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

ADAVALLI-5 (4D4A2P3a) MICROWATERSHED

Koppal Taluk and District. Karnataka

Karnataka Watershed Development Project – II

SUJALA – III

World Bank funded Project



THE WORLD BANK



ICAR – NATIONAL BUREAU OF SOIL SURVEY AND LAND USE PLANNING



ICAR - NBSS & LUP

**WATERSHED DEVELOPMENT DEPARTMENT
GOVT. OF KARNATAKA, BANGALORE**



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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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TO OBTAIN COPIES,

Please write to:

Director, ICAR - NBSS & LUP,

Amaravati Road, NAGPUR - 440 033, India

Phone : (0712) 2500386, 2500664, 2500545 (O)

Telefax : 0712-2522534

E-Mail : director@nbsslup.ernet.in

Website URL : nbsslup.in

Or

Head, Regional Centre, ICAR - NBSS&LUP, Hebbal, Bangalore - 560 024

Phone : (080) 23412242, 23510350 (O)

Telefax : 080-23510350

E-Mail : nbssrcb@gmail.com



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KARNATAKA, BANGALORE



PREFACE

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

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

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

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

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

ICAR-NBSS&LUP, Regional Centre, Bangalore has taken up a project sponsored by the Karnataka Watershed Development Project-II, (Sujala-III), Government of Karnataka funded by the World Bank under Component -1 Land Resource Inventory. This study was taken up to demonstrate the utility of such a database in reviewing, monitoring and evaluating all the land based watershed development programs on a scientific footing. To meet the requirements of various land use planners at grassroots level, the present study on “Land Resource Inventory and Socio-Economic Status of Farm Households for Watershed Planning and Development of for Adavalli-5microwatershed in Koppal Taluk and District, Karnataka” for integrated development was taken up in collaboration with the State Agricultural Universities, IISC, KSRISAC, 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 randomly 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, agricultural extension personnel, KVK officials, developmental departments and other land users to manage the land resources in a sustainable manner.

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

Nagpur

Date: 15.12.2018

S.K. SINGH

Director, ICAR - NBSS&LUP Nagpur

Contributors

Dr. RajendraHegde Principal Scientist, Head & Project Leader, Sujala-III Project ICAR-NBSS&LUP, Regional Centre, Bangalore	Dr. S.K.Singh Director, ICAR-NBSS&LUP Coordinator, Sujala-III Project Nagpur
Soil Survey, Mapping & Report Preparation	
Dr. K.V. Niranjana	Sh. R.S. Reddy
Dr. B.A. Dhanorkar	Ms. Arpitha, G.M
	Smt. Chaitra, S.P.
	Dr. Savitha, H.R.
	Dr. Gayathri, B.
	Dr. GopaliBardhan
	Sh. Nagendra, B.R.
	Sh. Somashekar T.N
Field Work	
Sh. C.Bache Gowda	Sh. MayurPatil
Sh. Somashekar	Sh. Arun Kumar, S.
Sh. M. Jayaramaiah	Sh. Sunil Raj
	Sh. Yogesh Kumar, B.
	Sh. Vikas, N.K.
	Sh. Arun Kumar, S.G.
	Sh. UmeshJadiyappaMadolli
	Sh. Praveen Kumar P. Achalkar
	Sh. Veerabhadraswamy
	Sh. Vinay
	Sh. Shankarappa, K.
	Sh. Lankesh, R.S.
	Sh. Appanna B. Hattigoudar
	Sh. Maharudra
GIS Work	
Dr. S.Srinivas	Sh. A.G. Devendra Prasad
Sh. D.H.Venkatesh	Sh. AbhijithSastry, N.S.
Smt.K.Sujatha	Sh. NagendraBabuKolukondu
Smt. K.V.Archana	Sh. Avinash
Sh. N.Maddileti	Sh. Amar Suputhra, S.
	Sh. Deepak M.J.
	Sh. Madappaswamy
	Smt. K.Karunya Lakshmi
	Ms. Seema, K.V.
	Ms. Ramireddy Lakshmi Silpa
	Ms. BhanuRekha, T.
	Ms. RajataBhat
	Ms. Shruthi
	Ms. Suman, S.

Laboratory Analysis	
Dr. M. Lalitha	Ms. Thara, V.R.
Smt. ArtiKoyal	Ms. Roopa, G.
Smt. Parvathy, S.	Ms. Vindhya, N.G.
	Ms. Shwetha N.K.
	Ms. PavanaKumari, P.
	Ms. Leelavathy, K.U.
	Ms. Rashmi, N.
	Ms. Padmaja, S.
	Ms. Veena, M.
	Ms. Chaithrashree B
	Ms. Shwetha N
Socio-economic Analysis	
Dr. Ramesh Kumar, S.C.	Sh. M.K. Prakashanaik
	Ms. Shraddha Hegde
	Mrs. Sowmya A.N
	Sh. Vijay Kumar
	Sh. Pradyumna
	Ms. Sowmya K.B
	Mrs. Prathibha, D.G
	Sh. Rajendra,D
	Sh. Basavaraj
	Sh. Vinod, R.
Soil & Water Conservation	
Sh. Sunil P. Maske	
Watershed Development Department, GoK, Bangalore	
Sh. Rajeev Ranjan IFS Project Director & Commissioner, WDD	Dr. A. Natarajan NRM Consultant, Sujala-III Project
Dr. S.D. Pathak IFS Executive Director & Chief Conservator of Forests, WDD	

PART-A
LAND RESOURCE INVENTORY

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EXECUTIVE SUMMARY

The land resource inventory of Adavalli-5microwatershed was conducted using village cadastral maps and IRS satellite imagery on 1:7920 scale. The false colour composites of IRS imagery were interpreted for physiography and these physiographic delineations were used as base for mapping soils. The soils were studied in several transects and a soil map was prepared with phases of soil series as mapping units. Random checks were made all over the area outside the transects to confirm and validate the soil map unit boundaries. The soil map shows the geographic distribution and extent, characteristics, classification, behavior and use potentials of the soils in the Microwatershed.

The present study covers an area of 481 ha in Koppaltaluk and district, Karnataka. The climate is semiarid and categorized as drought - prone with an average annual rainfall of 662 mm, of which about 424 mm is received during south –west monsoon, 161 mm during north-east and the remaining 77 mm during the rest of the year. An area of about 95 per cent is covered by soils, five per cent by waterbodies, settlements and others. The salient findings from the land resource inventory are summarized briefly below.

- ❖ The soils belong to 9 soil series and 14 soil phases (management units) and 5 land use classes.*
- ❖ The length of crop growing period is <90 days and starts from 2nd week of August to 2nd week of November.*
- ❖ From the master soil map, several interpretative and thematic maps like land capability, soil depth, surface soil texture, soil gravelliness, available water capacity, soil slope and soil erosion were generated.*
- ❖ Soil fertility status maps for macro and micronutrients were generated based on the surface soil samples collected at every 250 m grid interval.*
- ❖ Land suitability for growing 28 major agricultural and horticultural crops were assessed and maps showing the degree of suitability along with constraints were generated.*
- ❖ Entire area is suitable for agriculture.*
- ❖ About 36 per cent of the soils are shallow (25-50 cm), 9 per cent moderately shallow (50-75 cm), 2 per cent moderately deep (75- 100 cm) and 52 per cent has deep to very deep soils (100 ->150 cm).*
- ❖ About 4 per cent of the area is having loamy soils and 95 per cent has clayey soils at the surface.*
- ❖ About 55 per cent of the area has non-gravelly (<15%) soils, 41 per cent has gravelly soils (15-35 % gravel) and 4 per cent has very gravelly (35- 60% gravel) soils.*
- ❖ With respect to available water capacity 4 per cent of the area has very low (<50mm/m), 42 per cent of the area has low (51-100 mm/m), 2 per cent medium (101-150 mm/m) and 51 per cent area has very high (>200mm/m) .*

- ❖ *An area of about 30 per cent has nearly level (0-1%) lands and 69 per cent has very gently sloping (1-3%) lands .*
- ❖ *An area of about 37 per cent is slightly eroded (e1) and 62 per cent is moderately eroded (e2) lands.*
- ❖ *An area of about 3 per cent has neutral (pH 6.5 to 7.3) soils, 3 per cent slightly alkaline (pH 7.3 to 7.8), 3 per cent moderately alkaline (pH 7.8 to 8.4) , 23 per cent strongly alkaline (pH 8.4 to 9.0) and 66 per cent soils are very strongly alkaline (pH > 9.0).*
- ❖ *The Electrical Conductivity (EC) of the soils are dominantly $< 2 \text{ dsm}^{-1}$ indicating that soils are non saline.*
- ❖ *Organic carbon is low ($< 0.5\%$) in about 88 per cent and medium (0.5-0.75%) in 11 per cent area of the soils.*
- ❖ *Available phosphorus is low ($< 23 \text{ kg/ha}$) in 92 per cent and medium (23-57 kg/ha) in 7 per cent of the soils.*
- ❖ *Available potassium is medium (145-337 kg/ha) in 16 per cent and high ($> 337 \text{ kg/ha}$) in 83 per cent of the soils.*
- ❖ *Available sulphur is low ($< 10 \text{ ppm}$) in 49 per cent, medium (10-20 ppm) in 47 per cent and high ($> 20 \text{ ppm}$) in 4 per cent area of the soils*
- ❖ *Available boron is low ($< 0.5 \text{ ppm}$) in about 13 per cent and medium (0.5-1.0 ppm) in 86 per cent area of the soils.*
- ❖ *Available iron is deficient in 92 per cent of the area and sufficient ($> 4.5 \text{ ppm}$) in 7 per cent of the area.*
- ❖ *Available zinc is deficient ($< 0.6 \text{ ppm}$) in 97 per cent of the area and sufficient ($> 0.6 \text{ ppm}$) in 2 per cent of the area.*
- ❖ *Available manganese and copper are sufficient in the entire area.*
- ❖ *The land suitability for 28 major crops grown in the microwatershed was assessed and the areas that are highly suitable (S1) and moderately suitable (S2) are given below. It is however to be noted that a given soil may be suitable for various crops but what specific crop to be grown may be decided by the farmer looking to his capacity to invest on various inputs, marketing infrastructure, market price, and finally the demand and supply position.*

Land suitability for various crops in the microwatershed

<i>Crop</i>	<i>Suitability Area in ha (%)</i>		<i>Crop</i>	<i>Suitability Area in ha (%)</i>	
	<i>Highly suitable (S1)</i>	<i>Moderately suitable (S2)</i>		<i>Highly suitable (S1)</i>	<i>Moderately suitable (S2)</i>
<i>Sorghum</i>	235(49)	50 (10)	<i>Pomegranate</i>	-	256(53)
<i>Maize</i>	-	-	<i>Guava</i>	-	-
<i>Bajra</i>	-	17(4)	<i>Jackfruit</i>	-	-
<i>Redgram</i>	-	245(51)	<i>Jamun</i>	-	245 (51)
<i>Bengal gram</i>	235(49)	66 (14)	<i>Musambi</i>	235 (49)	21 (4)
<i>Groundnut</i>	-	3 (<1)	<i>Lime</i>	235 (49)	21 (4)
<i>Sunflower</i>	235(49)	22(4)	<i>Cashew</i>	-	-
<i>Cotton</i>	235(49)	49(10)	<i>Custard apple</i>	235 (49)	69(14)
<i>Chilli</i>	-	-	<i>Amla</i>	-	304(63)
<i>Tomato</i>	-	-	<i>Tamarind</i>	-	245 (51)
<i>Drumstick</i>	-	259 (54)	<i>Marigold</i>	-	284 (59)
<i>Mulberry</i>	-	116(24)	<i>Chrysanthemum</i>	-	284 (59)
<i>Mango</i>	-	-	<i>Jasmine</i>	-	29 (6)
<i>Sapota</i>	-	-	<i>Crossandra</i>	-	246(51)

Apart from the individual crop suitability, a proposed crop plan has been prepared for the 5identified LUCs by considering only the highly and moderately suitable lands for different crops and cropping systems with food, fodder, fibre and other horticulture crops.

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

INTRODUCTION

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

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

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

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

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

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

The land resource inventory aims to provide site specific database for Adavalli-5 microwatershed in Koppal Taluk, Koppal District, Karnataka State for the Karnataka Watershed Development Department. The database was generated by using cadastral map of the village as a base along with high resolution IRS LISS IV and Cartosat-1 merged satellite imagery. Later, an attempt will be made to uplink this LRI data generated at 1:7920 scale under Sujala-III Project to the proposed Landscape Ecological Units (LEUs) map.

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

GEOGRAPHICAL SETTING

2.1 Location and Extent

The Adavalli-5 micro-watershed is located in the central part of Karnataka in Koppal taluk and district (Fig.2.1). It lies between 15°14' and 15°15' North latitudes and 75°59' and 76°0' East longitudes and covers an area of about 481 ha. It is about 70 km from Koppal town and is surrounded by Alavandi village on all the sides.

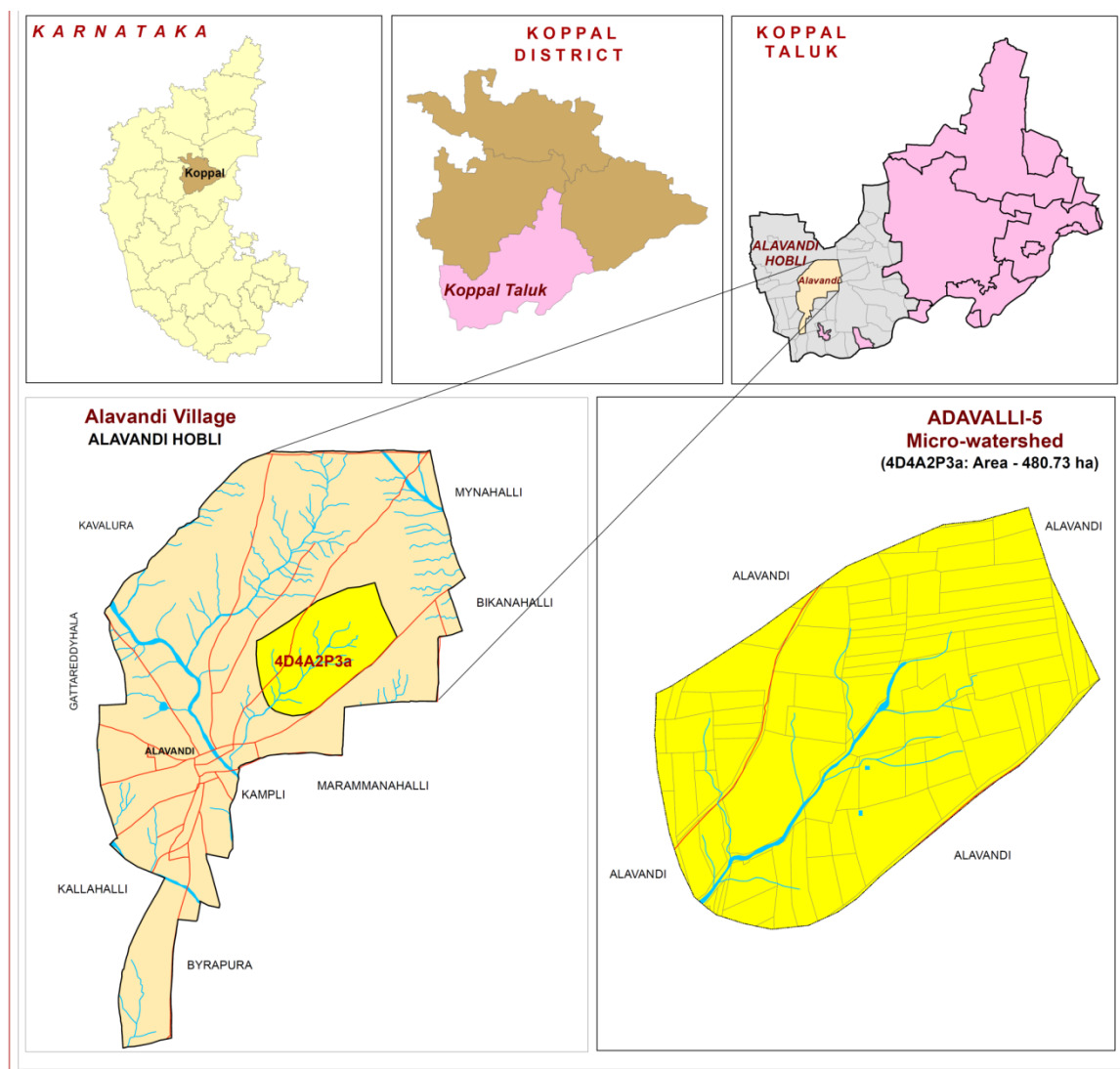


Fig.2.1 Location map of Adavalli-5 Microwatershed

2.2 Geology

Major rock formations observed in the microwatershed are granite gneiss and alluvium (Fig.2.2 a 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 Adavalli-5 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, side slopes and very gently sloping uplands and nearly level

plains based on slope and its relief features. The elevation ranges from 540 to 566 m in the gently sloping uplands. The mounds and ridges are mostly covered by rock outcrops.

2.4 Drainage

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

2.5 Climate

The district falls under semiarid tract of the state and is categorized as drought - prone with total annual rainfall of 662 mm (Table 2.1). Maximum of 424 mm precipitation is received during south-west monsoon period from June to September, north-east monsoon contributes about 161 mm and prevails from October to early December and the remaining 77 mm is received during the rest of the year. The winter season is from December to February. During April and May, the temperatures reach up to 45°C and in December and January, the temperatures will go down to 16°C. Rainfall distribution is shown in Figure 2.3. The average Potential Evapo Transpiration (PET) is 145 mm and varies from a low of 101 mm in December to 193 mm in the month of May. The PET is always higher than precipitation in all the months except in the month of September. Generally, the Length of crop Growing Period (LGP) is <90 days and starts from 2nd week of August to 2nd week of November.

Table 2.1 Mean Monthly Rainfall, PET, 1/2 PET at Koppal Taluk and District

Sl.No.	Months	Rainfall	PET	1/2 PET
1	January	1.60	116.70	58.35
2	February	1.50	129.20	64.60
3	March	14.10	169.80	84.90
4	April	18.10	180.60	90.30
5	May	41.60	193.50	96.75
6	June	85.80	167.90	83.95
7	July	72.10	156.20	78.10
8	August	110.50	152.50	76.25
9	September	155.60	138.50	69.25
10	October	116.30	122.30	61.15
11	November	36.00	106.40	53.20
12	December	9.10	101.00	50.50
TOTAL		662.30	144.55	

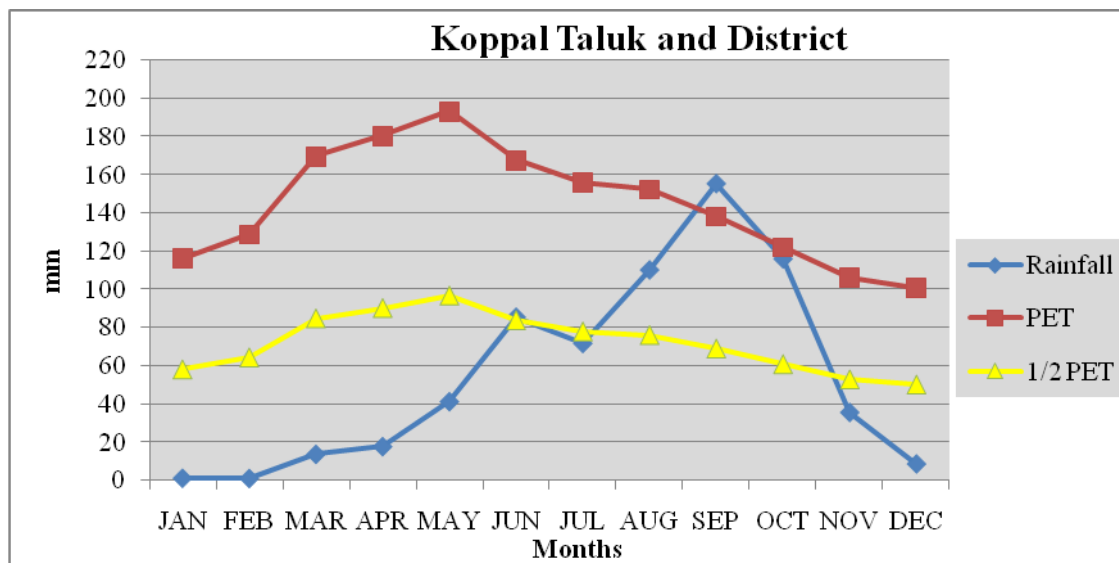


Fig. 2.3 Rainfall distribution in Koppal Taluk and District

2.6 Natural Vegetation

The natural vegetation is sparse comprising few tree species, shrubs and herbs. The mounds, ridges and boulders occupy sizeable areas which are under thin to moderately thick forest vegetation. Still, there are some remnants of the past forest cover which can be seen in patches in some ridges and hillocks in the microwatershed (Fig 2.4).



Fig 2.4 Natural vegetation of Adavalli-5 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 and eventually resulting in the heavy siltation of few tanks and reservoirs in the microwatershed.

2.7 Land Utilization

About 91 per cent area (Table 2.2) in Koppal district is cultivated at present and about 17 per cent of the area is sown more than once. An area of about 3 per cent is currently barren. Forests occupy a small area of about 5 per cent and the tree cover is in a very poor state. Most of the mounds, ridges and boulder areas have very poor vegetative cover. Major crops grown in the area are sorghum, maize, bajra, cotton, safflower, sunflower, red gram, horse gram, onion, mulberry, pomegranate, sugarcane, bengalgram and groundnut (Fig 2.5 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 Adavalli-5 microwatershed is presented in Fig.2.6.

Table 2.2 Land Utilization in Koppal District

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



Fig.2.5 (a) Different crops and cropping systems in Adavalli-5 Microwatershed



Redgram



Groundnut



Cotton



Mulberry

Fig.2.5 (b) Different crops and cropping systems in Adavalli-5 Microwatershed

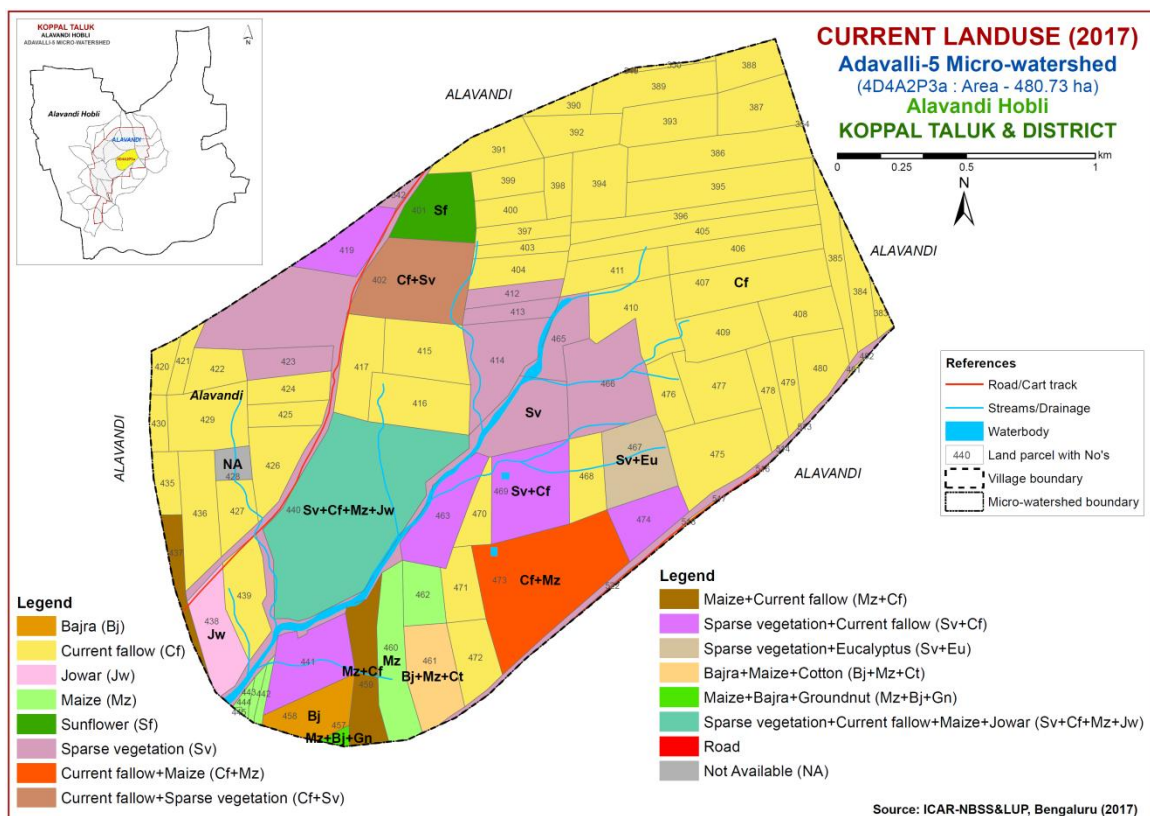


Fig.2.6 Current Land Use – Adavalli-5 Microwatershed

SURVEY METHODOLOGY

The purpose of land resource inventory is to delineate similar areas (soil series and phases), which respond or expected to respond similarly to a given level of management. This was achieved in Adavalli-5 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, erosion, drainage, occurrence of rock fragments etc.) followed by grouping of similar areas based on soil-site characteristics into homogeneous (management units) units and showing their extent and geographic distribution on the microwatershed cadastral map. The detailed soil survey at 1:7920 scale was carried out in 481 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 as a base. The cadastral map shows field boundaries with their survey numbers, location of tanks, streams and other permanent features of the area (Fig. 3.1). Apart from the cadastral map, remote sensing data products from Cartosat-1 and LISS IV merged at the scale of 1:7920 were used in conjunction with the cadastral map to identify the geology, landscapes, landforms and other surface features. The imagery helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Fig.3.2). The cadastral map was overlaid on the satellite imagery (Fig.3.3) that helps to identify the parcel boundaries and other permanent features. Apart from cadastral maps and images, toposheets of the area (1:50,000 scale) were used for initial traversing, identification of geology, landscapes and landforms, drainage features, present land use and also for selection of transects in the microwatershed.

3.2 Image Interpretation for Physiography

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

Image Interpretation Legend for Physiography

G- Granite gneiss landscape

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

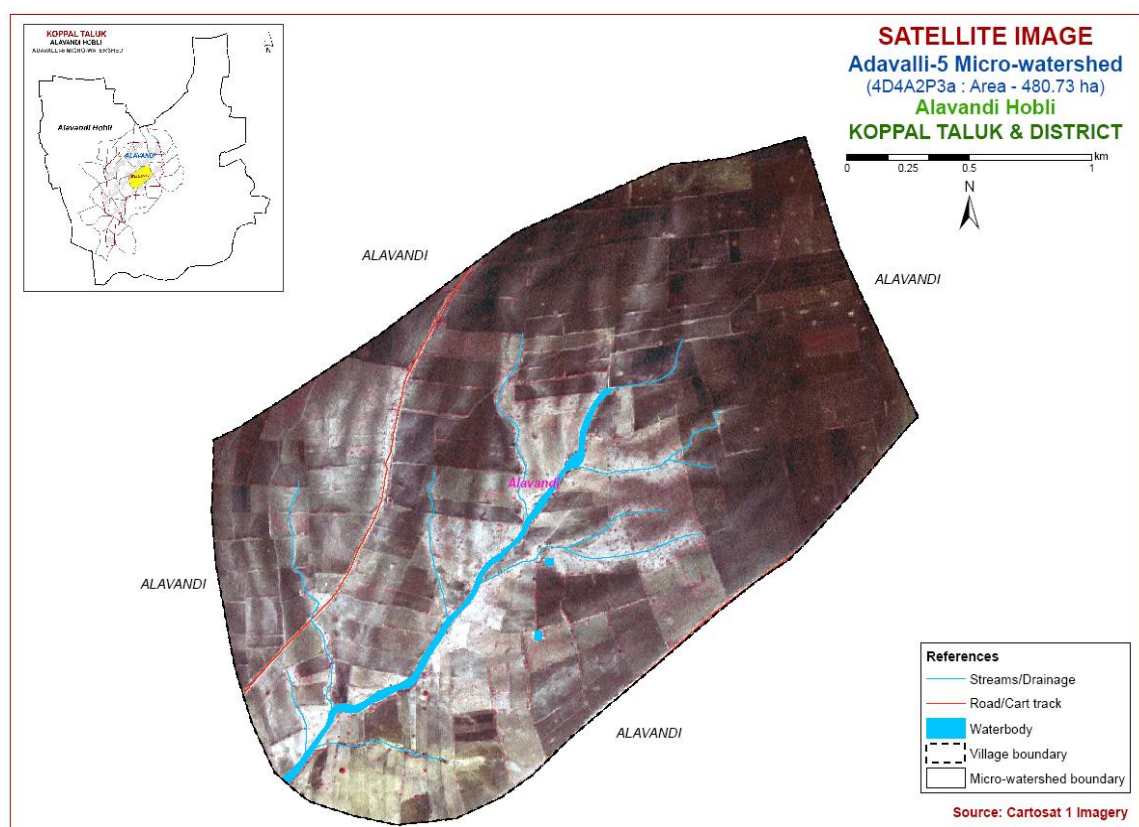
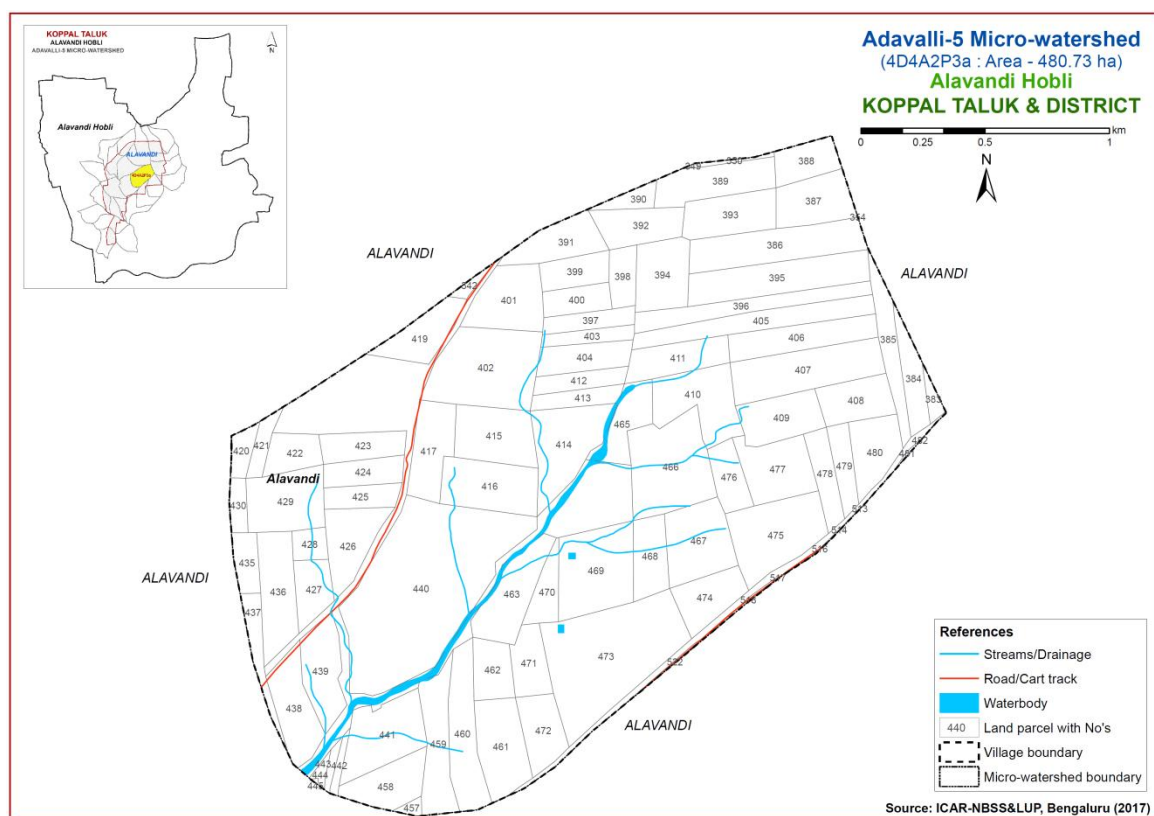
DSe -Alluvial landscape

