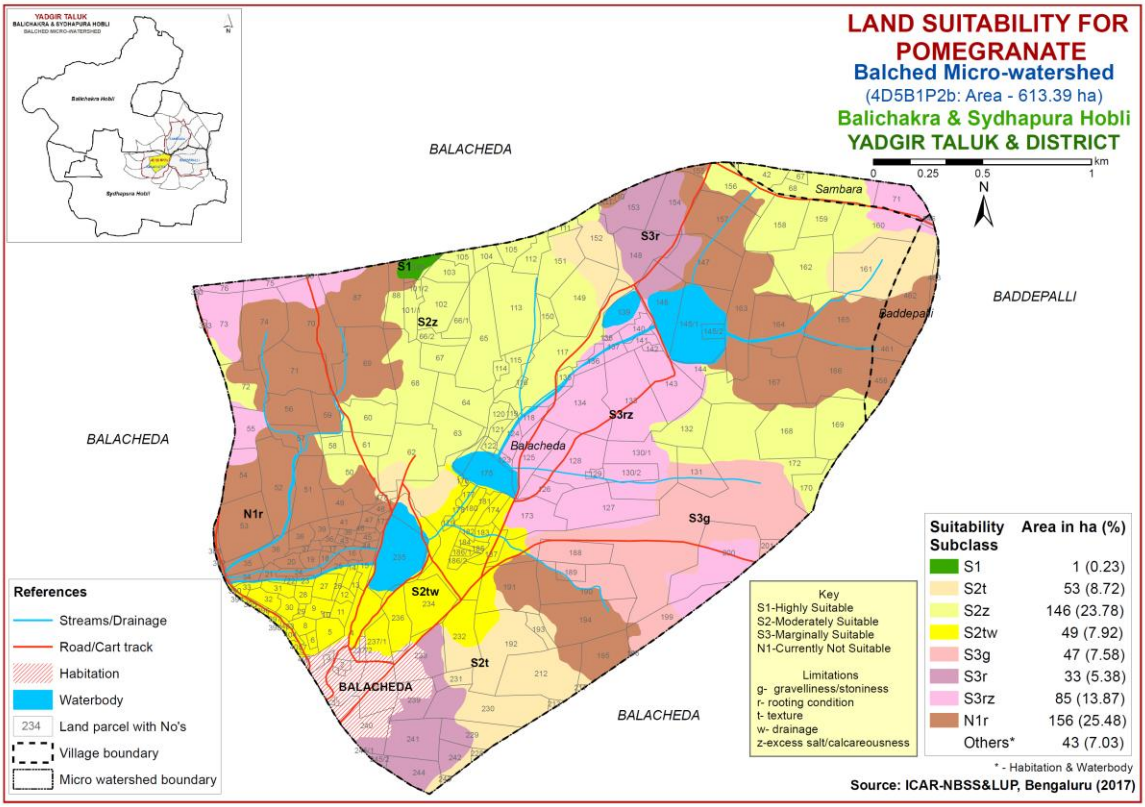


Fig 7.16 Land Suitability map of Pomegranate

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

Jackfruit is one of the most important fruit crop grown in 5368 ha in almost all the districts of the State. The crop requirements for growing jackfruit (Table 7.18) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jackfruit was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.17.

Table 7.18 Crop suitability criteria for Jackfruit

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

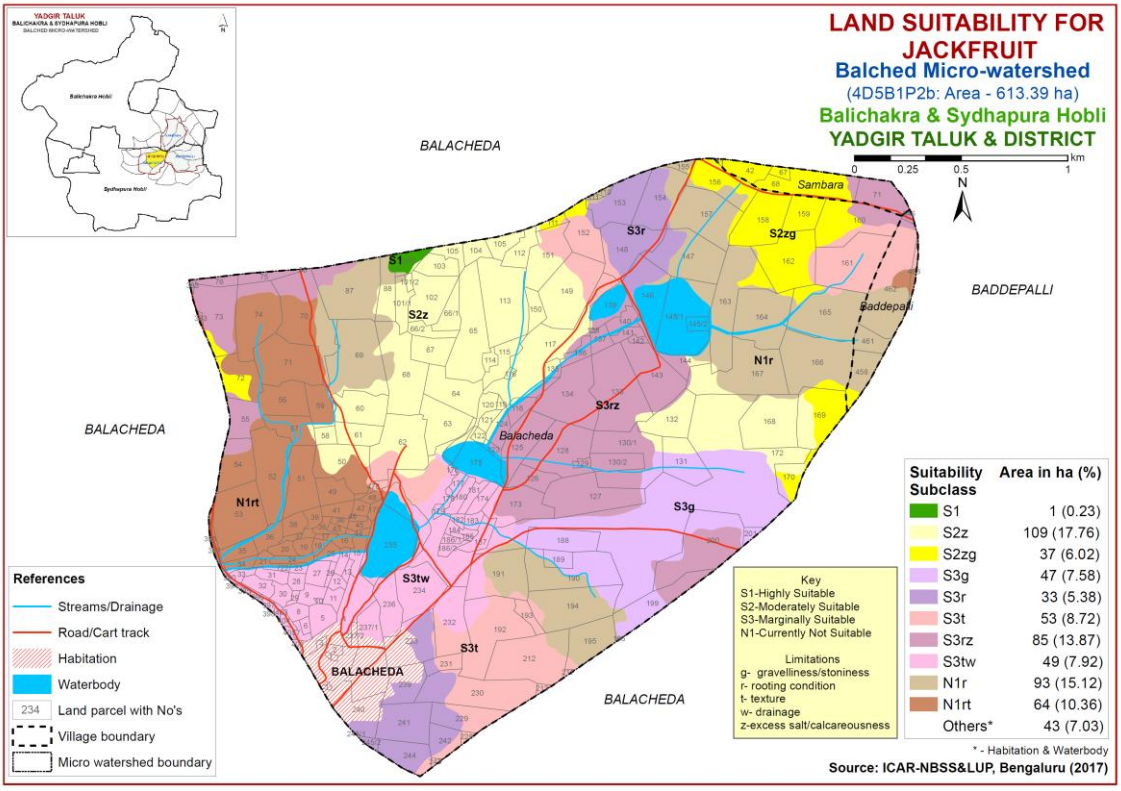


Fig 7.17 Land Suitability map of Jackfruit

An area of about 1 ha (<1%) is highly suitable (Class S1) for growing jackfruit in the microwatershed. Moderately suitable (Class S2) lands occur in an area of 146 ha (24%) and are distributed in the eastern, northeastern, northern and northwestern part of the microwatershed. They have minor limitations of gravelliness and calcareousness.

Maximum area of about 267 ha (43%) is marginally suitable (Class S3) and are distributed in the major part of the microwatershed. They have moderate limitations of texture, drainage, calcareousness, gravelliness and rooting depth. Not suitable lands (Class N1) occur in an area of about 157 ha (25%) and are distributed in the western, northwestern, northeastern and south-eastern part of the microwatershed with severe limitations of rooting condition and texture.

7.18 Land Suitability for Jamun (*Syzygium cumini*)

Jamun is one of the most important fruit crop grown in almost all the districts of the state. The crop requirements for growing jamun (Table 7.19) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jamun was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.18.

A minor area of 1 ha (<1%) is highly suitable (Class S1) for growing jamun in the microwatershed. Maximum area of about 248 ha (40%) is moderately suitable (Class S2) for jamun and are distributed in the northeastern, northern, southern, northwestern and eastern part of the microwatershed. They have minor limitations of texture, rooting condition, calcareousness and drainage. An area of about 165 ha (27%) is marginally suitable (Class S3) and are distributed in the central, eastern, southern, northern, northeastern and northwestern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness and calcareousness. Not suitable lands (Class N1) occur an area of about 157 ha (25%) and are distributed in the northeastern, southeastern, western and northwestern part of the microwatershed with severe limitations of rooting condition and texture.

Table 7.19 Crop suitability criteria for Jamun

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

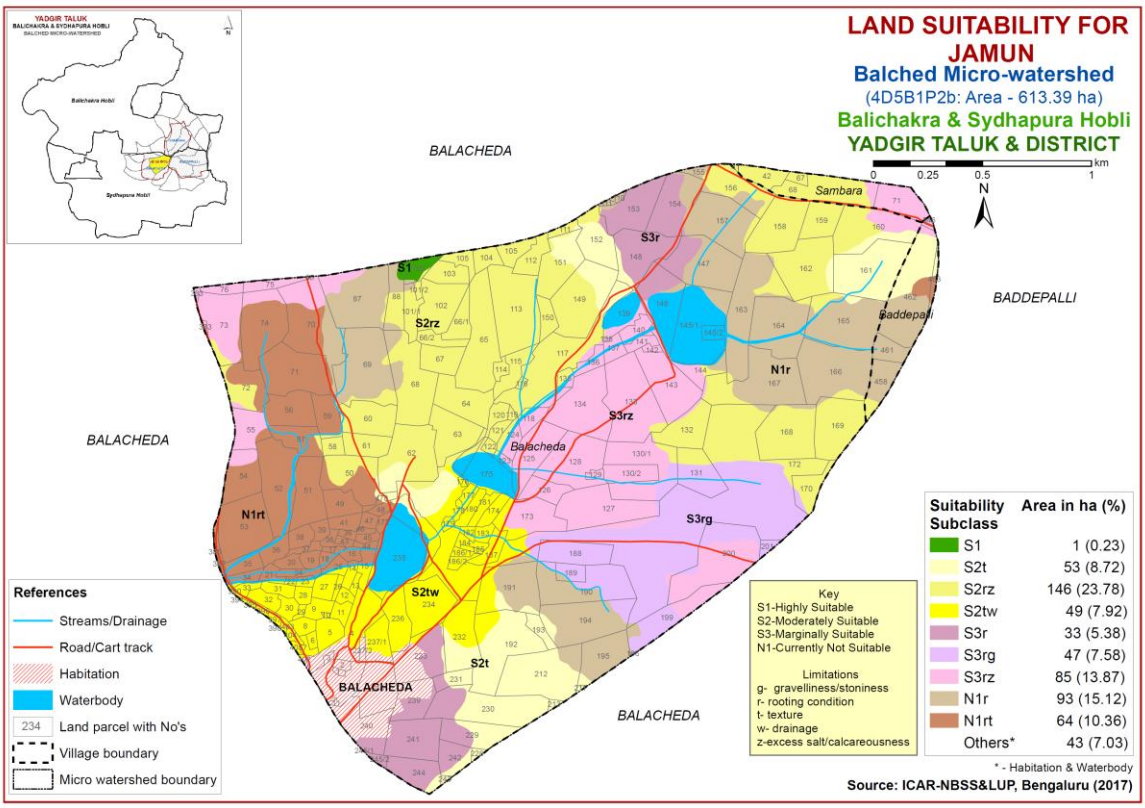


Fig 7.18 Land Suitability map of Jamun

7.19 Land Suitability for Musambi (*Citrus limetta*)

Musambi is one of the most important fruit crop grown in an area of 5446 ha in almost all the districts of the State. The crop requirements for growing musambi (Table 7.20) 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 is given in Figure 7.19.

A minor area of about 1 ha (<1%) is highly suitable (Class S1) for growing musambi in Balched microwatershed. Maximum area of about 248 ha (40%) is moderately suitable (Class S2) for musambi and are distributed in the major part of the microwatershed. They have minor limitations of calcareousness and drainage. An area of about 165 ha (27%) is marginally suitable (Class S3) and are distributed in the central, northern, northeastern, eastern, southern and northwestern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness and calcareousness. Not suitable (Class N1) lands occur in an area of about 156 ha (25%) and are distributed in the southeastern, western, northwestern and northeastern part of the microwatershed with the severe limitation of rooting condition.

Table 7.20 Crop suitability criteria for Musambi

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

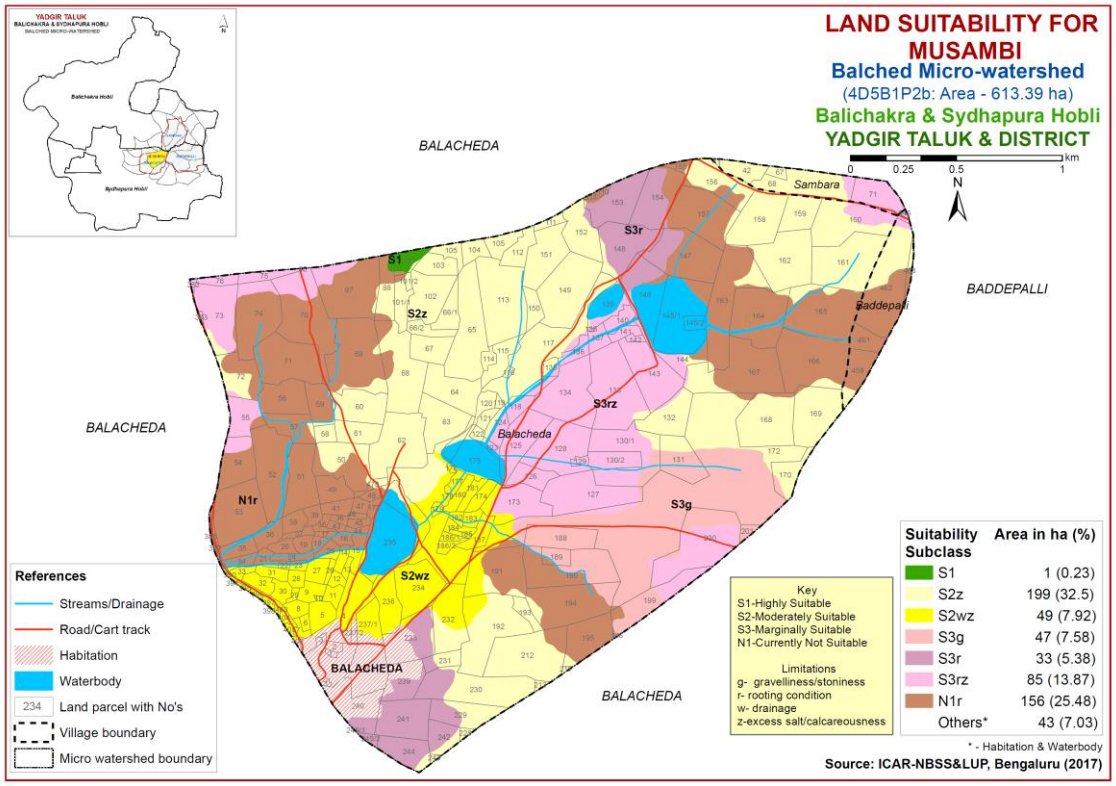


Fig 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in 11752 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) were matched

with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.20.

Table 7.21 Crop suitability criteria for Lime

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

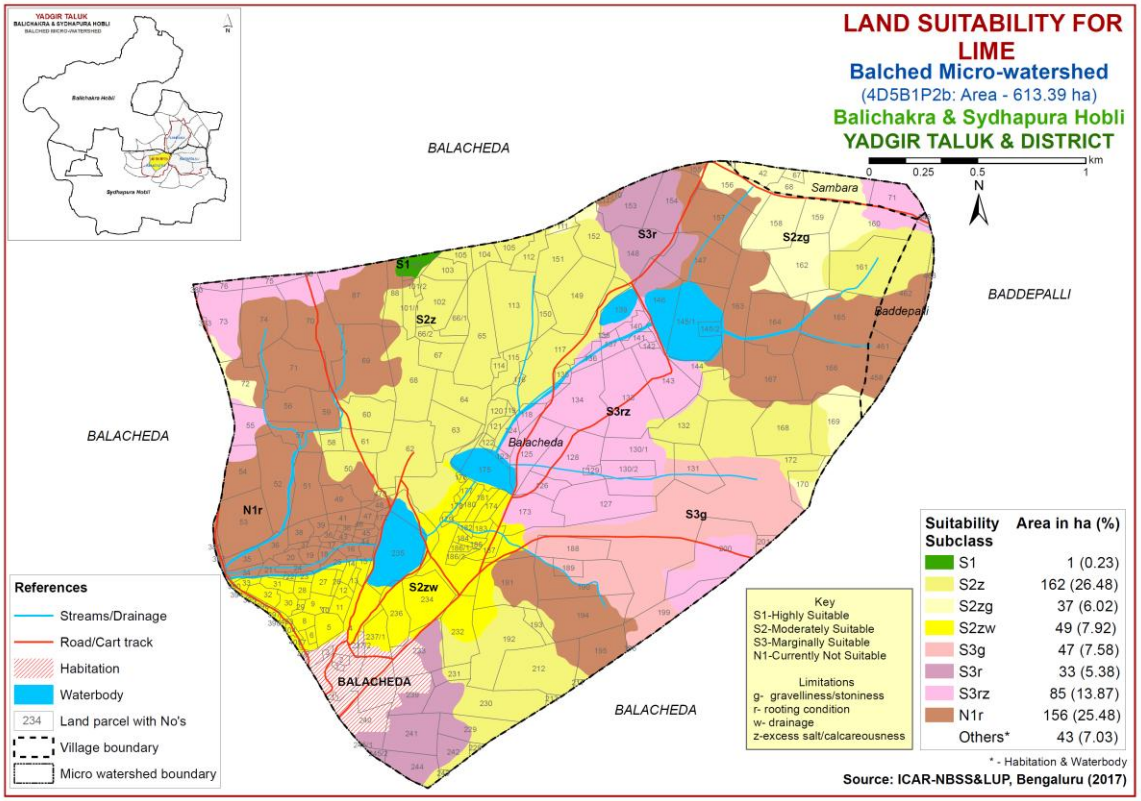


Fig 7.20 Land Suitability map of Lime

7.21 Land Suitability for Cashew (*Anacardium occidentale)*

Cashew is one of the most important plantation nut crop grown in an area of about 70552 ha in almost all the districts. The crop requirements for growing Cashew (Table 7.22) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing Cashew was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.21.