DSe 1 Summit

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

DSe 2 Very gently sloping

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



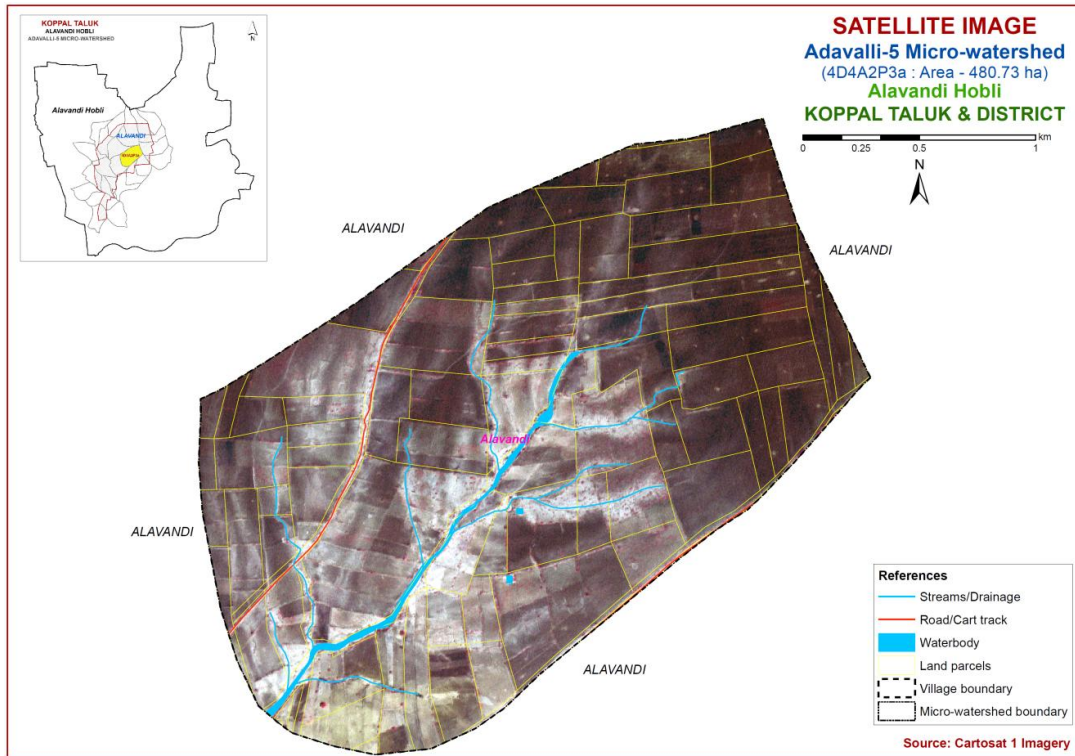


Fig.3.3 Cadastral map overlaid on IRS PAN+LISS IV merged imagery of Adavalli-5 Microwatershed

3.3 Field Investigation

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

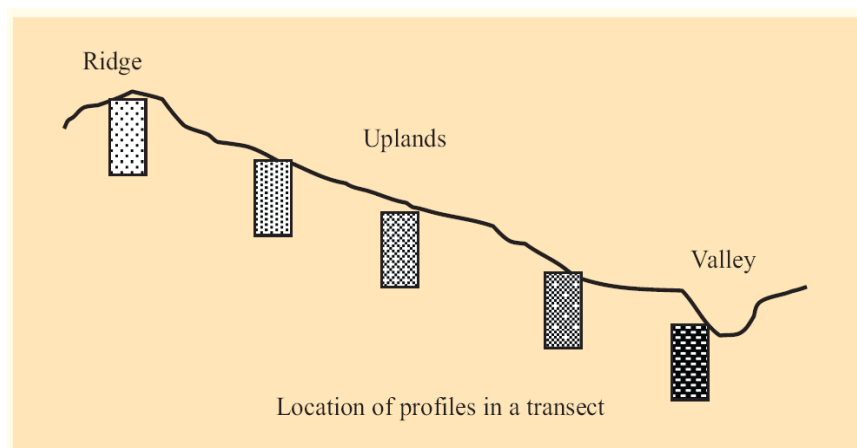


Fig: 3.4. Location of profiles in a transect

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

Based on the soil characteristics, the soils were grouped into different soil series. Soil series is the most homogeneous unit having similar horizons and properties and behaves similarly for a given level of management. Soil depth, texture, colour, kind of horizon and horizon sequence, amount and nature of gravel present, calcareousness, nature of substratum etc, were used as the major differentiating characteristics for identifying soil series occurring in the area. The differentiating characteristics used for identifying the soil series are given in Table 3.1. Based on the above characteristics, 9 soil series were identified in Adavalli-5 microwatershed.

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

Soils of Granite Gneiss Landscape							
Sl. No	Soil Series	Depth (cm)	Colour (moist)	Texture	Gravel (%)	Horizon sequence	Calcareousness
1	Lakkur (LKR)	50-75	2.5YR2.5/3, 2.5/4, 3/4, 3/6	gsc	40-60	Ap-Bt-Bc-Cr	-
2	Nagalapur (NGP)	100-150	5YR 2.5/2, 3/2, 2.5YR3/6, 4/6	gsc-gc	>35	Ap-Bt-Cr	-
Soils of Alluvial Landscape							
3	Muttal(MTL)	25-50	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bw-Ck	e-es
4	Ravanki (RNK)	50-75	7.5YR3/2, 3/3, 5/2, 5/3, 10YR3/1, 3/2, 4/1, 4/2, 5/1, 6/1	c	<15	Ap-Bw-Cr	e-ev
5	Dambarahalli (DRL)	75-100	10YR 2/1, 3/1, 4/3	c	<15	Ap-Bw-Ck	e-es
6	Handrala (HDL)	100-150	10YR2/1, 3/1, 4/1	c	-	Ap-Bss-Ck	es
7	(Kadagathur) (KDT)	>150	10 YR 3/1, 3/2, 3/3, 7.5YR 3/3, 3/4	sc-c	-	Ap-Bw	-
8	Murlapur (MLR)	>150	10YR2/1, 2/2, 3/1, 3/2, 4/1	c	10-20	AP-Bss	e-es
9	Bardur(BDR)	>150	10YR 2/1, 3/1, 3/2	c	<15	AP-Bss	es

3.4 Soil Mapping

The area under each soil series was further separated into soil phases and their boundaries delineated on the cadastral map based on the variations observed in the texture

of the surface soil, slope, erosion, presence of gravel, stoniness etc. A soil phase is a subdivision of soil series based mostly on surface features that affect its use and management. The soil mapping units are shown on the map (Fig.3.5) in the form of symbols. During the survey soil profile pits, few mini pits and a few auger bores representing different landforms occurring in the microwatershed were studied. In addition to the profile study, spot observations in the form of mini pits, road cuts, terrace cuts etc., were studied to validate the soil boundaries on the soil map.

The soil map shows the geographic distribution of 14 mapping units representing 9 soil series occurring in the microwatershed. The soil map unit (soil legend) description is presented in Table 3.2. The soil phase map (management units) shows the distribution of 14 phases mapped in the microwatershed. Each mapping unit (soil phase) delineated on the map has similar soil and site characteristics. In other words, all the farms or survey numbers included in one phase will have similar management needs and have to be treated accordingly.

3.5 Land Use Classes

The 14 soil phases identified and mapped in the microwatershed were regrouped into five Land Use Classes (LUC'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 Use Classes (LUC'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 LUCs. For Adavalli-5 microwatershed, five soil and site characteristics, namely soil depth, soil texture, slope, erosion and gravel content have been considered for defining LUCs. The land use classes are expected to behave similarly for a given level of management.

3.5 Laboratory Characterization

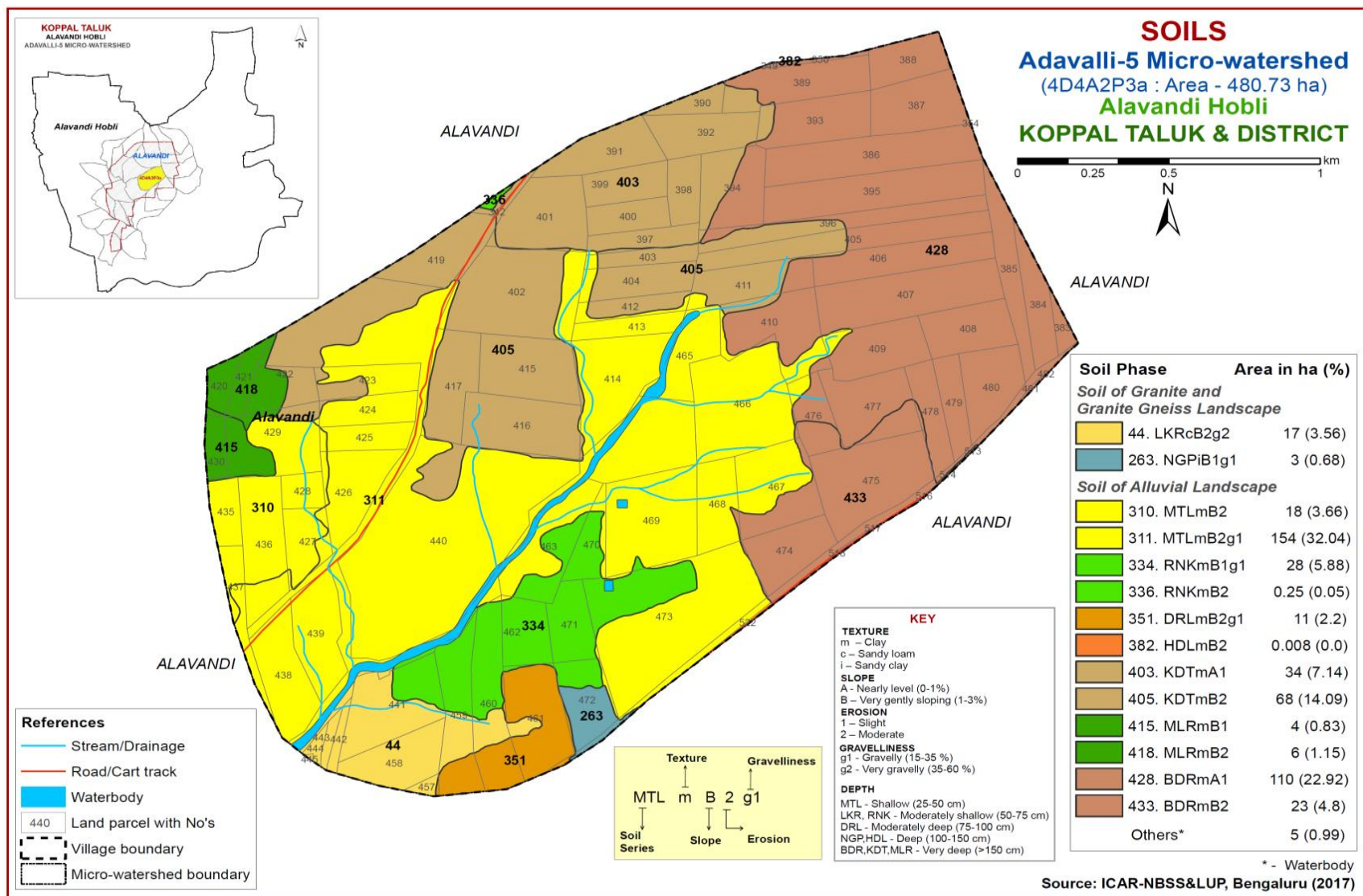
Soil samples for each series were collected from representative master profiles for laboratory characterization by following the methods outlined in the Laboratory Manual (Sarma *et al*, 1987). Surface soil samples collected in the year 2017 from farmer's fields in Adavalli-5 microwatershed (47 samples) for fertility status (major and micronutrients) at 250 m grid interval were analyzed in the laboratory (Katyal and Rattan, 2003). By linking the soil fertility data to the survey numbers through GIS, soil fertility maps were generated using Kriging method for the microwatershed.

Table 3.2 Soil map unit description of Adavalli-5 Microwatershed

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss landscape				
	LKR	Lakkur soils are moderately shallow (50-75 cm), well drained, have dark reddish brown to dark red, red gravelly sandy clay soils occurring on very gently to moderately sloping uplands under cultivation		17 (3.56)
44		LKRcB2g2	Sandy loam surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	17 (3.56)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils occurring on nearly level to gently sloping uplands under cultivation		3 (0.68)
263		NGPiB1g1	Sandy clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	3 (0.68)
Soils of Alluvial landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black clay soils occurring on nearly level to gently sloping plains under cultivation		172 (35.7)
310		MTLmB2	Clay surface, slope 1-3%, moderate erosion	18 (3.66)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	154 (32.04)
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, calcareous clay black soils occurring on nearly level to very gently sloping plains under cultivation		28 (5.93)
334		RNKmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	28 (5.88)
336		RNKmB2	Clay surface, slope 1-3%, moderate erosion	0.25 (0.05)
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		11 (2.2)
351		DRLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	11 (2.2)
	HDL	Handrala soils are deep (100-150 cm), moderately well drained, have dark gray to very dark gray, black calcareous cracking clay soils occurring on very gently sloping plains under cultivation		0.008 (0.0)
382		HDLmB2	Clay surface, slope 1-3%, moderate erosion	0.008 (0.0)

	KDT	Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown, sandy clay to clay black soils occurring on nearly level to very gently sloping plains under cultivation		102 (21.23)
403		KDTmA1	Clay surface, slope 0-1%, slight erosion	34 (7.14)
405		KDTmB2	Clay surface, slope 1-3%, moderate erosion	68 (14.09)
	MLR	Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		10 (1.98)
415		MLRmB1	Clay surface, slope 1-3%, slight erosion	4 (0.83)
418		MLRmB2	Clay surface, slope 1-3%, moderate erosion	6 (1.15)
	BDR	Bardur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		133 (27.72)
428		BDRmA1	Clay surface, slope 0-1%, slight erosion	110 (22.92)
433		BDRmB2	Clay surface, slope 1-3%, moderate erosion	23 (4.8)
1000		Others	Water body	5 (0.99)

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



THE SOILS

Detailed information pertaining to the nature, extent and distribution of different kinds of soils occurring in Adavalli-5 microwatershed is provided in this chapter. The microwatershed area has been identified as granite gneiss and alluvial landscapes based on geology. In all, 9 soil series were identified. Soil formation is the result of the combined effect of environmental and terrain factors that are reflected in soil morphology. The soil formation is dominantly influenced by the parent material, climate, time and relief.

A brief description of each of the 9 soil series identified followed by 14 soil phases (management units) mapped under each series (Fig. 3.5) are furnished below. The physical and chemical characteristics of soil series identified in Adavalli-5 microwatershed are given in Table 4.1. The soils in any one map unit differ from place to place in their depth, texture, slope, gravelliness, erosion or any other site characteristic that affect management. The soil phase map can be used for identifying the suitability of areas for growing specific crops or for other alternative uses and also for deciding the type of conservation structures needed. The detailed information on soil and site-characteristics like soil depth, surface soil texture, slope, erosion, gravelliness, AWC, LCC etc, with respect to each of the soil phase identified is given village/survey number wise for the microwatershed in Appendix-I.

4.1 Soils of Granite and Granite gneiss landscape

In this landscape, two soil series were identified and mapped. The brief description of the soil series along with the soil phases identified and mapped is given below.

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

The thickness of the solum ranges from 51 to 74 cm. The thickness of A horizon ranges from 12 to 18 cm. Its colour is in 5YR and 2.5 YR hue with value 3 to 4 and chroma 4 to 6. The texture varies from loamy sand to sandy clay loam with 15 to 50 per cent gravel. The thickness of B horizon ranges from 39 to 58 cm. Its colour is in 2.5 YR hue with value 3 to 4 and chroma 4 to 6. Texture is sandy clay with 40 to 60 per cent gravel. The available water capacity is low (50-100 mm/m). One soil phase was identified and mapped.



Landscape and soil profile characteristics of Lakkur (LKR) Series

4.1.2 Nagalapur (NGP) Series: Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay to clay soils. They are developed from weathered granite gneiss and occur on very gently to gently sloping uplands.

The thickness of the solum ranges from 105 to 145 cm. The thickness of A-horizon ranges from 14 to 20 cm. Its colour is in 7.5 YR hue with value and chroma 3 to 4. The texture ranges from sandy loam to sandy clay with 10 to 50 per cent gravel. The thickness of B horizon ranges from 90 to 128 cm. Its colour is in 2.5 YR, 5 YR and 7.5 YR hue with value 3 to 5 and chroma 3 to 6. Texture is sandy clay to clay with 35 to 80 per cent gravel. The available water capacity is low (51-100 mm/m). One soil phase was identified and mapped.



Landscape and soil profile characteristics of Nagalapur (NGP) Series

4.2 Soils of Alluvial Landscape

In this landscape, 7 soil series were identified and mapped. Of these series, Muttal (MTL) occupies maximum area of 172 ha (36 %) followed by Bardur (BDR) 133 ha (28%). The brief description of soil series along with the soil phases identified and mapped is given below.

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

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



Landscape and soil profile characteristics of Muttal (MTL) Series

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

The thickness of the solum ranges from 50 to 75 cm. The thickness of A horizon ranges from 15 to 20 cm. Its colour is in 7.5 YR and 10 YR hue with value 2 to 3 and chroma 2.5 to 4. The texture varies from sandy clay to clay with 10 to 15 per cent gravel. The thickness of B horizon ranges from 35 to 60 cm. Its colour is in 10 YR and 7.5 YR

hue with value 2 to 6 and chroma 2 to 4. Its texture is clay with gravel content of < 15per cent. The available water capacity is low (51-100 mm/m). Two soil phases were identified and mapped.



Landscape and Soil Profile Characteristics of Ravanaki (RNK) Series

4.2.3 Dambarahalli (DRL) Series: Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have black and very dark gray to dark brown calcareous cracking clay soils. They have developed from alluvium and occur on very gently to gently sloping uplands under cultivation.

The thickness of the solum ranges from 75 to 99 cm. The thickness of A horizon ranges from 13 to 24 cm. Its colour is in 10 YR hue with value 3 to 4 and chroma 1 to 2. The texture is clay. The thickness of B horizon ranges from 54 to 85 cm. Its colour is in 10 YR hue with value 2 to 4 and chroma 1 to 3. Its texture is clay and is calcareous. The available water capacity is high (150-200 mm/m). One soil phase was identified and mapped.



Landscape and soil profile characteristics of Dambarahalli (DRL) Series

4.2.4 Kadagathur (KDT) Series: Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown, sandy clay to clay soils. They have developed from alluvium 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 8 to 14 cm. Its colour is in 10 YR hue with value 3 and chroma 4. The texture varies from sandy loam to sandy clay loam and clay. The thickness of B horizon is more than 150 cm. Its colour is in 10 YR and 7.5 YR hue with value 3 and chroma 1 to 4. Its texture is sandy clay to clay. The available water capacity is very high (>200 mm/m). Two soil phases were identified and mapped.



Landscape and soil profile characteristics of Kadagathur (KDT) Series

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

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



Landscape and soil profile characteristics of Handrala (HDL) Series

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

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



Landscape and soil profile characteristics of Murlapur (MLR) Series

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

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



Landscape and soil profile characteristics of Bardur (BDR) Series

Table: 4.1 Physical and Chemical Characteristics of Soil Series identified in Adavalli-5 microwatershed

Soil Series: Lakkur (LKR), **Pedon:** RM-8.

Location: 15°04'26.3"N, 75°37'84.1"E, (4D4A3I1f), Belhatti village, Shirahatti taluk, Gadag district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand							1/3 Bar	15 Bar
		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)				
0-21	Ap	74.00	8.34	17.66	9.62	11.57	15.76	23.13	13.92	20	sl	-	-
21-35	Bt1	54.37	10.48	35.14	16.33	8.64	9.69	11.59	8.11	40	sc	-	-
35-56	Bt2	48.37	13.46	38.17	10.96	7.69	9.17	11.28	9.27	60	sc	-	-

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
	Water	CaCl ₂	M KCl				Ca	Mg	K	Na	Total				
				dS m ⁻¹	%	%	cmol kg ⁻¹							%	%
0-21	8.18	-	-	0.30	0.56	0.94	-	-	0.31	0.55	0.86	12.19	0.69	100.00	4.51
21-35	8.17	-	-	0.30	0.52	1.29	-	-	0.19	0.84	1.03	22.18	0.63	100.00	3.79
35-56	7.95	-	-	0.46	0.48	1.99	-	-	0.24	0.58	0.82	22.94	0.60	100.00	2.53

Series Name: Muttal (MTL), Pedon: RM-13

Location: 15°14'30.8"N, 75°56'50.6"E, Gatareddihalla village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Clayey, mixed, isohyperthermic (calcareous) (Paralithic) Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand							1/3 Bar	15 Bar
		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)				
0-20	Ap	39.05	13.74	47.21	3.05	5.05	8.21	14.63	8.11	15-30	c	29.95	17.94
20-34	Bwk	28.77	19.57	51.66	4.81	4.71	4.92	9.09	5.24	10	c	33.44	21.56

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
	Water	CaCl ₂	M KCl				Ca	Mg	K	Na	Total				
				dS m ⁻¹	%	%	cmol kg ⁻¹							%	%
0-20	8.27			0.202	0.79	6.10			0.62	0.25		36.64	0.78	-	0.69
20-34	8.36			0.177	0.99	23.04			0.29	0.38		39.60	0.77	-	0.96

Series Name: Ravanaki (RNK), **Pedon:** RM-20

Location: 15°14'22.7"N, 75°57'45.8"E, Gatareddihalla village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore **Classification:** Very fine, smectitic, isohyperthermic (calcareous) Typic Haplustepts

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand							1/3 Bar	15 Bar
		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)				
0-28	Ap	24.43	17.76	57.81	5.30	3.89	3.78	7.14	4.32	20	c	41.40	29.60
28-55	Bw	18.77	15.59	65.64	2.74	3.73	2.85	4.83	4.61	10	c	46.71	35.18
55-80	Bc	12.53	15.43	72.04	2.60	1.92	1.47	3.16	3.39	10	c	56.82	43.73

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/Clay	Base saturation	ESP
	Water	CaCl ₂	M KCl				Ca	Mg	K	Na	Total				
				dS m ⁻¹	%	%	cmol kg ⁻¹							%	%
0-28	8.86	-	-	0.483	0.63	15.48	-	-	0.86	6.27		37.00	0.64	-	16.94
28-55	8.61	-	-	1.4	0.23	13.68	-	-	0.68	12.27		53.20	0.81	-	23.06
55-80	8.35	-	-	4.53	0.91	11.40	-	-	0.75	28.97		54.80	0.76	-	52.86

Series Name: Handrala (HDL), Pedon: A2/RM-1

Location: 15°19'69.8"N, 75°58'00"E, Kavalura village, Koppal taluk and district

Analysis at: NBSS&LUP, Regional Centre, Bangalore

Classification: Very fine, smectitic, isohyperthermic (calcareous) Typic Haplusterts

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
							Ca	Mg	K	Na	Total				
	Water	CaCl ₂	M KCl	dS m ⁻¹	%	%	cmol kg ⁻¹						%	%	
0-25	9.06	-	-	0.371	0.16	4.80	-	-	0.80	7.93	-	62.33	1.01	-	12.72
25-50	9.09	-	-	0.719	0.2	7.20	-	-	0.42	14.94	-	67.10	0.97	-	22.26
50-82	9.28	-	-	0.47	0.19	9.36	-	-	0.47	11.59	-	60.21	1.00	-	19.26
82-117	8.76	-	-	1.55	0.36	8.64	-	-	0.11	2.28	-	25.33	0.36	-	9.02

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

Location: 15°19'42.9"N, 75°55'84.7"E, Kavalura village, Koppal taluk and district

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

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

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
	Water	CaCl ₂	M KCl				Ca	Mg	K	Na	Total				
				dS m ⁻¹	%	%	cmol kg ⁻¹							%	%
0-30	9.19	-	-	0.313	0.57	10.08	-	-	0.64	5.67	-	42.08	0.72	-	13.48
30-53	9.22	-	-	0.449	0.24	13.08	-	-	0.35	8.23	-	41.02	0.73	-	20.06
53-83	9.17	-	-	0.377	0.82	16.92	-	-	0.39	14.28	-	51.20	0.84	-	27.90
83-105	9.18	-	-	0.477	0.61	15.48	-	-	0.35	13.19	-	53.11	0.81	-	24.84
105-160	9.01	-	-	1.17	0.24	16.92	-	-	0.43	19.61	-	53.95	0.83	-	36.35

Series Name: Bardur (BDR), Pedon: R-4

Location: 15°14'31.7"N, 76°01'19.1"E, Moranali village, Koppal taluk and district

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

Depth (cm)	Horizon	Size class and particle diameter (mm)								Coarse fragments w/w (%)	Texture Class (USDA)	% Moisture	
		Total			Sand							1/3 Bar	15 Bar
		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)				
0-25	Ap	21.78	22.78	55.44	2.17	3.68	4.44	6.61	4.88	-	c	36.78	26.95
25-53	BA	18.62	18.56	62.82	2.23	4.24	3.46	5.24	3.46	-	c	41.25	29.87
53-90	Bss1	15.87	18.60	65.53	2.23	1.34	4.25	3.91	4.13	-	c	44.73	33.64
90-126	Bss2	13.66	20.02	66.32	1.68	2.80	2.35	3.70	3.14	-	c	49.24	38.37
126-152	Bss3	11.64	20.79	67.57	1.69	1.81	1.81	3.50	2.82	-	c	53.50	41.90
152-210	Bss4	11.38	23.21	65.42	2.16	2.16	1.93	3.07	2.05	-	c	51.53	39.64

Depth (cm)	pH (1:2.5)			E.C. (1:2.5)	O.C.	CaCO ₃	Exchangeable bases					CEC	CEC/ Clay	Base saturation	ESP
	Water	CaCl ₂	M KCl				Ca	Mg	K	Na	Total				
				dS m ⁻¹	%	%	cmol kg ⁻¹							%	%
0-25	8.73	-	-	0.203	0.24	5.76	-	-	0.65	4.43	-	40.56	0.73	-	10.93
25-53	9.17	-	-	0.295	0.45	4.92	-	-	0.32	10.47	-	74.70	1.19	-	14.02
53-90	9.27	-	-	0.388	0.66	6.00	-	-	0.24	10.49	-	76.20	1.16	-	13.77
90-126	9.22	-	-	0.608	0.57	5.88	-	-	0.21	15.93	-	77.20	1.16	-	20.63
126-152	9.21	-	-	0.936	0.33	6.60	-	-	0.37	20.88	-	80.90	1.20	-	25.81
152-210	9.03	-	-	1.47	0.33	8.16	-	-	0.24	15.34	-	73.10	1.12	-	20.98

INTERPRETATION FOR LAND RESOURCE MANAGEMENT

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

5.1 Land Capability Classification

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

Soil characteristics: Soil depth, soil texture, coarse fragments, soil reaction, available water capacity, calcareousness, salinity/alkali *etc.*

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

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

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

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

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

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

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

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

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

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

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

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

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

The 14 soil map units identified in the Adavalli-5 microwatershed are grouped under two land capability classes and four land capability subclasses (Fig. 5.1).

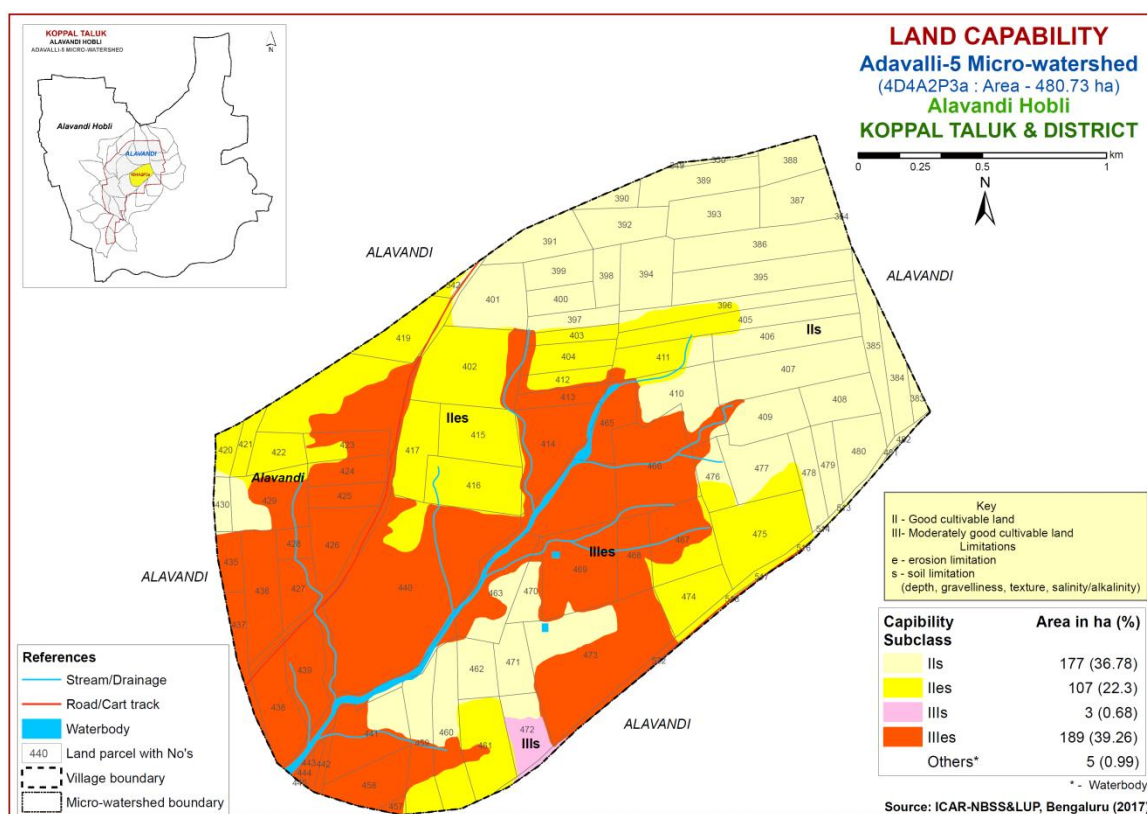


Fig. 5.1 Land Capability map of Adavalli-5 Microwatershed

Entire area in the microwatershed is suitable for agriculture. Good cultivable lands (Class II) cover an area of about 284 ha (59 %) and distributed in the major part of the microwatershed with moderate problems of soil and erosion. Moderately good cultivable lands occupy an area of about 192 ha (40 %) and distributed in the central and southwestern part of the microwatershed with severe limitations of soil and erosion.