Table 7.22 Crop suitability criteria for Cashew

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

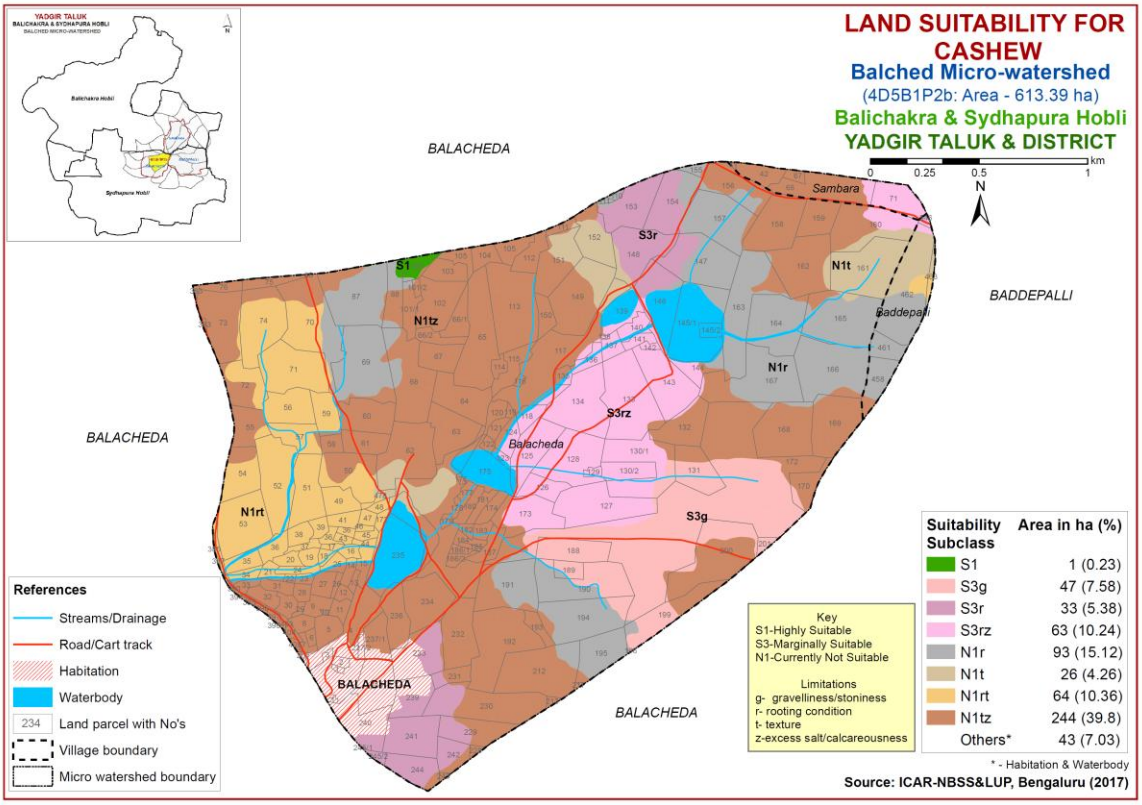


Fig 7.21 Land Suitability map of Cashew

A small area of about 1 ha (<1%) is highly suitable (Class S1) for growing cashew and are distributed in the northern part of the microwatershed. There are no moderately suitable (Class S2) lands for growing cashew. Marginally suitable (Class S3) lands occur

in an area of 143 ha (6%) and are distributed in the northern, northeastern, central, eastern and southern part of the microwatershed. They have moderate limitations of rooting condition, gravelliness and calcareousness. Not suitable (Class N1) lands for growing cashew occur in maximum area of 427 ha (70%) and are distributed in all parts of the microwatershed. They have severe limitations of rooting condition, texture and calcareousness.

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the state. The crop requirements for growing custard apple (Table 7.23) 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 geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.22.

Highly (Class S1) suitable lands occur in a small area of about 1 ha (<1%) for growing custard apple and are distributed in the northern part of the microwatershed. Maximum area of about 413 ha (67%) is moderately suitable (Class S2) and are distributed in all parts of the microwatershed. They have minor limitations of gravelliness, drainage, calcareousness and rooting condition. Marginally suitable lands (Class S3) occupy an area of 156 ha (25%) and are distributed in the northeastern, southeastern, western and northwestern part of the microwatershed. They have moderate limitation of rooting condition.

Table 7.23 Crop suitability criteria for Custard Apple

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

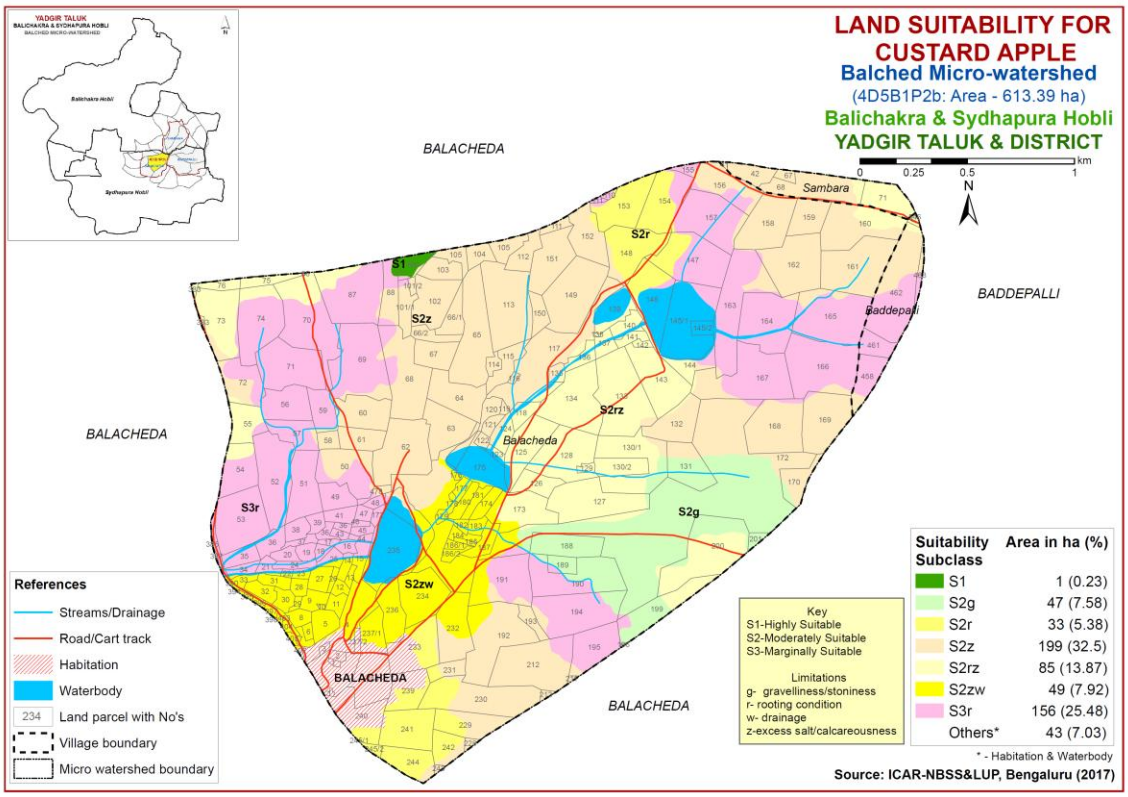


Fig 7.22 Land Suitability map of Custard Apple

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

Amla is one of the most important medicinal and fruit plant grown in 151 ha in almost all the districts of the state. The crop requirements for growing amla (Table 7.24) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing amla was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.23.

Table 7.24 Crop suitability criteria for Amla

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

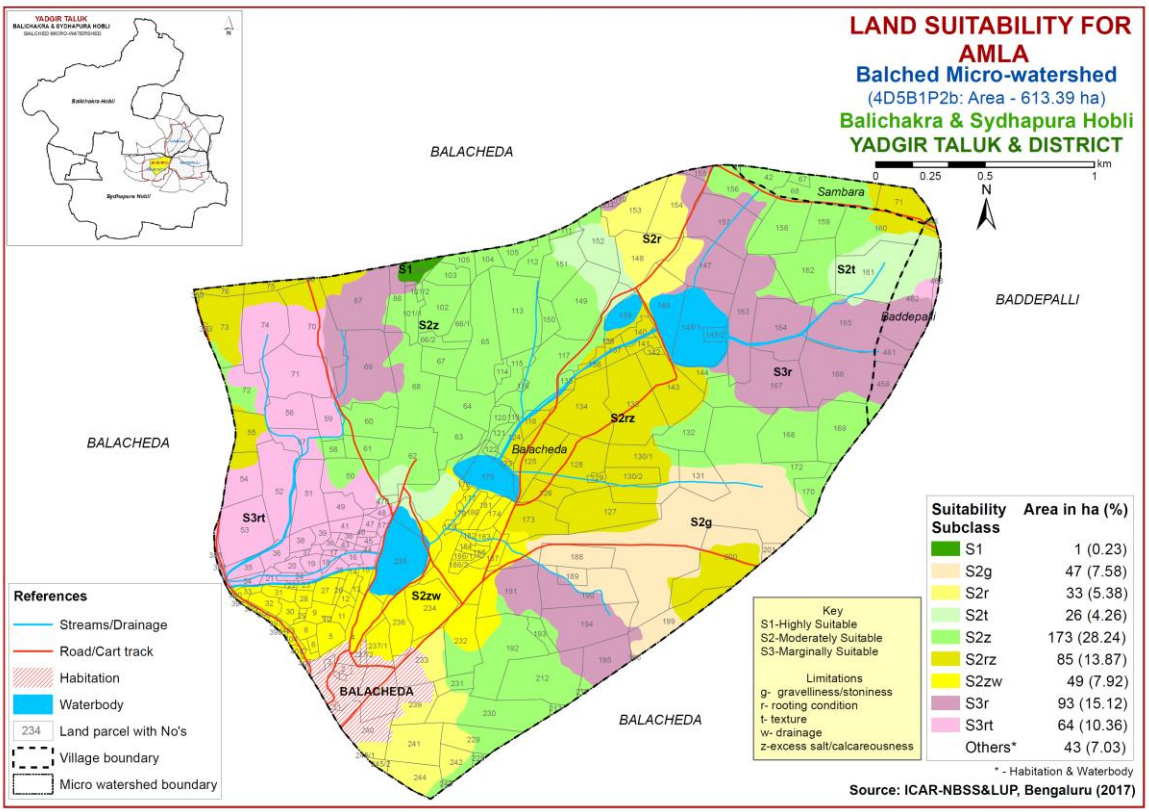


Fig 7.23 Land Suitability map of Amla

In Balched microwatershed, a small area of 1 ha (<1%) is highly suitable (Class S1) and are distributed in the northern part of the microwatershed. Moderately suitable (Class S2) lands occur an area of 413 ha (67%) and are distributed in the major part of the microwatershed. They have minor limitations of drainage, texture, calcareousness, rooting condition and gravelliness. An area of about 157 ha (25%) is marginally suitable (Class S3) and are distributed in the northeastern, southeastern, western and northwestern part of the microwatershed. They have moderate limitations of rooting condition and texture.

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

Tamarind is one of the most important spice crop raised in 14897 ha in all the districts of the state. The crop requirements for growing tamarind (Table 7.25) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tamarind was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed is given in Figure 7.24.

A minor area of 1 ha (<1%) is highly suitable (Class S1) for growing tamarind in the microwatershed. Moderately suitable (Class S2) lands occur in an area of 248 ha (40%) and are distributed in the eastern, northeastern, northern, western and northwestern part of the microwatershed. They have minor limitations of texture, rooting condition, calcareousness and drainage. A small area of 47 ha (8%) is marginally suitable (Class S3) and are distributed in the eastern part of the microwatershed with moderate limitations of

rooting condition and gravelliness. Not suitable lands (Class N1) occupy an area of 275 ha (45%) and are distributed in the major part of the microwatershed. They have severe limitations of rooting condition, texture and calcareousness.

Table 7.25 Crop suitability criteria for Tamarind

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Soil aeration	Soil drainage	Class	Well drained	Mod.well drained	Poorly drained	V.Poorly drained
Nutrient availability	Texture	Class	scl,cl,sc,c (red)	sl, c (black)	ls	-
	pH	1:2.5	6.0-7.3	5.0-6.0,7.3-7.8	7.8-8.4	>8.4
Rooting conditions	Soil depth	cm	>150	100-150	75-100	<50
	Gravel content	% vol.	<15	15-35	35-60	60-80
Erosion	Slope	%	0-3	3-5	5-10	>10

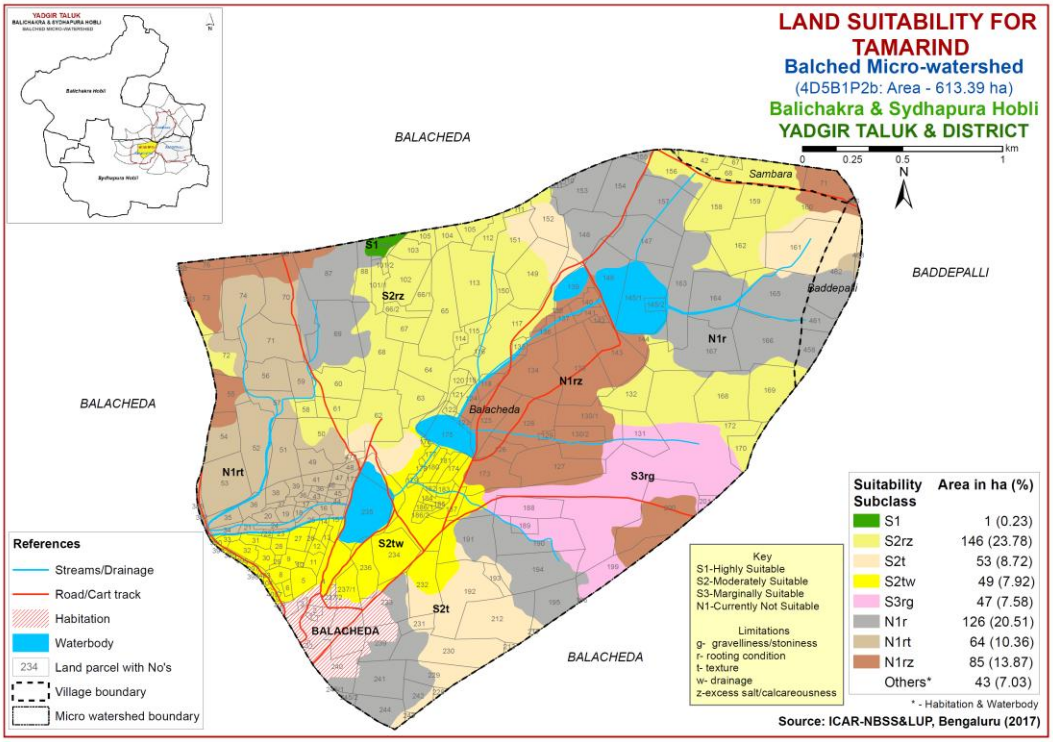


Fig 7.24 Land Suitability map of Tamarind

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

Marigold is one of the most important flower crop grown in an area of 9108 ha in almost all the districts of the State. The crop requirements for growing marigold (Table 7.26) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing marigold was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.25.

Highly (Class S1) suitable lands occur in a small area of 1 ha (<1%) for growing marigold and are distributed in the northern part of the microwatershed. Maximum area of

about 366 ha (60%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of drainage, gravelliness, texture, calcareousness and rooting condition. Marginally suitable lands (Class S3) occur in an area of about 204 ha (33%) and are distributed in the northeastern, eastern, western and northwestern part of the microwatershed. They have moderate limitations of texture, rooting condition and gravelliness.

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	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l ,sl, scl, cl, sil	sicl, sc, sic, c	c	ls, s
	pH	1:2.5	7.0-7.5	5.5-5.9,7.6-8.5	<5, >8.5	-
	$CaCO_3$ in root zone	%	Non calcareous	Slightly calcareous	Strongly calcareous	-
Rooting conditions	Soil depth	cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	-
Soil toxicity	Salinity	ds/m	Non saline	Slightly	Strongly	-
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	-

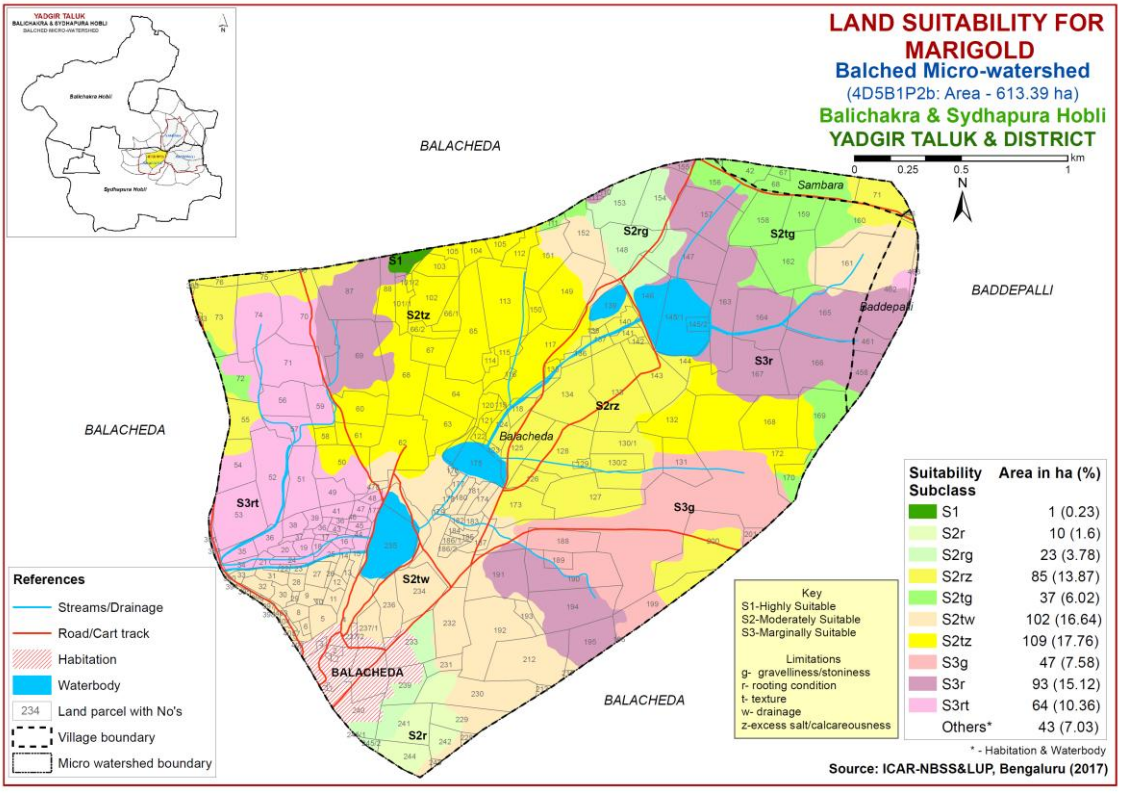


Fig. 7.25 Land Suitability map of Marigold

7.26 Land suitability for Chrysanthemum (*Dendranthema grandiflora*)

Chrysanthemum is one of the most important flower crop grown in an area of 4978 ha in almost all the districts of the State. The crop requirements for growing chrysanthemum (Table 7.27) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing chrysanthemum was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.26.