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

Fig. 5.2 Soil Depth map of Adavalli-5 Microwatershed

distributed in the southern part of the microwatershed. Deep to Very deep (100- >150 cm) soils occupy maximum area of about 248 ha (52%) and occur in the major part of the microwatershed.

The most productive lands cover about 248 ha (52%) where all climatically adapted long duration crops be grown. The problem lands cover about 172 ha(36%) where only short duration crops can be grown. The probability of crop failure is high.

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 Fig 5.3.

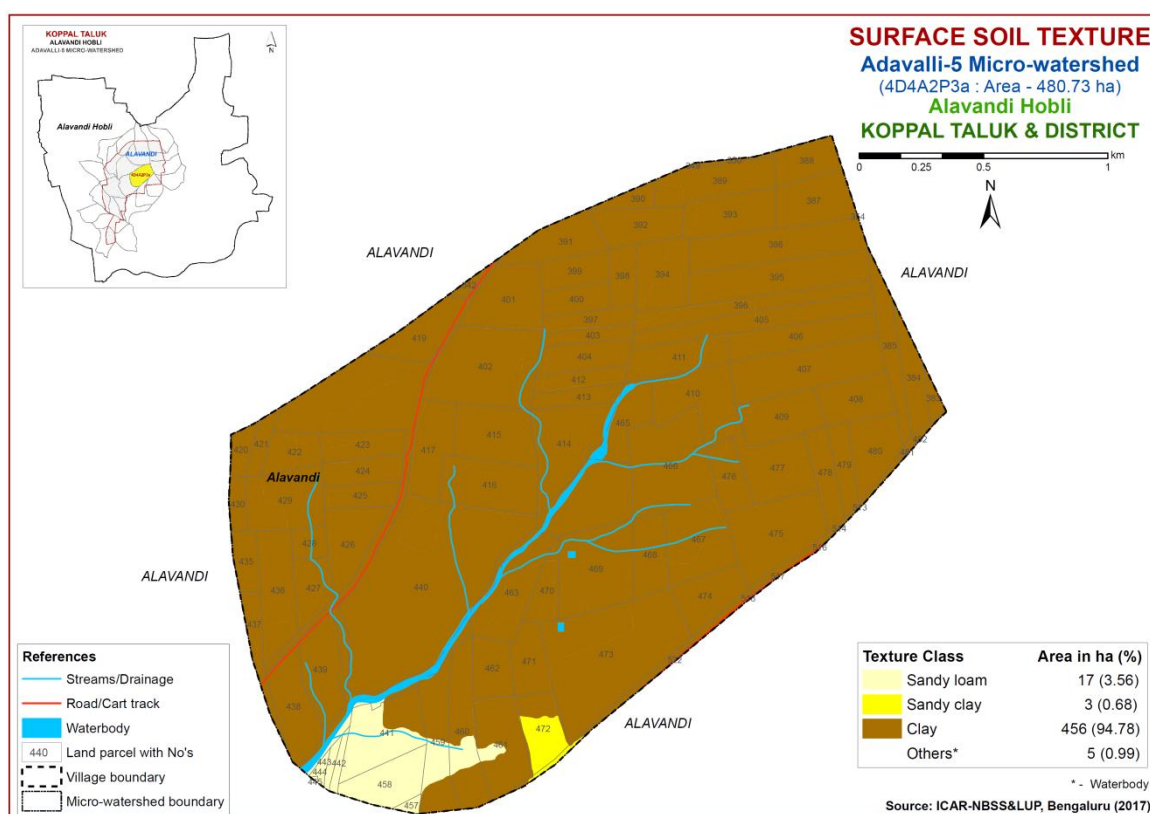


Fig. 5.3 Surface Soil Texture map of Adavalli-5 Microwatershed

A small area of about 17 ha (4%) is loamy at the surface and distributed in the southern part of the microwatershed. Maximum area of about 459 ha (95%) is clayey at the surface and distributed in the major part of the microwatershed. Clayey and loamy soils are most productive lands that have high potential for soil-water retention and

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

5.4 Soil Gravelliness

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

The soils that are non-gravelly (<15% gravel) cover maximum area of about 263 ha (55 %) and distributed in the major part of the microwatershed. An area of about 196 ha (41%) is covered by gravelly (15-35% gravel) soils and are distributed in the southern and central part of the microwatershed. A small area of about 17 ha (4%) is covered by very gravelly (35-60%) and distributed in the southern part of the microwatershed (Fig. 5.4).

The most productive lands with respect to gravelliness are found to be 55 per cent. They are non-gravelly with less than 15 per cent gravel and have potential for growing both annual and perennial crops. The problem soils that are very gravelly (35-60%) cover about 4 per cent where only short duration can be grown.

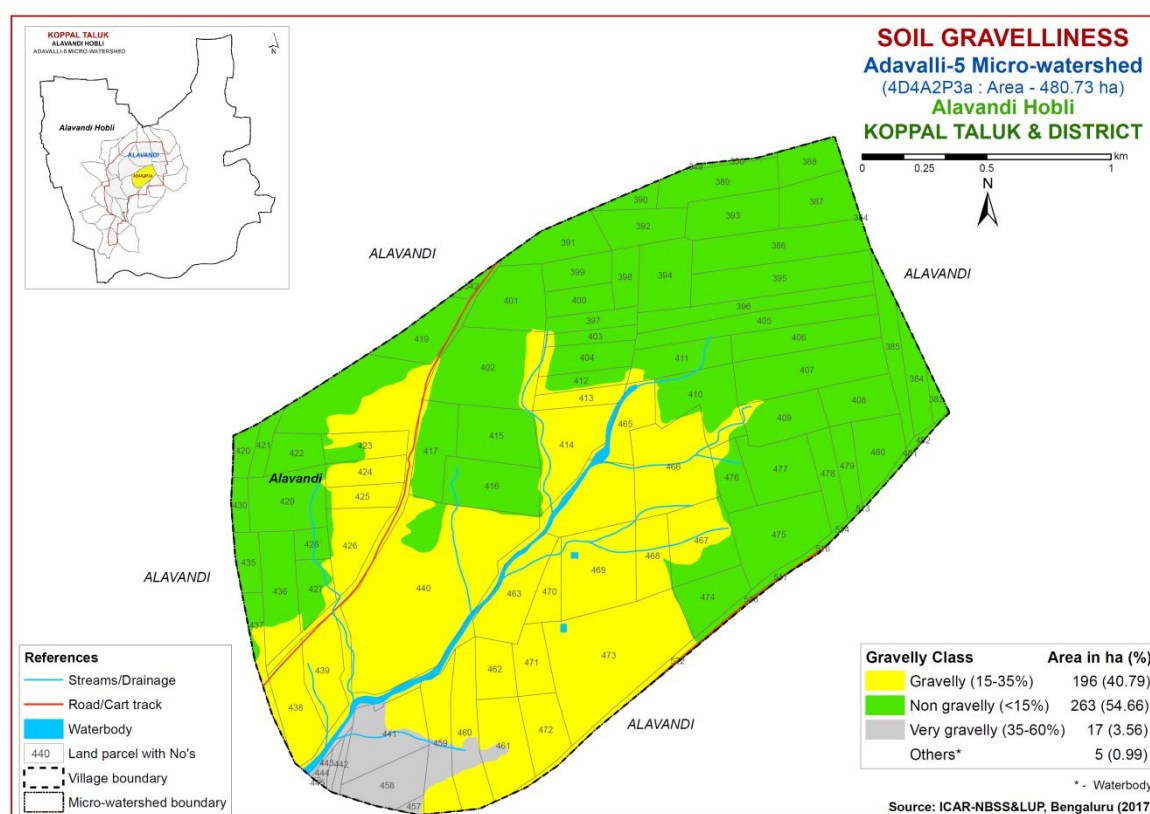


Fig. 5.4 Soil Gravelliness map of Adavalli-5 Microwatershed

5.5 Available Water Capacity

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

An area of about 17 ha (4%) in the microwatershed has soils that are very low (<50 mm/m) in available water capacity and are distributed in the southern part of the microwatershed. An area of about 203 ha (42%) has soils that are low (51 to 100 mm/m) in available water capacity and are distributed in the southwestern and central part of the microwatershed. A small area of about 11 ha (2%) has soils that are medium (101-150 mm/m) in available water capacity and are distributed in the southern part of the microwatershed. Maximum area of about 245 ha (51 %) is very high (>200 mm/min) in available water capacity and distributed in the major part of the microwatershed.

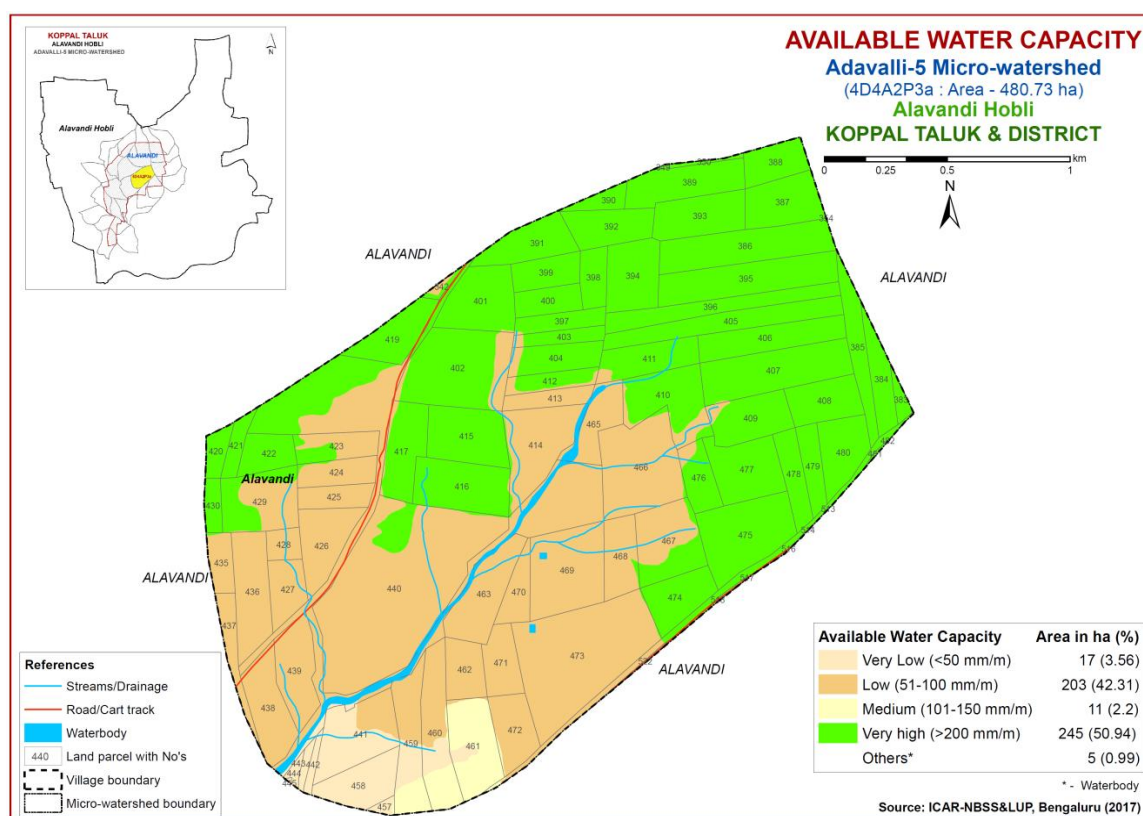


Fig. 5.5 Soil Available Water Capacity map of Adavalli-5 Microwatershed

An area of about 17 ha (4 %) in the microwatershed has soils that are problematic with regard to available water capacity. Here, only short duration crops can be grown and the

probability of crop failure is very high. These areas are best put to other alternative uses. An area of about 245 ha (51 %) has soils that have high potential (>200 mm/m) with regard to available water capacity where all climatically adapted long duration crops can be grown successfully.

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 two slope classes and a slope map was generated showing the area extent and their geographic distribution of different slope classes in the microwatershed (Fig. 5.6).

An area of about 145 ha (30%) falls under nearly level (0-1% slope) lands and distributed in the northeastern and eastern part of the microwatershed. Very gently sloping (1-3%) lands cover a maximum area of about 331 ha (69%) and distributed in the major part of the microwatershed. In all these areas, all climatically adapted annual and perennial crops can be grown without much soil and water conservation and other land development measures.

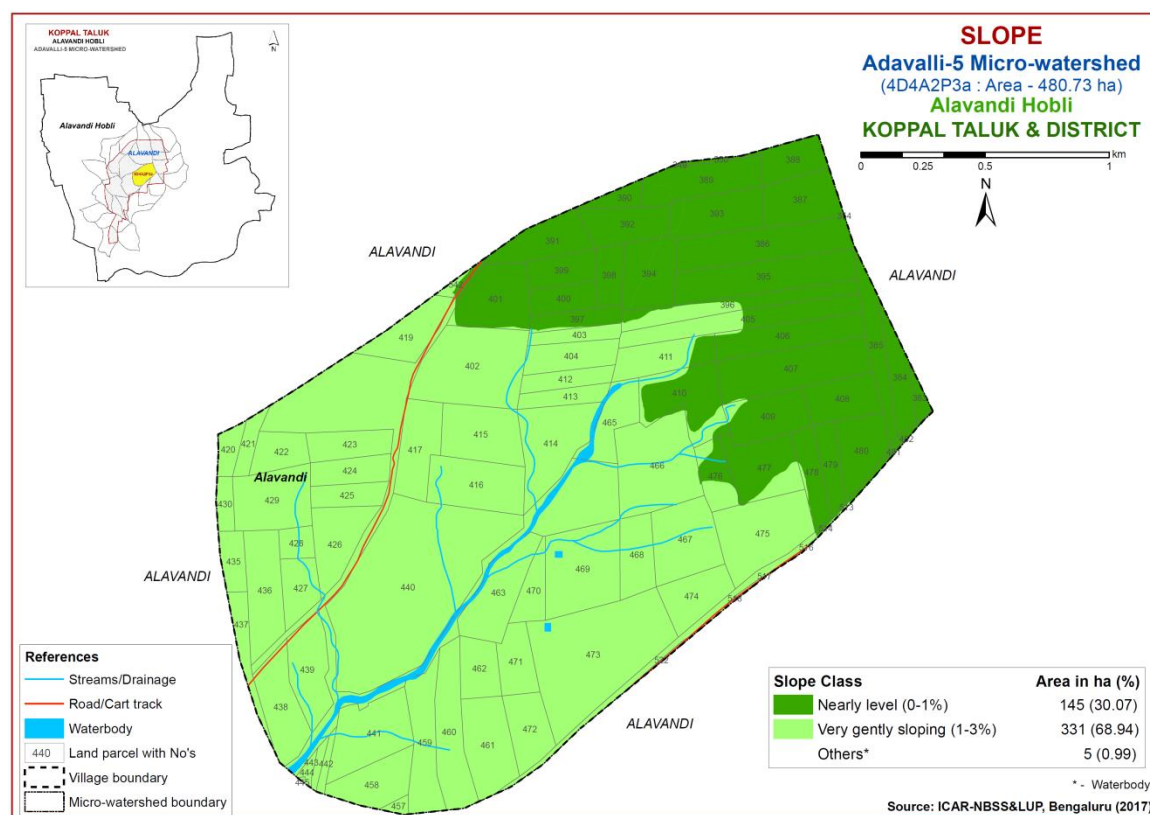


Fig. 5.6 Soil Slope map of Adavalli-5 Microwatershed

5.7 Soil Erosion

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

Slightly eroded lands cover an area of about 180 ha (37%) and distributed in the northern, northeastern and southern part of the microwatershed. An area of about 296 ha (62 %) is moderately eroded (e2 class) and distributed in the major part of the microwatershed.

Moderately eroded lands are problematic and need appropriate soil and water conservation and other land development measures.

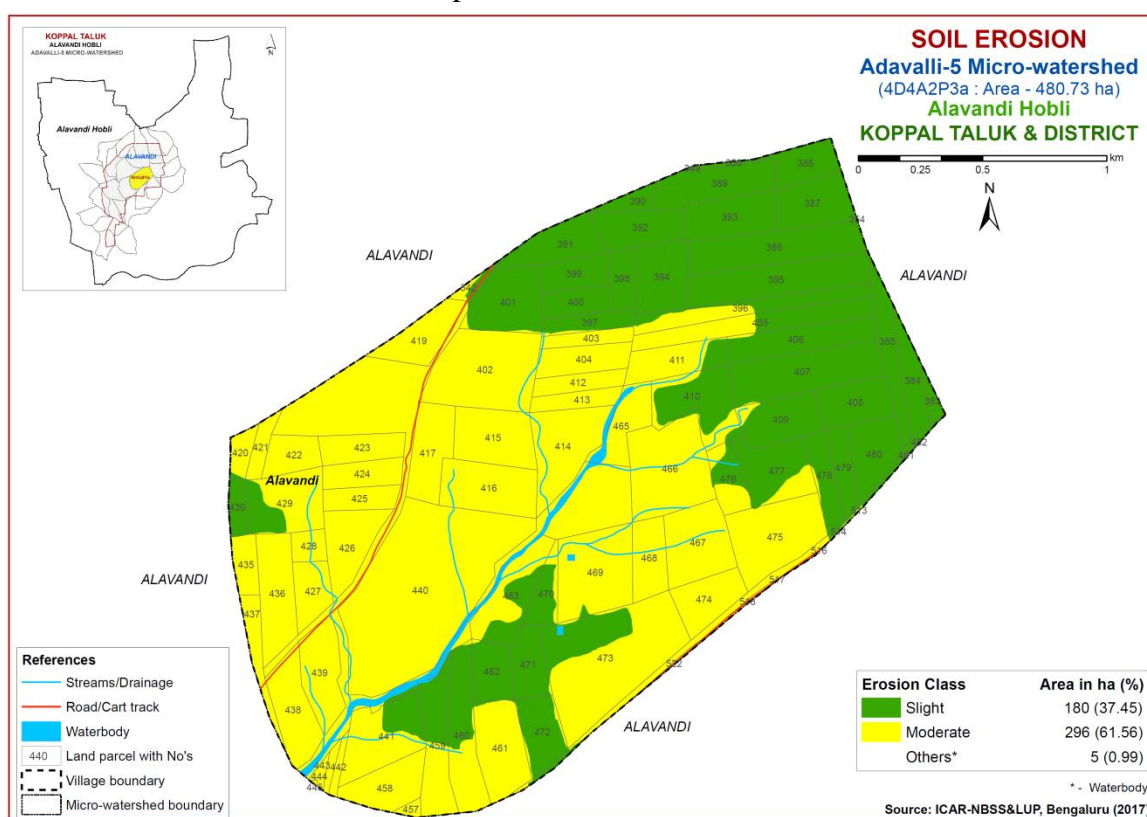


Fig. 5.7 Soil Erosion map of Adavalli-5 Microwatershed

FERTILITY STATUS

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status, as these areas are characterised by low rainfall and high temperatures. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. For this purpose, the surface soil samples collected from the grid points (one soil sample at every 250 m grid interval) all over the microwatershed through land resource inventory in the year 2017 were analysed for pH, EC, organic carbon, available phosphorus and potassium, and for micronutrients like zinc, boron, copper, iron and manganese, and secondary nutrient sulphur.

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

6.1 Soil Reaction (pH)

The soil analysis of the Adavalli-5 microwatershed for soil reaction (pH) showed that neutral soils cover an area of about 15 ha (3%) and distributed in the southern part of the microwatershed. An area of about 16 ha (3%) is slightly alkaline (pH 7.3-7.8) and distributed in the southern part. Moderately alkaline (pH 7.8-8.4) soils cover about 16 ha (3%) area and distributed in the southern part of the microwatershed. Strongly alkaline (pH 8.4-9.0) soils cover an area of about 112 ha (23%) and is distributed in the southern and southwestern part of the microwatershed. Maximum area of about 317 ha (66%) is very strongly alkaline (pH > 9.0) and distributed in the major part of the microwatershed (Fig.6.1).

6.2 Electrical Conductivity (EC)

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

6.3 Organic Carbon

Maximum area of about 424 ha (88%) is low ($<0.5\%$) in organic carbon and distributed in the major part of the microwatershed. An area of about 52 ha (11%) is medium (0.5-0.75%) in organic carbon content and distributed in the central and southern part of the microwatershed (Fig.6.3).

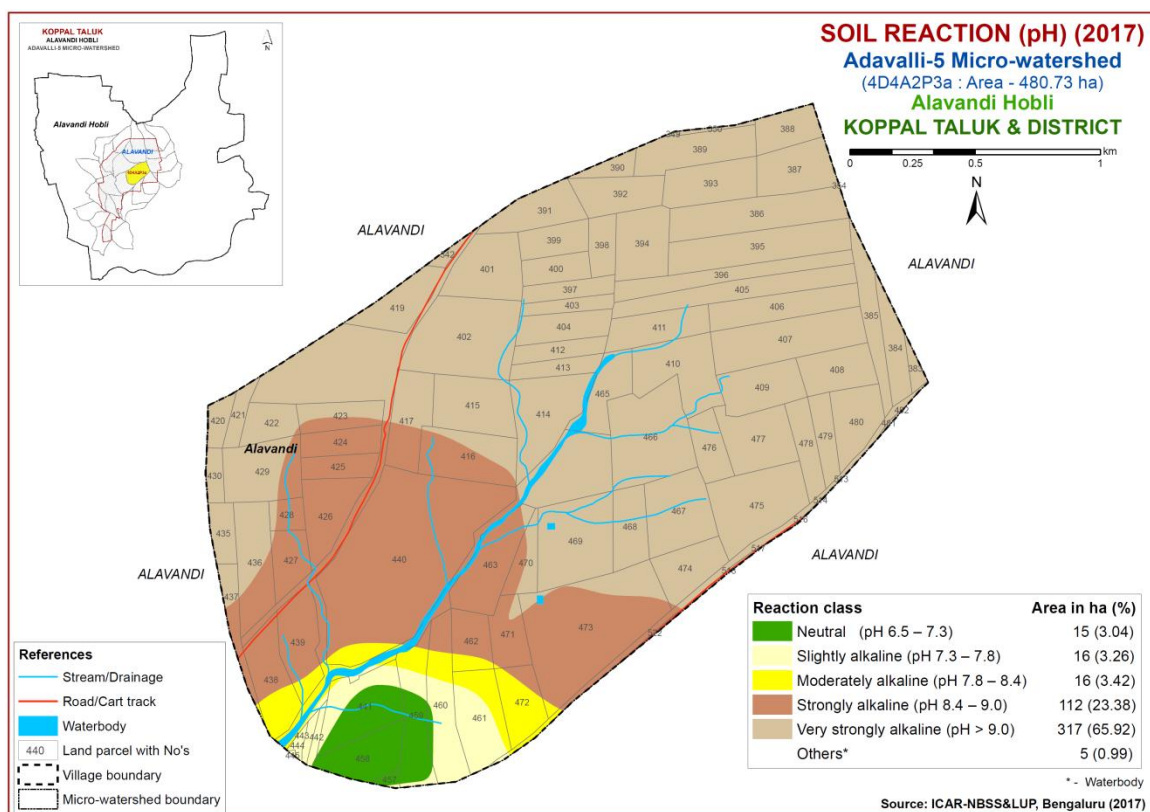


Fig.6.1 Soil Reaction (pH) map of Adavalli-5 Microwatershed

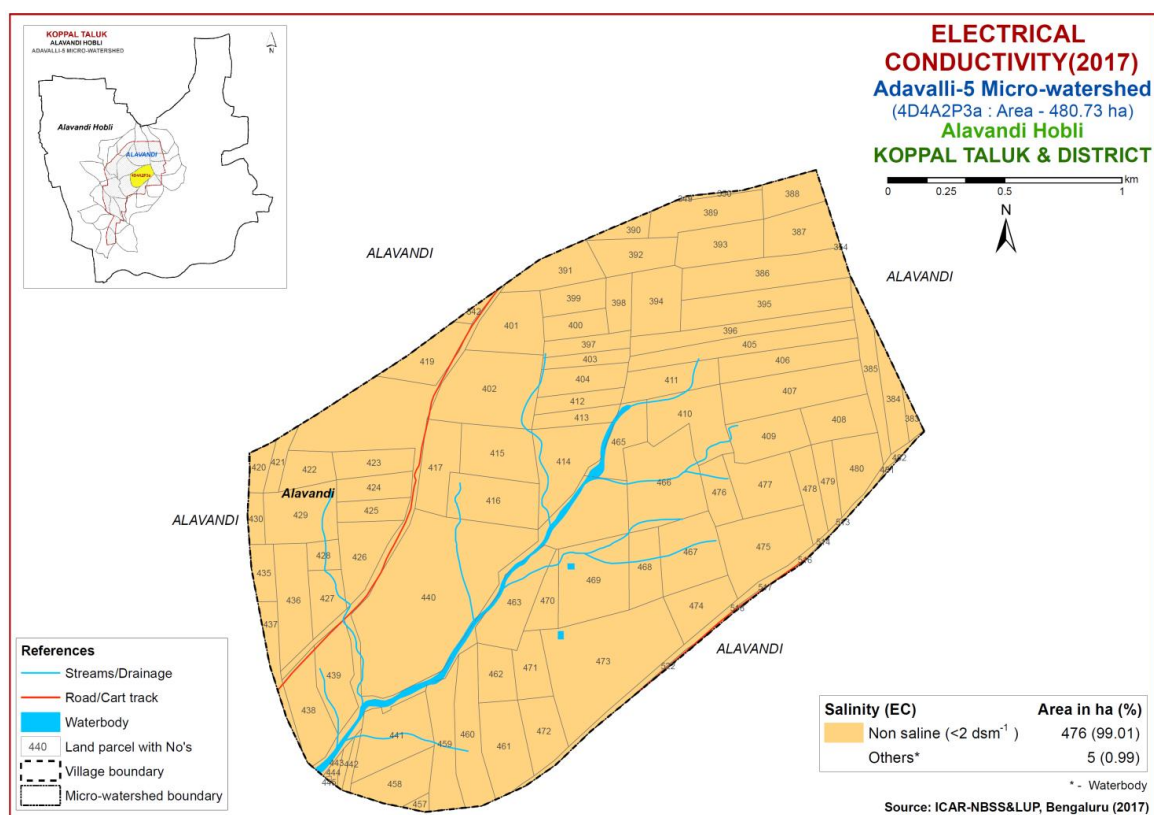


Fig.6.2 Electrical Conductivity (EC) map of Adavalli-5 Microwatershed

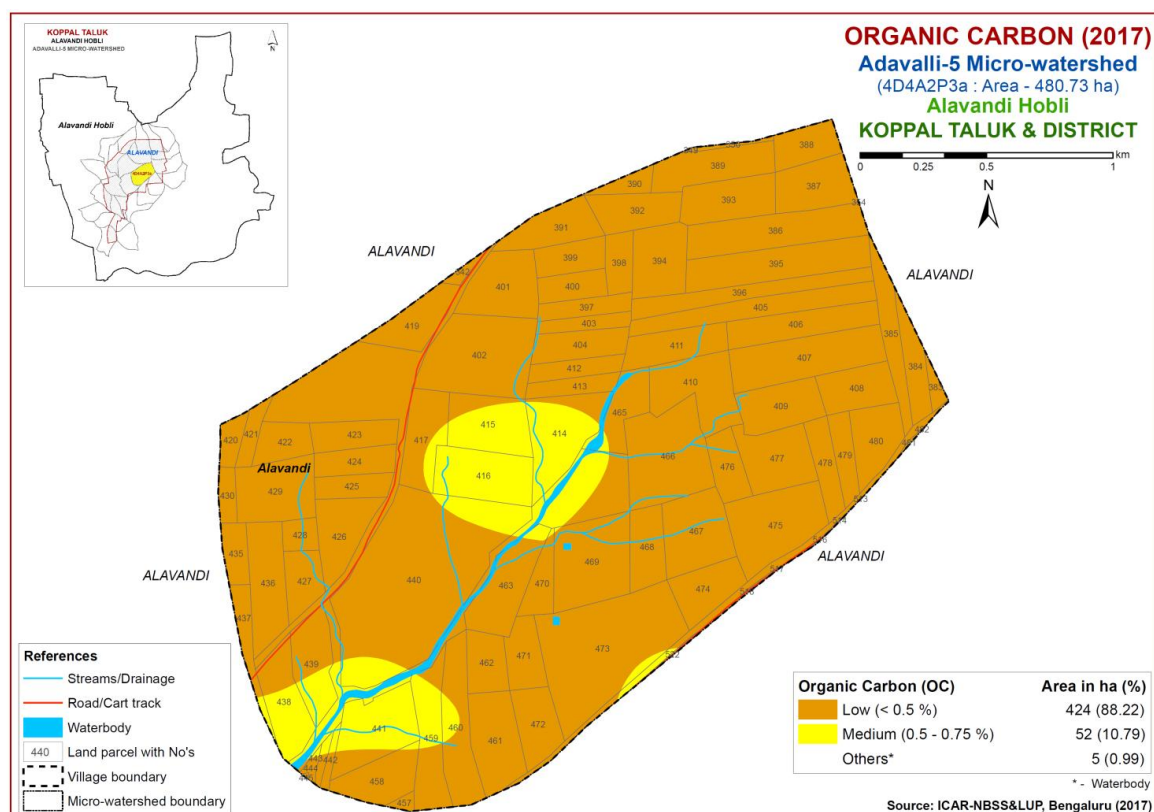


Fig.6.3 Soil Organic Carbon map of Adavalli-5 Microwatershed

6.4 Available Phosphorus

Maximum area of about 444 ha (92%) is low (<23 kg/ha) in available phosphorus and distributed in the major part of the microwatershed. Available phosphorus is medium (23-57 kg/ha) in a small area of about 32 ha (7 %) and distributed in the southern part of the microwatershed. In areas that are low to medium in available phosphorous, apply extra 25 per cent phosphorous over the RDF to realize better crop performance (Fig 6.4).

6.5 Available Potassium

An area of about 79 ha (16%) is medium (145-337 kg/ha) in available potassium content and distributed in the southern part of the microwatershed. Maximum area of about 397 ha (83 %) is high in available potassium content and distributed in the major part of the microwatershed. The areas with high potassium content needs to reduce 25 per cent from the recommended dose to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is medium (Fig 6.5).

6.6 Available Sulphur

Soil analysis of available sulphur content in Adavalli-5 microwatershed showed that an area of about 233 ha (49 %) is low (<10 ppm) in available sulphur content and distributed in the southeastern, central and eastern part of the microwatershed. An area of about 225 ha (47 %) is medium (10-20 ppm) and distributed in the western, central and northern part of the microwatershed. A small area of about 17 ha (4%) is high (>20ppm) in available sulphur and distributed in the southern part of the microwatershed (Fig.6.6).

The areas that are 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.

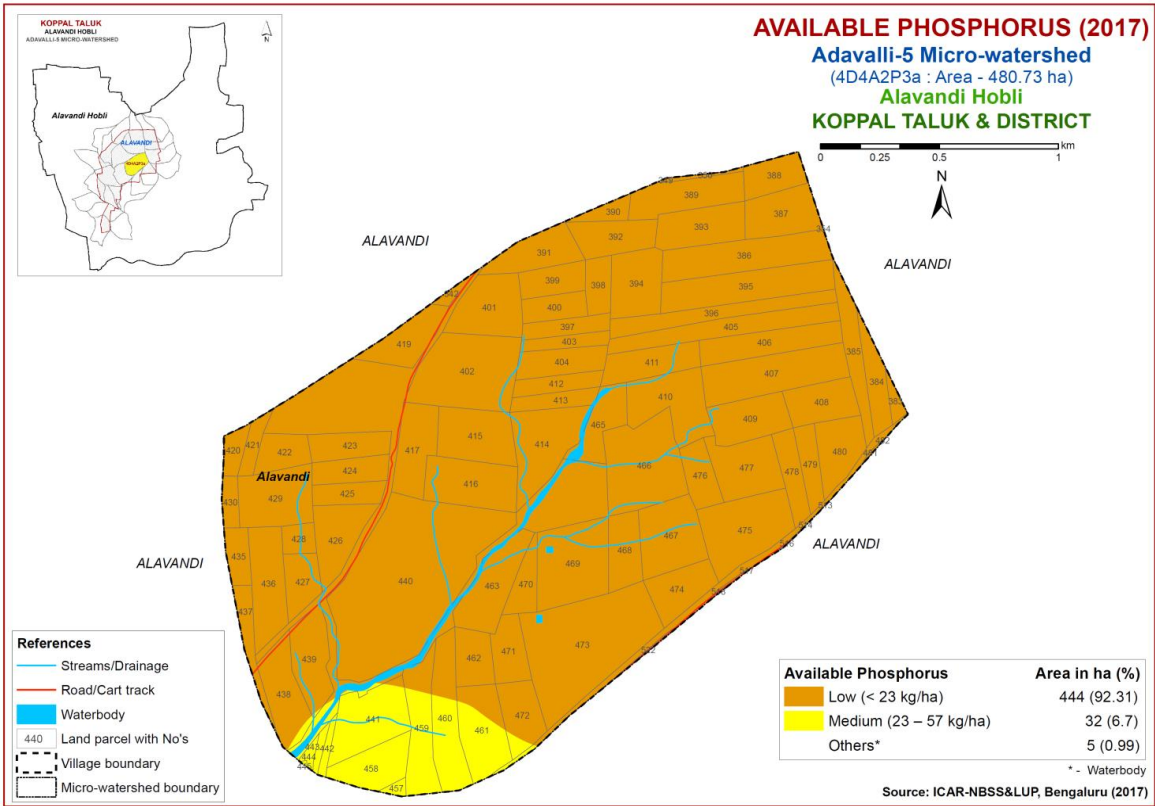


Fig.6.4 Soil Available Phosphorus map of Adavalli-5 Microwatershed

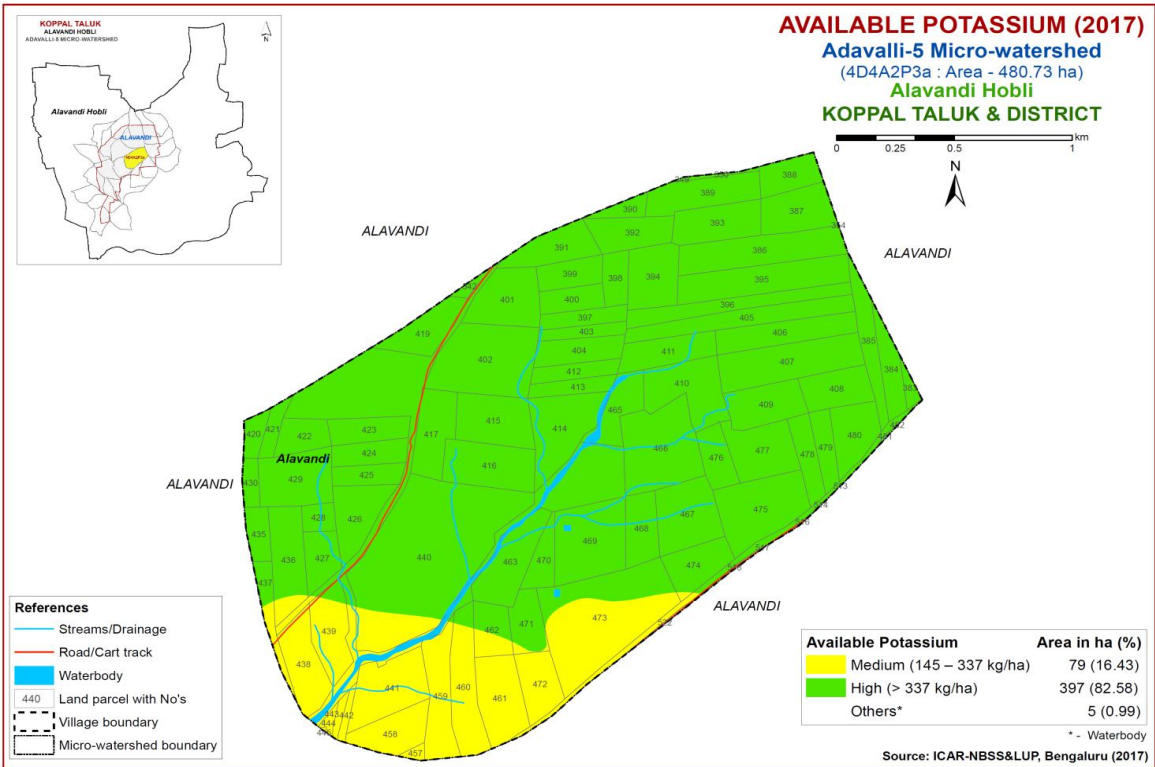


Fig.6.5 Soil Available Potassium map of Adavalli-5 Microwatershed

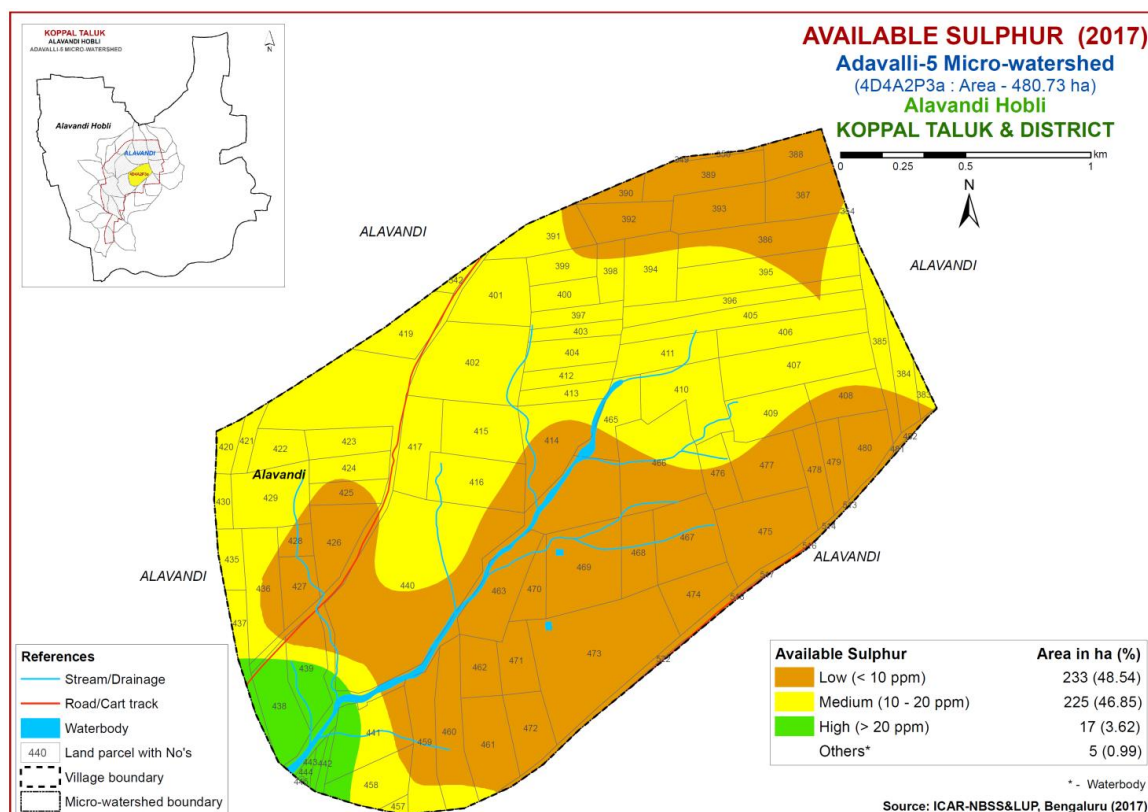


Fig.6.6 Soil Available Sulphur map of Adavalli-5 Microwatershed

6.7 Available Boron

Soil analysis of available boron content in Adavalli-5 microwatershed showed that an area of about 64 ha (13%) is low (<0.5ppm) in available boron content and distributed in the southwestern part of the microwatershed. Maximum area of about 412 ha (86%) is medium (0.5-1.0ppm) in available boron content and distributed in the major part of the microwatershed (Fig.6.7).

6.8 Available Iron

Available iron content in the soils of the Adavalli-5 microwatershed is deficient (<4.5 ppm) in maximum area of about 441 ha (92 %) and distributed in the major part. A small area of about 35 ha (7 %) showed sufficiency (>4.5 ppm) with respect to iron content and distributed in the southern part of the microwatershed (Fig 6.8).

6.9 Available Manganese

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

6.10 Available Copper

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

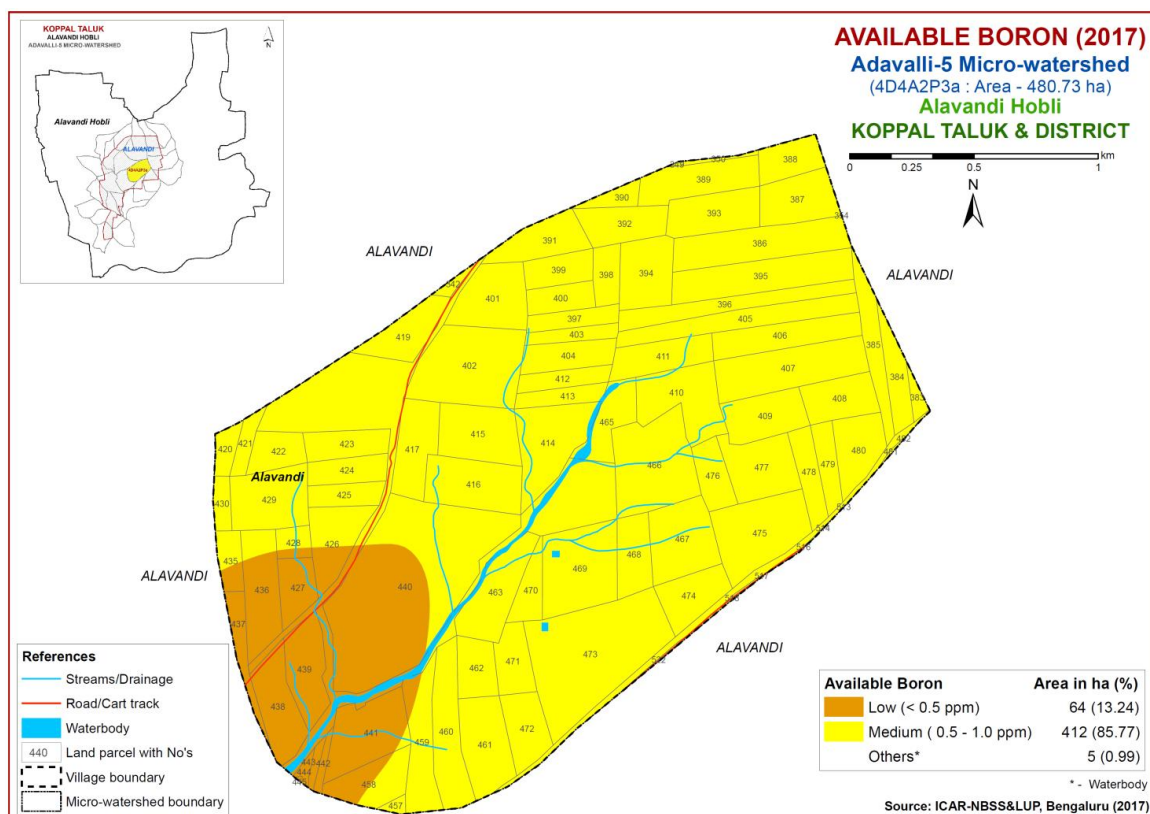


Fig.6.7 Soil Available Boron map of Adavalli-5 Microwatershed

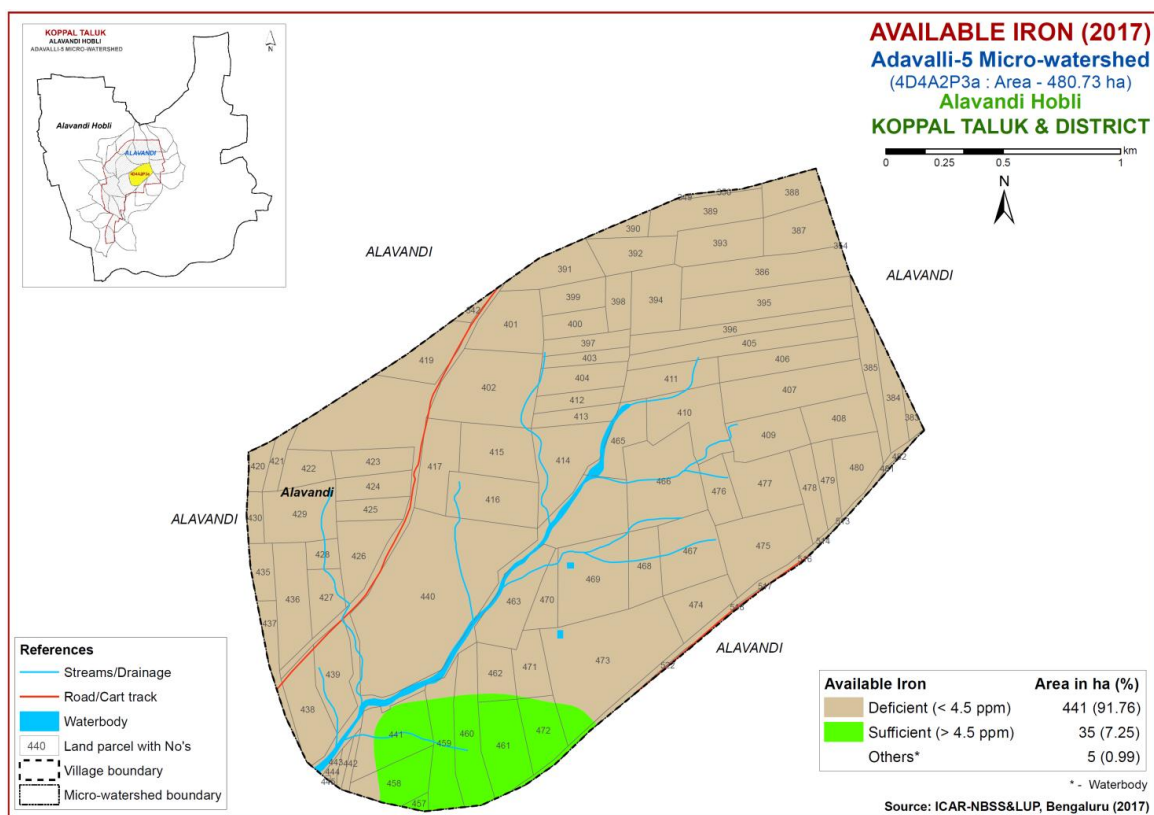


Fig.6.8 Soil Available Iron map of Adavalli-5 Microwatershed

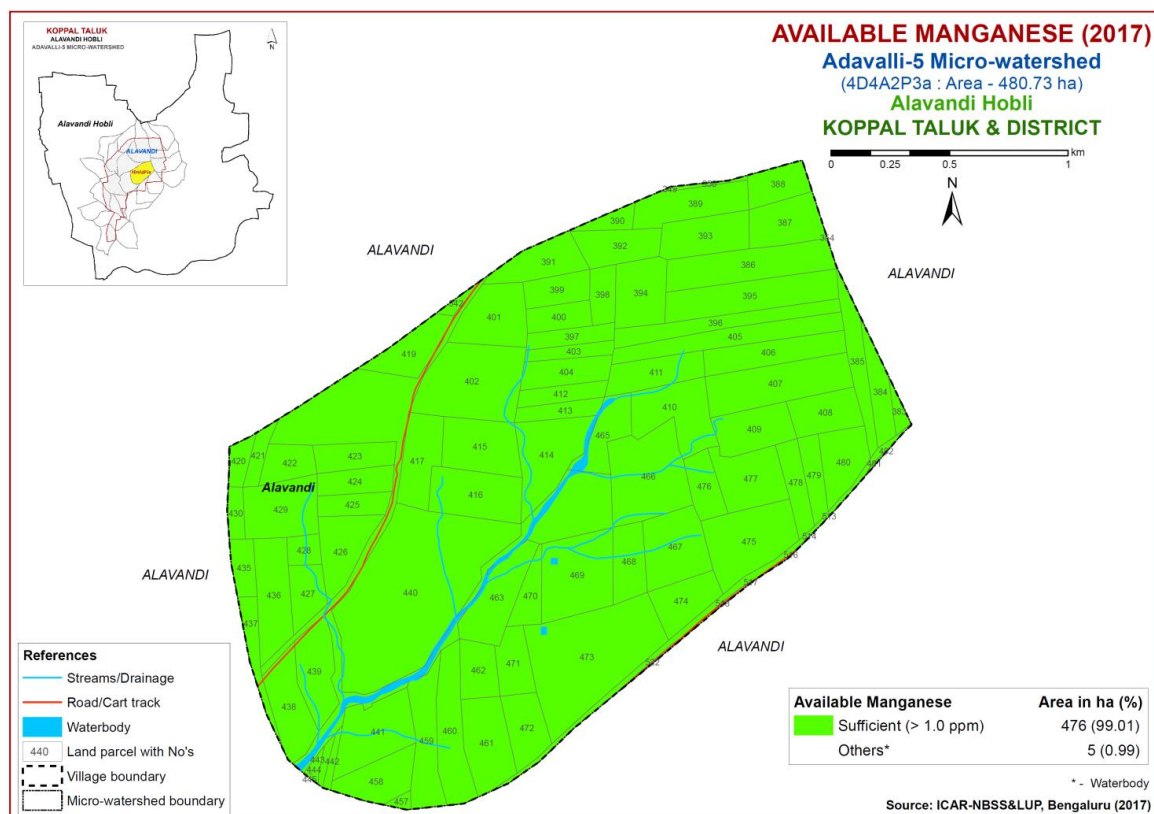


Fig.6.9 Soil Available Manganese map of Adavalli-5 Microwatershed

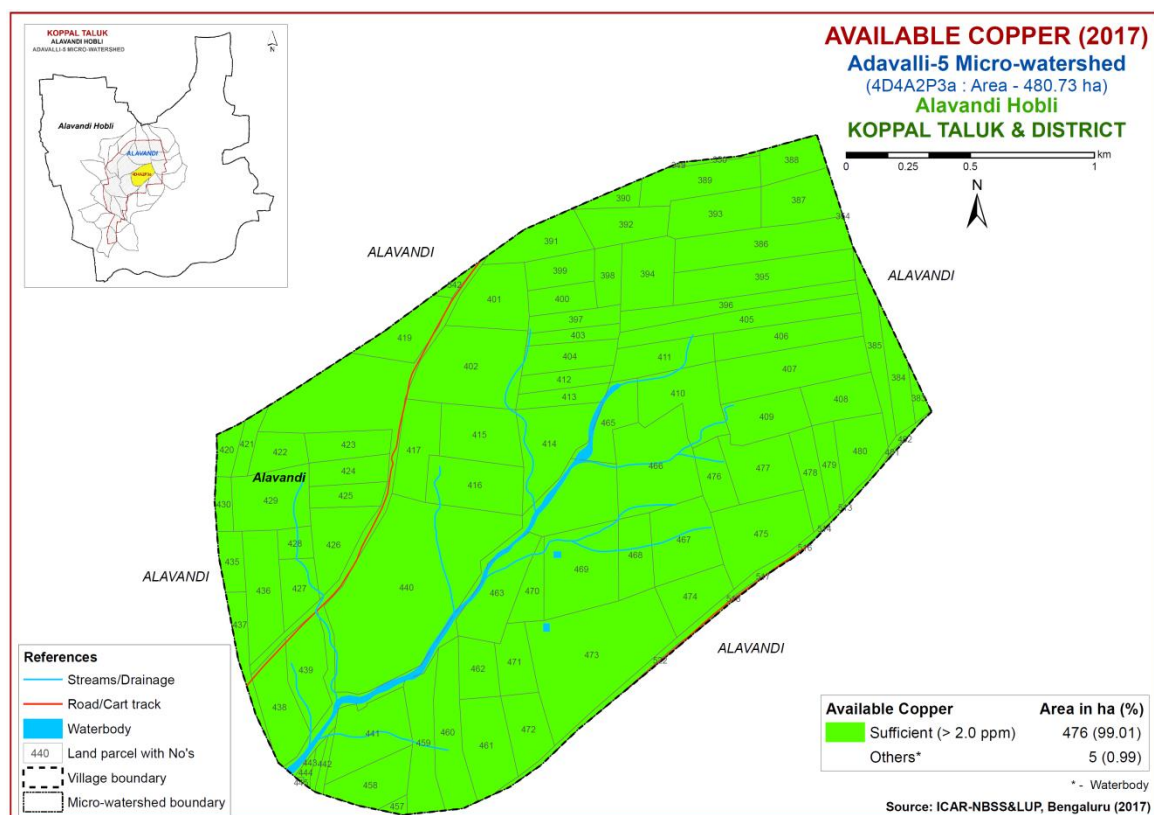


Fig.6.10 Soil Available Copper map of Adavalli-5 Microwatershed

Available zinc content is deficient (<0.6 ppm) in a maximum area of about 466 ha (97%) and distributed in the major part of the microwatershed. A small area of about 10 ha (2 %) is sufficient (>0.6) in zinc content and distributed in the western part of the microwatershed (Fig 6.11).



LAND SUITABILITY FOR MAJOR CROPS

The soil and land resource units (soil phases) of Adavalli-5 microwatershed were assessed for their suitability for growing food, fodder, fibre and other horticulture crops by following the procedure as outlined in FAO, 1976 and 1983. Crop requirements were developed for each of the crop from the available research data and also by referring to Naidu *et. al.* (2006) and Natarajan *et. al* (2015). The crop requirements were matched with the soil and land characteristics (Table 7.1) to arrive at the crop suitability. In FAO land suitability classification, two orders are recognized. Order S- Suitable and Order N- Not suitable. The orders have classes, subclasses and units. Order-S has three classes, Class S1- Highly Suitable, Class S2- Moderately Suitable and Class S3- Marginally Suitable. Order N has two Classes, N1- Currently not Suitable and N2- Permanently not Suitable. There are no subclasses within the Class S1 as they will have very minor or no limitations for crop growth. Classes S2, S3 and N1 are divided into subclasses based on the kinds of limitations encountered. The limitations that affect crop production are 'c' for erratic rainfall and its distribution and length of growing period (LGP), 'e' for erosion hazard, 'r' for rooting condition, 't' for lighter or heavy texture, 'g' for gravelliness or stoniness, 'n' for nutrient availability, 'l' for topography, 'm' for moisture availability, 'z' for calcareousness and 'w' for drainage. These limitations are indicated as lower case letters to the class symbol. For example, moderately suitable lands with the limitations of soil depth and erosion are designated as S2re. For the microwatershed, the soil mapping units were evaluated and classified up to subclass level.

Using the above criteria, the soil map units of the microwatershed were evaluated and land suitability maps for 28 major annual and perennial crops were generated. The detailed information on the kind of suitability of each of the soil phase for the crops assessed are given village/ survey number wise for the microwatershed in Appendix-III.

7.1 Land Suitability for Sorghum (*Sorghum bicolor*)

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

Highly suitable (Class S1) lands occupy maximum area of about 235 ha (49 %) for growing sorghum and occur in the northern, northeastern and eastern part of the microwatershed. An area of about 50 ha (10 %) is moderately suitable (Class S2) for growing sorghum and distributed in the southern part of the microwatershed with minor limitations of calcareousness, nutrient availability and rooting depth.

Table 7.1 Soil-Site Characteristics of Adavalli-5 Microwatershed

Soil Map Units	Climate (P) (mm)	Growing period (Days)	Drainage Class	Soil depth (cm)	Soil texture		Gravelliness		AWC (mm/m)	Slope (%)	Erosion	pH	EC (dSm ⁻¹)	ESP	CEC [Cmol (p ⁺)kg ⁻¹]	BS (%)
					Surface	Sub-surface	Sur-face	Sub-surface								
LKRcB2g2	662	<90	WD	50-75	sl	gsc	35-60	40-60	51-100	1-3	moderate	8.18	0.3	4.51	12.19	100
NGPiB1g1	662	<90	WD	100-150	sc	gsc-gc	15-35	>35	51-100	1-3	slight	-	-	-	-	-
MTLmB2	662	<90	WD	25-50	c	gc	-	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
MTLmB2g1	662	<90	WD	25-50	c	gc	15-35	15-35	51-100	1-3	moderate	8.27	0.20	0.69	36.64	-
RNKmB1g1	662	<90	WD	50-75	c	c	15-35	<15	51-100	1-3	slight	8.86	0.48	16.94	37.00	-
RNKmB2	662	<90	WD	50-75	c	c	-	<15	51-100	1-3	mod	8.86	0.48	16.94	37.00	-
DRLmB2g1	662	<90	MWD	75-100	c	c	15-35	<15	151-200	1-3	moderate	-	-	-	-	-
HDLmB2	662	<90	MWD	100-150	c	c	-	-	>200	1-3	moderate	9.06	0.37	12.72	62.33	-
KDTmA1	662	<90	MWD	>150	c	sc-c	-	-	>200	0-1	slight	-	-	-	-	-
KDTmB2	662	<90	MWD	>150	c	sc-c	-	-	>200	1-3	moderate	-	-	-	-	-
MLRmB1	662	<90	MWD	>150	c	c	-	10-20	>200	0-1	slight	9.19	0.31	13.48	42.08	-
MLRmB2	662	<90	MWD	>150	c	c	-	10-20	>200	1-3	moderate	9.19	0.31	13.48	42.08	-
BDRmA1	662	<90	MWD	>150	c	c	-	<15	>200	0-1	slight	8.73	0.20	10.93	40.56	-
BDRmB2	662	<90	MWD	>150	c	c	-	<15	>200	1-3	moderate	8.73	0.20	10.93	40.56	-

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

An area of about 192 ha (40 %) is marginally suitable for growing sorghum and distributed in the western, southern and central part of the microwatershed. They have moderate limitations of gravellines, rooting depth and calcareousness.

Table 7.2 Crop suitability criteria for Sorghum

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

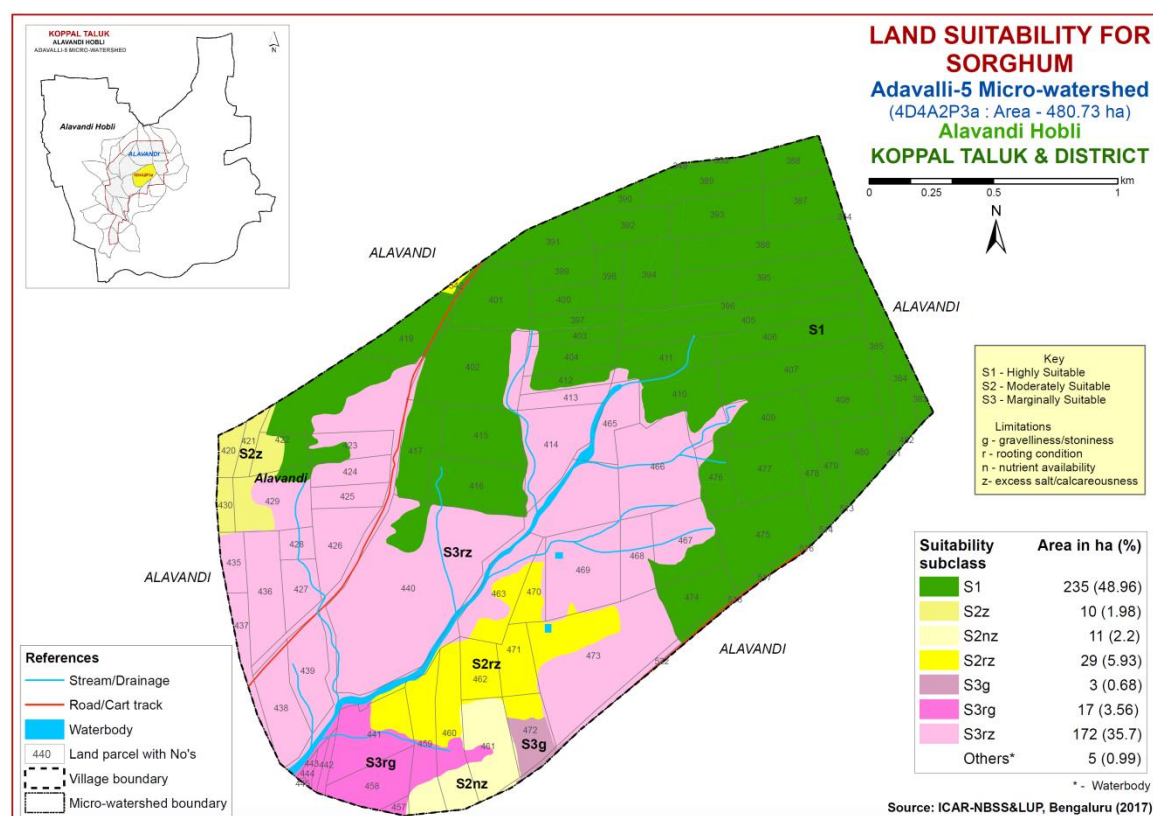


Fig. 7.1 Land Suitability map of Sorghum

7.2 Land Suitability for Maize (*Zea mays*)

Maize is one of the most important food crop grown in an area of 13.37 lakh ha in almost all the districts of the State. The crop requirements for growing maize (Table 7.3) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for

growing maize was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.2.