Table 7.27 Land suitability criteria for Chrysanthemum

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

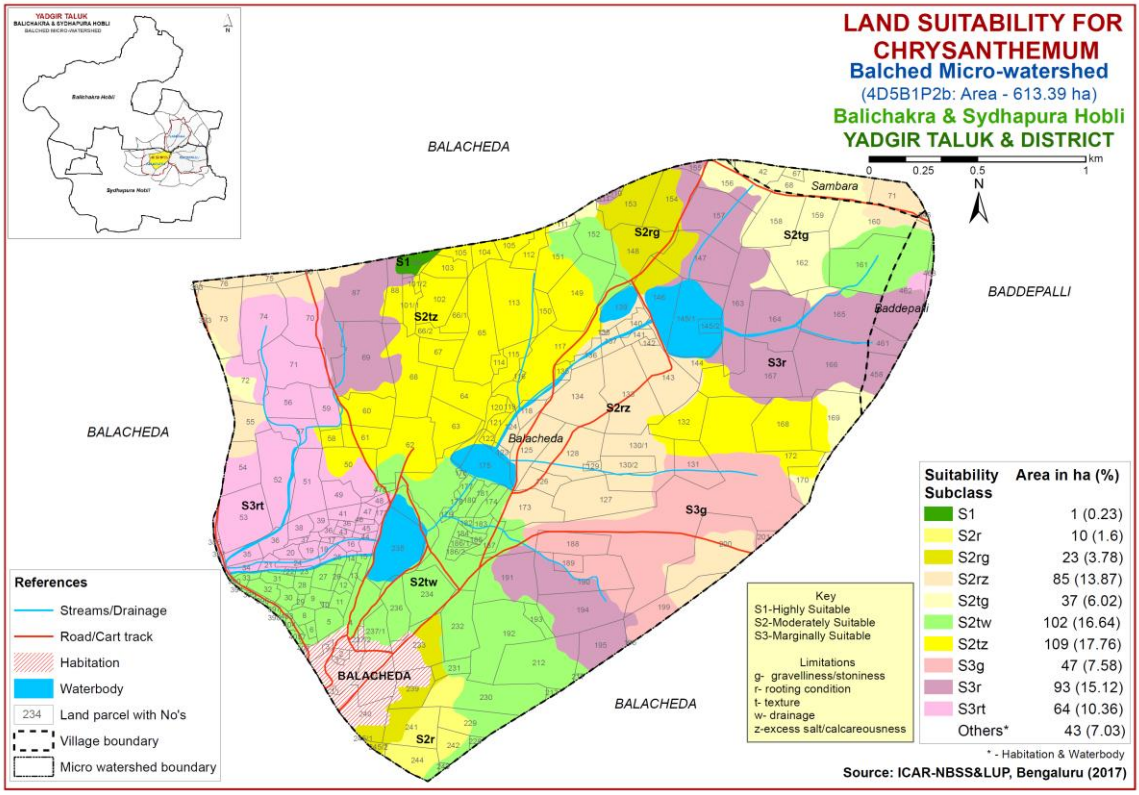


Fig. 7.26 Land Suitability map of Chrysanthemum

A small area of about 1 ha (<1%) is highly suitable (Class S1) for growing chrysanthemum in the microwatershed. Maximum area of about 366 ha (60%) is moderately suitable (Class S2) and are distributed in the major part of the microwatershed. They have minor limitations of drainage, gravelliness, texture, calcareousness and rooting condition. Marginally suitable lands (Class S3) occur in an area of about 204 ha (33%) and are distributed in the northeastern, eastern, western and northwestern part of the microwatershed. They have moderate limitations of texture, gravelliness and rooting condition.

7.27 Land Management Units (LMU)

The 23 soil map units identified in Balched microwatershed have been grouped into nine Land Management Units (LMU) for the purpose of preparing a Proposed Crop Plan. Land Management Units are grouped based on the similarities in respect of the type of soil, the depth of the soil, the surface soil texture, gravel content, AWC, slope, erosion etc. and a Land Management Units map (Fig. 7.27) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

The 23 soil map units that have been grouped into nine Land Management Units along with brief description of soil and site characteristics are given below.

LMU NO.	Soil Map Unit number	Soil Map Units	Soil and site characteristics
1	102,104	TMKbB3 TMKiB2	Very deep, lowland black clay soils
2	92, 95	HGNcB2 HGNmB2	Very deep, black clay soils
3	39	KBDbB3	Moderately deep, red gravelly clay soils
4	64, 44, 45,46	BMDcB2, GDGbB2 GDGbB3g1, GDGiB2	Deep to very deep, red sandy clay to sandy clay loam soils
5	51, 52, 54	ANRbB2g1, ANRbB3 ANRhB3	Deep, black clay soils
6	25, 26, 27, 29	DPLcB2, DPLiB2 YLRbB2, YLRcB2g1	Moderately shallow, red clay soils
7	14, 16	HLGbB2g1, HLGcB2	Moderately shallow, black sandy clay to sandy clay loam soils
8	9, 10	VNKcB2, VNKiB2	Shallow, red clay soils
9	3, 4, 5	BDLbC3, BDLhB2 BDLiB2	Shallow, black clay soils

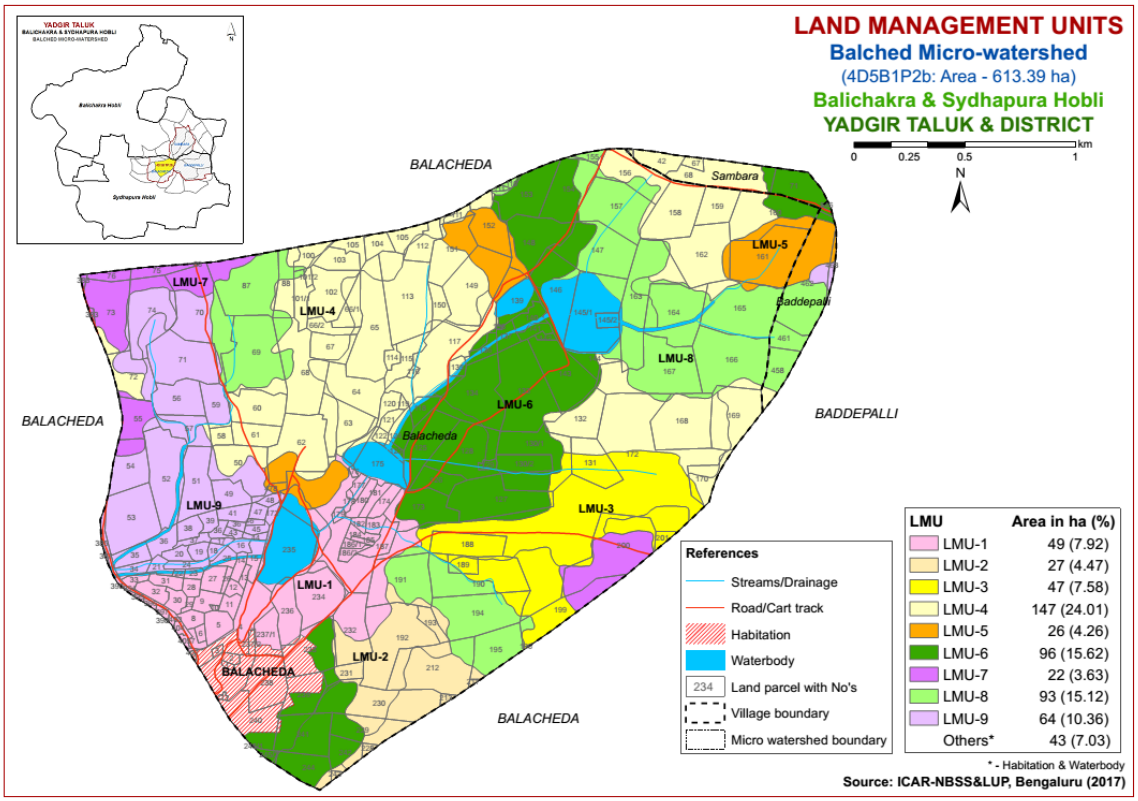


Fig. 7.27 Land Management Units (LMU) map of Balched microwatershed

7.28 Proposed Crop Plan for Balched Microwatershed

After assessing the land suitability for the 26 crops, a proposed crop plan has been prepared for the 9 identified LMUs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 26 crops. The resultant proposed crop plan is presented in Table 7.26.

Table 7.28 Proposed Crop Plan for Balched Micro watershed

Proposed LMU	Soil Map Units	Survey Number	Soil characters	Field Crops	Horticulture Crops	Suitable Interventions
LMU 1 49 ha (8%)	102.TMKbB3 104.TMKiB2	**Balacheda:**4,5,6,7,8,9,10,11,12,13,14,15,22,23,26,27,28,29,30,31,32,33,174,176,177,178,179,180,181,182,183,184,185,186/1,186/2,187,232,234,236,237/1,390,394,395,396,397,398,403,404,405	Very deep, lowland black clay soils	Sunflower, Cotton, Bengal gram, Bajra	**Fruit crops:** Lime, Musambi, Amla, Jamun **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, suitable soil and water conservation practices
LMU 2 27 ha (4%)	92.HGNcB2 95.HGNmB2	**Balacheda:**192,193,211,212,213,228,230,231, 243	(Very deep, black clay soils)	Sunflower, Sorghum, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Custard apple, Amla, Tamarind, Jamun **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
LMU 3 47 ha (8%)	39.KBDbB3	**Balacheda:**131,172,188,189,190,196,199,201	Moderately deep, red gravelly clay soils	Groundnut, Redgram, Bajra	**Fruit crops:**, Musambi, lime, Amla, Custard apple **Vegetables:** Drumstick	Drip irrigation, mulching, suitable conservation practices (Crescent Bunding with Catch Pit etc)
LMU 4 147 ha (24%)	64.BMDcB2 44.GDGbB2 45.GDGbB3g1 46.GDGiB2	**Balacheda:**100,101/1,101/2,102,103,104,105,111,112,113,114,115,116,117,119,120,121,122,132,135,149,150,151,156,158,159,160,162,168,169,170,58,60,61,62,63,64,65,66/1,66/2,67,68,72,88 **Sambara:** 41,42,67,68	Deep to very deep, red sandy clay to sandy clay loam soils	Maize, Sorghum, Groundnut, Redgram, Bajra	**Fruit crops:** Sapota, Guava, Jackfruit, Musambi, Pomegranate, Lime, Amla, Custard apple , Tamarind, Jamun **Vegetables:** Tomato, Drumstick, Chilli, **Flowers:** Marigold, Chrysanthemum	Drip irrigation, mulching, suitable conservation practices (Crescent Bunding with Catch Pit etc)

LMU 5 26 ha (4%)	51.ANRbB2g1 52.ANRbB3 54.ANRhB3	**Balacheda:** 152,161,478	Deep, black clay soils	Sunflower, Sorghum, Cotton, Bengal gram, Safflower, Linseed, Bajra	**Fruit crops:** Pomegranate, Lime, Musambi, Jamun, Amla, Custard apple, Tamarind **Vegetables:** Drumstick, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
LMU 6 96 ha (16%)	25.DPLcB2 26.DPLiB2 27.YLRbB2 29.YLRcB2g1	**Balacheda:** 118,124,125,126,127,128,129,130/1,130/2,133,134,136,137,138,140,141,14,143,144,148,153,154,173,229,233,241,242,244,245/1,245/2 **Sambara:** 71 **Baddepalli:** 546	Moderately shallow, red clay soils	Groundnut, Bajra, Red gram	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli **Flowers:** Marigold Chrysanthemum	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
LMU 7 22 ha (4%)	14.HLGbB2g1 16.HLGcB2	**Balacheda:** 55,73,75,76,86,200,383	Moderately shallow, black sandy clay to sandy clay loam soils	Maize, Sorghum, Groundnut, Bengal gram, Bajra	**Fruit crops:**, Amla, Custard apple, **Vegetables:** Tomato, Chilli, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
LMU 8 93 ha (15%)	9.VNKcB2 10.VNKiB2	**Balacheda:**69,87,110,147,155,157,163,164,165,166,167,191,194,195 **Baddepalli:** 458,461,462	Shallow, red clay soils	Horsegram, Bajra	**Agri-Silvi-Pasture:** Custard apple, Amla, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
LMU 9 64 ha (10%)	3.BDLbC3 4.BDLhB2 5.BDLiB2	**Balacheda:**16,17,18,19,20,21,24,25,34,35,36,37,38,39,41,43,44,45,46,47,48,49,50,51,52,53,54,56,57,59,70,71,74 172, 385,387 **Baddepalli:** 463	Shallow, black clay soils	Bengal gram, Horse gram, Linseed, Safflower, Coriander	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *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 health is basic to plant health and plant health is basic to human and bovine health. Soil is fundamental to crop production. Without soil, no food could be produced nor would livestock be fed on a large scale. Because it is finite and fragile, soil is a precious resource that requires special care from its users.

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Balched Microwatershed

- The soil phases with sizeable area identified in the microwatershed belonged to the soil series of Gondedagi (GDG) 146 ha (24%), Vanakanahalli (VNK) 93 ha (15%), Badiyala (BDL) 63 ha (10%), Duppali (DPL) 62 ha (10%), Kalabelagundi (KBD) 47 ha (8%), Yalleri (YLR) 33 ha (5%), Anur (ANR) 26 ha (4%), Halagera (HLG) 22 ha (4%), Thumakur (TMK) 48 ha (8%) and Hegganakera (HGN) 27 ha (4%) in the microwatershed.

- As per land capability classification, entire area comes under arable land category (Class II, III and IV). The major limitations identified in the arable lands were soil and erosion.
- On the basis of soil reaction, about 171 ha (28%) area is neutral (pH 6.5-7.3) followed by slightly alkaline (pH 7.3-7.8) soils of 113 ha (18%). An area of about 243 ha (40%) is moderately alkaline (pH 7.8-8.4) in reaction. An area of about 43 ha (7%) is strongly alkaline (pH 8.4-9.0) in reaction and a small area of 0.024 ha (<1%) is very strongly alkaline (pH >9.0 in the microwatershed. Major area in the microwatershed is alkaline in reaction.

Soil Health Management

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

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. Out of total 613 ha area in the microwatershed, an area of about 436 ha (71%) is suffering from moderate and 134 ha (22%) is suffering from severe erosion. The areas with moderate and severe erosion need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

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

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

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

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

units. In general, erosion and soil are the major constraints in Balched microwatershed.

- **Organic Carbon:** The OC content (an index of available Nitrogen) is low (<0.5%) in an area of 30 ha (5%), 316 ha (52%) medium (0.5-0.75%) and about 224 ha (36%) area high (>0.75%). In the areas of low and medium OC, it needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- **Promoting green manuring:** Growing of green manuring crops cost Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in 247 ha area where OC is less than 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**: In 199 ha (32%) area, the available phosphorus is medium and about 372 ha (61%) is high. Hence for all the crops, 25% additional P-needs to be applied, where it is low or medium in available phosphorus.
- **Available Potassium:** Available potassium is low in 152 ha (25%), medium in 384 ha (63%) and high in 34 ha (6%) area of the microwatershed. In the medium plots, for all crops, additional 25% potassium may be applied.
- **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. It is low in 303 ha (49%) area of the microwatershed and medium in 219 ha (36%). These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected. Available sulphur is high in 48 ha (8%) area in the microwatershed**.**
- **Available Boron:** It is low in 30 ha (5%) area of the microwatershed and medium in 486 ha (79%). The areas that are low and medium need to be applied with sodium borate @ 10 kg/ha as soil application or 0.2% borax as foliar spray to correct the deficiency. High in an area of about 54 ha (9%) in the microwatershed.
- **Available Iron:** It is deficient in 26 ha (4%) area and sufficient in 545 ha (89%) area in the microwatershed. To manage iron deficiency, iron sulphate @ 25 ka/ha needs to be applied for 2-3 years.
- **Available Zinc:** Entire area is deficient in available zinc. Application of zinc sulphate @25kg/ha is to be followed.

Soil Alkalinity: The microwatershed has 399 ha area with soils that are slightly to very strongly alkaline in reaction. These areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sulphur can be recommended. Management practices like treating repeatedly with good quality water to drain out the excess salts and, provision of subsurface drainage and growing of salt tolerant crops like Casuarina, Acasia, Neem, Ber etc., are recommended.

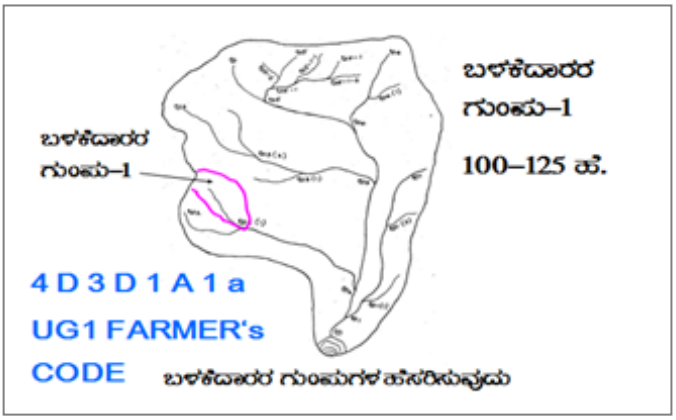
Land Suitability for various crops: Areas that are highly, moderately, marginally suitable and not suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting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

Chapter 9

SOIL AND WATER CONSERVATION TREATMENT PLAN

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

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



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

Steps for Survey and Preparation of Treatment Plan

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

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

9.1 Treatment Plan

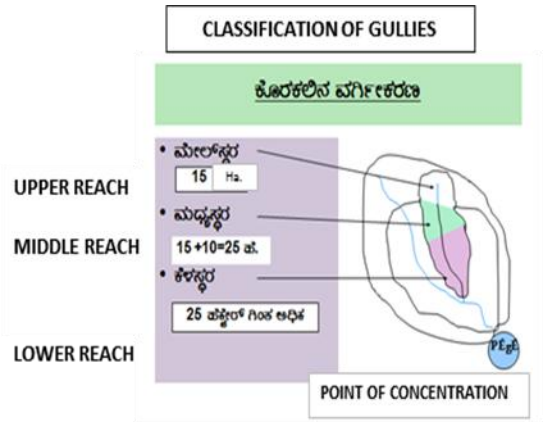
The treatment plan recommended for arable lands is briefly described below

9.1.1 Arable Land Treatment

A. BUNDING

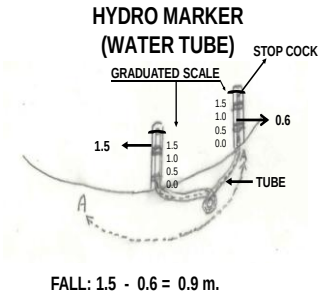
Steps for Survey and Preparation of Treatment Plan	
• Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale • Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale • Drainage lines 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)

USER GROUP-1



Measurement of Land Slope

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



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

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

Note: (i) The above intervals are maximum.

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

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

Section of the Bund

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

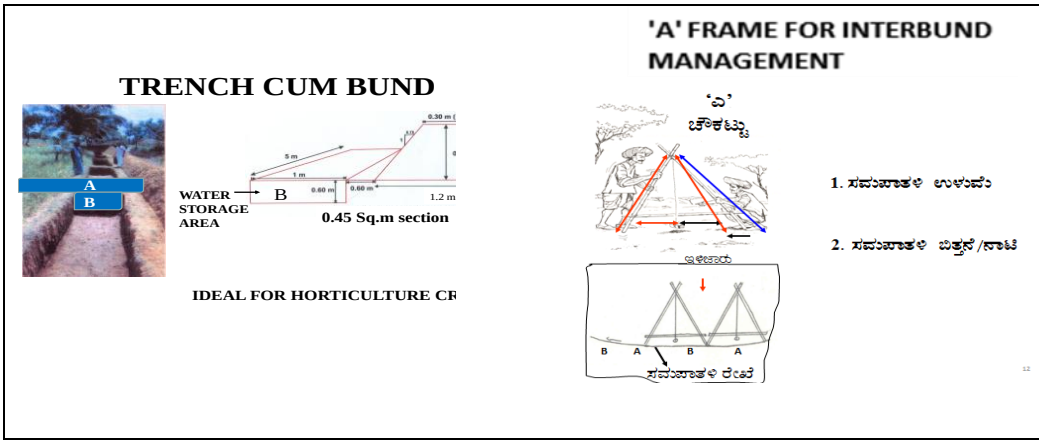
Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below:



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

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

B. Water Ways

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

C. Farm Ponds

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

D. Diversion Channel

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

9.1.2 Non-Arable Land Treatment

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

9.1.3 Treatment of Natural Water Course/ Drainage Lines

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

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

c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff in water budgeting and quality of water in the wells and site suitability.
e) Detailed Levelling Survey using Dumpy Level / Total Station has to be carried out to arrive at the site-specific designs as shown in the Manual.
f) The location of ground water recharge structures are decided by examining the lineaments and fracture zones from geological maps.
g) Rainfall intensity data of the nearest Rain Gauge Station is considered for Hydrologic Designs.
h) Silt load to the Storage/Recharge Structures is reduced by providing vegetative, boulder and earthen checks in the natural water course. Location and design details are given in the Manual.