There are no highly (S1) and moderately suitable (S2) lands for growing maize. Marginally suitable (Class S3) lands cover a maximum area of about 475 ha (99 %) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

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	

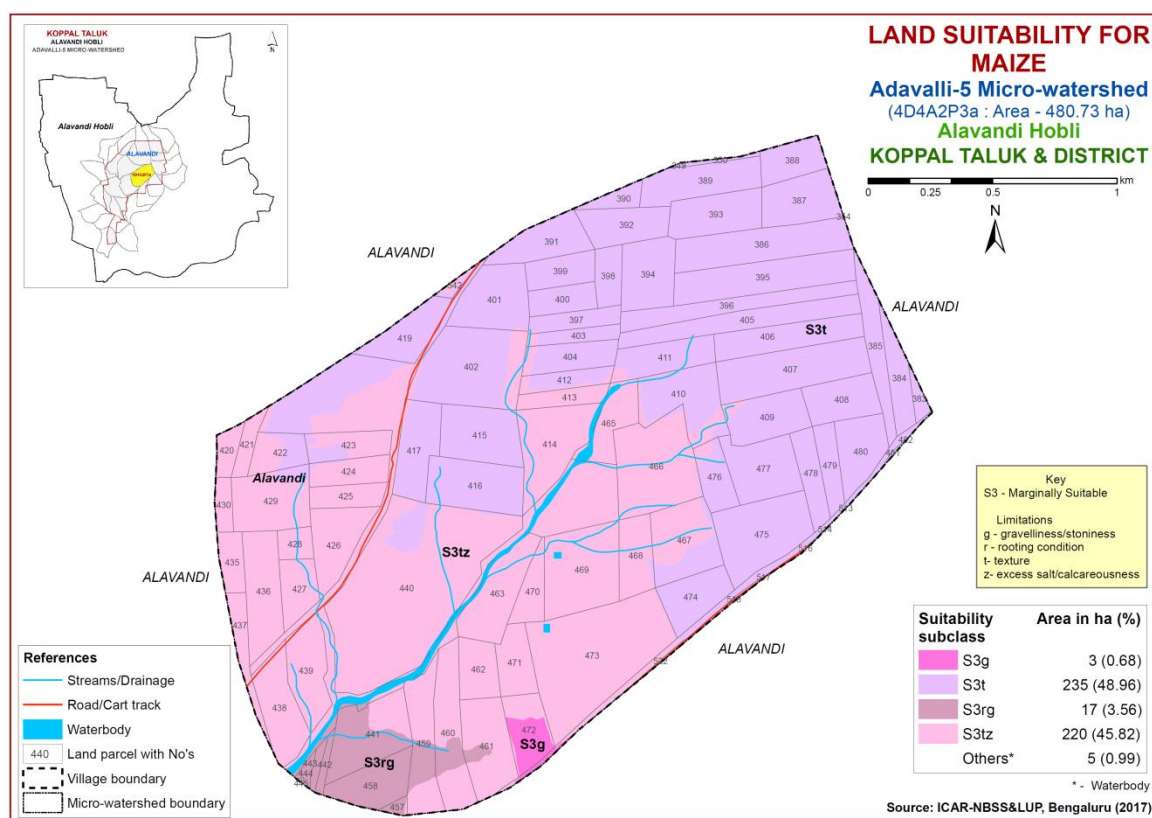


Fig. 7.2 Land Suitability map of Maize

7.3 Land Suitability for Bajra (*Pennisetum glaucum*)

Bajra is one of the major food crop grown in an area of 2.34 lakh ha in Karnataka in the northern districts. The crop requirements (Table 7.4) for growing bajra were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing bajra was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.3.

Table 7.4 Crop suitability criteria for Bajra

Crop requirement		Rating			
Soil –site characteristics	Unit	Highly suitable (S1)	Moderately suitable(S2)	Marginally suitable (S3)	Not suitable (N)
Slope	%	2-3	3-8	8-15	>15
LGP	Days	120-150	120-90	<90	
Soil drainage	Class	Well to mod. Well drained	imperfect	Poorly/excessively	V.poorly
Soil reaction	pH	5.5-8.0	5.0-5.5,7.8-8.4	8.4-9.0	>9.0
Surface soil texture	Class	c(red), scl, sc,sl, cl	l, c (black) scl, sil, sic	sl, ls	S, fragmental skeletal
Soil depth	cm	100-75	50-75	25-50	<25
Gravel content	% vol.	15-35	35-60	60-80	-
Salinity (EC)	dSm ⁻¹	2-4	4-8	8-10	>10
Sodicity (ESP)	%	5-8	8-10	10-15	>15

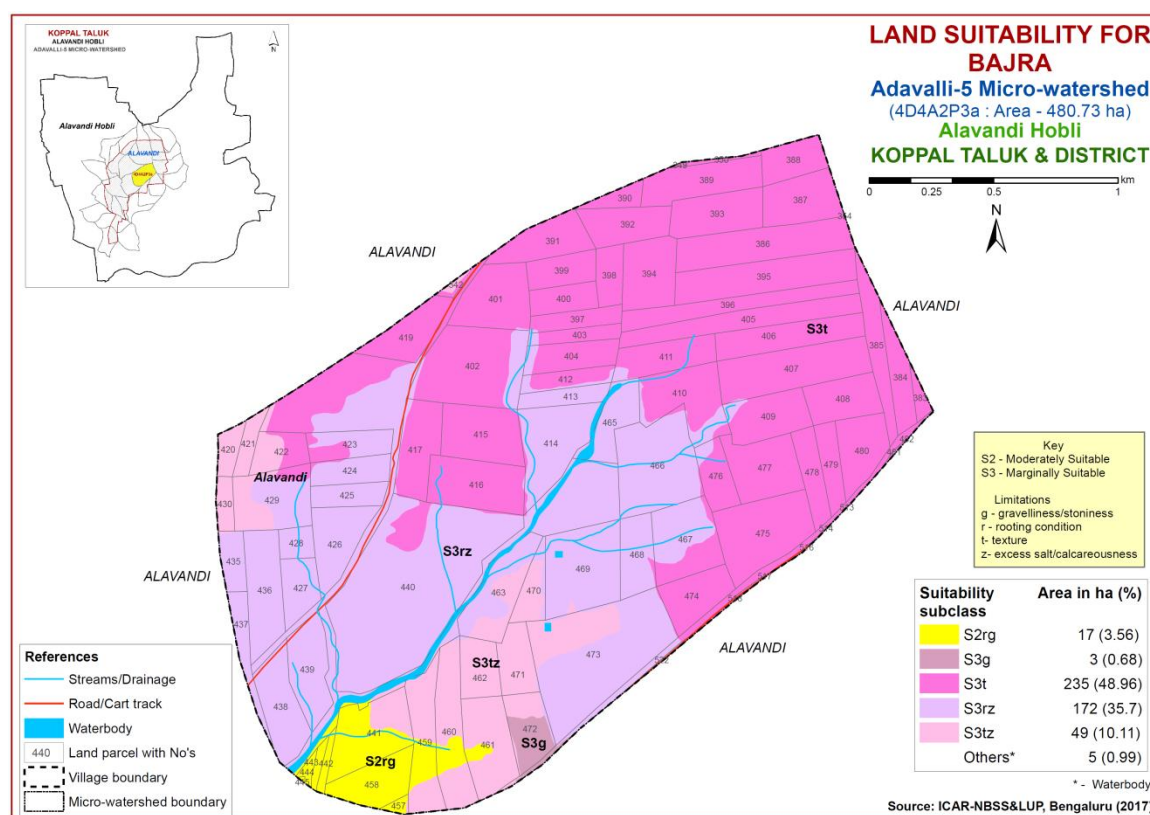


Fig. 7.3 Land Suitability map of Bajra

Moderately suitable (S2) lands cover a small area of about 17 ha (4%) and occur in the southern part of the microwatershed with minor limitations of rooting depth and gravelliness. Marginally suitable (Class S3) lands cover a maximum area of about 459 ha (95%) and distributed in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

7.4 Land Suitability for Redgram (*Cajanus cajan*)

Redgram is one of the most important pulse crop grown in an area of 7.28 lakh ha in almost all the districts of the State. The crop requirements for growing redgram (Table 7.5) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing redgram was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed is given in Figure 7.4.

There are no highly suitable (Class S1) lands for growing redgram. Maximum area of about 245 ha (51 %) is moderately suitable (Class S2) for growing redgram and occur in the major part of the microwatershed. They have minor limitations of texture, and calcareousness. Marginally suitable lands (Class S3) occupy an area of about 59 ha (12 %) and occur in the southern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. Area not suitable (class N1) for growing redgram cover about 172 ha (36 %) and distributed in the southwestern, southern and central part of the microwatershed with severe limitations of rooting depth and calcareousness.

Table 7.5 Land suitability criteria for Red gram

Crop requirement		Rating			
Soil –site characteristics	Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Slope	%	<3	3-5	5-10	>10
LGP	Days	>210	180-210	150-180	<150
Soil drainage	class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Soil reaction	pH	6.5-7.5	5.0-6.5,7.6-8.0	8.0-9.0	>9.0
Sub Surface soil texture	Class	l, scl, sil, cl, sl	sicl, sic, c(m)	ls	
Soil depth	cm	>100	75-100	50-75	<50
Gravel content	% vol.	<15	15-35	3-60	>60
Salinity (EC)	dsm ⁻¹	<1.0	1.0-2.0	>2.0	
Sodicity (ESP)	%	<10	10-15	>15	

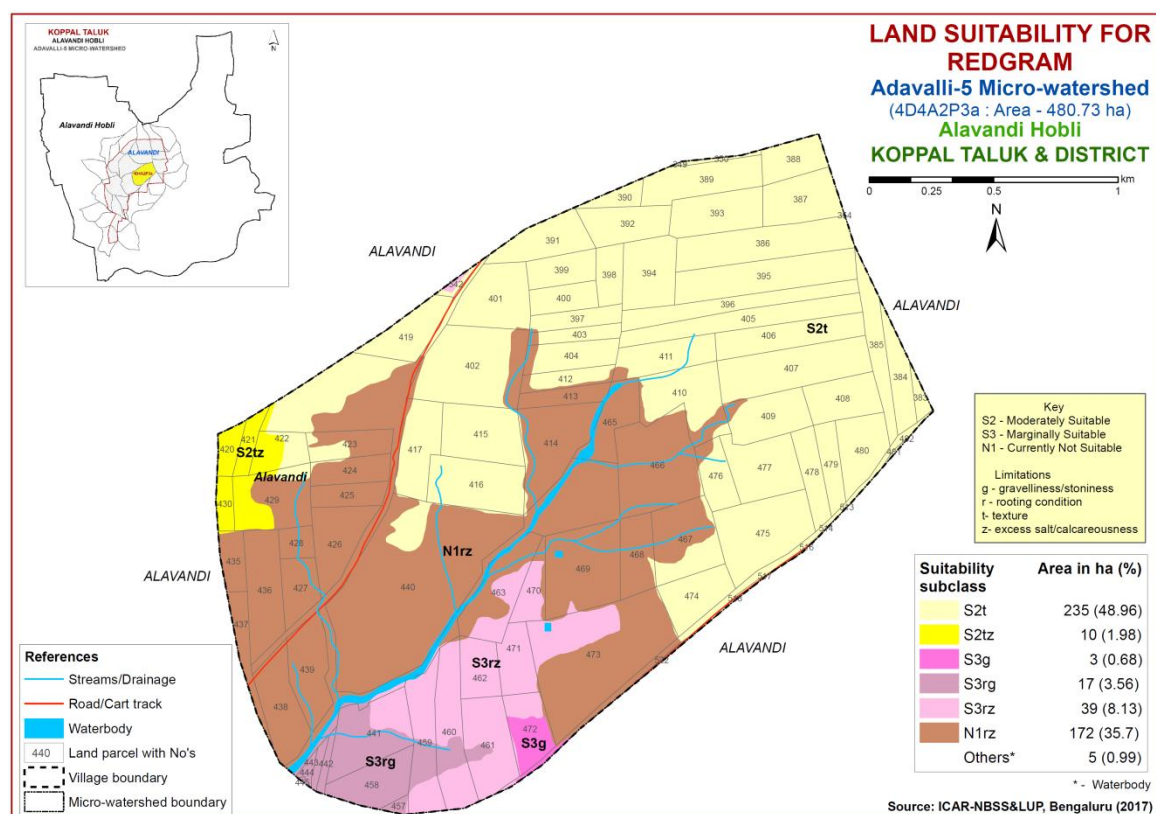


Fig. 7.4 Land Suitability map of Redgram

7.5 Land Suitability for Bengal gram (*Cicer arietinum*)

Bengal gram is one of the major pulse crop grown in an area of 9.39 lakh ha in northern Karnataka in Bijapur, Gulbarga, Raichur, Bidar, Belgaum, Dharwad and Bellary districts. The crop requirements for growing Bengal gram (Table 7.6) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing Bengal gram was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.5.

Table 7.6 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	P.drained; exc.drained	Very Poorly drained
Soil reaction	pH	6.0-7.5	5.5-5.77.6-8.0	8.1-9.0;4.5-5.4	>9.0
Surface soil texture	Class	l, scl, sil, cl,	sicl, sic, c	Sl, c>60%	S, fragmental
Soil depth	cm	>75	51-75	25-50	<25
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	

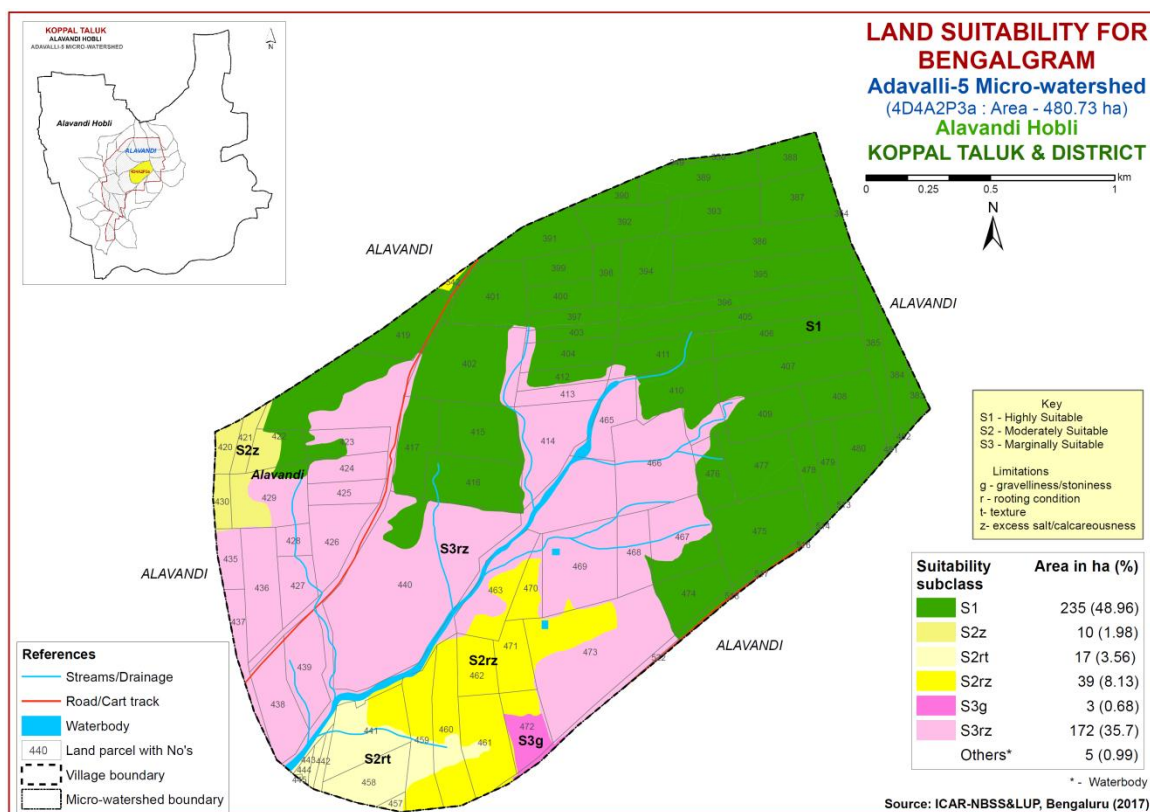


Fig. 7.5 Land Suitability map of Bengal gram

An area of about 235 ha (49 %) in the microwatershed has soils that are highly suitable (Class S1) for growing Bengal gram and are distributed in the northern, northeastern and eastern part of the microwatershed. An area of about 66 ha (14 %) is moderately suitable (Class S2) for growing bengalgram and are distributed in the southern part of the microwatershed. They have minor limitations of rooting depth, calcareousness and texture. Marginally suitable (class S3) lands cover an area of about 175 ha (36 %) and are distributed in the southern, western and central part of the microwatershed. They have moderate limitations of gravelliness, rooting depth and calcareousness.

7.6 Land Suitability for Groundnut (*Arachis hypogaea*)

Groundnut is one of the major oilseed crop grown in an area of 6.54 lakh ha in Karnataka in most of the districts either as rainfed or irrigated crop. The crop requirements for growing groundnut (Table 7.7) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing groundnut was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.6.

Table 7.7 Crop suitability criteria for Groundnut

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

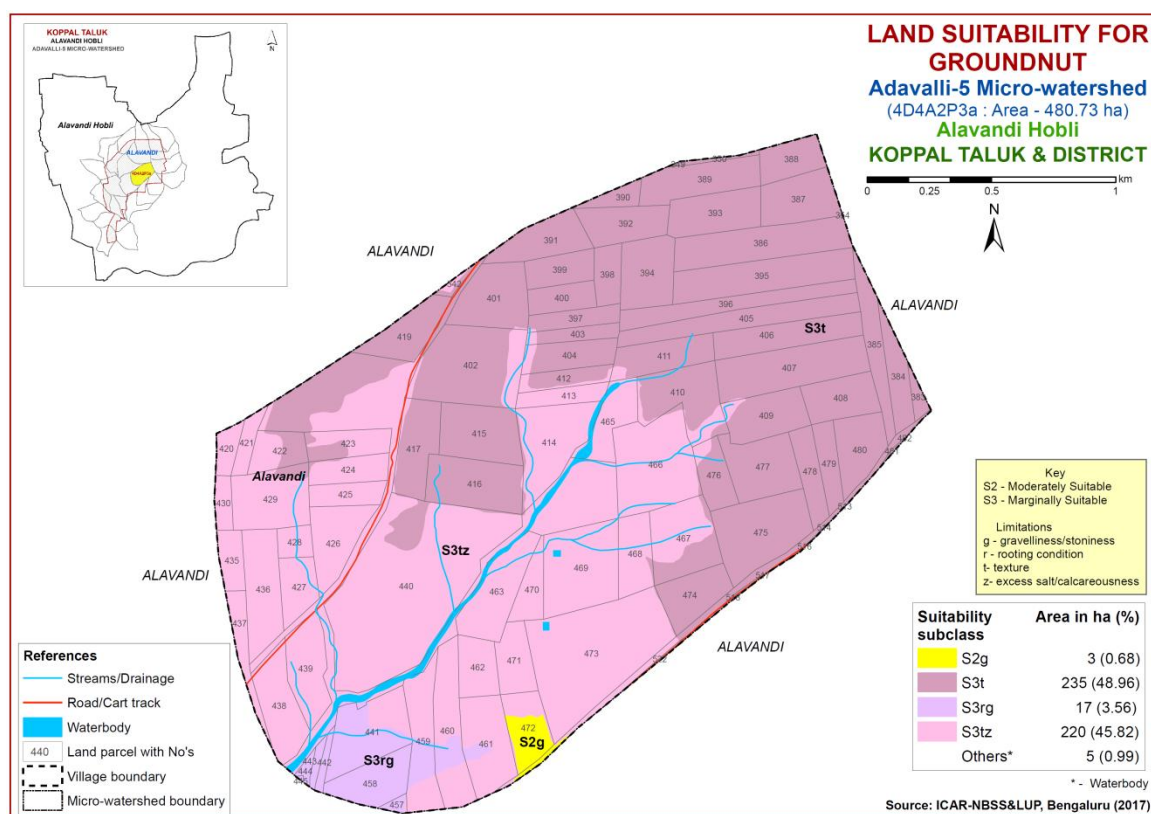


Fig. 7.6 Land Suitability map of Groundnut

A small area of about 3 ha (<1%) is moderately suitable (Class S2) for growing groundnut and distributed in the southern part of the microwatershed. They have minor limitation of gravelliness. Maximum area of about 472 ha (98%) is marginally suitable (Class S3) for growing groundnut and occupy the major part of the microwatershed with moderate limitations of gravelliness, texture, rooting depth and calcareousness.

7.7 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 7.8) 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 7.7.

Table 7.8 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	Sc1, 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	

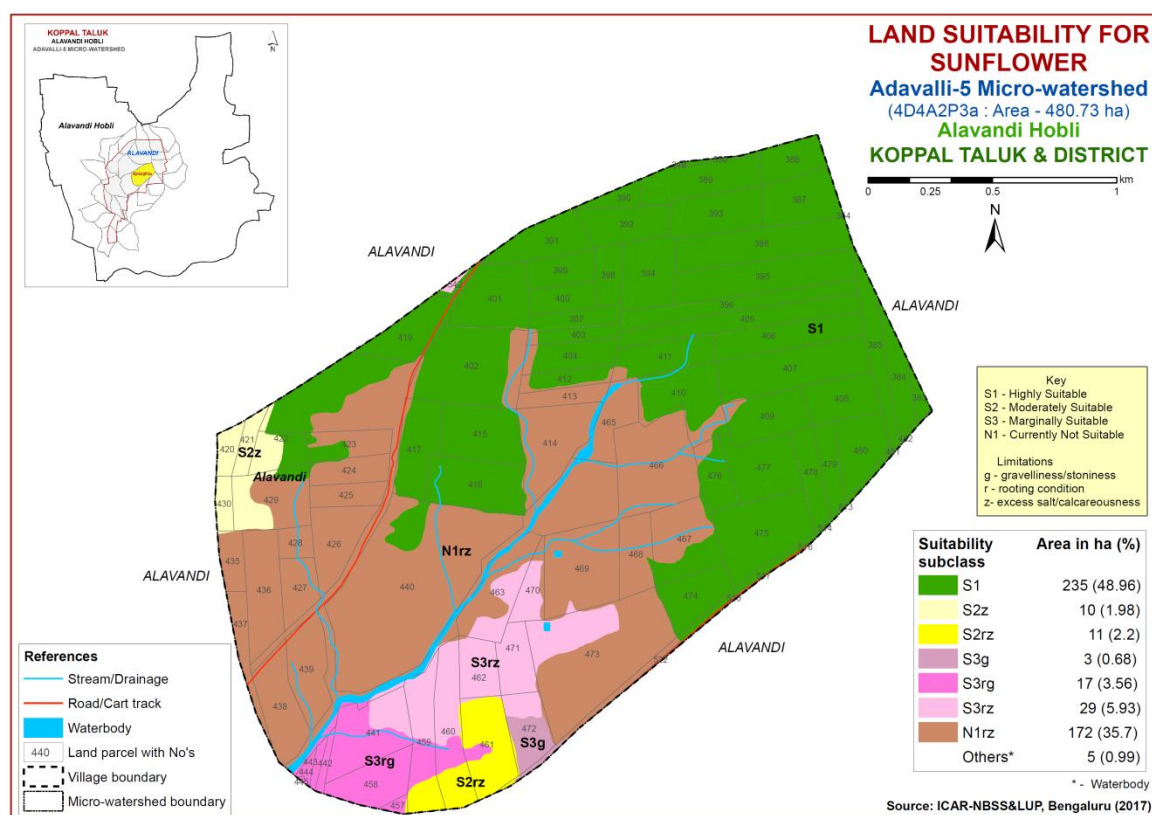


Fig. 7.7 Land Suitability map of Sunflower

Maximum area of about 235 ha (49%) is highly suitable (Class S1) for growing sunflower and are distributed in the northern, northeastern and eastern part of the microwatershed. An area of about 21 ha (4%) is moderately suitable (Class S2) and distributed in the southern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Marginally suitable (Class S3) lands occupy an area of about 49 ha (10%) and are distributed in the southern part of the microwatershed with moderate limitations of rooting depth, calcareousness and gravelliness. An area of about 172 ha (36 %) is not suitable (Class N1) and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

7.8 Land Suitability for Cotton (*Gossypium hirsutum*)

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

An area of about 235 ha (49 %) in the microwatershed has soils that are highly suitable (Class S1) for growing cotton and are distributed in the northern, northeastern and eastern part of the microwatershed. An area of about 49 ha (10 %) is moderately suitable (Class S2) for growing cotton and are distributed in the southern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Marginally suitable (class S3) lands cover an area of about 192 ha (40%) and are distributed in the southern, western and central part of the microwatershed. They have moderate limitations of gravelliness, rooting depth and calcareousness.

Table 7.9 Crop suitability criteria for Cotton

Crop requirement		Rating			
Soil-site characteristics	unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Slope	%	1-2	2-3	3-5	>5
LGP	Days	180-240	120-180	<120	
Soil drainage	class	Well to 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

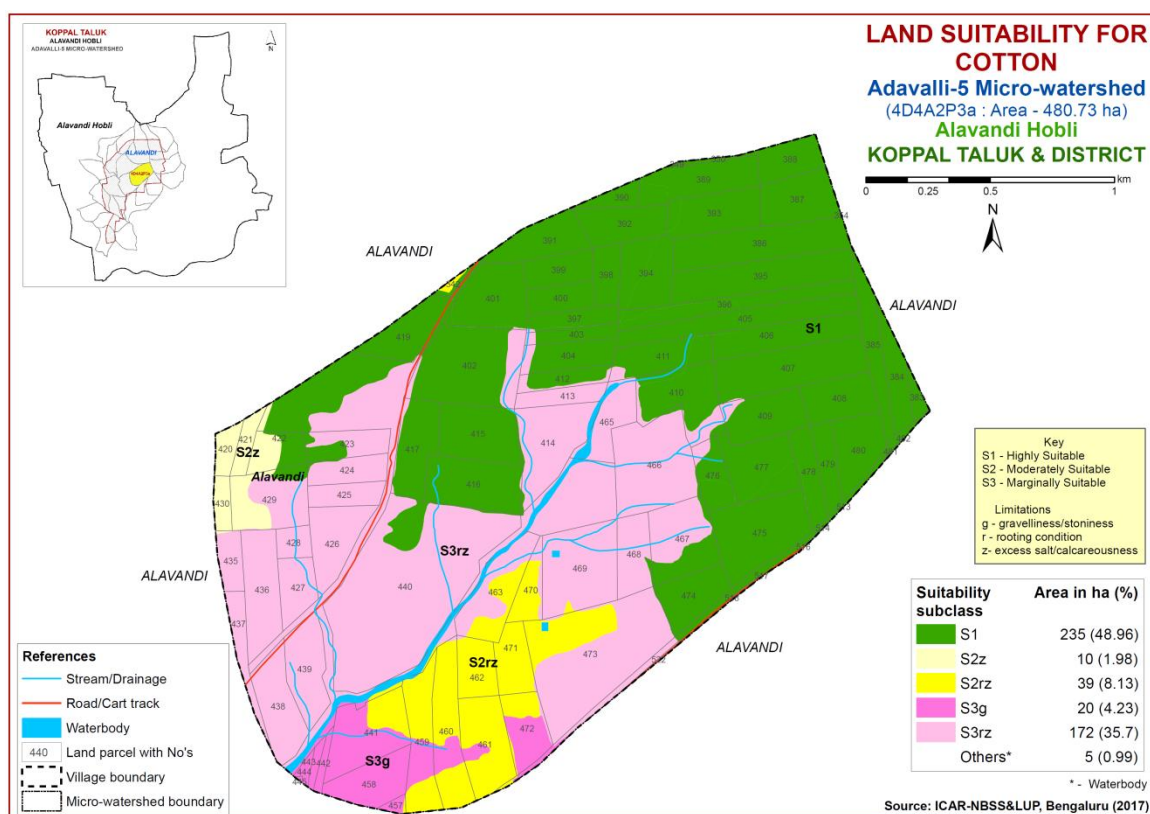


Fig. 7.8 Land Suitability map of Cotton

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

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

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	$^{\circ}\text{C}$	20-30	30-35 13-15	35-40 10-12	>40 <10
Slope	%	<3	3-5	5-10	>10
LGP	Days	>150	120-150	90-120	<90
Soil drainage	Class	Well drained	Moderately drained	Imp./poor drained/ excessively	V.poorly drained
Soil reaction	pH	6.5-7.8,6.0-7.0	7.8-8.4	8.4-9.0,5.0-5.9	>9.0
Surface soil texture	Class	scl, cl, sil	sl,sc,sic,c(m/k)	C(ss), ls, s	
Soil depth	cm	>75	50-75	25-50	<25
Gravel content	% vol.	<15	15-35	35-60	>60
Salinity (ECe)	dsm^{-1}	<1.0	1.0-2.0	2.0-4.0	<4
Sodicity (ESP)	%	<5	5-10	10-15	

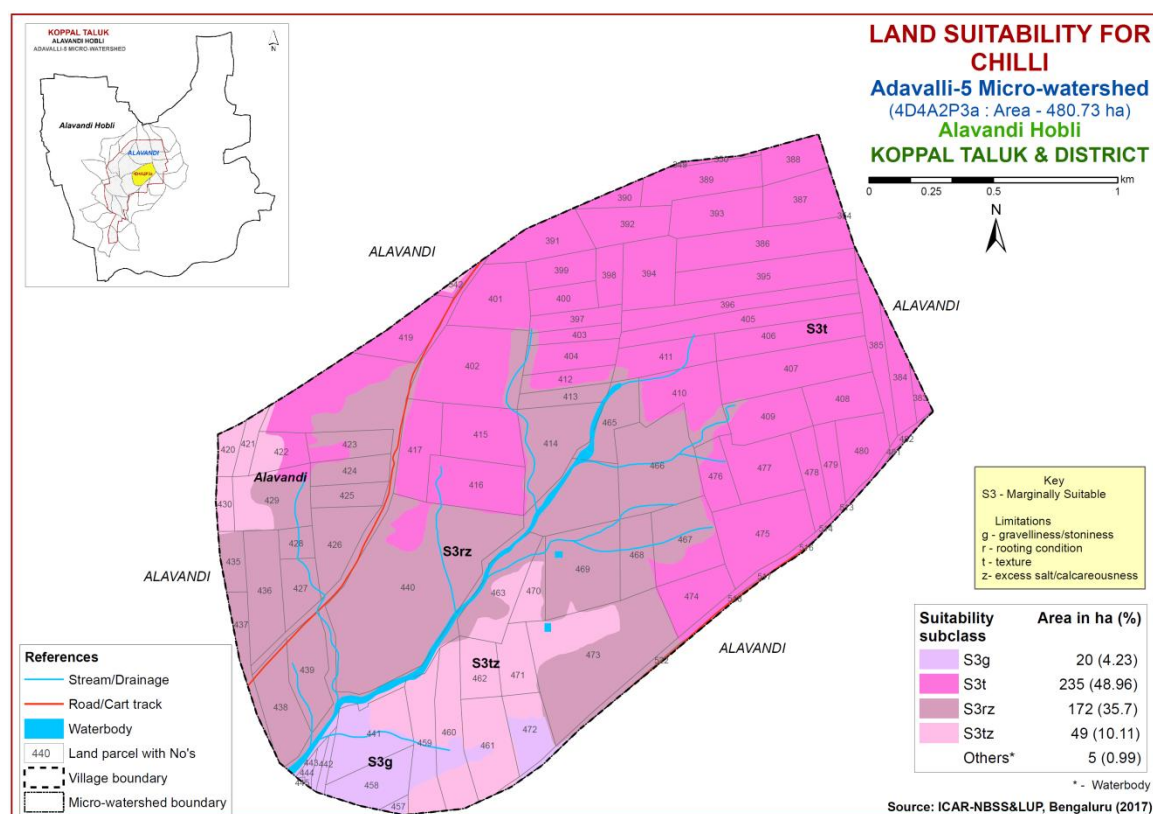


Fig. 7.9 Land Suitability map of Chilli

There are no highly (S1) and moderately suitable (S2) lands for growing Chilli. Marginally suitable (Class S3) lands cover an entire area of the microwatershed. They have moderate limitations of graveliness, texture, rooting depth and calcareousness.

7.10 Land Suitability for Tomato (*Solanum lycopersicum*)

Tomato is one of the most important vegetable and fruit crop grown in an area of 0.65 lakh ha in almost all the districts of the State. The crop requirements (Table 7.11) for growing tomato were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing tomato was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.10.

There are no highly (S1) and moderately suitable (S2) lands for growing tomato. Marginally suitable (Class S3) lands cover an entire area of the microwatershed. They have moderate limitations of graveliness, texture, rooting depth and calcareousness.

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	°c	25-28	29-32 20-24	15-19 33-36	<15 >36
Soil moisture	Growing period	Days	>150	120-150	90-120	
Soil aeration	Soil drainage	Class	Well drained	Mod. well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	1, sl, cl, scl	Sic,sicl,sc,c(m/k)	C (ss)	ls, s
	pH	1:2.5	6.0-7.0	5.0-5.9:7.1-8.5	<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	slight	strongly	
	Sodicity (ESP)	%	<10	10-15	>15	-
Erosion	Slope	%	1-3	3-5	5-10	>10

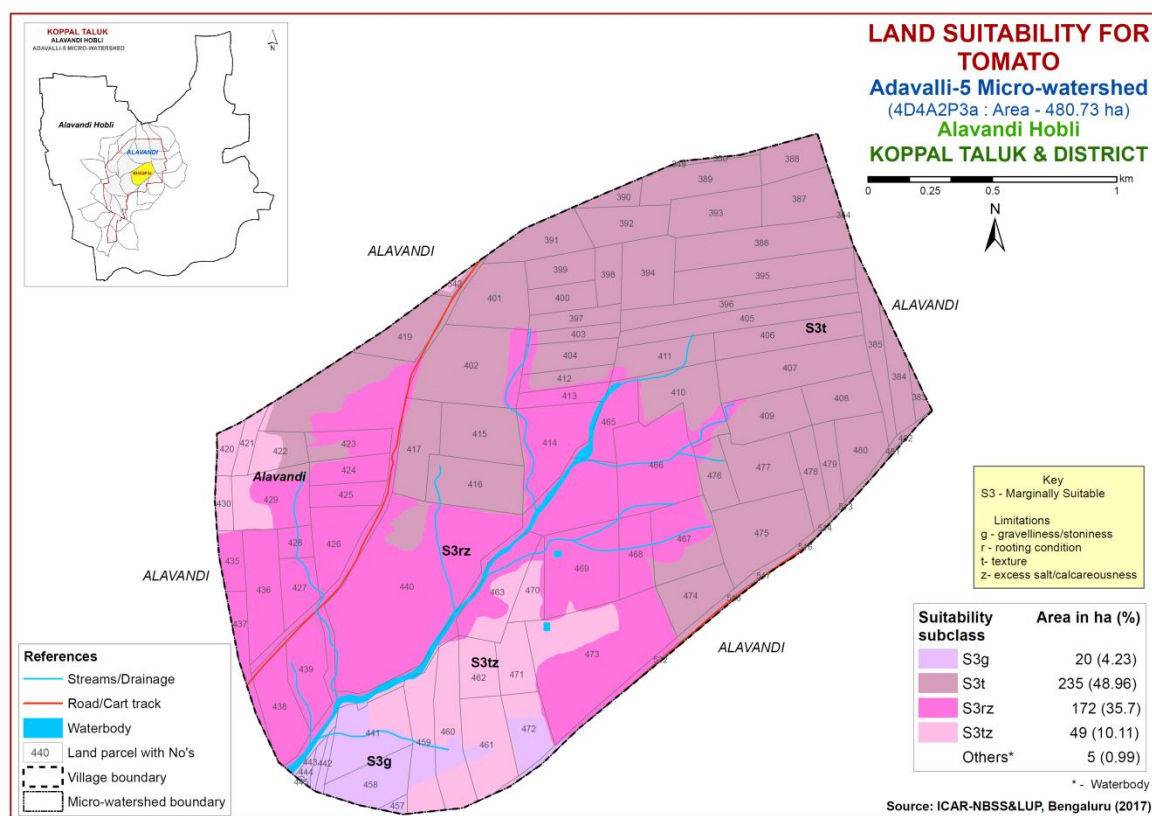


Fig. 7.10 Land Suitability map of Tomato

7.11 Land Suitability for Drumstick (*Moringa oleifera*)

Drumstick is one of the most important vegetable crop grown in 2403 ha area 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 are given in Figure 7.11.

Table 7.12 Land 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

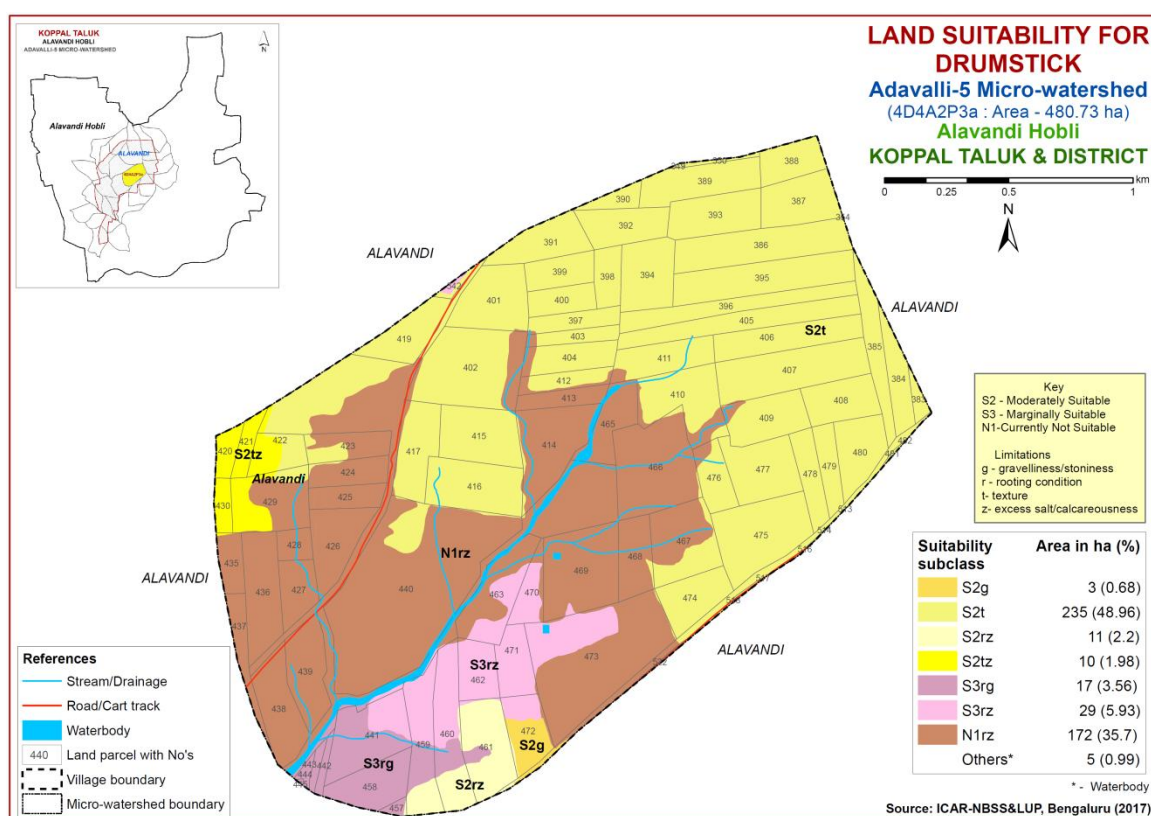


Fig. 7.11 Land Suitability map of Drumstick

Maximum area of about 259 ha (54%) in the microwatershed has soils that are moderately suitable (Class S2) for growing drumstick and are distributed in the major part. They have minor limitations of graveliness, rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 46 ha (9 %) and occur in the southern part of the microwatershed. They have moderate limitations of rooting depth, calcareousness and graveliness. An area of about 172 ha (36 %) is not suitable (Class N1) and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

7.12 Land Suitability for Mulberry (*Morus nigra*)

Mulberry is the most important leaf crop grown for rearing silkworms in about 1.66 lakh ha in all the districts of the state. The crop requirements for growing mulberry (Table 7.13) 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.

Table 7.13 Land 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

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

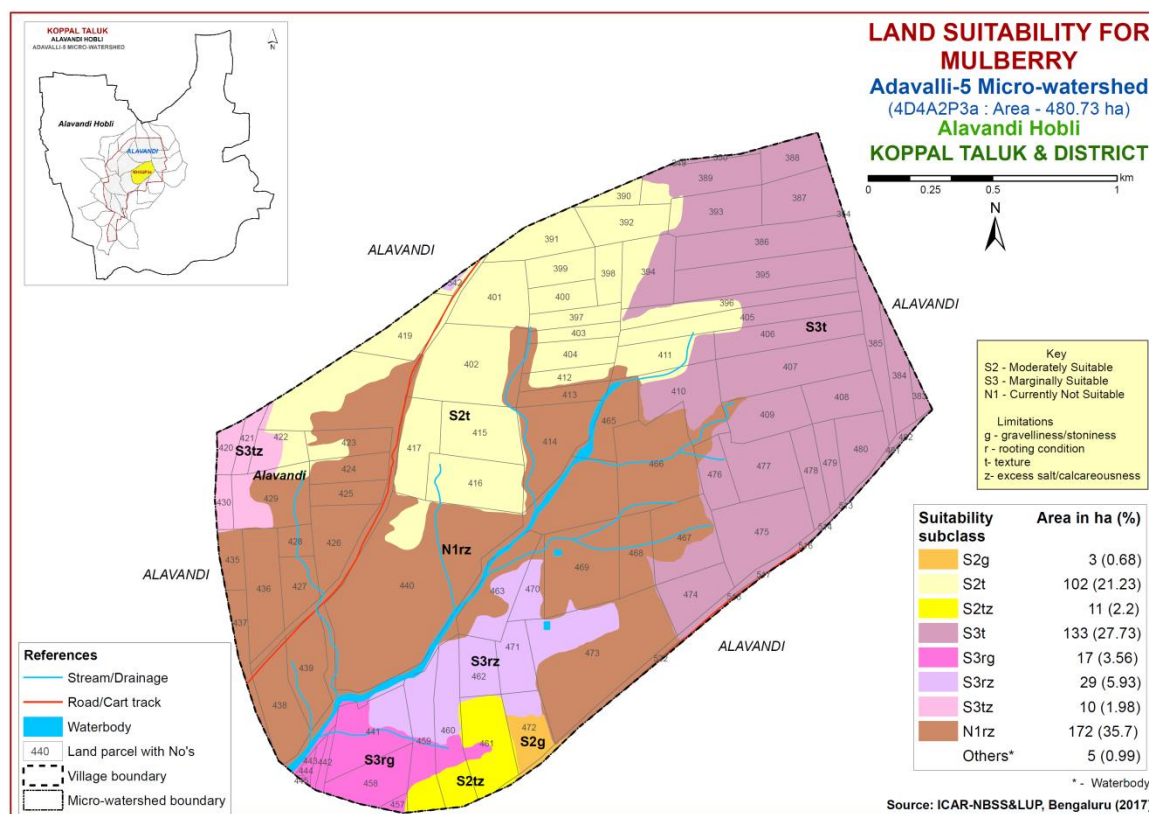


Fig. 7.12 Land Suitability map of Mulberry

An area of about 116 ha (24 %) in the microwatershed has soils that are moderately suitable (Class S2) and distributed in the northern and northwestern part of the microwatershed. They have minor limitations of texture, gravelliness and

calcareousness. Marginally suitable lands cover an area of about 189 ha (39 %) and occur in the northeastern, eastern and southern part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 172 ha (36 %) is not suitable (Class N1) for growing mulberry and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

7.13 Land suitability for Mango (*Mangifera indica*)

Mango is one of the most important fruit crop grown in about 1.73 lakh ha in almost all the districts of the State. The crop requirements (Table 7.14) for growing mango were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing mango was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.13.

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 imp.drained	Poor drained	V.poorly drained
	Water table	M	>3	2.50-3.0	2.5-1.5	<1.5
Nutrient availability	Texture	Class	Sc,l, sil, cl	Sl, sc, sic,l,c	C (<60%)	C(>60%),
	pH	1:2.5	5.5-7.5	7.6-8.5:5.0-5.4	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	Nonsaline	<2.0	2.0-3.0	>3.0
	Sodicity	%	Non sodic	<10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

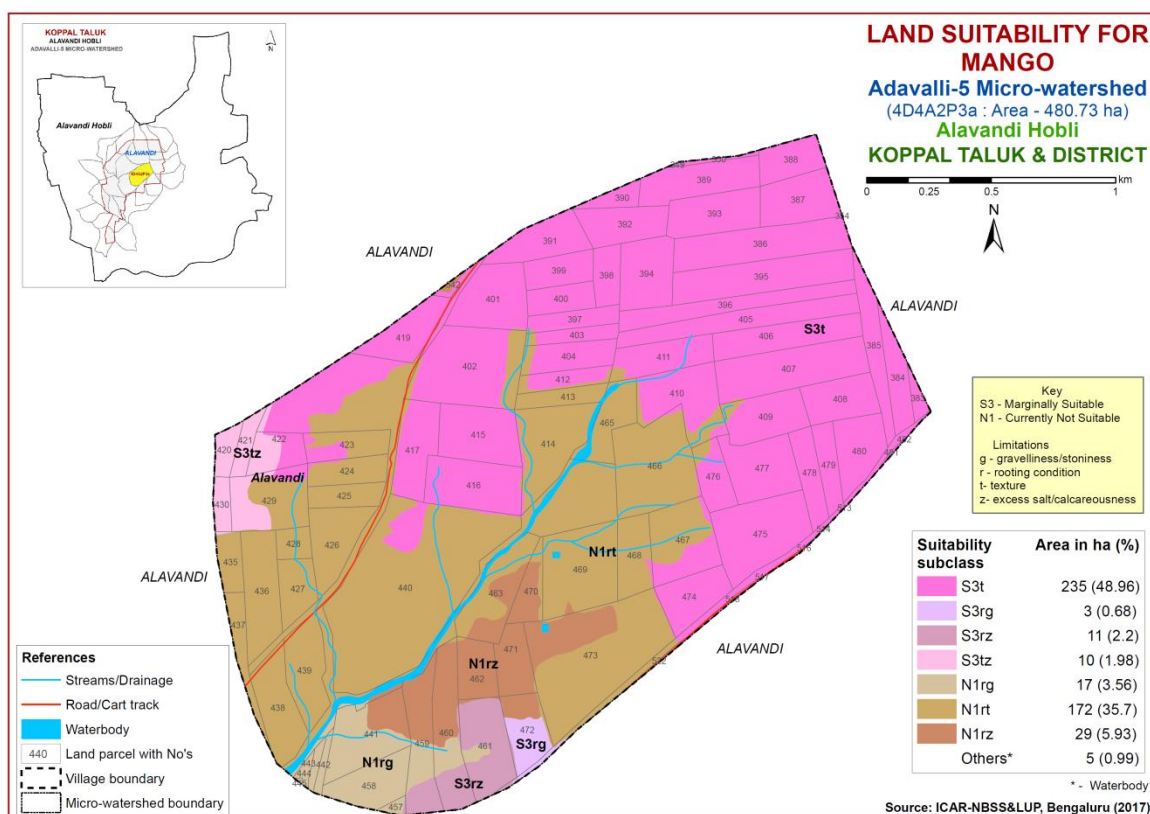


Fig. 7.13 Land Suitability map of Mango

There are no highly (S1) and moderately suitable (S2) lands for growing mango. Marginally suitable (Class S3) lands cover a maximum area of about 259 ha (54%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 218 ha (45 %) is not suitable (Class N1) for growing mango and occur in the southern, central and western part of the microwatershed with severe limitations of rooting depth, gravelliness, texture and calcareousness.

7.14 Land suitability for Sapota (*Manilkara zapota*)

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

Marginally suitable (Class S3) lands cover a maximum area of about 304 ha (63%) and occur in the major part of the microwatershed. They have moderate limitations of rooting depth, texture, gravelliness and calcareousness. An area of about 172 ha (36 %) is not suitable (Class N1) for growing sapota and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

Table 7.15 Crop suitability criteria for Sapota

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

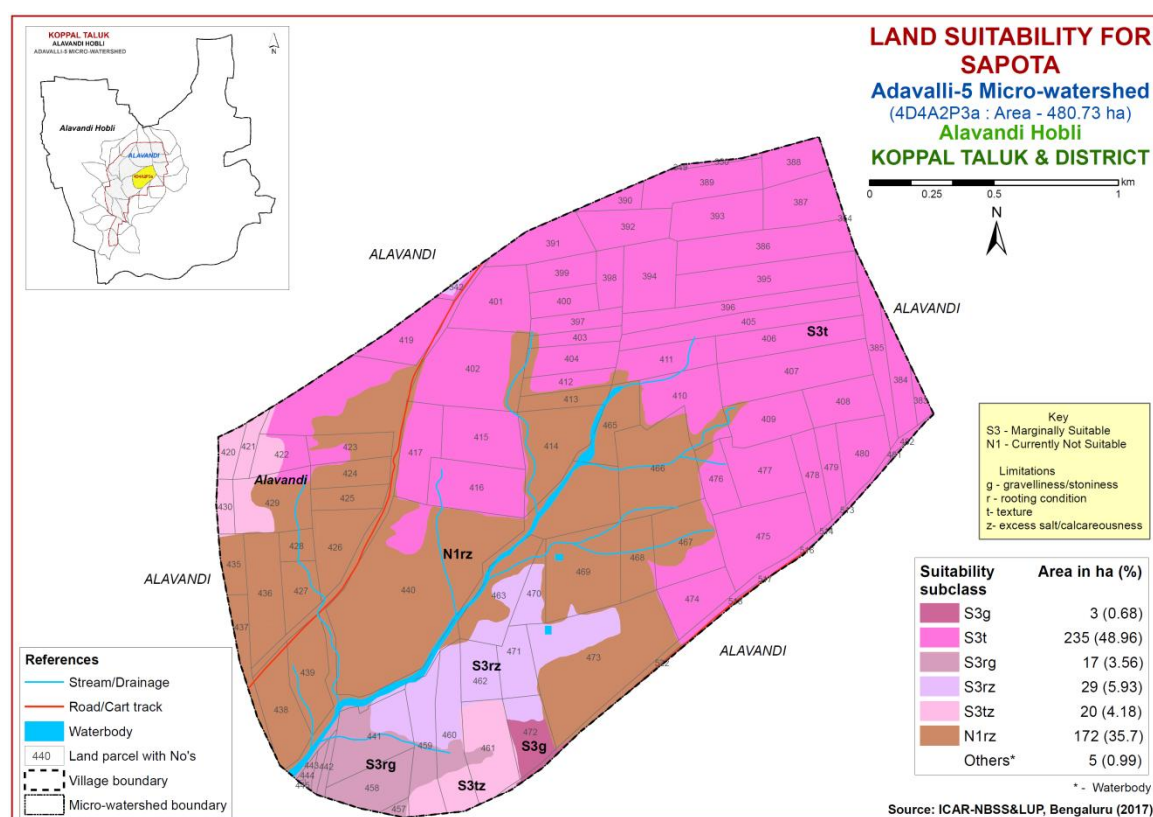


Fig. 7.14 Land Suitability map of Sapota

7.15 Land Suitability for Pomegranate (*Punica granatum*)

Pomegranate is one of the commercially grown fruit crop in about 18488 ha in Karnataka mainly in Bijapur, Bagalkot, Koppal, Gadag and Chitradurga districts. The

crop requirements for growing pomegranate (Table 7.16) were matched with the soil-site characteristics (Table 7.1) of the soils of the microwatershed and a land suitability map for growing pomegranate was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.15.

Table 7.16 Crop suitability criteria for Pomegranate

Crop requirement			Rating			
Soil –site characteristics		Unit	Highly suitable(S1)	Moderately suitable(S2)	Marginally suitable(S3)	Not suitable(N)
Climate	Temperature in growing season	$^{\circ}\text{C}$	30-34	35-38 25-29	39-40 15-24	
Soil moisture	Growing period	Days	>150	120-150	90-120	<90
Soil aeration	Soil drainage	Class	Well drained	imperfectly drained		
Nutrient availability	Texture	Class	Sl, scl, l, cl	C, sic, siel	Cl, s, ls	S, fragmental
Rooting conditions	pH	1:2.5	5.5-7.5	7.6-8.5	8.6-9.0	
	Soil depth	cm	>100	75-100	50-75	<50
	Gravel content	% vol.	nil	15-35	35-60	>60
Soil toxicity	Salinity	dS/m	Nil	<9	>9	<50
	Sodicity	%	nil			
Erosion	Slope	%	<3	3-5	5-10	

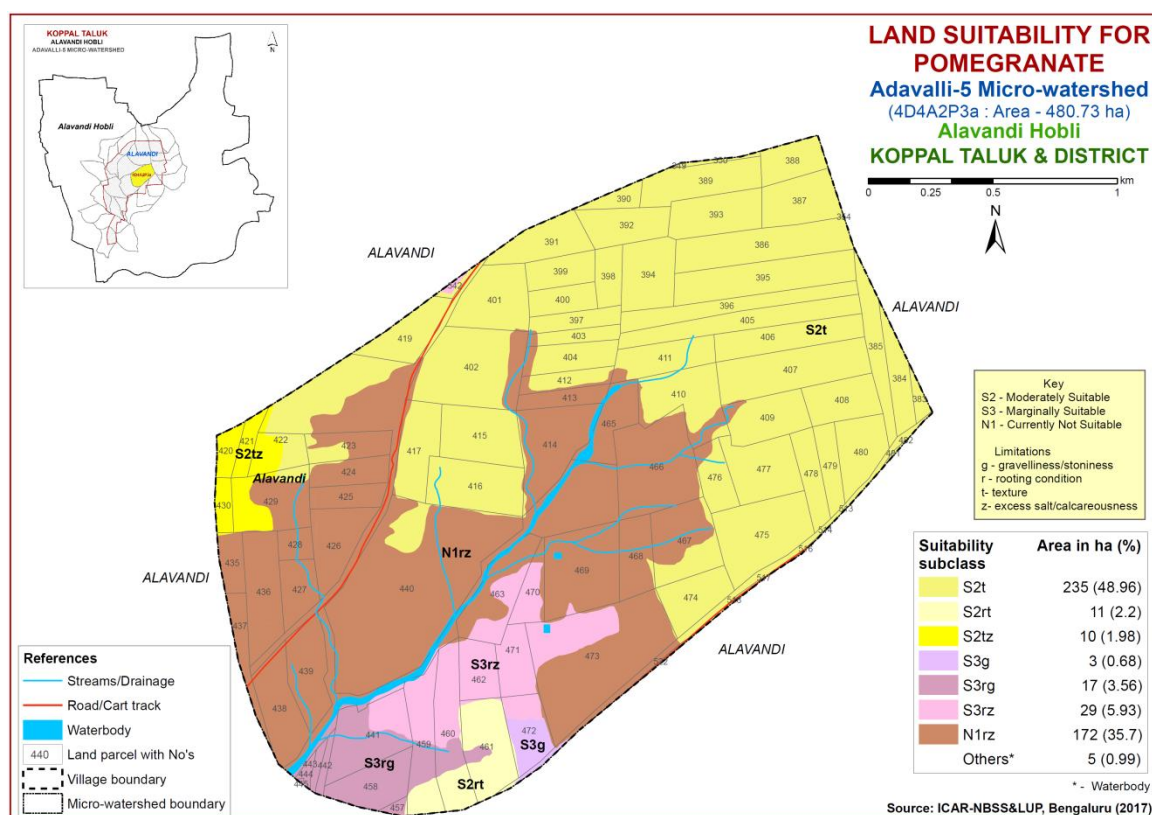


Fig. 7.15 Land Suitability map of Pomegranate

Moderately suitable (Class S2) lands occupy maximum area of about 256 ha (53 %) and are distributed in the major part of the microwatershed. They have minor limitations of rooting depth, calcareousness and texture. Marginally suitable (Class S3) lands for growing pomegranate occupy an area of about 49 ha (10%) and are distributed in the southern part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 172 ha (36 %) is not suitable (Class N1) and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

7.16 Land suitability for Guava (*Psidium guajava*)

Guava is one of the most important fruit crop grown in an area of about 6558 ha in almost all the districts of the state. The crop requirements (Table 7.17) for growing guava were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing guava was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.16.

Marginally suitable (Class S3) lands cover a maximum area of about 304 ha (63%) and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness. An area of about 172 ha (36 %) is not suitable (Class N1) for growing guava and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.17 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

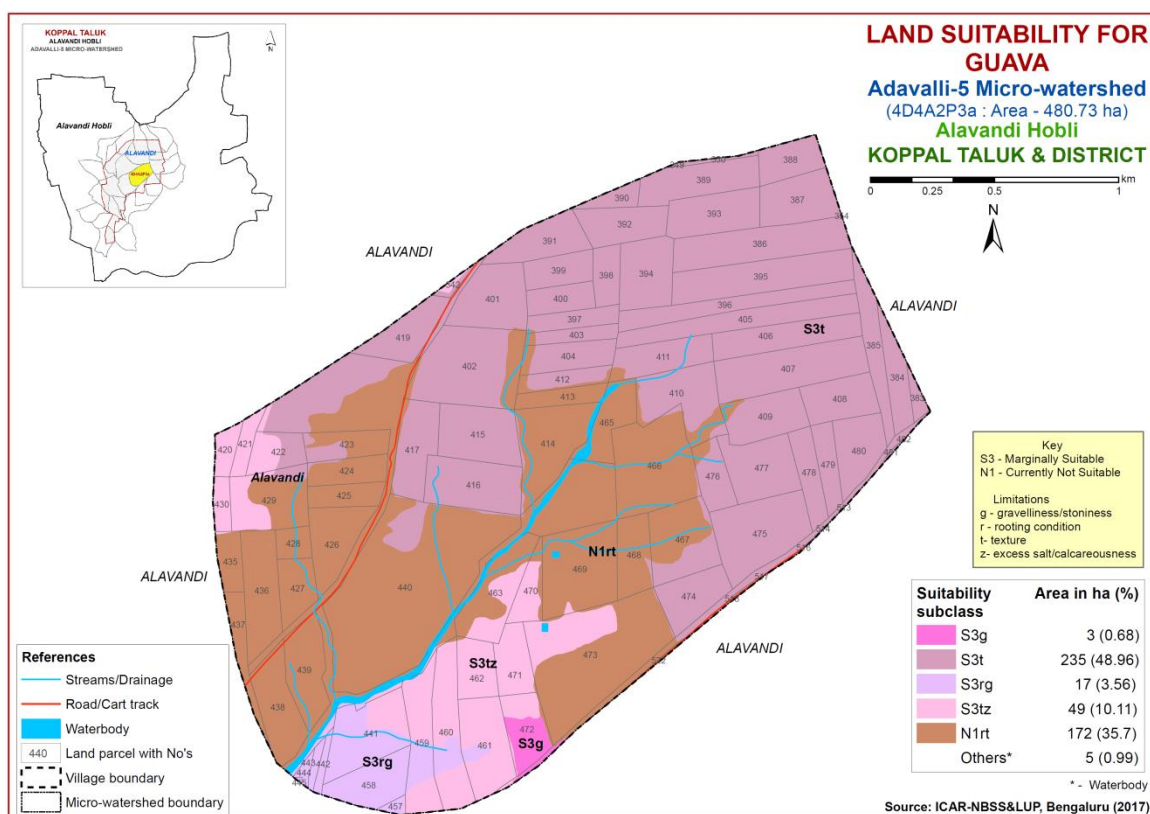


Fig. 7.16 Land Suitability map of Guava

7.17 Land Suitability for Jackfruit (*Artocarpus heterophyllus*)

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

Table 7.18 Land suitability criteria for Jackfruit

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

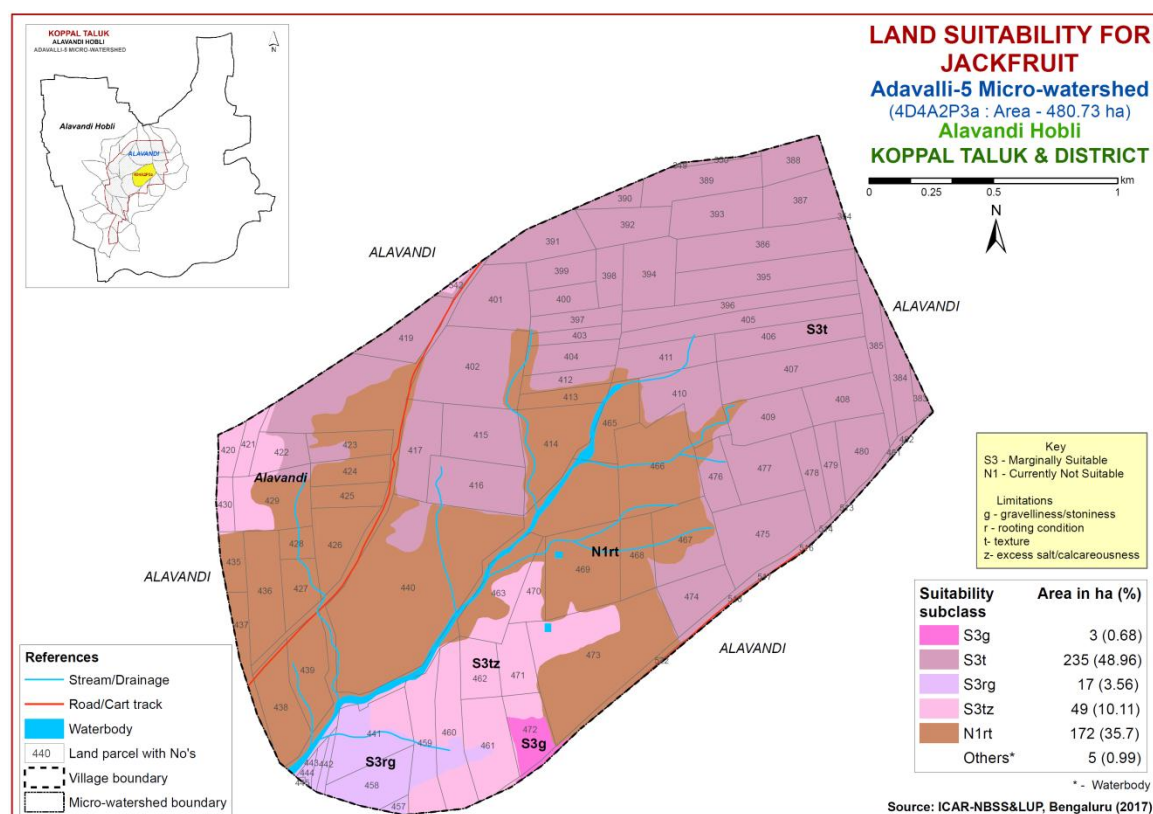


Fig. 7.17 Land Suitability map of Jackfruit

Marginally suitable (Class S3) lands cover a maximum area of about 304 ha (63%) and occur in the major part of the microwatershed. They have moderate limitations of graveliness, texture, rooting depth and calcareousness. An area of about 172 ha (36 %) is not suitable (Class N1) for growing jackfruit and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and texture.

7.18 Land Suitability for Jamun (*Syzygium cumini*)

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

There are no highly suitable (Class S1) lands for growing jamun. An area of about 245 ha (51%) is moderately suitable (Class S2) and occur in the major part of the microwatershed. They have minor limitations of rooting depth, texture and calcareousness. Marginally suitable (Class S3) lands cover an area of about 60 ha (12%) and are distributed in the southern part of the microwatershed with moderate limitations of rooting depth, calcareousness, graveliness and texture. An area of about 172 ha (36 %) is not suitable (Class N1) for growing jamun and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and texture.