9.2 Recommended Soil and Water Conservation Measures

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

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

A map (Fig. 9.1) showing soil and water conservation plan with the kind of conservation structures recommended has been prepared, which shows the spatial distribution and extent of area. Major area of about 382 ha (62%) requires Trench cum Bunding and 188 ha (31%) requires Graded Bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after including their suggestions, the conservation plan for the microwatershed may be finalised in a participatory approach.

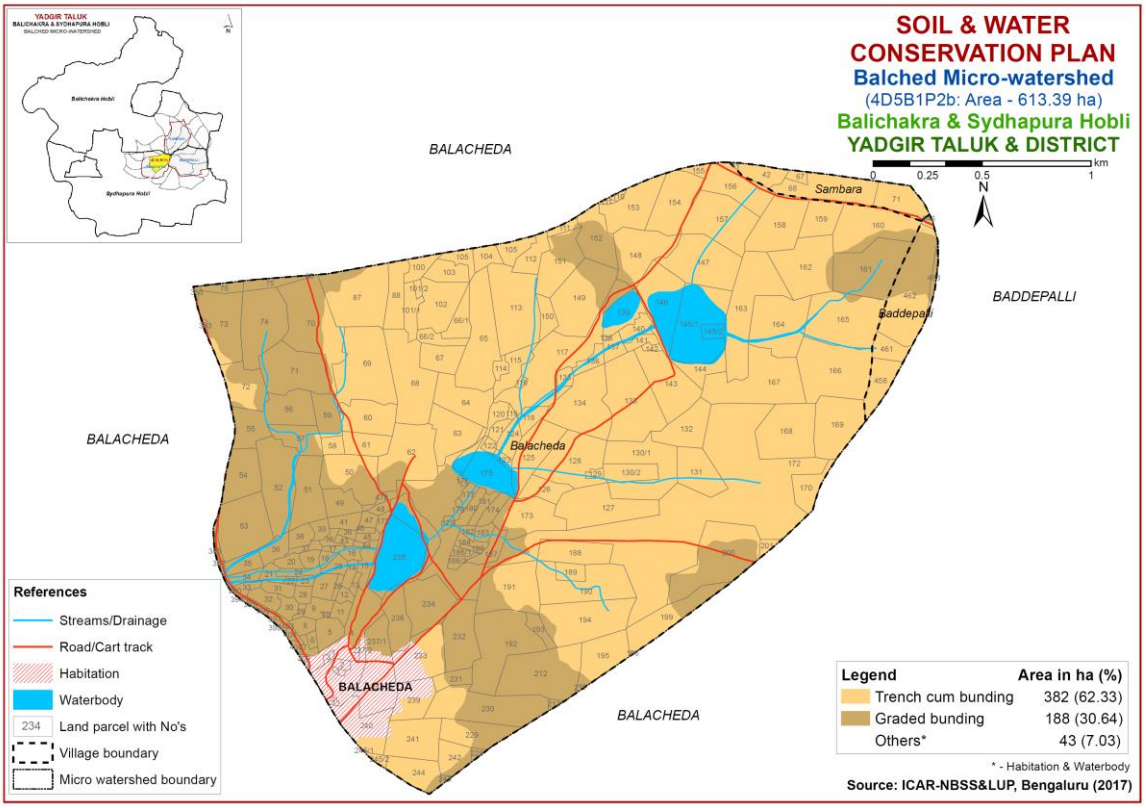


Fig. 9.1 Soil and Water Conservation Plan map of Balched Microwatershed

9.3 Greening of Microwatershed

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

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

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

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

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Appendix I

Balched 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
Baddepalli	458	2.48	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Baddepalli	461	1.54	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Baddepalli	462	8.43	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	TCB
Baddepalli	463	0.53	BDLhB2	LMU-9	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
Baddepalli	546	0.1	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	1	0.51	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	2	0.34	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	3	0.19	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	4	4.54	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	5	1.49	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIws	Graded bunding
Balacheda	6	0.32	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	7	0.42	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	8	0.76	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	9	0.97	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIws	Graded bunding
Balacheda	10	0.09	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	11	0.73	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIws	Graded bunding
Balacheda	12	0.46	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	13	0.3	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	14	0.59	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	15	1.02	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	16	0.53	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	17	0.27	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	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
Balacheda	18	0.43	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	19	0.67	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	20	0.71	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Graded bunding
Balacheda	21	0.67	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	22	0.19	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	23	0.39	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	24	0.73	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Scrub land (Sl)	Not Available	IIIes	Graded bunding
Balacheda	25	0.73	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	26	0.29	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	27	1.12	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	28	0.61	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	29	0.23	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	30	0.82	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	31	0.81	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	32	0.97	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	33	0.5	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	34	0.75	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	35	1.27	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIIes	Graded bunding
Balacheda	36	6.16	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	37	0.49	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	38	1.01	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	39	0.66	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	41	1.95	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	43	0.31	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	44	0.3	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	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
Balacheda	45	0.44	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	46	0.22	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIIes	Graded bunding
Balacheda	47	0.51	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	48	0.43	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	Graded bunding
Balacheda	49	1.78	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	Graded bunding
Balacheda	50	4.88	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Graded bunding
Balacheda	51	4.12	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Graded bunding
Balacheda	52	6.14	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIIes	Graded bunding
Balacheda	53	5.86	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Paddy (Ct+Pd)	Not Available	IIIes	Graded bunding
Balacheda	54	3.51	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Graded bunding
Balacheda	55	2.57	HLGcB2	LMU-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	Graded bunding
Balacheda	56	3.33	BDLbC3	LMU-9	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Groundnut (Gn)	Not Available	IVes	Graded bunding
Balacheda	57	2.53	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Graded bunding
Balacheda	58	0.81	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	59	2.17	BDLbC3	LMU-9	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Redgram (Rg)	Not Available	IVes	Graded bunding
Balacheda	60	3.67	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	61	2.11	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	62	6.39	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	63	3.9	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	64	3.89	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	65	7.11	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	66/1	1.64	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	66/2	1.11	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	67	4.61	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	68	13.9	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB

Village	Survey No.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Balacheda	69	8.1	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	70	8.17	BDLbC3	LMU-9	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Groundnut (Gn)	Not Available	IVes	Graded bunding
Balacheda	71	11.89	BDLbC3	LMU-9	Shallow (25-50 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Gently sloping (3-5%)	Severe	Groundnut+No crop (Gn+Nc)	Not Available	IVes	Graded bunding
Balacheda	72	3.48	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Cotton (Ct)	Not Available	IIIes	TCB
Balacheda	73	5.3	HLGbB2g1	LMU-7	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Balacheda	74	6.17	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	Graded bunding
Balacheda	75	1.08	HLGbB2g1	LMU-7	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Balacheda	76	0.8	HLGbB2g1	LMU-7	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Balacheda	86	0.01	HLGbB2g1	LMU-7	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Balacheda	87	7.39	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram (Gn+Rg)	Not Available	IIIes	TCB
Balacheda	88	2.56	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	100	1.15	BMDcB2	LMU-4	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	101/1	1.55	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	101/2	0.25	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	102	3.99	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	103	1.71	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	104	1.13	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	105	2.34	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	110	0.21	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Balacheda	111	0.72	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	112	1.73	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	113	7.62	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	114	0.55	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	1 Open well	IIes	TCB
Balacheda	115	1.89	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	116	0.18	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB

Village	Survey No.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Balacheda	117	9.29	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	118	1.08	DPLiB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	119	0.19	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	120	0.86	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	121	0.6	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	122	0.38	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Waterbody	Not Available	IIes	TCB
Balacheda	123	0.43	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Balacheda	124	1.31	DPLiB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	125	4.13	DPLiB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIes	TCB
Balacheda	126	1.81	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	127	6.22	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	128	5.79	DPLiB2	LMU-6	Moderately shallow (50-75 cm)	Sandy clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Groundnut+Paddy (Ct+Gn+Pd)	Not Available	IIes	TCB
Balacheda	129	0.32	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	130/1	6.39	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	130/2	1.98	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	131	3.56	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	132	3.52	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	133	8.11	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	134	6.49	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	135	0.59	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	136	0.98	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	137	0.97	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	138	0.05	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	139	2.44	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	Not Available	Others	Others

Village	Survey No.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Balacheda	140	1.15	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	141	0.7	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	142	0.27	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	TCB
Balacheda	143	5.31	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	144	1.71	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	145/1	7.17	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	Not Available	Others	Others
Balacheda	145/2	0.69	Waterbody	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	146	5.47	Waterbody	Others	Others	Others	Others	Others	Others	Others	Redgram (Rg)	1 Bore well	Others	Others
Balacheda	147	6.5	VNKiB2	LMU-8	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	TCB
Balacheda	148	5	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	149	6.92	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	150	1.25	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIes	TCB
Balacheda	151	4.21	GDGiB2	LMU-4	Deep (100-150 cm)	Sandy clay	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	152	3.55	ANRbB3	LMU-5	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	Graded bunding
Balacheda	153	4.3	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	154	4.83	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	1 Bore well	IIes	TCB
Balacheda	155	0.52	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	156	4.13	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	157	6.24	VNKiB2	LMU-8	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	158	5.22	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	TCB
Balacheda	159	2.57	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	160	6.19	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	TCB
Balacheda	161	6.98	ANRbB2g1	LMU-5	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	Graded bunding
Balacheda	162	6.31	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	163	8.07	VNKiB2	LMU-8	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB

Village	Survey No.	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Balacheda	164	6.39	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	165	7.71	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	166	8.01	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	167	8.23	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	168	6.18	GDGbB2	LMU-4	Deep (100-150 cm)	Loamy sand	Non gravelly (<15%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	169	5.28	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	170	2.07	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIes	TCB
Balacheda	172	0.41	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	1 Open well	IIIes	Graded bunding
Balacheda	172	49.84	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	No crop+Scrub land (Nc+Sl)	Not Available	IIIes	TCB
Balacheda	173	4.43	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	1 Bore well	IIes	TCB
Balacheda	174	0.94	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	175	3.24	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Balacheda	176	0.13	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	177	0.55	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	178	0.25	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIws	Graded bunding
Balacheda	179	0.3	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIws	Graded bunding
Balacheda	180	0.89	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	181	0.74	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	182	0.35	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	183	0.59	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	184	0.55	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	185	0.21	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	186/1	0.36	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIws	Graded bunding
Balacheda	186/2	0.49	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	Graded bunding
Balacheda	187	1.32	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Paddy (Pd)	Not Available	IIIws	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
Balacheda	188	3.3	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	189	1.08	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Jowar (Jw)	Not Available	IIIes	TCB
Balacheda	190	6.34	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Jowar+Redgram (Jw+Rg)	1 Check Dam	IIIes	TCB
Balacheda	191	5.91	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Paddy (Gn+Pd)	Not Available	IIIes	TCB
Balacheda	192	7.67	HGNcB2	LMU-2	Very deep (>150 cm)	Sandy loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Jowar (Ct+Jw)	Not Available	IIes	Graded bunding
Balacheda	193	0.93	HGNcB2	LMU-2	Very deep (>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
Balacheda	194	6.93	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	TCB
Balacheda	195	3.78	VNKcB2	LMU-8	Shallow (25-50 cm)	Sandy loam	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIIes	TCB
Balacheda	196	0.03	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Cotton (Ct)	Not Available	IIIes	TCB
Balacheda	199	4.34	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	Cotton+Jowar (Ct+Jw)	Not Available	IIIes	TCB
Balacheda	200	8.48	HLGcB2	LMU-7	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton (Ct)	Not Available	IIes	Graded bunding
Balacheda	201	0.44	KBDbB3	LMU-3	Moderately deep (75-100 cm)	Loamy sand	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Balacheda	211	0.1	HGNmB2	LMU-2	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
Balacheda	212	7.61	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+Redgram (Gn+Rg)	1 Open well	IIes	Graded bunding
Balacheda	213	0.22	HGNmB2	LMU-2	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
Balacheda	228	0.25	HGNmB2	LMU-2	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Cotton+Redgram (Ct+Rg)	Not Available	IIes	Graded bunding
Balacheda	229	3.42	YLRbB2	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar+Redgram (Jw+Rg)	Not Available	IIes	TCB
Balacheda	230	7.26	HGNmB2	LMU-2	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
Balacheda	231	1.23	HGNcB2	LMU-2	Very deep (>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
Balacheda	232	4.44	TMKbB3	LMU-1	Very deep (>150 cm)	Loamy sand	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	Redgram (Rg)	Not Available	IIIws	Graded bunding
Balacheda	233	4.61	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	No crop (Nc)	Not Available	IIes	TCB
Balacheda	234	4.47	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	2 Bore well	IIws	Graded bunding
Balacheda	235	6.46	Waterbody	Others	Others	Others	Others	Others	Others	Others	Waterbody	Not Available	Others	Others
Balacheda	236	2.89	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIws	Graded bunding
Balacheda	237/1	2.08	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIws	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
Balacheda	237/2	0.31	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	238	3.84	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	239	2.97	Habitation	Others	Others	Others	Others	Others	Others	Others	Jowar (Jw)	Not Available	Others	Others
Balacheda	240	4.06	Habitation	Others	Others	Others	Others	Others	Others	Others	Cotton (Ct)	Not Available	Others	Others
Balacheda	241	4.38	YLRbB2	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	TCB
Balacheda	242	1.96	YLRbB2	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	243	0.13	HGNcB2	LMU-2	Very deep (>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
Balacheda	244	2.88	YLRbB2	LMU-6	Moderately shallow (50-75 cm)	Loamy sand	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIes	TCB
Balacheda	245/1	0.01	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	TCB
Balacheda	245/2	0.37	YLRcB2g1	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	TCB
Balacheda	383	0.26	HLGbB2g1	LMU-7	Moderately shallow (50-75 cm)	Loamy sand	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+No crop (Gn+Nc)	Not Available	IIes	Graded bunding
Balacheda	385	0	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Redgram (Rg)	Not Available	IIIes	Graded bunding
Balacheda	387	0.06	BDLiB2	LMU-9	Shallow (25-50 cm)	Sandy clay	Non gravelly (<15%)	Very low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut (Gn)	Not Available	IIIes	Graded bunding
Balacheda	390	0.01	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	394	0.06	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	395	0.09	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	396	0.14	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	397	0.21	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	398	0.01	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	403	0.11	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	404	0.22	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIws	Graded bunding
Balacheda	405	0.18	TMKiB2	LMU-1	Very deep (>150 cm)	Sandy clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Paddy (Pd)	Not Available	IIws	Graded bunding
Balacheda	407	0.14	Habitation	Others	Others	Others	Others	Others	Others	Others	Not Available (NA)	Not Available	Others	Others
Balacheda	478	0.5	ANRhB3	LMU-5	Deep (100-150 cm)	Sandy clay loam	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	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
Sambara	41	0.15	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Not Available (NA)	Not Available	IIIes	TCB
Sambara	42	1.63	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Cotton+Redgram (Ct+Rg)	Not Available	IIIes	TCB
Sambara	67	0.92	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	No crop (Nc)	Not Available	IIIes	TCB
Sambara	68	9.74	GDGbB3g1	LMU-4	Deep (100-150 cm)	Loamy sand	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Severe	Groundnut (Gn)	Not Available	IIIes	TCB
Sambara	71	5.67	DPLcB2	LMU-6	Moderately shallow (50-75 cm)	Sandy loam	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Groundnut+No crop (Gn+Nc)	Not Available	IIes	TCB

Appendix II

Balched Microwatershed

Soil Fertility Information

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Baddepalli	458	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (<145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Baddepalli	461	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Baddepalli	462	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Baddepalli	463	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Baddepalli	546	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	1	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	3	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	4	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	5	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	6	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	7	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	8	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	9	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	10	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	11	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	12	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	13	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	14	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	15	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	16	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	17	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	18	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	19	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	20	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	21	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	22	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	23	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	24	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	25	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	26	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	27	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	28	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	29	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	30	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	31	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	32	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	33	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	34	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	35	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	36	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	37	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	38	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	39	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	41	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	43	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	44	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	45	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	46	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	47	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	48	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	49	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	50	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	51	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	High (> 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	52	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	53	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	54	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)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	55	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	56	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	57	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	58	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	59	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	60	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	61	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	62	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	63	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	64	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	65	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	66/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	66/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	67	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	68	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	69	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	70	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	71	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	72	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	73	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	74	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	75	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	76	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2ppm)	Deficient (<0.6 ppm)
Balacheda	86	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	87	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	88	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	100	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	101 /1	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	101 /2	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	102	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	103	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	104	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	105	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	110	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	111	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	112	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	113	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	114	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	115	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	116	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	117	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	118	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	119	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	120	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	121	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	122	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	123	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	124	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	125	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	126	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	127	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	128	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	129	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	130 /1	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	130 /2	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	131	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	132	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	133	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	134	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	135	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	136	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	137	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	138	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	139	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	140	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	141	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	142	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	143	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	144	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	145/1	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	145/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	146	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	147	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (<0.6 ppm)
Balacheda	148	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	149	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	150	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	151	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	152	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	153	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	154	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	155	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	156	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	157	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	158	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	159	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	160	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	161	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	162	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	163	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	164	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	165	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	166	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Deficient (< 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	167	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	168	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	169	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	170	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	172	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (> 337 kg/ha)	High (> 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	172	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	173	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	174	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	175	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	176	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	177	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	178	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	179	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	180	Moderately alkalin (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (<0.6 ppm)
Balacheda	181	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	182	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	183	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	184	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	185	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	186/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	186/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	187	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	188	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	189	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	190	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	191	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	192	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	193	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	194	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	Medium (0.5-0.75%)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	195	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	196	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	199	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75%)	Medium (23-57kg/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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	200	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75%)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	201	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	211	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	212	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	213	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	228	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	High (> 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	229	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	230	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145-337kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	231	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	232	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	233	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Others	Medium (145-337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	234	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	235	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	236	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	High (>337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	237/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (>57 kg/ha)	High (>337 kg/ha)	Medium (10 - 20 ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	237/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	238	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Balacheda	239	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	240	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	241	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	242	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	243	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	High (>337 kg/ha)	Medium (10 - 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	244	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	245/1	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	245/2	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	383	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Low (< 0.5 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	385	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	Medium (0.5-0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Low (< 0.5 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	387	Slightly alkaline (pH 7.3 – 7.8)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145 - 337 kg/ha)	High (> 20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	390	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	394	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	395	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	396	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (<0.6 ppm)
Balacheda	397	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	398	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	403	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	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 (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	404	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10 - 20 ppm)	Medium (0.5-1.0ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	405	Strongly alkaline (pH 8.4 – 9.0)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23- 57 kg/ha)	Medium (145-337 kg/ha)	Medium (10-20 ppm)	Medium (0.5-1.0ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Balacheda	407	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	478	Moderately alkaline (pH 7.8 – 8.4)	Non saline (<2 dsm)	High (>0.75 %)	High (> 57 kg/ha)	Medium (145-337kg/ha)	High (> 20 ppm)	Medium (0.5-1.0ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	41	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	42	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	67	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (<145 kg/ha)	Medium (10-20 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Village	SY NO	Soil Reaction	Salinity (EC)	Organic Carbon	Available Phosphorus	Available Potassium	Available Sulphur	Available Boron	Available Iron	Available Manganese	Available Copper	Available Zinc
Sambara	68	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	High (>0.75 %)	Medium (23 - 57 kg/ha)	Low (< 145 kg/ha)	Low (<10 ppm)	Medium (0.5 - 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)
Sambara	71	Neutral (pH 6.5 – 7.3)	Non saline (<2 dsm)	Medium (0.5 - 0.75 %)	Medium (23 - 57 kg/ha)	Medium (145 - 337 kg/ha)	Medium (10-20ppm)	High (> 1.0 ppm)	Sufficient (> 4.5 ppm)	Sufficient (> 1.0 ppm)	Sufficient (> 0.2ppm)	Deficient (< 0.6 ppm)