Table 7.19 Land suitability criteria for Jamun

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

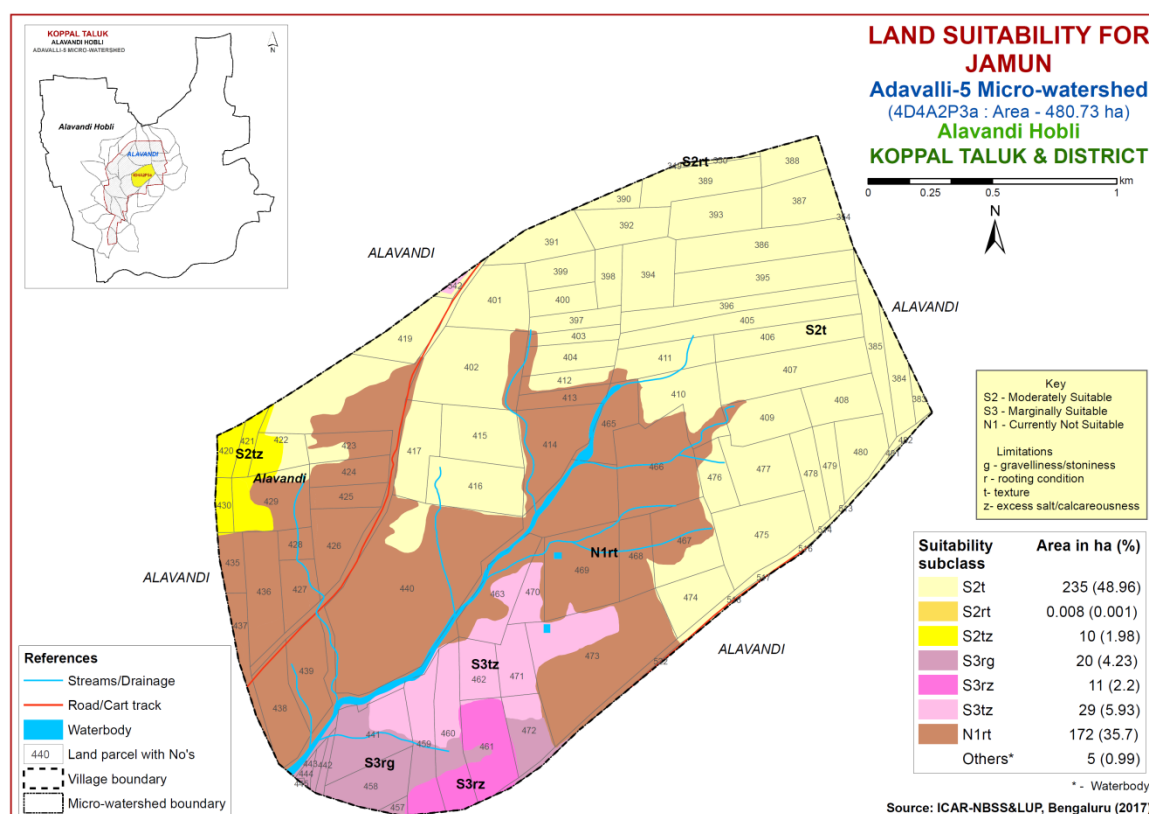


Fig. 7.18 Land Suitability map of Jamun

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 (Table 7.20) for growing musambi were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing musambi was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.19.

Maximum area of about 235 ha (49 %) is highly suitable (Class S1) for growing musambi and are distributed in the major part of the microwatershed. An area of about 21 ha (4%) is moderately suitable (Class S2) and occur in the southern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. An

area of about 49 ha (10 %) is marginally suitable (Class S3) for growing musambi and are distributed in the southern part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 172 ha (36 %) is not suitable (Class N1) for growing musambi and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness

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	Temperature 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 imp.drained	Poorly	Very poorly
Nutrient availability	Texture	Class	Sc1,l,slcl,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 conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

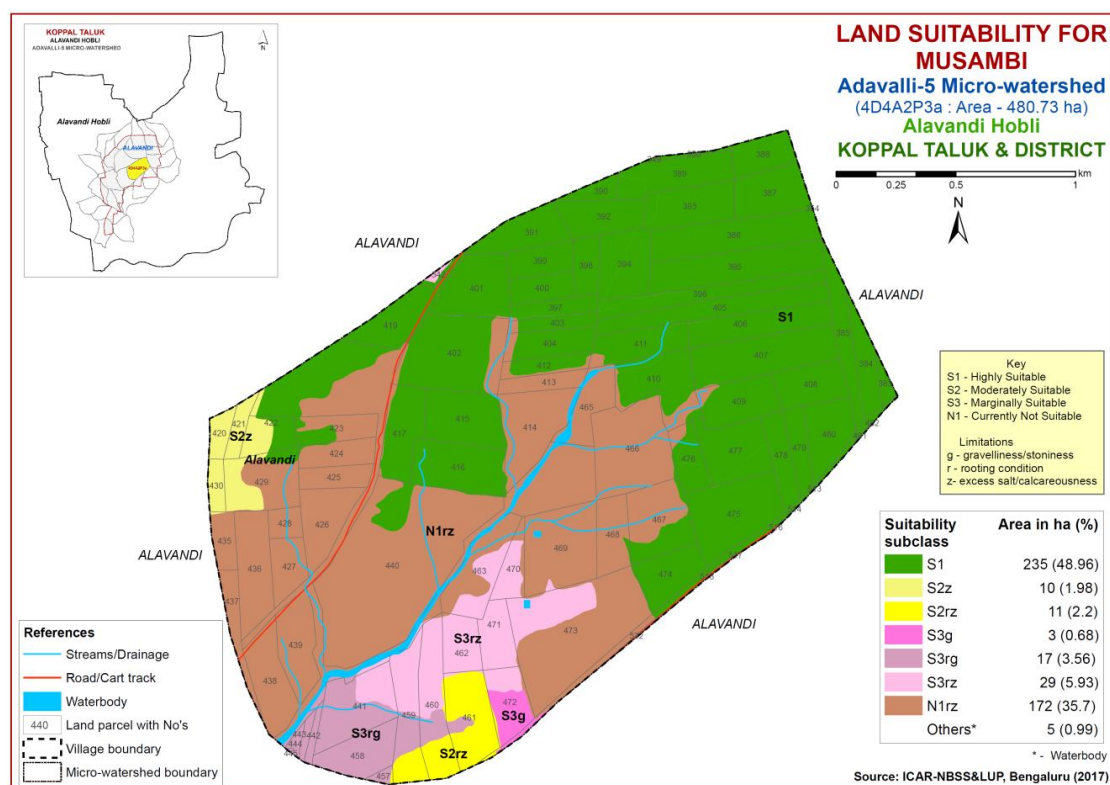


Fig. 7.19 Land Suitability map of Musambi

7.20 Land Suitability for Lime (*Citrus sp*)

Lime is one of the most important fruit crop grown in an area of 11752 ha in almost all the districts of the State. The crop requirements for growing lime (Table 7.21) were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing lime was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.20.

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	Temperature 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 imp. 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 conditions	Soil depth	cm	>150	100-150	50-100	<50
	Gravel content	% vol.	Non gravelly	15-35	35-55	>55
Soil toxicity	Salinity	dS/m	Non saline	Upto 1.0	1.0-2.5	>2.5
	Sodicity	%	Non sodic	5-10	10-15	>15
Erosion	Slope	%	<3	3-5	5-10	

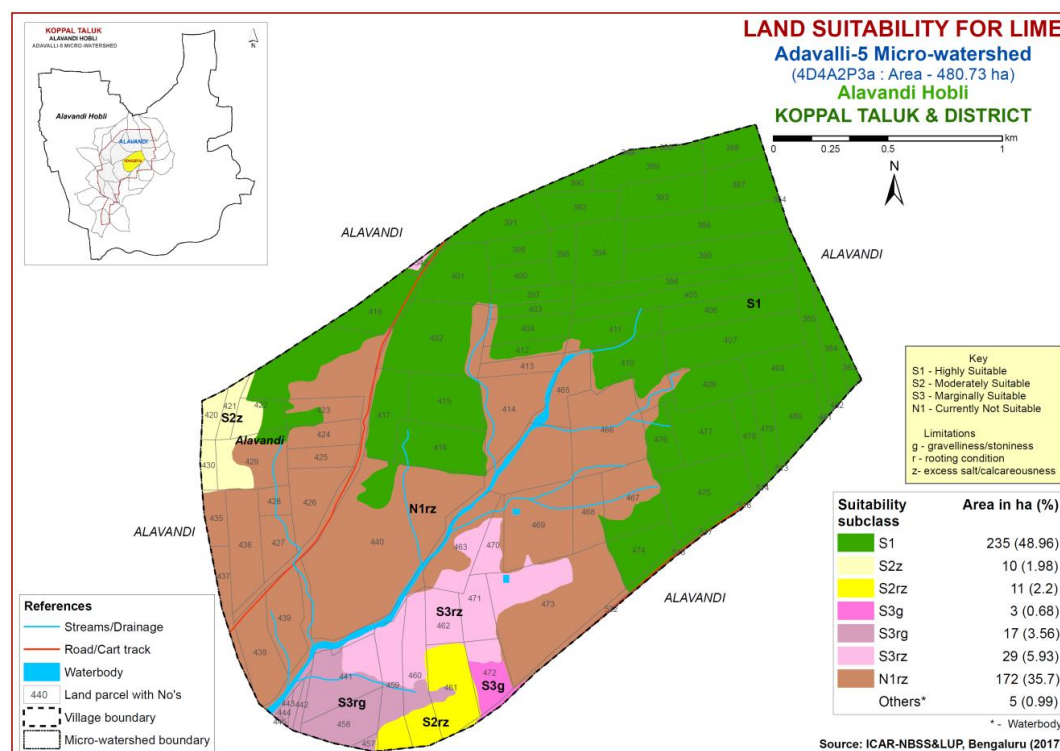


Fig. 7.20 Land Suitability map of Lime

Maximum area of about 235 ha (49 %) is highly suitable (Class S1) for growing lime and are distributed in the major part of the microwatershed. An area of about 21 ha (4%) is moderately suitable (Class S2) and occur in the southern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. An area of about 49 ha (10 %) is marginally suitable (Class S3) for growing lime and are distributed in the southern part of the microwatershed with moderate limitations of gravelliness, calcareousness and rooting depth. An area of about 172 ha (36 %) is not suitable (Class N1) for growing lime and distributed in the western, central and southern part of the microwatershed with severe limitations of rooting depth and calcareousness.

7.21 Land Suitability for Cashew (*Anacardium occidentale*)

Cashew is one of the most important nut crop grown in an area of 7052 ha in almost all the districts of the State. The crop requirements for growing cashew (Table 7.22) 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 are given in Figure 7.21.

An area of about 20 ha (4%) is marginally suitable (Class S3) for growing cashew and distributed in the southern part of the microwatershed with moderate limitations of rooting depth and gravelliness. Maximum area of about 456 ha (95 %) is not suitable (Class N1) for growing cashew and distributed in the major part of the microwatershed with severe limitations of texture, rooting depth and calcareousness.

Table 7.22 Land suitability criteria for Cashew

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

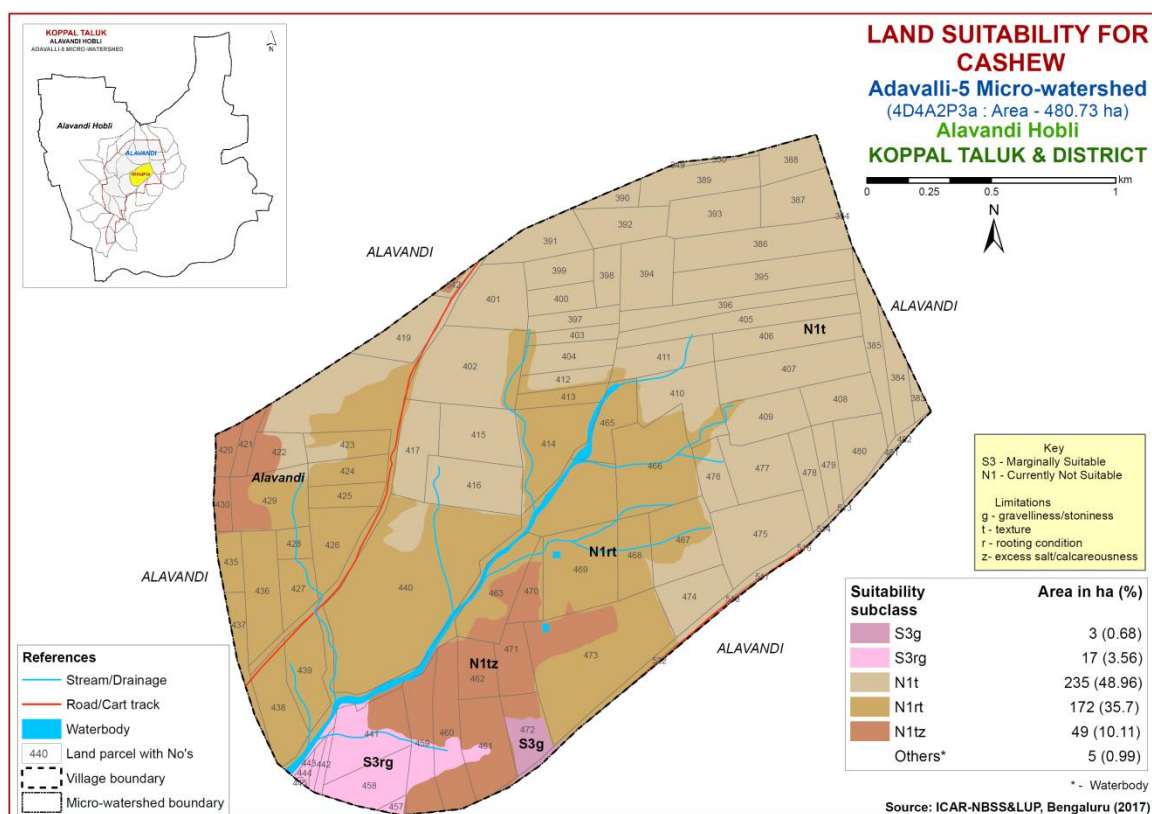


Fig. 7.21 Land Suitability map of Cashew

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

Custard apple is one of the most important fruit crop grown in 1426 ha in almost all the districts of the State. The crop requirements (Table 7.23) for growing custard apple were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing custard apple was generated. The area extent and their geographic distribution of different suitability subclasses in the microwatershed are given in Figure 7.22.

Table 7.23 Land suitability criteria for Custard apple

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

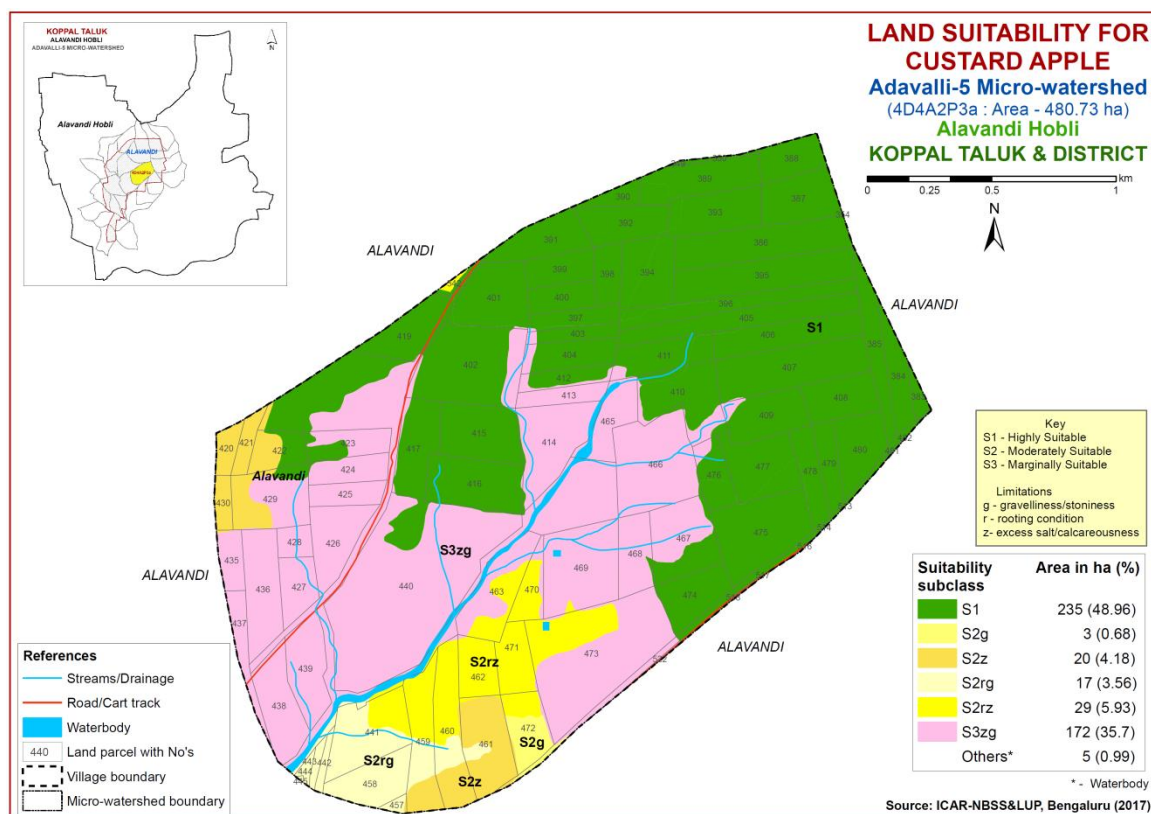


Fig. 7.22 Land Suitability map of Custard Apple

An area of about 235 ha (49%) is highly suitable (Class S1) for growing custard apple and are distributed in the eastern, northern and northeastern part of the microwatershed. Moderately suitable (Class S2) lands cover an area of about 69 ha (14%) and occur in the southern part of the microwatershed. They have minor limitations of rooting depth, gravelliness and calcareousness. An area of about 172 ha (36 %) is marginally suitable (Class S3) for growing custard apple and distributed in the western, central and southern part of the microwatershed with moderate limitations of gravelliness and calcareousness.

7.23 Land Suitability for Amla (*Phyllanthus emblica*)

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

Moderately suitable lands (Class S2) for growing amla occupy a maximum area of about 304 ha (63%) and distributed in the major part of the microwatershed. They have minor limitations of rooting depth, gravelliness, texture and calcareousness. Marginally suitable lands cover an area of about 172 ha (36 %) and distributed in the western, central

and southern part of the microwatershed. They have moderate limitations of texture and calcareousness.

Table 7.24 Land suitability criteria for Amla

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

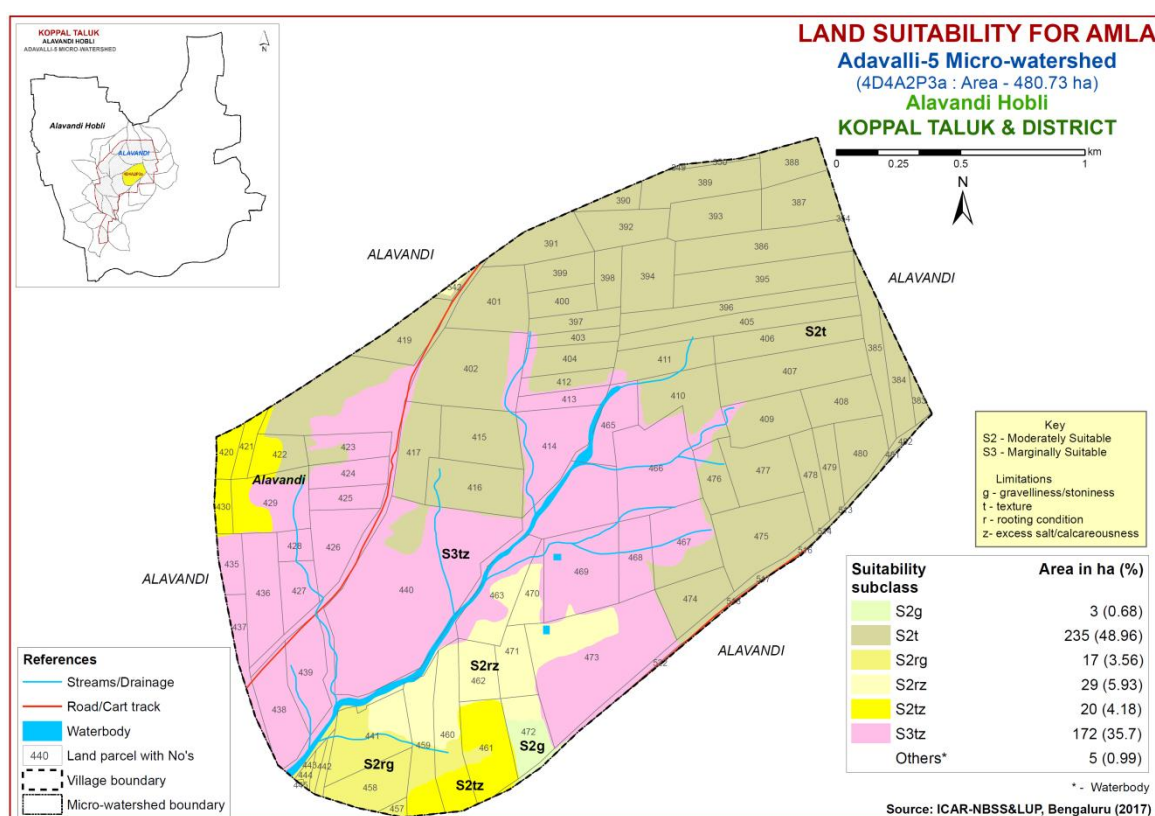


Fig. 7.23 Land Suitability map of Amla

7.24 Land Suitability for Tamarind (*Tamarindus indica*)

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

There are no highly suitable lands (Class S1) for growing tamarind. An area of about 245 ha (51 %) is moderately suitable (Class S2) and occur in the northern, eastern and northeastern part of the microwatershed. They have minor limitations of texture, calcareousness and rooting depth. An area of about 14 ha (3 %) is marginally suitable (Class S3) and occur in the southern part of the microwatershed. They have moderate limitations of rooting depth, gravelliness and calcareousness. An area of about 217 ha (45 %) is not suitable (Class N1) for growing tamarind and are distributed in the western, central and southern part of the microwatershed. They have severe limitations of rooting depth, calcareousness and gravelliness.

Table 7.25 Land suitability criteria for Tamarind

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

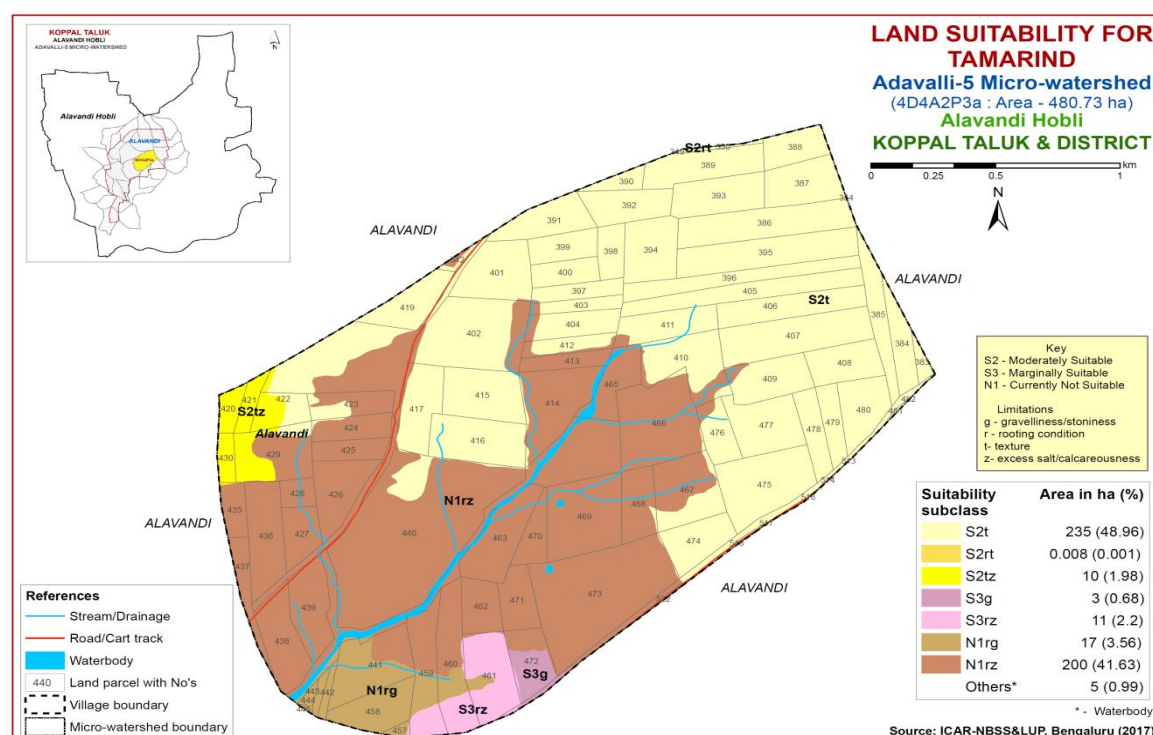


Fig. 7.21 Land Suitability map of Tamarind

7.25 Land Suitability for Marigold (*Tagetes erecta*)

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

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	-

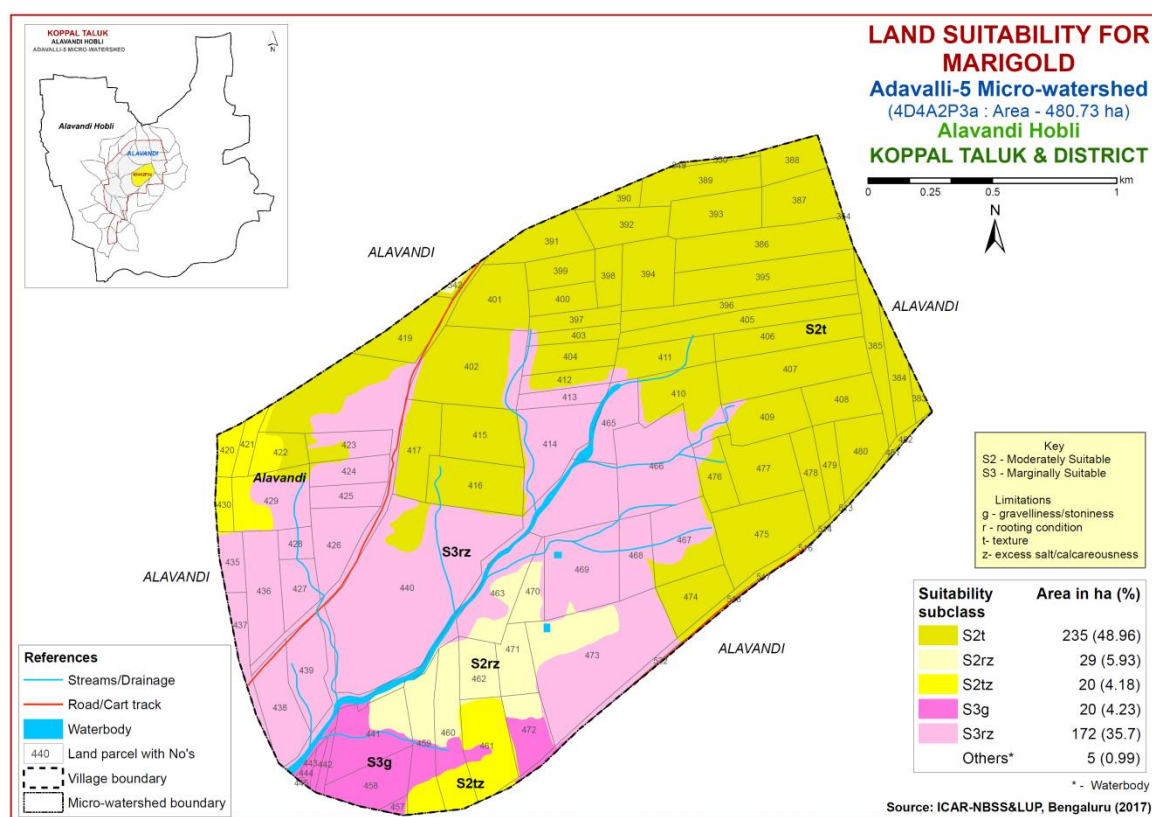


Fig. 7.25 Land Suitability map of Marigold

7.26 Land Suitability for Chrysanthemum (*Chrysanthemum indicum*)

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

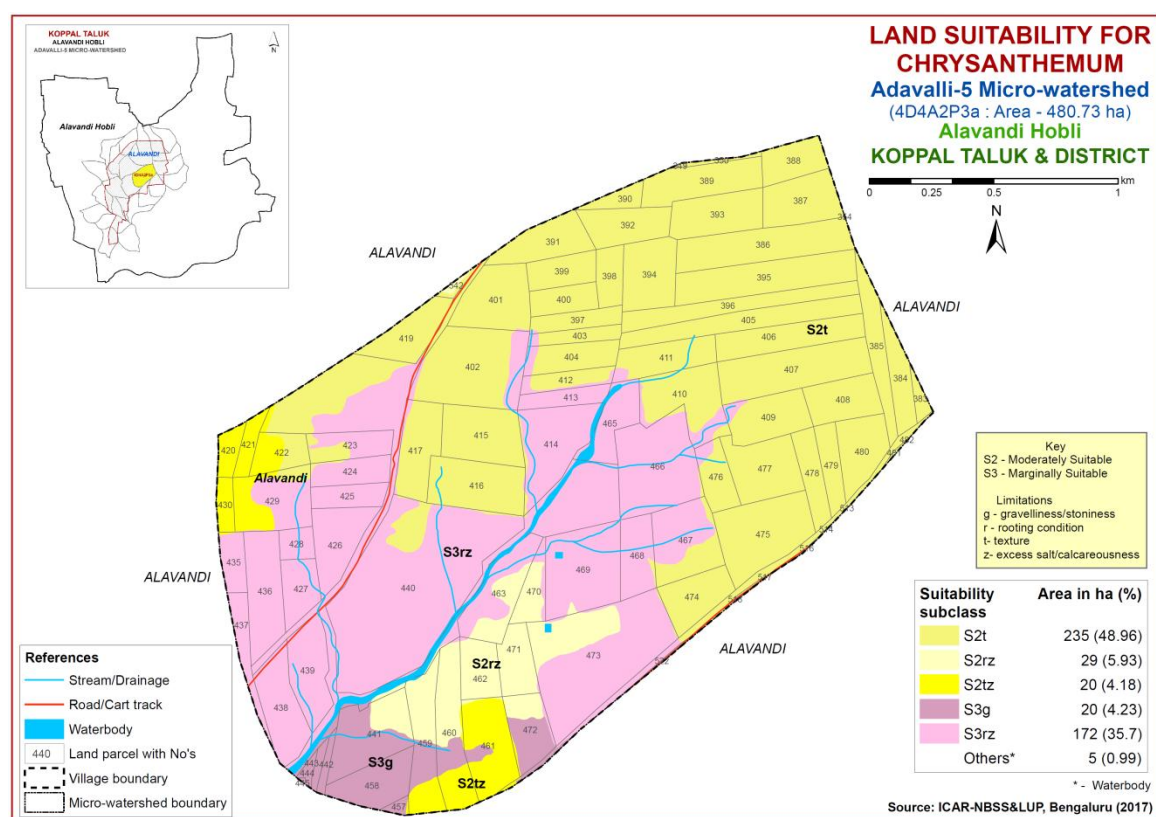


Fig. 7.26 Land Suitability map of Chrysanthemum

Maximum area of about 284 ha (59 %) is moderately suitable (Class S2) for growing chrysanthemum and occur in the major part of the microwatershed. They have

minor limitations of rooting depth, calcareousness and texture. An area of about 192 ha (40 %) is marginally suitable (Class S3) and distributed in the western, southern and central part of the microwatershed with moderate limitations of gravelliness, rooting depth and calcareousness.