Appendix I

Balched Microwatershed

Soil Suitability Information

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Badd epalli	458	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Badd epalli	461	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Badd epalli	462	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Badd epalli	463	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
Badd epalli	546	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balac heda	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
Balac heda	2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balac heda	3	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balac heda	4	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
Balac heda	5	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
Balac heda	6	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
Balac heda	7	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
Balac heda	8	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
Balac heda	9	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
Balac heda	10	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
Balac heda	11	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
Balac heda	12	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
Balac heda	13	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
Balac heda	14	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
Balac heda	15	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
Balac heda	16	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

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	17	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
Balacheda	18	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
Balacheda	19	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
Balacheda	20	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
Balacheda	21	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
Balacheda	22	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
Balacheda	23	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
Balacheda	24	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
Balacheda	25	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
Balacheda	26	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
Balacheda	27	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
Balacheda	28	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
Balacheda	29	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
Balacheda	30	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
Balacheda	31	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
Balacheda	32	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
Balacheda	33	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
Balacheda	34	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Balacheda	35	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Balacheda	36	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Balacheda	37	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Balacheda	38	N1r	S3rt	N1r	S3r	N1rt	S3r	N1rt	N1r	S3r	N1r	S3rt	S3rt	N1rt	S3r	N1rt	N1rt	N1r	S3rt	S3rt	S3rt	S3rt	S3rt	N1r	S3rt	N1rt	N1rt
Balacheda	39	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

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	41	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
Balacheda	43	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
Balacheda	44	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
Balacheda	45	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
Balacheda	46	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
Balacheda	47	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
Balacheda	48	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
Balacheda	49	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
Balacheda	50	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
Balacheda	51	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
Balacheda	52	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
Balacheda	53	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
Balacheda	54	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
Balacheda	55	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	56	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
Balacheda	57	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
Balacheda	58	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	59	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
Balacheda	60	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	61	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	62	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	63	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	64	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	65	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	66/1	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	66/2	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	67	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	68	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	69	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	70	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
Balacheda	71	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
Balacheda	72	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balacheda	73	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	74	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
Balacheda	75	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	76	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	86	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	87	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	88	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	100	S1	S1	S1	S2t	S1	S3t	S1	S1	S3t	S1	S2t	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
Balacheda	101/1	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	101/2	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	102	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	103	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	104	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	105	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	110	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	111	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balacheda	112	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	113	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	114	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	115	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	116	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	117	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	118	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	119	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	120	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	121	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	122	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	123	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
Balacheda	124	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	125	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	126	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	127	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	128	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	129	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	130/1	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	130/2	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	131	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	132	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	133	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	134	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	135	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	136	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	137	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	138	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	139	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
Balacheda	140	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	141	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	142	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	143	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	144	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	145/1	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
Balacheda	145/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	146	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
Balacheda	147	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	148	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Balacheda	149	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	150	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	151	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balacheda	152	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Balacheda	153	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Balac	154	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r

Village	Survey No	Mango	Maize	Sapota	Sorghum	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
heda																											
Balac heda	155	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	156	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	157	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	158	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	159	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	160	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	161	S3tz	S3t	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Balac heda	162	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	163	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	164	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	165	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	166	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	167	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balac heda	168	S2rz	S2z	S2z	S2z	S2tz	S2z	S2rz	S2z	S2tz	S2z	S2z	S2z	S2z	S2z	N1tz	S2rz	S2z	S2tz	S2tz	S2z	S2tz	S2tz	S2z	S2z	S2z	S2z
Balac heda	169	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	170	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Balac heda	172	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
Balac heda	172	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balac heda	173	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balac heda	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
Balac heda	175	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
Balac heda	176	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
Balac heda	177	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	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	178	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
Balacheda	179	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
Balacheda	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
Balacheda	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
Balacheda	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
Balacheda	183	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
Balacheda	184	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
Balacheda	185	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
Balacheda	186/1	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
Balacheda	186/2	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
Balacheda	187	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
Balacheda	188	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balacheda	189	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balacheda	190	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balacheda	191	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	192	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	193	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	194	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	195	N1r	S3r	N1r	S3r	N1r	S3r	N1r	N1r	S3r	N1r	S3r	S3r	N1r	S3r	N1r	N1r	N1r	S3rt	S3r	S3r	S3r	S3r	N1r	S3r	N1r	N1r
Balacheda	196	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balacheda	199	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g
Balacheda	200	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	201	S3rg	S3g	S3g	S3g	S3g	S3g	S3rg	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S2g	S2g	S2g

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	211	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	212	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	213	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	228	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	229	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Balacheda	230	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	231	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	232	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
Balacheda	233	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Balacheda	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
Balacheda	235	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
Balacheda	236	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
Balacheda	237/1	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
Balacheda	237/2	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	238	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
Balacheda	239	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
Balacheda	240	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
Balacheda	241	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Balacheda	242	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Balacheda	243	S3t	S3tw	S3t	S2wz	S3t	S2wz	S2t	S2z	S2wz	S2rw	S2tw	S2z	S3t	S2z	N1tz	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tw	S2tw	S3tw
Balacheda	244	N1r	S2r	S3r	S2r	S3r	S2r	N1r	S3r	S2r	S3r	S3r	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2r	S2r	S2r	S2r	S3r	S2r	S3r	S3r
Balacheda	245/1	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r
Balacheda	245/2	N1r	S2rg	S3r	S2rg	S3r	S2rg	N1r	S3r	S2rg	S3rg	S3rg	S2r	S3r	S2r	S3r	S3r	S3r	S2r	S2rg	S2rg	S2rg	S2rg	S3r	S2r	S3r	S3r

Village	Survey No	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	engalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	hrysanthemum	Pomegranate	Bajra	Drumstick	Mulberry
Balacheda	383	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	N1tz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz
Balacheda	385	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
Balacheda	387	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
Balacheda	390	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
Balacheda	394	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
Balacheda	395	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
Balacheda	396	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
Balacheda	397	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
Balacheda	398	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
Balacheda	403	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
Balacheda	404	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
Balacheda	405	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
Balacheda	407	)thers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	)thers	Others	Others	)thers	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others	Others
Balacheda	478	S3tz	S3tw	S3t	S2zw	S3t	S2z	S2t	S2z	S2z	S2zw	S2tw	S2t	S3t	S2z	N1t	S2t	S2z	S3tw	S2tw	S3tw	S2tw	S2tw	S2t	S2tz	S2tw	S3tw
Sambara	41	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Sambara	42	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Sambara	67	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Sambara	68	S2rz	S2zg	S2zg	S2zg	S2tz	S2zg	S2rz	S2zg	S2tg	S2zg	S2zg	S2z	S2zg	S2z	N1tz	S2rz	S2z	S2tz	S2tg	S2zg	S2tg	S2tg	S2z	S2z	S2z	S2z
Sambara	71	N1rz	S2rz	S3rz	S2rz	S3rz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3rz	S2rz	S3rz	S3rz	S3rz	S2rz	S2rz	S2rz	S2rz	S2rz	S3rz	S2rz	S3rz	S3rz

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: Balched micro-watershed (Yadgiri taluk and district) is located in between $16^0 33'$ – $16^0 35'$ North latitudes and $77^0 18'$ – $77^0 20'$ East longitudes, covering an area of about 613.39 ha, bounded by Sambara, Baddepalli, Kanikal, Balacheda & Sowrashtralli village 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 Balched micro-watershed in Yadgir taluk and district are presented here.*

Social Indicators;

- *Male and female ratio is 65.9 to 34.1 per cent to the total sample population.*
- *Younger age group 18 to 50 of population is around 64.4 per cent to the total population.*
- *Literacy population is around 58.3 per cent.*
- *Social groups belong to other backward caste (OBC) are around 66.7 per cent.*
- *Fire wood is the source of energy for a cooking among all sample households.*
- *About 20.0 per cent of households have a yashaswini health card.*
- *About 43.3 per cent farm households having MGNREGA card for rural employment.*
- *Dependence on ration cards for food grains through public distribution system is around 90.0 per cent.*
- *Swach bharath program providing closed toilet facilities around 33.3 per cent of sample households.*
- *Women participation in decisions making are around 83 per cent of households were found.*

Economic Indicators;

- *The average land holding is 2.22 ha indicates that majority of farm households are belong to medium farmers and semi-medium farmers. The account for dry land of 55.54 ha among the total cultivated land among the sample households.*
- *Agriculture is the main occupation is only 19.7 per cent and agriculture is the main and non agriculture labour is subsidiary occupation for 40.2 per cent of sample households.*

- *The average value of domestic assets is around Rs.12950 per household. Mobile and television are popular media mass communication.*
- *The average value of farm assets is around Rs.6625 per household, about 16.7 per cent of sample farmers are owing plough.*
- *The average value of livestock is around Rs.27769 per household; about 67.50 per cent of household are having livestock.*
- *The average per capita food consumption is around 1134.7 grams (2639.8 kilo calories) against national institute of nutrition recommendation at 827 gram. Around 92 per cent of sample households are consuming more than the NIN recommendation.*
- *The annual average income is around Rs. 22630 per household. About 100 per cent of farm households are below poverty line.*
- *The per capita monthly average expenditure is around Rs.4456.*

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.3629/ ha/year. Per hectare food grain production services is maximum in groundnut (Rs.9046) followed by cotton (Rs.8643), redgram (Rs.4232) and paddy is a negative returns.*
- *The average value of ecosystem service for fodder production is around Rs.2367/ ha/year. Per hectare fodder production services is maximum in paddy (Rs. 3705) followed by groundnut (Rs.1029).*
- *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 paddy (Rs.82646) followed by cotton (Rs. 43455), redgram (Rs. 37986) and groundnut (Rs. 32617).*

Economic Land Evaluation;

- *The major cropping pattern is redgram (66.2 %) followed by groundnut (19.8 %), cotton (13.1 %) and paddy (1.0 %).*
- *The total cost of cultivation in study area for cotton ranges between Rs.47784/ha in semi-medium farmers (with BCR of 1.31) and Rs.31036/ha in small farmers (with BCR of 1.13).*
- *In groundnut the costs of cultivation range between Rs.63123/ha in medium farmers (with BCR of 1.13) and Rs.35112/ha in semi-medium farmers (with BCR of 1.23).*
- *In red gram the cost of cultivation range between is Rs.36918/ha in marginal farmers (with BCR of 1.02) and Rs.19824/ha in medium farmers (with BCR of 1.28).*

- *The cost of cultivation of paddy is Rs.130903/ha in small farmers (with BCR of 1.03).*
- *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 strengthening 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 strengthening 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 redgram (38.4 to 46.9 %), cotton (10.8 to 54.2 %), groundnut (7.5 to 42.2 %), and paddy (15.7 %).*

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

Balched 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.

Balched micro-watershed (Yadgir taluk and district) is located in between $16^0$33' – $16^0$35' North latitudes and $77^0$18' – $77^0$20' East longitudes, covering an area of about 613.39 ha, bounded by Sambara, Baddepalli, Kanikal, Balacheda & Sowrashtralli village.

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).

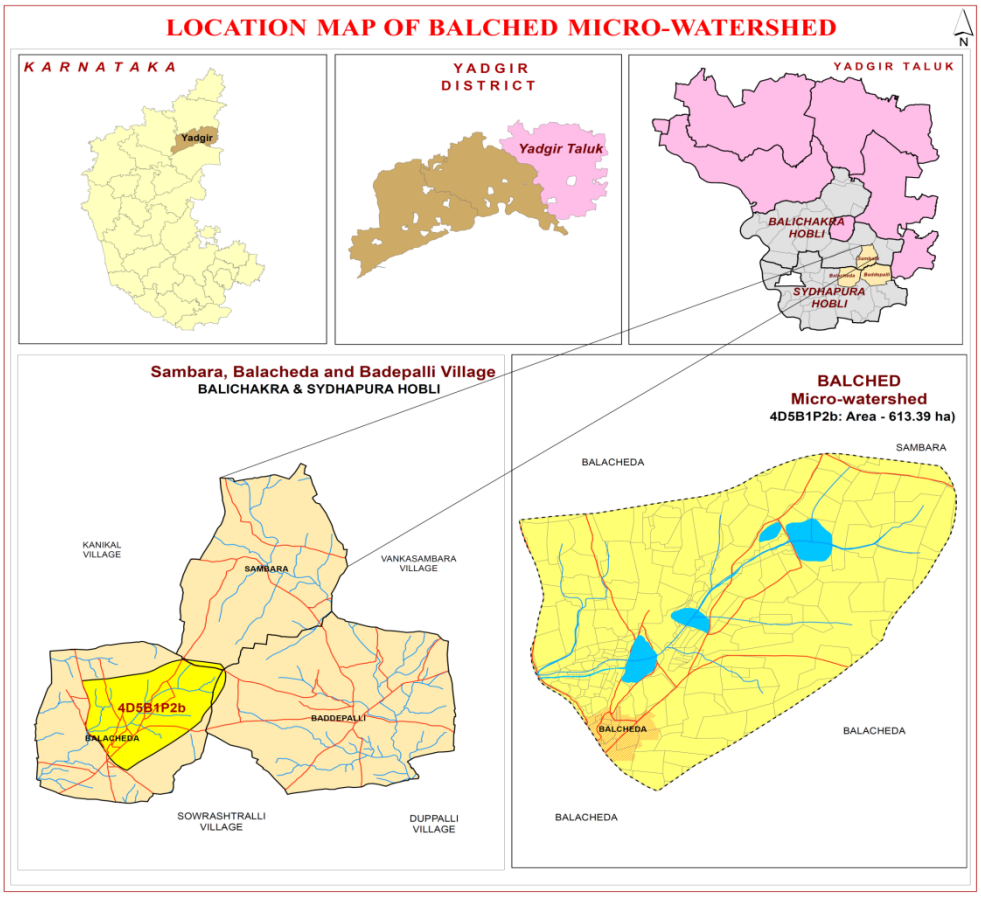
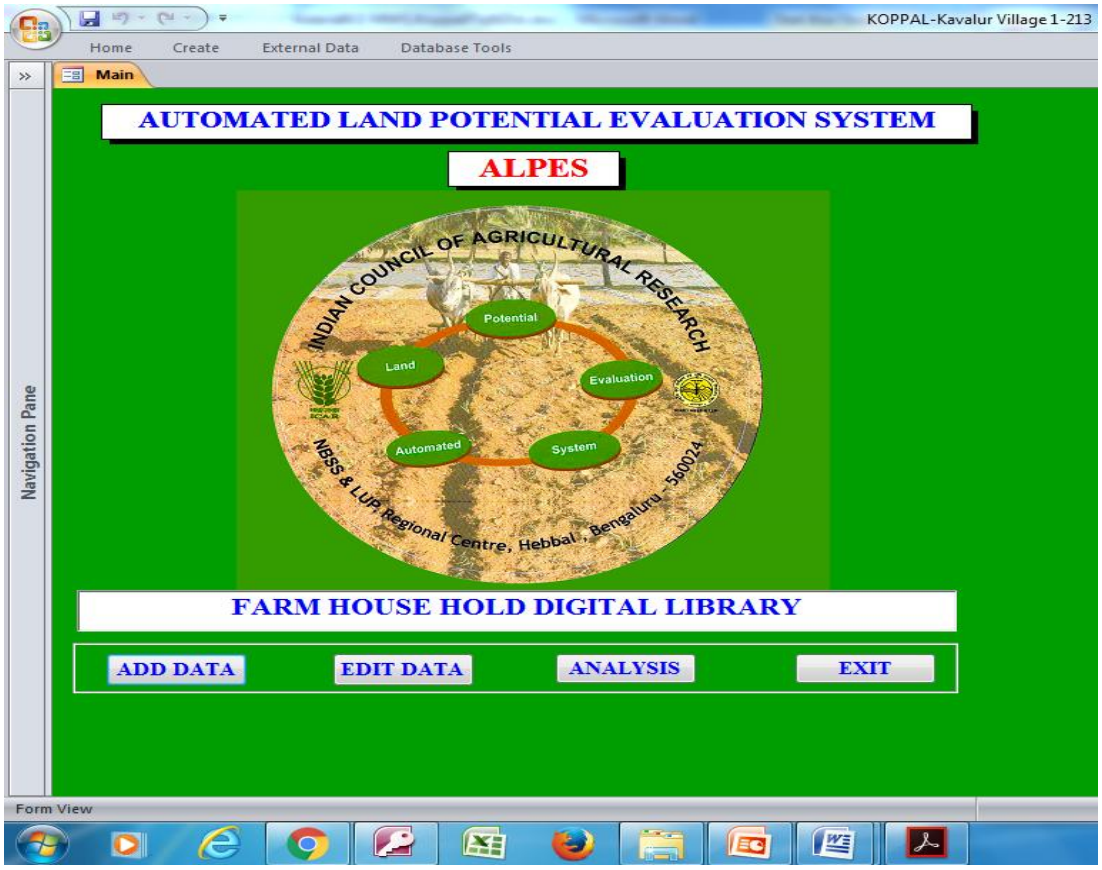


Figure 1: Location of study area

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 .



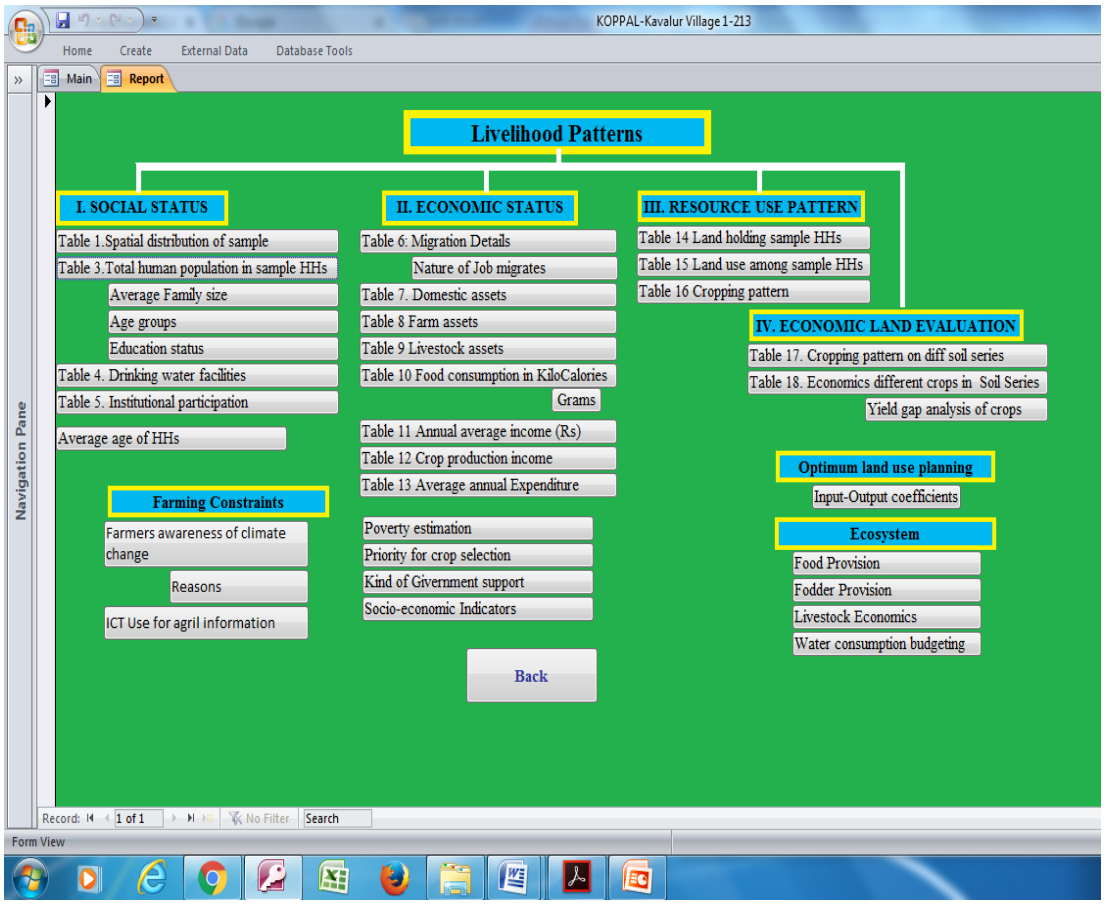


Figure 2: ALPES FRAMEWORK

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.

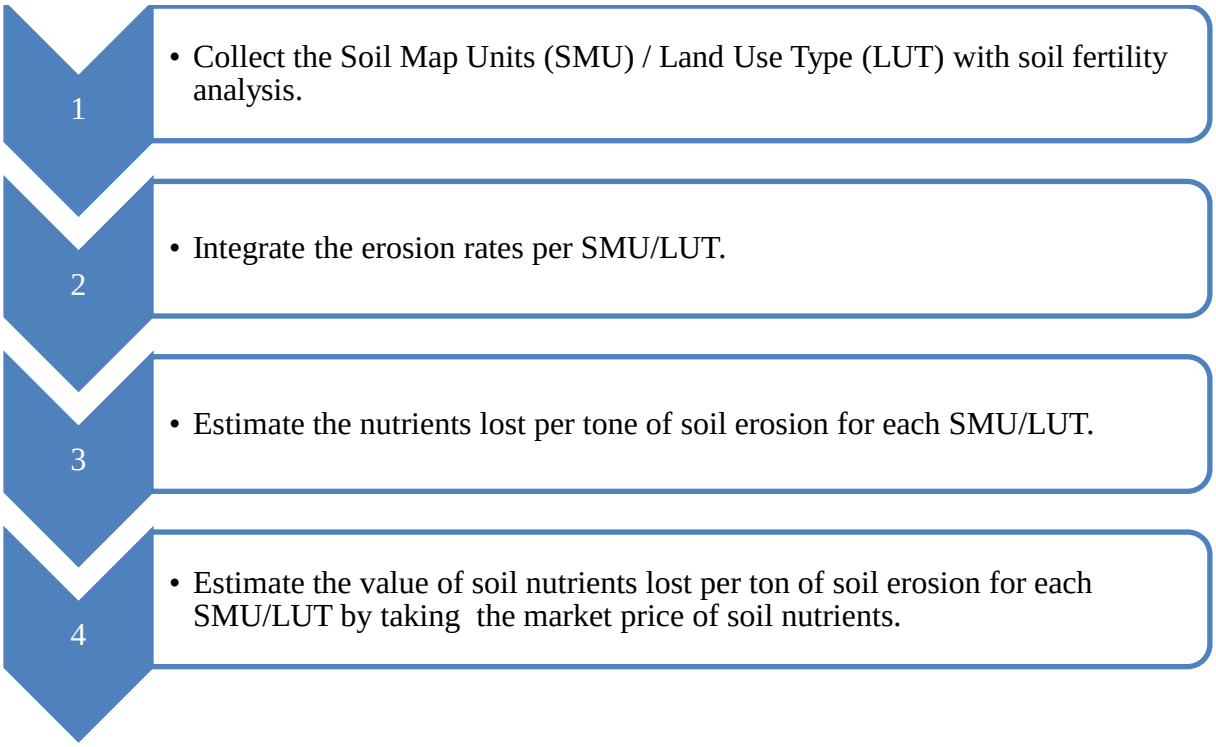
Operational Cost = cost of seeds, fertilizers, pesticides. Cost of human and bullock labour, cost of machinery, cost of irrigation water + interest on working capital.
Gross returns = Yield (Quintals/hectare)*Price (Rs/Quintal)
Net returns = Gross returns-Operational cost.
Benefit Cost Ratio = Net returns/Total 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 132, out of which 65.9 per cent were males and 34.1 per cent females. Average family size of the households is 4.40 among the sample population.

Table 1: Human population among sample households in Balched Microwatershed

Particulars	LL(22)		MF(10)		SF(50)		SMF(40)		MDF(10)		ALL (132)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	16	72.7	6	60.0	33	66.0	25	62.5	7	70.0	87	65.9
Female	6	27.3	4	40.0	17	34.0	15	37.5	3	30.0	45	34.1
Total human population	22	100	10	100	50	100	40	100	10	100	132	100
Average family size	4.40		5.00		4.55		4.00		5.00		4.40	

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 18 to 30 years (36.4 %) followed by 30 to 50 years (28.0 %), 0 to18 years (23.5 %) and more than 50 years (12.1 %). 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 Balched micro-watershed

Particulars	LL(22)		MF(10)		SF(50)		SMF(40)		MDF(10)		ALL (132)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 to 18 years	5	22.7	2	20.0	11	22.0	10	25.0	3	30.0	31	23.5
18 to 30 years	10	45.5	3	30.0	21	42.0	10	25.0	4	40.0	48	36.4
30 to 50 years	5	22.7	4	40.0	13	26.0	13	32.5	2	20.0	37	28.0
>50 years	2	9.1	1	10.0	5	10.0	7	17.5	1	10.0	16	12.1
Grand total	22	100	10	100	50	100	40	100	10	100	132	100
Average age	34.0		32.6		29.8		33.3		26.1		31.0	

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

Particulars	LL(22)		MF(10)		SF(50)		SMF(40)		MDF(10)		ALL (132)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterates	6	27.3	5	50.0	21	42.0	18	45.0	5	50.0	55	41.7
Literates	16	72.7	5	50.0	29	58.0	22	55.0	5	50.0	77	58.3
Primary School (<5 class)	4	18.2		0.0	6	12.0	15	37.5	3	30.0	28	21.2
Middle School (6- 8 class)	6	27.3	2	20.0	7	14.0	2	5.0		0.0	17	12.9
High School (9- 10 class)	4	18.2	1	10.0	7	14.0	3	7.5	1	10.0	16	12.1
Senior secondary	2	9.1		0.0	6	12.0	1	2.5		0.0	9	6.8
Graduate		0.0	2	20.0	3	6.0	1	2.5	1	10.0	7	5.3
Grand Total	22	100	10	100	50	100	40	100	10	100	132	100

Data on literacy (Table 3) indicated that 41.7 per cent of respondents were illiterate and 58.3 per cent literate with highest of primary school education (21.2 %) followed by the middle school education (12.9 %), high school education (12.1 %), senior secondary education (6.8 %) and graduates (5.3 %).

The ethnic groups among the sample farm households found to be 66.7 per cent belonging to other backward classes (OBC) followed by 20 per cent belonging to scheduled caste (SC), 10 per cent belong to scheduled tribes (ST) and 3.3 per cent belonging to general caste among the sample population (Table 4 and Figure 3).

Table 4: Social groups among sample households in Balched Microwatershed

Particulars	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
SC	3	60.0		0	2	18.2	1	10.0		0	6	20.0
ST	1	20.0		0	1	9.09	1	10.0		0	3	10.0
OBC	1	20.0	2	100	7	63.6	8	80.0	2	100	20	66.7
General		0.0		0	1	9.09		0.0		0	1	3.3
Grand Total	5	100	2	100	11	100	10	100	2	100	30	100

Among the entire sample households are using fire wood as source of fuel for cooking. Around 96.7 per cent of the sample farmers are having electricity connection. About 20.0 per cent are sample households having health cards. Only 43.3 per cent are having MNREGA job cards for employment generation. About 90.0 per cent of farm households are having ration cards for taking food grains from public distribution system. About 33.3 per cent of farm households are having toilet facilities (Table 5).

Table 5: Basic needs of sample households in Balched Microwatershed

Particulars	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Types of fuel use for cooking												
Fire wood	5	100	2	100	11	100.0	10	100	2	100	30	100.0
Energy supply for home												
Electricity	5	100	2	100	10	90.9	10	100	2	100	29	96.7
Solar	0	0	0	0	1	9.1	0	0	0	0	1	3.3
Health Card												
Yes	0	0	1	50	3	27.3	2	20	0	0	6	20.0
No	5	100	1	50	8	72.7	8	80	2	100	24	80.0
NREGA												
Yes	5	100	1	50	6	54.5	1	10	0	0	13	43.3
No	0	0	1	50	5	45.5	9	90	2	100	17	56.7
Ration Card												
Yes	4	80	2	100	10	90.9	9	90	2	100	27	90.0
No	1	20	0	0	1	9.1	1	10	0	0	3	10.0
Household with toilet												
Yes	2	40	0	0	5	45.5	3	30	0	0	10	33.3
No	3	60	2	100	6	54.5	7	70	2	100	20	66.7
Drinking Water												
Tank	0	0	1	50	2	18.2	0	0	0	0	3	10.0
Tube Well	5	100	1	50	9	81.8	10	100	2	100	27	90.0

The data collected on the source of drinking water in the study area is presented in Table 5. Majority of the sample respondents are having tube well source for water supply for domestic purpose with share of 90.0 per cent.

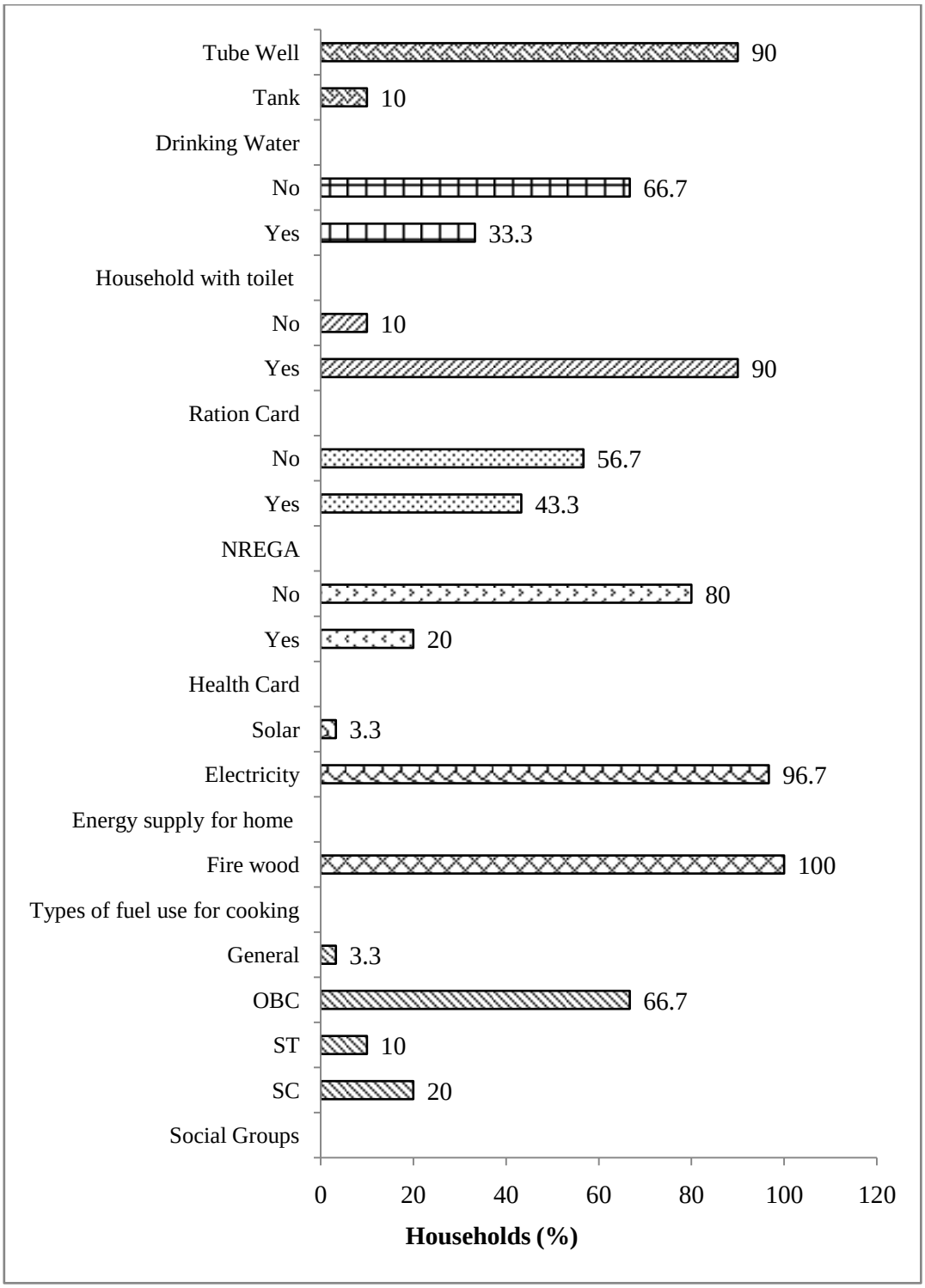


Figure 3: Basic needs of sample households in Balched Microwatershed

The occupational pattern (Table 6) among sample households shows that agriculture is the main occupation is around 19.7 per cent and agriculture is a main and non agriculture labour is subsidiary occupations around 40.2 per cent of population.

Private services are main occupation and non agriculture labour is subsidiary occupations around 12.9 per cent of population.

Table 6: Occupational pattern in sample population in Balched Microwatershed

Occupation		LL (22)		MF (10)		SF (50)		SMF (40)		MDF (10)		ALL (132)	
Main	**Subsidiary**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Agriculture	Agriculture	0	0.0	3	30.0	11	22.0	11	27.5	1	10.0	26	19.7
	Non Agriculture Labour	0	0.0	3	30.0	26	52.0	18	45.0	6	60.0	53	40.2
Private service	Non Agriculture Labour	15	68.2	0	0.0	1	2.0	1	2.5	0	0.0	17	12.9
Studying		7	31.8	4	40.0	12	24.0	10	25.0	3	30.0	36	27.3
Grand Total		22	100	10	100	50	100	40	100	10	100	132	100
Family labour availability		**Man days/month**											
Male		40	57	62.5	68	66.1	72	55	70	25	56	59.1	70
Female		30	43	30	32	26	28	23.7	30	20	44	25.3	30
Total		70	100	93	100	92	100	79	100	45	100	84	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 mobile phones (93.3 %), followed by television (90 %), mixer/grinder (13.3 %), motorcycle (6.7 %) and landline phone (3.3 %). The average value of domestic assets is around Rs. 12950 per households.

Table 7: Domestic assets among the sample households in Balched Microwatershed

Particulars	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Landline Phone	0	0	0	0	1	9	0	0	0	0	1	3.3
Mixer/grinder	0	0	0	0	0	0	4	40	0	0	4	13.3
Mobile Phone	4	80	2	100	10	91	10	100	2	100	28	93.3
Motorcycle	0	0	1	50	0	0	1	10	0	0	2	6.7
Television	2	40	2	100	11	100	10	100	2	100	27	90

Average value of durable assets: The data regarding the average value of durable assets owned by the households in Balched micro watershed is presented in Table 8. The results shows that the average value of landline phone was Rs.2000, mixer grinder was Rs.2500, mobile phone was Rs.4440, motor cycle was Rs.47500 and television Rs. 8309.

Table 8: Average value of durable asset of Balched micro-watershed

(Rupees)

Particulars	LL(5)	MF(2)	SF(11)	SMF(10)	MDF(2)	ALL (30)
Landline Phone	0	0	2000	0	0	2000
Mixer/grinder	0	0	0	2500	0	2500
Mobile Phone	2500	1500	5900	4800	7500	4440
Motorcycle	0	70000	0	25000	0	47500
Television	5000	10000	9545	9500	7500	8309
Average Value	3750	27167	5815	10450	7500	12950

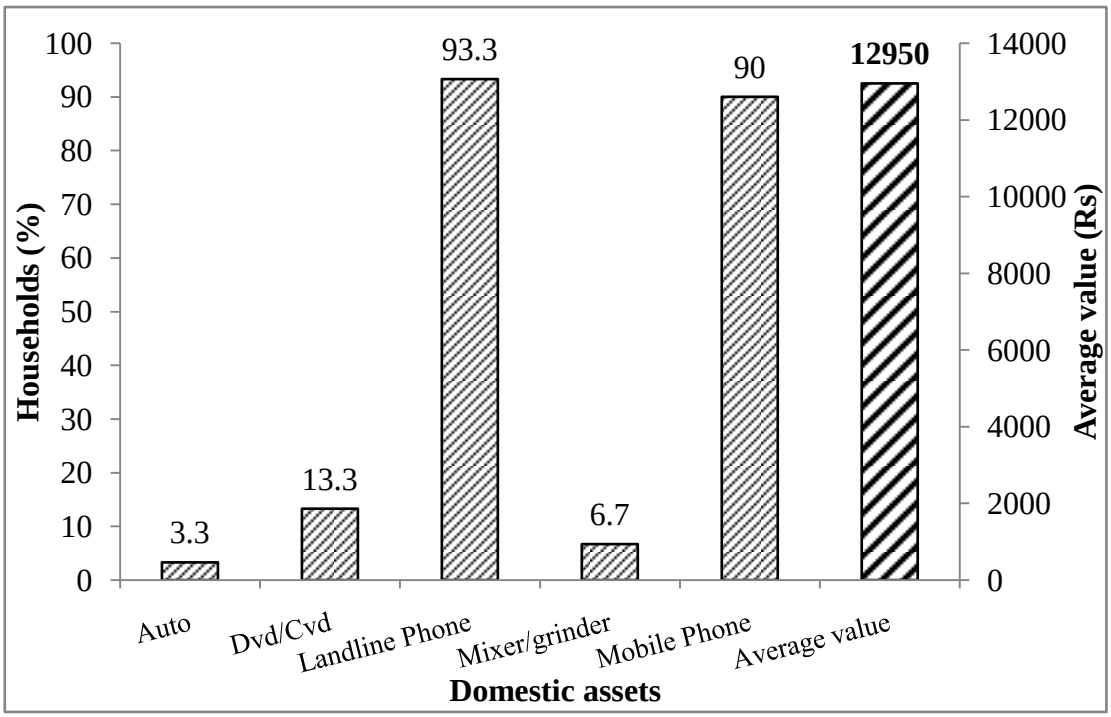


Figure 4: Domestic assets among the sample households in Balched Microwatershed

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 (16.7 %), plough (16.7 %), sprayer (3.3 %) and weeder (3.3 %) was found highest among the sample farmers. the average value of farm assets is around Rs. 6625 per households (Table 9 and Figure 5).

Table 9: Farm assets among samples households in Balched Microwatershed

	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
Particulars	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Bullock cart	0	0	0	0	2	18.2	1	10	2	100	5	16.7
Plough	0	0	0	0	2	18.2	1	10	2	100	5	16.7
Sprayer	0	0	0	0	0	0.0	0	0	1	50	1	3.3
Weeder	0	0	0	0	1	9.1	0	0	0	0	1	3.3
Blank	5	100	2	100	6	54.5	8	80	0	0	21	70

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

Particulars	**LL(5)**	**MF(2)**	**SF(11)**	**SMF(10)**	**MDF(2)**	**ALL (30)**
Bullock cart	0	0	15000	20000	20000	18000
Weeder	0	0	5000	0	0	5000
Plough	0	0	2750	2000	2000	2300
Sprayer	0	0	0	0	1200	1200
Average Value	0	0	7583	11000	7733	6625

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Balched micro watershed is presented in Table 10. The results show that the average value of bullock cart was Rs.18000, the average value of weeder was Rs. 5000, the average value of plough was 2300 and the average value of sprayer was Rs.1200.

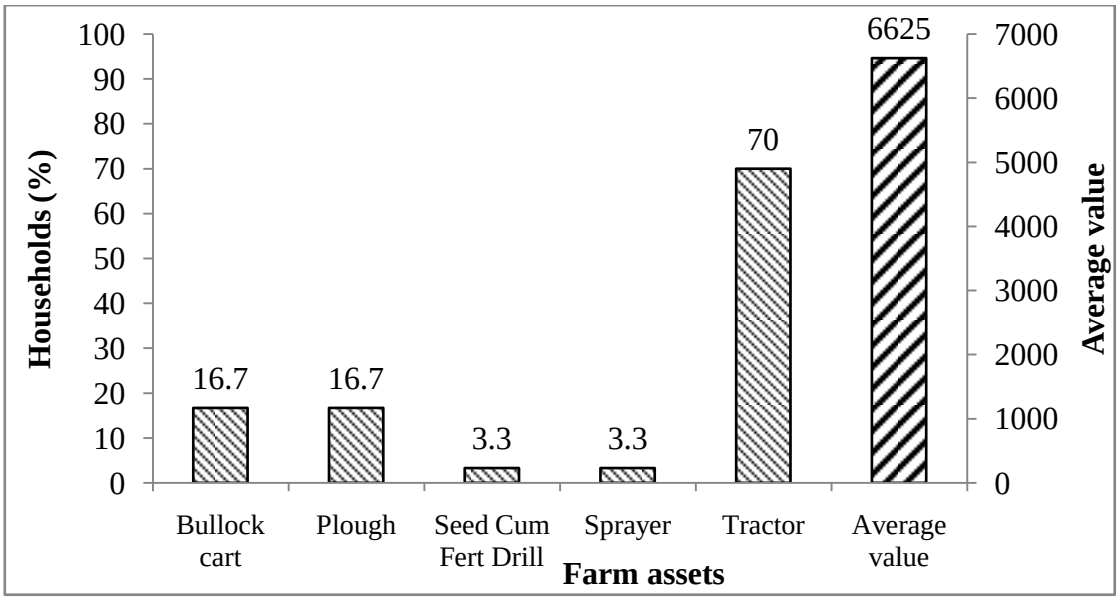


Figure 5: Farm assets among samples households in Balched Microwatershed

Livestock is an integral component of the conventional farming systems (Table 11 and Figure 6). The highest livestock population is bullocks were around 23.3 per cent followed by local dry cow (13.3 %), local milching cow (13.3 %), poultry (13.3 %), sheeps (10.0 %), goats (6.7 %), crossbred milching cow (3.3 %), dry buffalos (3.3%) and milching buffalos (3.3 %). The average livestock value was Rs. 27769 per households.

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

Livestock	MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Bullocks	1	50	2	18.2	2	20	2	100	7	23.3
Crossbred Milching Cow	1	50	0	0.0	0	0	0	0	1	3.3
Dry Buffalos	0	0	0	0.0	0	0	1	50	1	3.3
Goats	0	0	2	18.2	0	0	0	0	2	6.7
Local Dry Cow	0	0	3	27.3	1	10	0	0	4	13.3
Local Milching Cow	0	0	2	18.2	2	20	0	0	4	13.3
Milching Buffalos	0	0	0	0.0	0	0	1	50	1	3.3
Poultry	0	0	4	36.4	0	0	0	0	4	13.3
Sheeps	0	0	3	27.3	0	0	0	0	3	10.0

Average value of livestock: The data regarding the average value of farm Implements owned by the households in Balched micro watershed is presented in Table 12. The results show that the average value of bullocks was Rs.88571, the average value of

crossbred milching cow was Rs. 40000, the average value of dry buffalos was Rs. 10000, the average value of goats was Rs. 22500, the average value of local dry cow was Rs.11250, the average value of local milching cow was Rs.26250, the average value of milching buffalos was Rs. 10000, the average value of poultry was Rs.1350 and the average value of sheeps was Rs. 40000.

Table 12: Average value of livestock owned by households in Balched micro-watershed (Rupees)

Particulars	MF(2)	SF(11)	SMF(10)	MDF(2)	ALL (30)
Bullocks	100000	55000	55000	150000	88571
Crossbred Milching Cow	40000	0	0	0	40000
Dry Buffalos	0	0	0	10000	10000
Goats	0	22500	0	0	22500
Local Dry Cow	0	11667	10000	0	11250
Local Milching Cow	0	17500	35000	0	26250
Milching Buffalos	0	0	0	10000	10000
Poultry	0	1350	0	0	1350
Sheeps	0	40000	0	0	40000
Average Value	70000	24669	33333	56667	27769

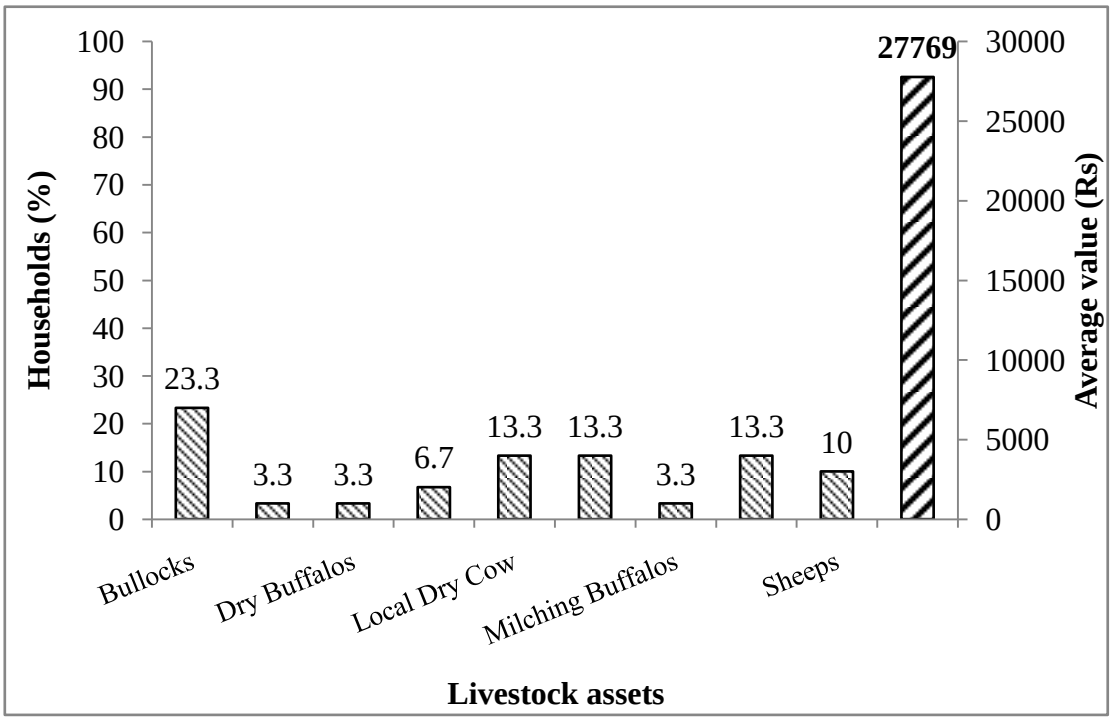


Figure 6: Livestock assets among sample households in Balched micro-watershed

Average milk produced in sample households is 963 litters/ annum. Among the farm households, groundnut and paddy are the main crops for domestic food and fodder for animals. About 3154 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 Balched Microwatershed

Particulars	MF(2)	SF(11)	SMF(10)	MDF(2)	ALL (30)
Name of the livestock	**Ltr./Lactation/animal**				
Crossbred Milching Cow	1840	0	0	0	1840
Local Milching Cow	0	540	600	0	570
Milching Buffalos	0	0	0	480	480
Average milk produced	***1840***	***540***	***600***	***480***	***963***
Fodder produces	**Fodder yield (kg/ha)**				
Groundnut	0	2422	2167	1500	2141
Paddy	0	4167	0	0	4167
Average fodder availability	***0***	***3294***	***2167***	***1500***	***3154***
Livestock having households (%)	66.67	76.19	41.67	100.00	67.50
Livestock population (Numbers)	6	148	12	7	173

A woman participation in decision making is in this micro-watershed is presented in Table 14. About 100 per cent women earning for her family requirement and 83 per cent of women taking decision in her family and agriculture related activities.

Table 14: Women empowerment of sample households in Balched Microwatershed

Particulars	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Women participation in local organization activities												
Yes	0	0	0	0	0	0	0	0	0	0	0	0
No	5	100	2	100	11	100	10	100	2	100	30	100
Women participation in Elected Panchayth												
Yes	0	0	0	0	0	0	0	0	0	0	0	0
No	5	100	2	100	11	100	10	100	2	100	30	100
Women earning for her family requirement												
Yes	5	100	2	100	11	100	10	100	2	100	30	100
No	0	0	0	0	0	0	0	0	0.0	0.0	0	0
Women taking decision in her family and agriculture related activities												
Yes	0	0	2	100	11	100	10	100	2	100	25	83
No	5	100	0	0	0	0	0	0	0.0	0.0	5	17

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 1638.0 kcal per person. The other important food items consumed was pulses 274.2 kcal followed by milk 78.5 kcal, vegetables 37.2 kcal, cooking oil 225.4 kcal, egg 333.5 kcal and meat 52.9 kcal. In the sampled households farmers were consuming more (2639.8 kcal) than NIN- recommended food requirement (2250 kcal).

Table 15: Per capita daily consumption of food among the sample households in Balched Microwatershed

Particulars	NIN recommendation (gram/per day/person/)	Present level of consumption (gram/per day/person)	Kilo calories / day/person
Cereals	396	481.8	1638.0
Pulses	43	80.0	274.2
Milk	200	120.7	78.5
Vegetables	143	155.1	37.2
Cooking Oil	31	39.5	225.4
Egg	0.48	222.4	333.5
Meat	14.2	35.3	52.9
Total	**827.68**	1134.7	2639.8
Threshold of NIN recommendation		**827***	**2250***
Below NIN		8	32
Above NIN		92	68

Note: * day/person

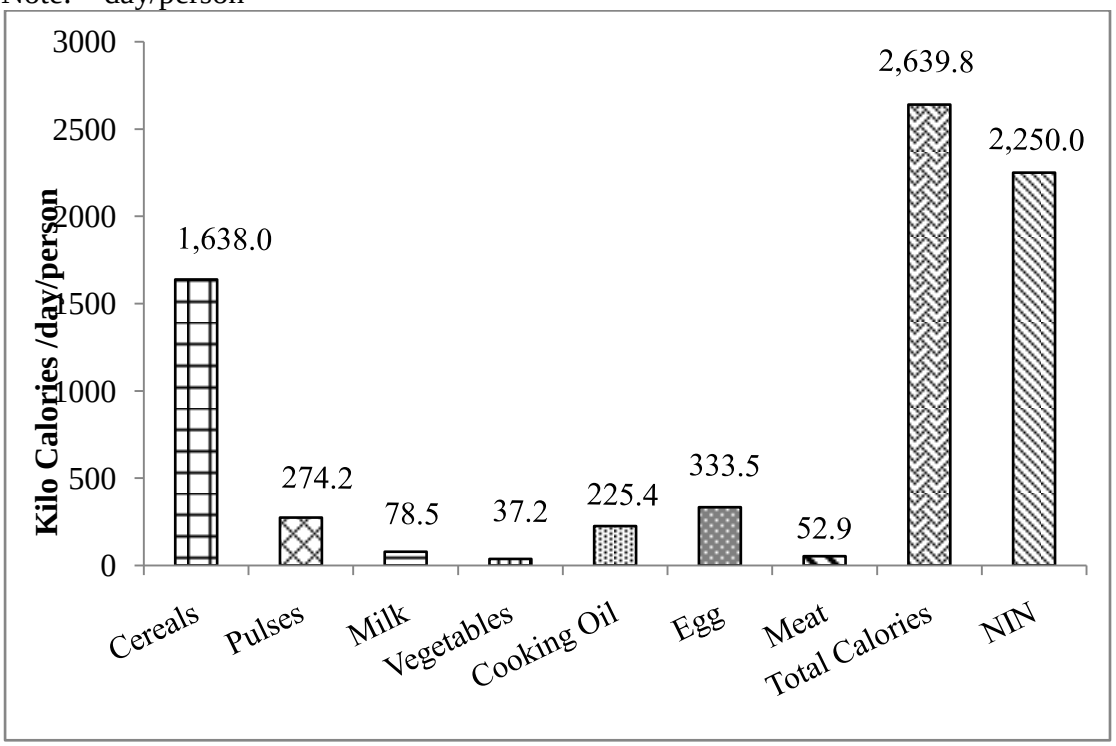


Figure 7: Per capita daily consumption of food among the sample households in Balched Microwatershed

Annual income of the sample HHs: The average annual household income is around Rs. 22630. Major source of income to the farmers in the study area is from livestock (Rs.11976) followed by crop production (Rs. 10654). The monthly per capita income is Rs. 429, which is less than the threshold monthly income of Rs.975 for considering above 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 Balched Microwatershed

Particulars	MF (2)*	SF (11)*	SMF (10)*	MDF (2)*	ALL (30)*
Nonfarm income	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Livestock income	0 (0)	4625 (18.18)	13150 (20)	24330 (50)	11976 (20)
Crop Production	485 (100)	5680 (100)	13148 (100)	35715 (100)	10654 (100)
Total Income (Rs)	485	10305	26298	60045	22630
Average monthly per capita income (Rs)	8	189	548	1001	429
Thresholds for poverty level (Rs 975 per month/person)					
% of households Above poverty line	0.0	0.0	0.0	0.0	0.0
% of households below poverty line	100	100	100	100	100

* 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.53223) followed by social function, health, education, and clothing. 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. 4456 and about 100 per cent of farm households are below poverty line (Table 17 and Figure 8).

Table 17: Average annual expenditure of sample HHs in Balched Microwatershed

Particulars	LL(5)		MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Food	42621	57.1	54510	38.7	58342	35.1	52110	49.9	58530	56.5	53223	45.1
Education	2500	3.4	35000	24.8	5545	3.3	2000	1.9	5000	4.8	10009	8.5
Clothing	3500	4.7	5000	3.5	9545	5.7	7900	7.6	10000	9.7	7189	6.1
Social functions	25000	33.5	40000	28.4	80909	48.7	26000	24.9	10000	9.7	36382	30.8
Health	1000	1.3	6500	4.6	11818	7.1	16500	15.8	20000	19.3	11164	9.5
Total	74621	100	141010	100	166160	100	104510	100	103530	100	117966	100
Monthly per capita	1244		2350		3046		7052		3226		4456	

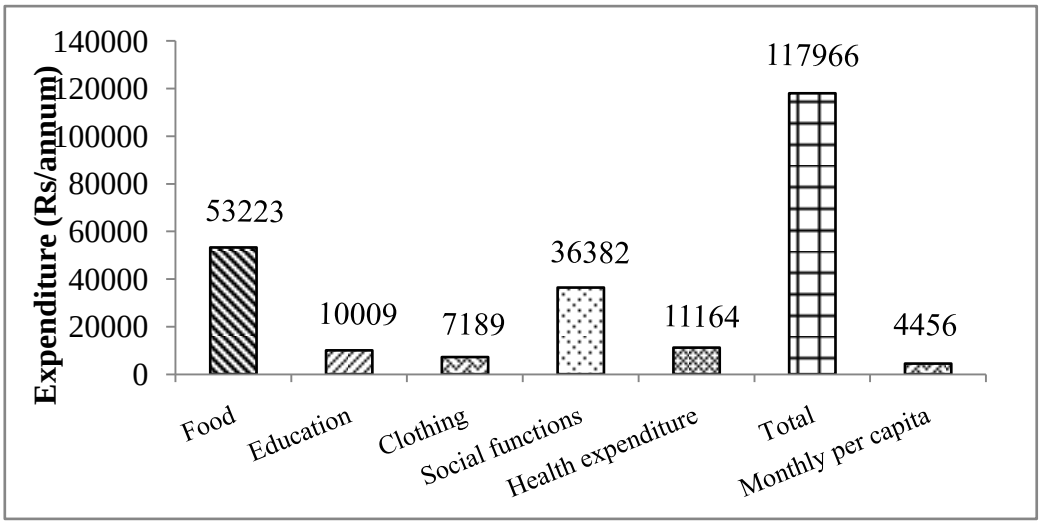


Figure 8: Average annual expenditure of sample HHs in Balched Microwatershed

Land holding: Total sample households are 25 and total area cultivated by them is 55.54 ha. The average land holding of sample HHs is 2.22 ha. the large number of households is (11) belong to small size group with an average holding size of 1.41 ha followed by semi-medium farmers (10) with an average holding size of 2.41 ha, marginal farmers (2) with an average land holding is 0.69 ha and medium size groups (2) with an average land holding is 7.29 ha (Table 18).

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

Size groups	Particulars	Value
Marginal Farmers	Total sample HHs in number	2
	Total land holding (ha)	1.38
	Avg of Total land holding (ha)	0.69
Small Farmers	Total sample HHs in number	11
	Total land holding (ha)	15.47
	Avg of Total land holding (ha)	1.41
Semi-Medium Farmers	Total sample HHs in number	10
	Total land holding (ha)	24.12
	Avg of Total land holding (ha)	2.41
Medium Farmers	Total sample HHs in number	2
	Total land holding (ha)	14.57
	Avg of Total land holding (ha)	7.29
Total sample households	Total sample HHs in number	25
	Total land holding (ha)	55.54
	Avg of Total land holding (ha)	2.22

Land use: The total land holding in the Balched micro-watershed is 55.54 ha it's a dry land condition (Table 19). The average land holding per household is worked out to be 2.22 ha.

Table 19: Land use among samples households in Balched Microwatershed

Particulars	MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Irrigated land	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Dry land	1.38	100	15.47	100	24.12	100	14.57	100	55.54	100
Fallow land	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Total land	1.38	100	15.47	100	24.12	100	14.57	100	55.54	100
Average of land area	0.69		1.41		2.41		7.29		2.22	

In the micro-watershed, the prevalent present land uses under perennial plants are neem trees (89.5 %) followed by peeple tree (Arali) (5.24 %), mango (2.38 %), coconut (1.43 %), tamarind (0.95 %) and banyan tree (Alada) (0.48 %) (Table 20).

Table 20: Number of trees/plants covered in sample farm households in Balched Microwatershed

Plants	MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Banyan tree(Alada)	0	0	0	0	1	1.96	0	0	1	0.48
Coconut	0	0	3	2.4	0	0	0	0	3	1.43
Mango	0	0	1	0.8	4	7.84	0	0	5	2.38
Neem trees	4	100	108	86.4	46	90.2	30	100	188	89.5
Peeple tree(Arali)	0	0	11	8.8	0	0	0	0	11	5.24
Tamarind	0	0	2	1.6	0	0	0	0	2	0.95
Grand Total	4	100	125	100	51	100	30	100	210	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 redgram (66.2 %) followed by groundnut (19.8 %), cotton (13.1 %) and paddy (1.0 %) which are taken during Kharif season respectively. The cropping intensity was 100 per cent (Table 21 and Figure 9).

Table 21: Present cropping pattern and cropping intensity in Balched Microwatershed

Crops	MF(2)		SF(11)		SMF(10)		MDF(2)		ALL (30)	
	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%	Area in ha	%
Red gram	1.4	100.0	8.1	52.5	15.1	62.5	12.2	83.9	36.8	66.2
Groundnut	0.0	0.0	3.0	19.1	5.6	23.2	2.4	16.1	11.0	19.8
Cotton	0.0	0.0	3.8	24.7	3.4	14.3	0.0	0.0	7.3	13.1
Paddy	0.0	0.0	0.6	3.7	0.0	0.0	0.0	0.0	0.5	1.0
Total	1.4	100	15.5	100	24.1	100	14.6	100	55.5	100

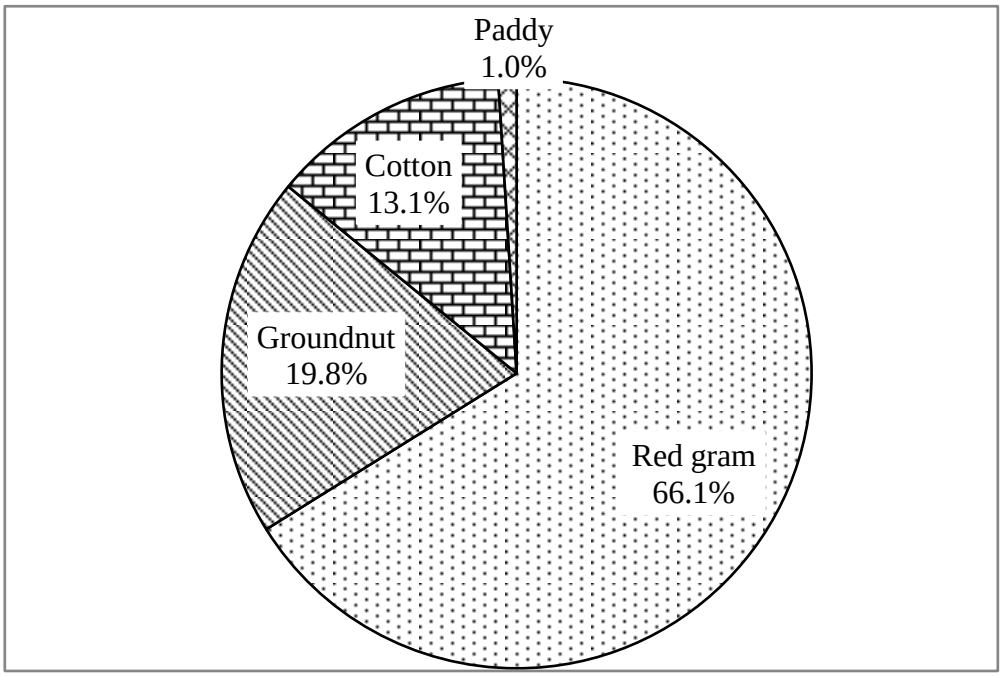


Figure 9: Present cropping pattern in Balched Microwatershed

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 Balched micro-watershed, 12 soil series are identified and mapped (Table 22). The distribution of major soil series are Gondedagi covering an area around 146 ha (23.78 %) followed by Vanakanahalli 93 ha (15.12%), Badiyala 63 ha (10.36 %), Duppali 62 ha (10.24 %), Thumakur 48 ha (7.92 %), Kalabelagundi 47 ha (7.58 %), Yalleri 33 (5.38 %), Hegganakera 27 ha (4.47 %), Anur 26 ha (4.25 %), Halagera 22ha (3.64 %) and Bomraldoddi (0.23 %).

Table 22: Distribution of soil series in Balched Microwatershed

Soil No*	Soil Series	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape			
1	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, sandy clay soils occurring on very gently to gently sloping uplands under cultivation	63 (10.36)
2	VNK	Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown, sandy clay red soils occurring on very gently to moderately sloping uplands under cultivation	93 (15.12)
3	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 black soils occurring on very gently sloping uplands under cultivation	22 (3.64)
4	DPL	Duppali soils are moderately shallow (50-75 cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay red soils occurring on very gently sloping uplands under cultivation	62 (10.24)
5	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	33 (5.38)
6	KBD	Kalabelagundi soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown and dark reddish gray, gravelly sandy clay red soils occurring on very gently sloping uplands under cultivation	47 (7.58)
7	GDG	Gondedagi soils are deep (100-150 cm), well drained, have brown to dark reddish gray, calcareous sandy clay soils occurring on very gently sloping uplands under cultivation	146 (23.78)
8	ANR	Anur soils are deep (100-150 cm), moderately well drained, have dark gray to brown, calcareous sandy clay soils occurring on very gently sloping uplands under cultivation	26 (4.25)
9	BMD	Bomraldoddi soils are very deep (>150 cm), well drained, have dark gray, reddish brown to dark reddish brown and yellowish	1 (0.23)

		red sandy clay loam to sandy clay red soils occurring on very gently sloping uplands under cultivation		
Soils of Alluvial Landscape				
10	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 plains under cultivation		27 (4.47)
Lowlands				
11	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have brown to very dark grayish brown, calcareous sandy clay to clay black soils occurring on nearly level to very gently sloping lowlands under cultivation		48 (7.92)
12		Others	Habitation and waterbody	43 (7.03)

Present cropping pattern on different soil series are given in Table 23. Crops grown on marginal farmers are redgram. Cotton, groundnut, paddy and red gram on small farmers are grown. Cotton, groundnut and red gram are grown on semi medium farmers and groundnut, and redgram on medium farmers are grown.

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

(Area in per cent)

Size groups	Crops	Kharif		Total
		Dry	Irrigated	
Marginal Farmers	Redgram	100.0	0.0	100.0
Small Farmers	Cotton	25.6	0.0	25.6
	Groundnut	9.6	0.0	9.6
	Paddy	0.0	3.2	3.2
	Redgram	61.5	0.0	61.5
Semi-Medium Farmers	Cotton	15.1	0.0	15.1
	Groundnut	18.9	0.0	18.9
	Redgram	56.6	9.4	66.0
Medium Farmers	Groundnut	0.0	16.1	16.1
	Redgram	83.9	0.0	83.9

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 Balched Microwatershed.

Crops	MF(2)	SF(11)	SMF(10)	MDF(2)	ALL (30)
Cotton		1.13	1.31		1.20
Groundnut		1.29	1.23	1.13	1.22
Paddy		1.03			1.03
Redgram	1.02	1.17	1.22	1.28	1.18

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

Particulars	Marginal Farmers	Small Farmers				Semi-Medium Farmers			Medium Farmers	
	Redgram	Cotton	Ground nut	Paddy	Red gram	Cotton	Ground nut	Red gram	Ground nut	Red gram
Total cost (Rs/ha)	36918	31036	38384	130903	26828	47784	35112	24027	63123	19824
Gross Return (Rs/ha)	37565	35198	49400	135356	31295	60927	43911	28594	71136	25240
Net returns (Rs/ha)	647	4161	11016	4453	4467	13143	8799	4567	8013	5416
BCR	1.02	1.13	1.29	1.03	1.17	1.31	1.23	1.22	1.13	1.28
Farmers Practices (FP)										
FYM (t/ha)	3.5	1.9	1.7	5.0	2.1	2.6	2.4	0.9	2.5	0.7
Nitrogen (kg/ha)	68.6	49.4	53.3	400.0	79.0	78.5	80.2	71.5	85.1	75.7
Phosphorus (kg/ha)	40.7	44.7	38.3	287.5	65.5	83.0	59.6	71.8	117.6	101.1
Potash (kg/ha)	0.0	0.0	0.0	0.0	5.6	6.4	2.1	1.2	17.0	16.1
Grain (Qtl/ha)	7.6	7.9	10.0	50.0	7.2	15.4	11.5	7.1	16.0	6.6
Price of Yield (Rs/Qtl)	5000	4500	5000	2500	4417	4000	3750	4171	4500	4167
Soil test based fertilizer Recommendation (STBR)										
FYM (t/ha)	7.4	12.4	8.6	9.9	7.4	12.4	8.6	7.4	8.6	7.4
Nitrogen (kg/ha)	24.7	148.2	24.7	98.8	24.7	148.2	24.7	24.7	24.7	24.7
Phosphorus (kg/ha)	49.4	74.1	61.8	49.4	49.4	74.1	61.8	49.4	61.8	49.4
Potash (kg/ha)	24.7	74.1	30.9	49.4	24.7	74.1	30.9	24.7	30.9	24.7
Grain (Qtl/ha)	12.4	17.3	17.3	59.3	12.4	17.3	17.3	12.4	17.3	12.4
% of Adoption/yield gap (STBR-FP) / (STBR)										
FYM (%)	52.2	84.3	80.7	49.4	71.2	79.1	72.3	87.4	71.1	90.7
Nitrogen (%)	-177.9	66.6	-115.9	-304.9	-219.7	47.0	-224.7	-189.4	-244.6	-206.5
Phosphorus (%)	17.6	39.6	37.9	-482.0	-32.6	-12.1	3.4	-45.2	-90.5	-104.7
Potash (%)	100.0	100.0	100.0	100.0	77.3	91.4	93.1	95.1	44.9	34.9
Grain (%)	38.4	54.2	42.2	15.7	41.4	10.8	33.7	42.6	7.5	46.9
Value of yield and Fertilizer (Rs)										
Additional Cost (Rs/ha)	4217	14365	8283	-8223	4296	11564	6252	5403	3239	4007
Additional Benefits (Rs/ha)	23729	42180	36450	23200	22571	7493	21869	21922	5805	24115
Net change income (Rs/ha)	19513	27815	28167	31423	18275	-4070	15617	16519	2566	20108

The productivity of different crops grown in Balched 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.47784/ha in semi-medium farmers (with BCR of 1.31) and Rs.31036/ha in small farmers (with BCR of 1.13), groundnut range between Rs.63123/ha in medium farmers (with BCR of 1.13) and Rs.35112/ha in semi-medium farmers (with BCR of 1.23), red gram range between Rs.36918/ha in marginal farmers(with BCR of 1.02) and Rs.19824/ha in medium farmers (with BCR of 1.28) and the cost of cultivation of paddy is Rs.130903/ha in small farmers (with BCR of 1.03).

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.31423 in paddy and a minimum of Rs.2566 in groundnut 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.3629/ ha/year (Table 26 and Figure 10). Per hectare food grain production services is maximum in groundnut (Rs.9046) followed by cotton (Rs.8643), redgram (Rs.4232) and paddy is a negative returns.

Table 26: Ecosystem services of food grain production in Balched 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	Paddy	0.5	49	2500	123500	130903	-7403
Pulses	Redgram	39.1	7	4356	30396	26164	4232
Oil seeds	Groundnut	8.4	12	4300	50414	41369	9046
Commercial crops	Cotton	7.5	11	4300	46378	37735	8643
Average value		55.5	20	3864	62672	59043	3629

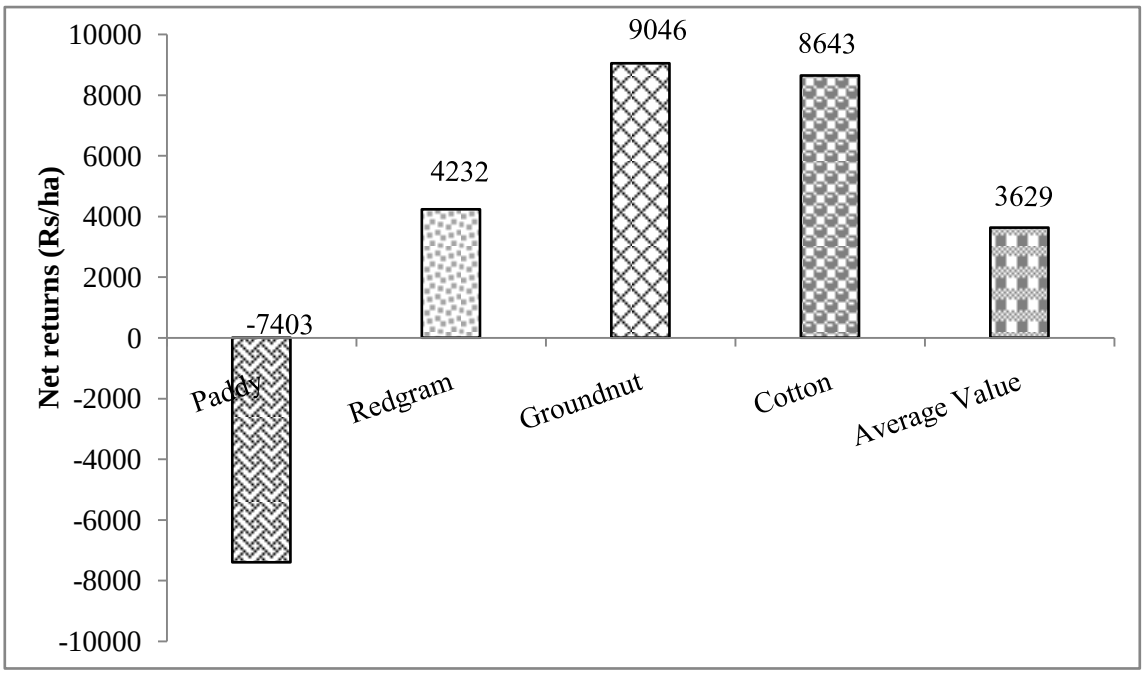


Figure 10: Ecosystem services of food production in Balched Microwatershed

The average value of ecosystem service for fodder production is around Rs.2367/ ha/year (Table 27). Per hectare fodder production services is maximum in paddy (Rs. 3705) followed by groundnut (Rs.1029).

Table 27: Ecosystem services of fodder production in Balched Microwatershed

Production items	Crops	Area in ha	Yield (Qtl/ha)	Price (Rs/Qtl)	Net Returns (Rs/ha)
Cereals	Paddy	0.40	2.47	1500	3705
Oil seeds	Groundnut	7.29	0.86	1200	1029
Average Value		7.69	1.66	1350	2367

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 paddy (Rs. 82646) followed by cotton (Rs. 43455), redgram (Rs. 37986) and groundnut (Rs. 32617).

Table 28: Ecosystem services of water supply in Balched Microwatershed

Crops	Yield (Qtl/ha)	Virtual water (cubic meter) per ha	Value of Water (Rs/ha)	Water consumption (Cubic meters/Qtl)
Cotton	10.8	4346	43455	403
Groundnut	11.7	3262	32617	278
Paddy	49.4	8265	82646	167
Redgram	7.0	3799	37986	544
Average value	19.7	4918	49176	348

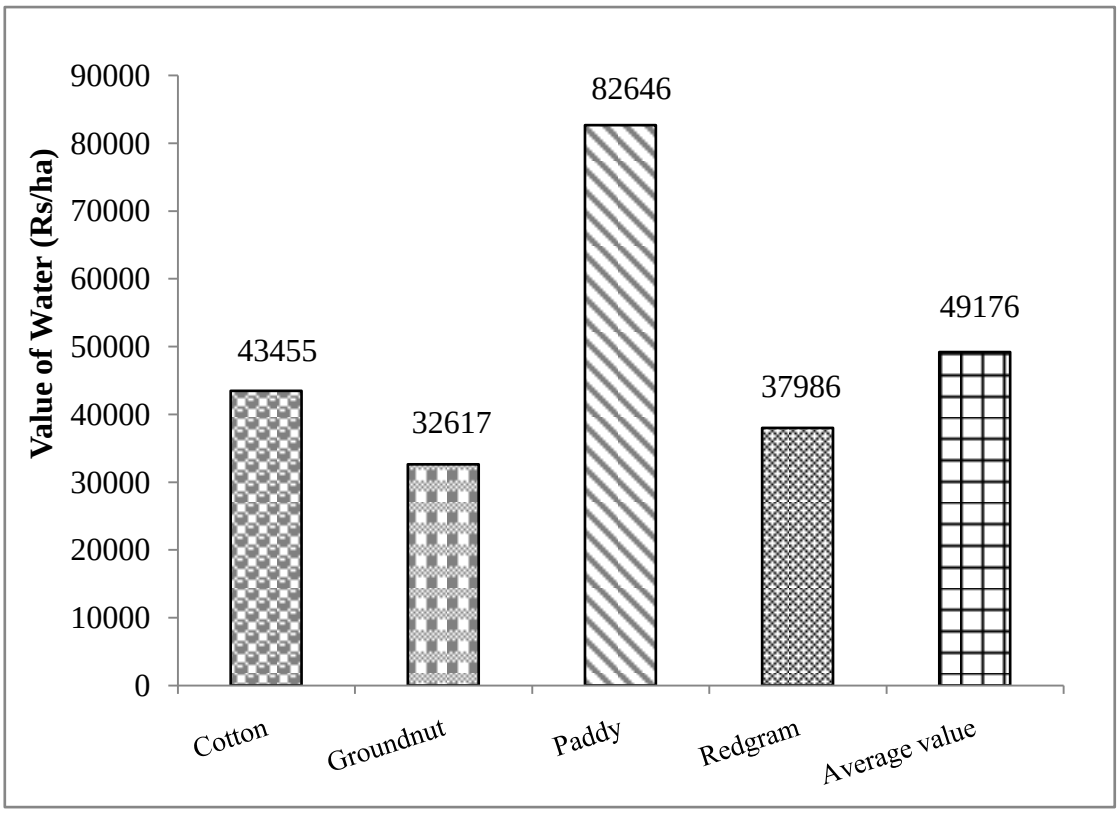


Figure 11: Ecosystem services of water supply in Balched Microwatershed

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 Balched 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	0
No	100

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.