7. 27 Land Suitability for Jasmine (*Jasminum sp.*)

Jasmine is one of the most important flower crop grown in an area of 803 ha in almost all the districts of the State. The crop requirements (Table 7.28) for growing jasmine were matched with the soil-site characteristics (Table 7.1) and a land suitability map for growing jasmine was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.27.

Moderately suitable (Class S2) lands for growing jasmine cover an area of about 29 ha (6%) and occur in the southern part of the microwatershed. They have minor limitations of rooting depth and calcareousness. Maximum area of about 447 ha (93 %) is marginally suitable (Class S3) for growing jasmine and occur in the major part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

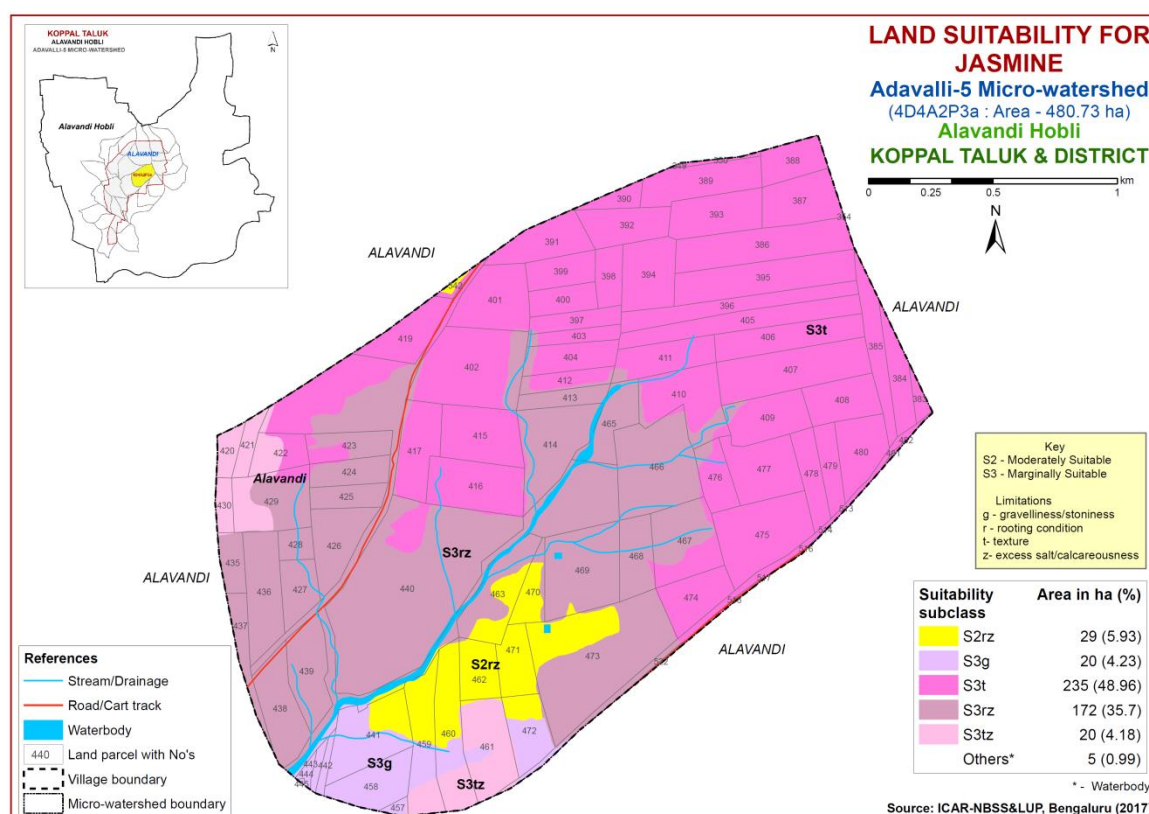


Fig. 7.27 Land Suitability map of Jasmine

Table 7.28 Land suitability criteria for jasmine (irrigated)

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	
Soil aeration	Soil drainage	Class	Well drained	Moderately drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	Scl,l,scl,cl,sil	sicl,sc,sic,c (m/k)	C(ss),	ls, s
	pH	1:2.5	6.0-7.5	5.5-5.9:7.6-8.5	<5: >8.5	
	CaCO ₃ in root zone	%	Non calcareous	Slightly calcareous	Strong calcareous	
Rooting conditions	Soil depth	Cm	>75	50-75	25-50	<25
	Gravel content	% vol.	<15	15-35	>35	
Soil toxicity	Salinity	ds/m	Non saline	Slight	Strongly	
	Sodicity	%	Non sodic	Slight	Strongly	
Erosion	Slope	%	1-3	3-5	5-10	

7. 28 Land Suitability for Crossandra (*Crossandra infundibuliformis*)

Crossandra is one of the most important flower crop grown in almost all the districts of the State. The crop requirements (Table 7.28) for growing crossandra were matched with the soil-site characteristics (Table 7.1). Land suitability map for growing crossandra was generated. The area extent and their geographical distribution of different suitability subclasses in the microwatershed are given in Figure 7.28.

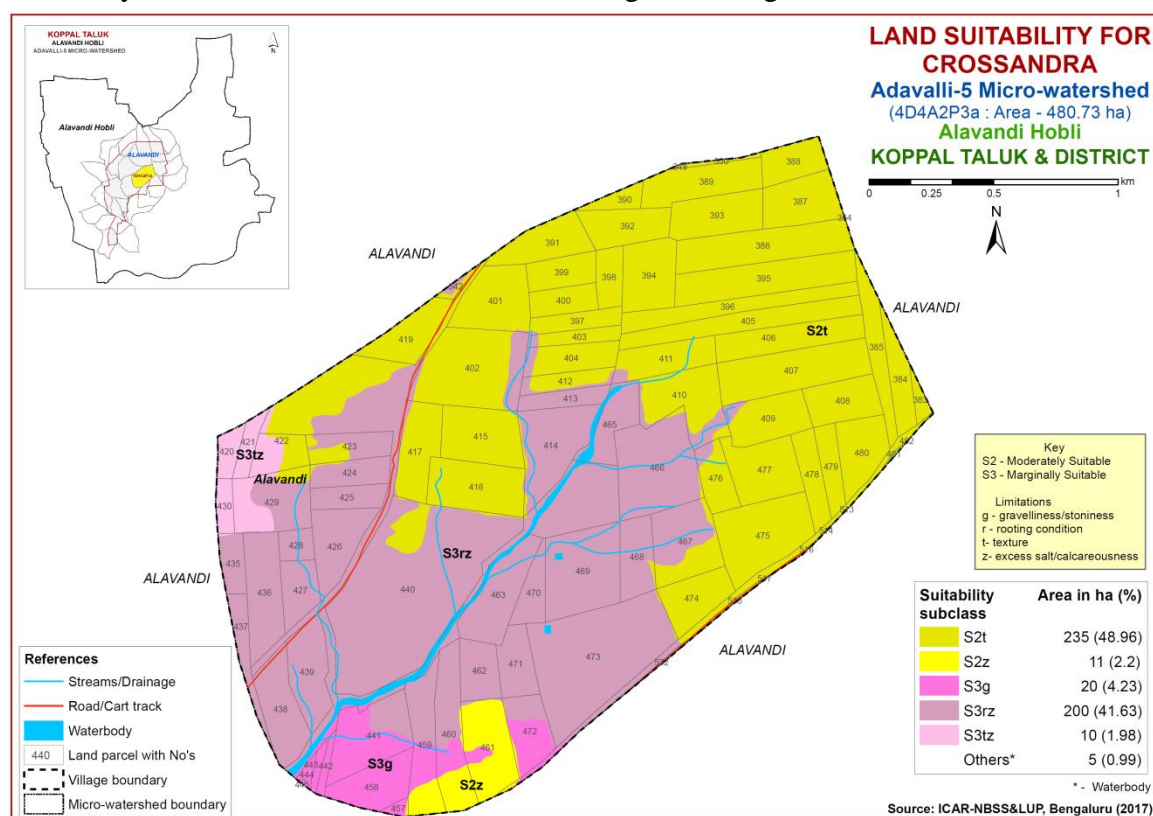


Fig. 7.28 Land Suitability map of Crossandra

Moderately suitable (Class S2) lands for growing crossandra cover an area of about 246 ha (51%) and occur in the northern, northeastern and eastern part of the microwatershed. They have minor limitations of texture and calcareousness. An area of about 230 ha (48%) is marginally suitable (Class S3) for growing crossandra and occur in the western, central and southern part of the microwatershed. They have moderate limitations of gravelliness, texture, rooting depth and calcareousness.

7.29 Land Management Units (LMU)

The 14 soil map units identified in Adavalli-5 microwatershed have been grouped into five 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.7.29) has been generated. These Land Management Units are expected to behave similarly for a given level of management.

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

LMU	Mapping unit	Soil and site characteristics
1	DRLmB2g1, HDLmB2, KDTmA1, KDTmB2, MLRmB1, MLRmB2, BDRmA1, BDRmB2	Moderately deep to very deep, black calcareous to non calcareous clayey soils with slopes of 0-3%, slight to moderate erosion, gravelly (15-35%)
2	NGPiB1g1	Deep, gravelly red clayey soils with slopes of 1-3%, slight erosion, gravelly (15-35%)
3	RNKmB1g1, RNKmB2	Moderately shallow, black calcareous clayey soils with slopes of 1-3%, slight to moderate erosion, gravelly (15-35%)
4	LKRcB2g2	Moderately shallow, red gravelly sandy clay to sandy clay loam soils with slopes of 1-3%, moderate erosion, very gravelly (35-60%)
5	MTLmB2, MTLmB2g1	Shallow, calcareous black gravelly sandy clay to clay soils with slopes of 1-3%, moderate erosion, gravelly(15-35%)

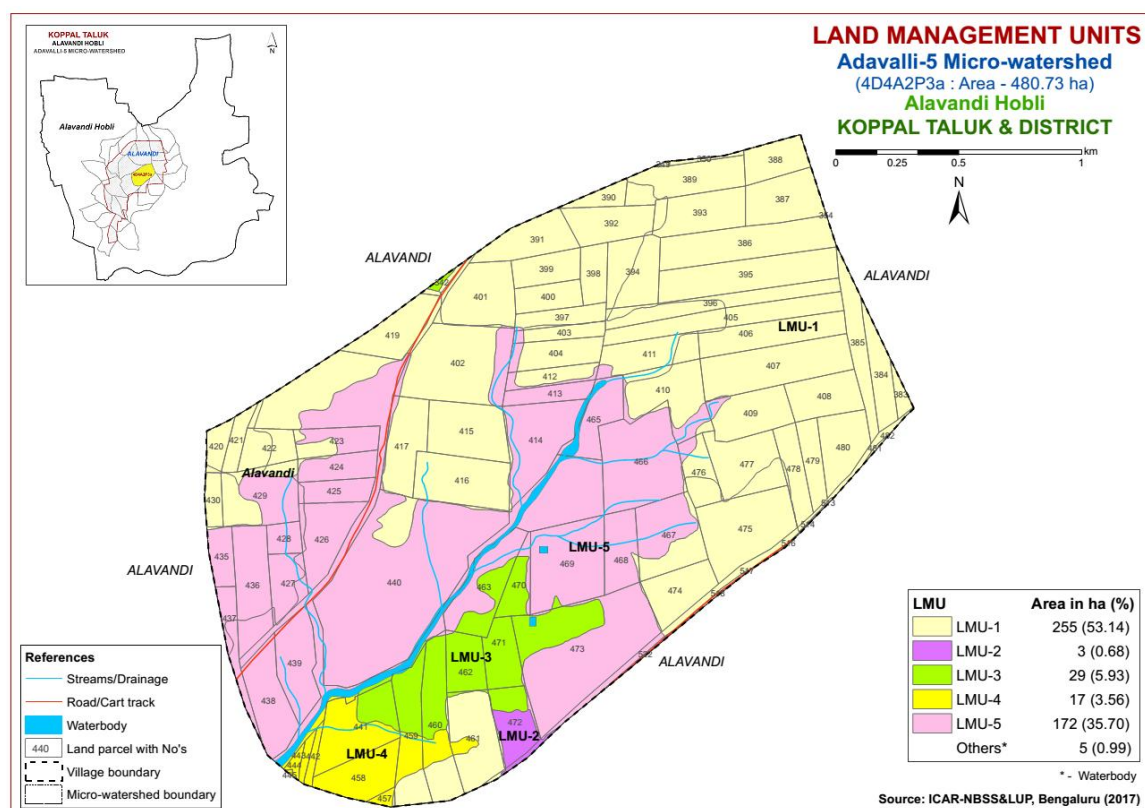


Fig 7.29 Land Management Units map of Adavalli-5 microwatershed

7.30 Proposed Crop Plan for Adavalli-5 Microwatershed

After assessing the land suitability for the 28 crops, the proposed crop plan has been prepared for the five identified LUCs by considering only the highly (Class S1) and moderately (Class S2) suitable lands for each of the 28 crops. The resultant proposed crop plan is presented in Table 7.28.

Table 7.28 Proposed Crop Plan for Adavalli-5 Microwatershed

Proposed LUC's	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	351.DRLmB2g1 382.HDLmB2 403.KDTmA1 405.KDTmB2 415.MLRmB1 418.MLRmB2 428.BDRmA1 433.BDRmB2 (Moderately deep to very deep, black calcareous to non calcareous clayey soils)	Alavandi : 349,350,354,383,384,385,386,387,388,389,390,391,392,393,394,395,396,397,398,399,400,401,402,403,404,405,406,407,408,409,410,411,412,415,416,417,419,420,421,422,430,461,474,475,476,477,478,479,480,481,482,513,514,516,517,518	Sorghum, Sunflower, Cotton, Bengal gram, Safflower, Linseed, Bajra	Fruit crops: Pomegranate, Jamun, Lime, Musambi, Tamarind, Amla, Custard apple Vegetables: Drumstick, Chilli, Coriander Flowers: Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practices
2	263.NGPiB1g1 (Deep, gravelly red clayey soils)	Alavandi : 472	Groundnut, Redgram, Bajra, Horsegram, Castor	Fruit crops: Lime, Musambi, Jackfruit, Jamun, Amla, Cashew, Custard apple Vegetables: Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)
3	334.RNKmB1g1 336.RNKmB2 (Moderately shallow, black calcareous clayey soils)	Alavandi : 342,459,460,462,470,471	Sorghum, Bajra, Bengal gram, Linseed, Safflower, Coriander	Fruit crops: Amla, Custard apple Flowers: Marigold, Jasmine, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practises
4	44.LKRcB2g2 (Moderately shallow, red gravelly sandy clay to sandy clay loam soils)	Alavandi : 441,442,443,444,445,457,458	Groundnut, Bajra, Horse gram, Castor	Fruit crops: Amla, Custard apple Vegetables: Drumstick	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit etc)

5	310. MTLmB2 311.MTLmB2g1 (Shallow, calcareous black gravelly sandy clay to clay soils)	Alavandi : 413,414,423,424,425,426, 427,428,429,435,436,437, 438,439,440,463,465,466, 467,468,469,473,522	Bengal gram, Horse gram, Coriander	Agri-Silvi-Pasture: Hybrid Napier, <i>Styloxanthes hamata</i> , <i>Styloxanthes scabra</i>	Sowing across the slope, drip irrigation and mulching is recommended
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SOIL HEALTH MANAGEMENT

8.1 Soil Health

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

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

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

The most important characteristics of a healthy soil are

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

Characteristics of Adavalli-5 Microwatershed

- ❖ The soil phases with sizeable area identified in the microwatershed belonged to the soil series of MTL (172 ha), BDR (133 ha), KDT (102 ha), RNK (28 ha), LKR (17 ha), DRL (11 ha), MLR (10 ha), NGP (3 ha) and HDL (<1 ha).
- ❖ As per land capability classification, entire area in the microwatershed falls under arable land category (Class II and III). The major limitations identified in the arable lands were soil and erosion.
- ❖ On the basis of soil reaction, an area of about 15 ha (3%) is neutral (pH 7.3-7.8), 16 ha (3%) is slightly alkaline (pH 7.3-7.8), 16 ha (3 %) is moderately alkaline (pH 7.8-8.4),

112 ha (23 %) under strongly alkaline (pH 8.4-9.0) and 317 ha (66 %) (pH >9.0) is very strongly 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 strongly alkaline soils)

1. Regular addition of organic manure, green manuring, green leaf manuring, crop residue incorporation and mulching needs to be taken up to improve the soil organic matter status.
2. Application of biofertilizers (Azospirillum, Azotobacter, 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 – 5 kg/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, (Azospirillum, 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 factors affecting the soil health in the microwatershed. An area of about 296 ha (62 %) is under moderate erosion. The areas with moderate erosion need immediate soil and water conservation and, other land development and land husbandry practices for restoring soil health.

Dissemination of Information and Communication of Benefits

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

Inputs for Net Planning (Saturation Plan) and Interventions needed

Net planning in IWMP is focusing on preparation of

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

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

- ❖ **Soil Depth:** The depth of a soil decides the amount of moisture and nutrients it can hold, what crops can be taken up or not, depending on the rooting depth and the length of growing period available for raising any crop. Deeper the soil, better for a wide variety of crops. If sufficient depth is not available for growing deep rooted crops, either choose medium or short duration crops or deeper planting pits need to be opened and additional good quality soil brought from outside has to be filled into the planting pits.
- ❖ **Surface soil texture:** Lighter soil texture in the top soil means, better rain water infiltration, less run-off and soil moisture conservation, less capillary rise and less evaporation losses. Lighter surface textured soils are amenable to good soil tilth and are highly suitable for crops like groundnut, root vegetables (carrot, radish, potato etc) but not ideal for crops that need stagnant water like lowland paddy. Heavy textured soils are poor in water infiltration and percolation. They are prone for sheet erosion; such soils can be improved by sand mulching. The technology that is developed by the AICRP-Dryland Agriculture, Vijayapura, Karnataka can be adopted.
- ❖ **Gravelliness:** More gravel content is favorable for run-off harvesting but poor in soil moisture storage and nutrient availability. It is a significant parameter that decides the kind of crop to be raised.
- ❖ **Land Capability Classification:** The land capability map shows the areas suitable and not suitable for agriculture and the major constraints in each of the plot/survey number. Hence, one can decide what kind of enterprise is possible in each of these units. In general, erosion and soil are the major constraints in Adavalli-5 Microwatershed.
- ❖ **Organic Carbon:** An area of about 424 ha (88 %) is low in OC content and 52 ha (11 %) is medium (0.5-0.75%) in OC content. The areas that are low and medium in OC needs to be further improved by applying farmyard manure and rotating crops with cereals and legumes or mixed cropping.
- ❖ **Promoting green manuring:** Growing of green manuring crops costs Rs. 1250/ha (green manuring seeds) and about Rs. 2000/ha towards cultivation that totals to Rs. 3250/- per ha. On the other hand, application of organic manure @ 10 tons/ha costs Rs. 5000/ha. The practice needs to be continued for 2-3 years or more. Nitrogen fertilizer needs to be supplemented by 25% in addition to the recommended level in the entire area where OC is less than 0.75 per cent. For example, for rainfed maize, recommended level is 50 kg N

per ha and an additional 12 kg /ha needs to be applied for all the crops grown in these plots.

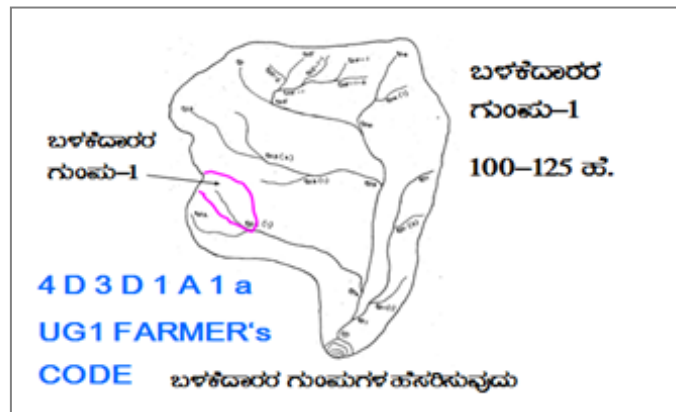
- ❖ **Available Phosphorus:** Available phosphorus is low (<23 kg/ha) in 444 ha (92%) and medium (23-57 kg/ha) in 32 ha (7 %) of the soils. Apply additional 25% phosphorus in areas where it is medium or low.
- ❖ **Available Potassium:** Available potassium is medium (145-337 kg/ha) in 79 ha (16%) and high (>337 kg/ha) in 397 ha (83%) area of the microwatershed. The areas where potassium content is high reduce 25% from the RDF to avoid the excess application of fertilizer and apply additional 25% potassium in areas where it is medium.
- ❖ **Available Sulphur:** Available sulphur is a very critical nutrient for oilseed crops. Available sulphur is low(<10 ppm) in 233 ha (49%), medium in 225 ha (47 %) and high (>20ppm) in 17 ha (4%) area of the microwatershed. Areas with low and medium in available sulphur 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 iron:** It is deficient (<4.5 ppm) in 441 ha (92 %) and sufficient (>4.5 ppm) in 35 ha (7 %) area of the microwatershed. To manage iron deficiency iron sulphate @ 25 kg/ha needs to be applied for 2-3 years.
- ❖ **Available Zinc:** It is deficient (<0.6 ppm) in 466 ha (97%) and sufficient (>0.6ppm) in 10 ha (2%) area of the microwatershed. Application of zinc sulphate @ 25kg/ha is to be followed in areas that are deficient in available zinc.
- ❖ **Available Boron:** Area of about 64 ha (13 %) is low (<0.5 ppm) in available boron, and 412 ha (86 %) is medium (0.5-1.0 ppm) in available boron content. The areas with low and medium in boron content need to be applied with sodium borate @ 10kg/ha as a soil application or 0.2% borax as foliar spray to correct the deficiency.
- ❖ **Available Manganese:** It is sufficient in the entire area of the microwatershed.
- ❖ **Available Copper:** It is sufficient in the entire area of the microwatershed.
- ❖ **Soil alkalinity:** The entire area in the microwatershed has soils that are slightly alkaline to very strongly alkaline, except a small area of 15 ha is under neutral. 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, Acacia, Neem, Ber etc, are recommended.

Land Suitability for various crops: Areas that are highly, moderately and marginally suitable for growing various crops are indicated. Along with the suitability, various constraints that are limiting the productivity are also indicated. For example, in case of cotton, gravel content, rooting depth and salinity/alkalinity are the major constraints in various plots. With suitable management interventions, the productivity can be enhanced. In order to increase water holding capacity of light textured soils, growing of green manure crops and application of organic manure is recommended.

SOIL AND WATER CONSERVATION TREATMENT PLAN

For preparing soil and water conservation treatment plan for Adavalli-5 microwatershed, the land resource inventory database generated under Sujala-III project has been transformed as information through series of interpretative (thematic) maps using soil phase map as a base. The various thematic maps (1:7920 scale) generated were

- Soil depth
 - Surface soil texture
 - Available water capacity
 - Soil slope
 - Soil gravelliness
 - Land capability
 - Present land use and land cover
 - Crop suitability maps
 - Rainfall map
 - Hydrology
 - Water Resources
 - Socio-economic data
 - Contour plan with existing features- network of waterways, pothissa boundaries, cut up/ minor terraces etc.
 - Cadastral map (1:7920 scale)
 - Satellite imagery (1:7920 scale)
- Apart from these, Hand Level/ Hydro Marker/ Dumpy Level/ Total Station and Kathedars' List needs to be collected.



Steps for Survey and Preparation of Treatment Plan

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

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

9.1 Treatment Plan

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

9.1.1 Arable Land Treatment

A. BUNDING

Steps for Survey and Preparation of Treatment Plan		USER GROUP-1
Cadastral map (1:7920 scale) is enlarged to a scale of 1:2500 scale		<div>CLASSIFICATION OF GULLIES</div> <div>ಕೊಡುಕುಳಿನ ವರ್ಗೀಕರಣ</div> <div><div>• ಮೇಲ್ಕಡುಕುಳು 15 Ha.</div><div>• ಮಧ್ಯಕಡುಕುಳು 15 +10=25 ಹೆ.</div><div>• ಕೆಳಕಡುಕುಳು 25 ಹೆಕ್ಟೇರ್ ಗಿಂತ ಅಧಿಕ</div></div> <div>UPPER REACH</div> <div>MIDDLE REACH</div> <div>LOWER REACH</div> <div>POINT OF CONCENTRATION</div>
Existing network of waterways, pothissa boundaries, grass belts, natural drainage lines/ watercourse, cut ups/ terraces are marked on the cadastral map to the scale		
Drainage lines are demarcated into		
Small gullies	(up to 5 ha catchment)	
Medium gullies	(5-15 ha catchment)	
Ravines	(15-25 ha catchment) and	
Halla/Nala	(more than 25ha catchment)	

Measurement of Land Slope

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



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

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

Note: i) The above intervals are maximum.

(ii) Considering the slope class and erosion status ($A_1 \dots A = 0-1\%$ 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 ($bg_0 \dots b = \text{loamy sand}$, $g_0 = <15\%$ gravel). The recommended sections for different soils are given below.

Recommended Bund Section

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

Formation of Trench cum Bund

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

Details of Borrow Pit dimensions are given below

TRENCH CUM BUND

WATER STORAGE AREA

0.45 Sq.m section

IDEAL FOR HORTICULTURE CROPS

'A' FRAME FOR INTERBUND MANAGEMENT

ಬೆಳೆಸುವುದು

ಸಮಸಾಧನ ರೇಖೆ

1. ಸಮಸಾಧನ ಉಳುವುದು
2. ಸಮಸಾಧನ ಬಿತ್ತನೆ/ನಾಟಿ

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

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

B. Waterways

- 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 are formed in the field.

9.1.3 Treatment of Natural Water Course/ Drainage Lines

- a) The cadastral map has to be updated as regards the network of drainage lines (gullies/ *nalas*/ *hallas*) and existing structures are marked to the scale and storage capacity of the existing water bodies are documented.
- b) The drainage line will be demarcated into Upper Reach, Middle Reach and Lower Reach.
- c) Considering the Catchment, *Nala* bed and bank conditions, suitable structures are decided.
- d) Number of storage structures (Check dam/ *Nala* bund/ Percolation tank) will be decided considering the commitments and available runoff 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 different kinds of structures recommended has been prepared which shows the spatial distribution and extent of area. A maximum area of about 311 ha (65 %) needs graded bunding, an area of about 145 ha (30 %) needs strengthening of existing bunds and a small area of about 20 ha (4%) requires trench cum bunding. The conservation plan prepared may be presented to all the stakeholders including farmers and after considering their suggestions, the conservation plan for the microwatershed may be finalized in a participatory approach.

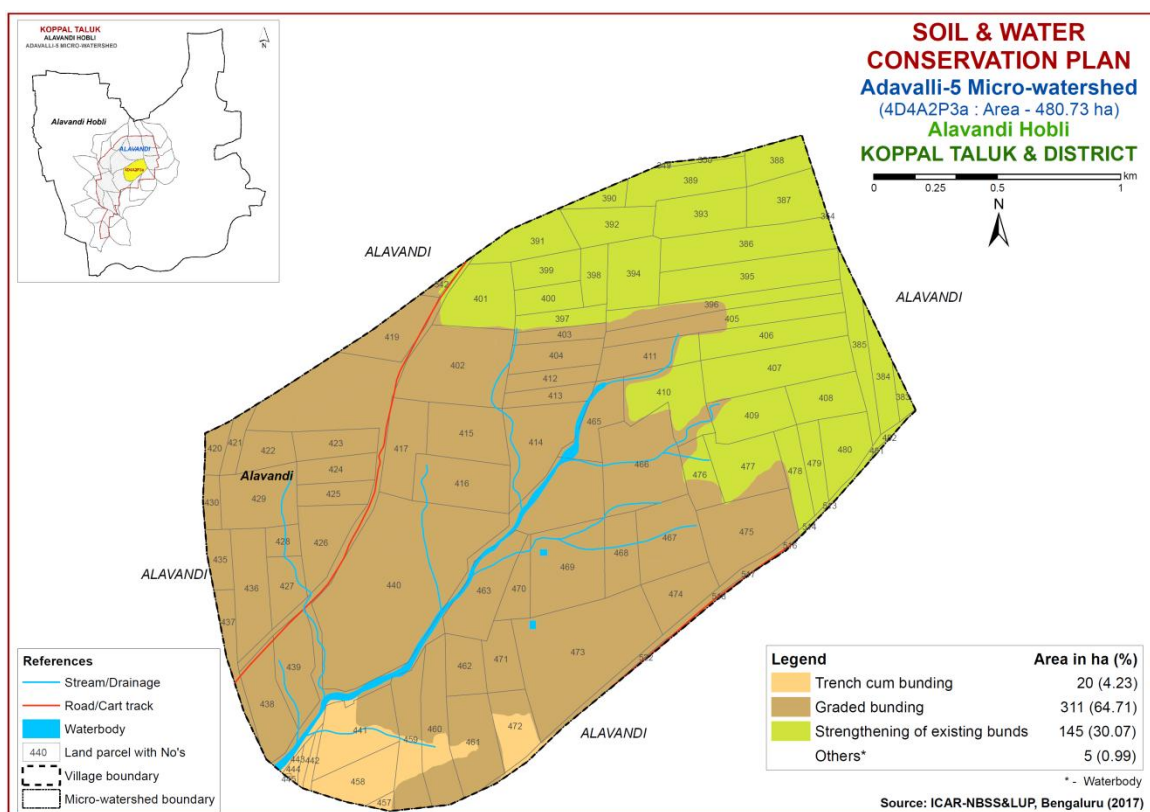


Fig. 9.1 Soil and Water Conservation Plan map of Adavalli-5 Microwatershed

9.3 Greening of Microwatershed

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

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

The tree species suitable for the area considering rainfall, temperature and adaptability is listed below; waterlogged areas are recommended to be planted with species like Neral (*Syzizium 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	<i>Azadiracta indica</i>	21–32	400 –1,200
2.	Tapasi	<i>Holoptelia integrifolia</i>	20-30	500 - 1000
3.	Seetaphal	<i>Anona Squamosa</i>	20-40	400 - 1000
4.	Honge	<i>Pongamia pinnata</i>	20 -50	500–2,500
5.	Kamara	<i>Hardwickia binata</i>	25 -35	400 - 1000
6.	Bage	<i>Albezzia lebbek</i>	20 - 45	500 - 1000
7.	Ficus	<i>Ficus bengalensis</i>	20 - 50	500–2,500
8.	Sisso	<i>Dalbargia Sissoo</i>	20 - 50	500 -2000
9.	Ailanthus	<i>Ailanthus excelsa</i>	20 - 50	500 - 1000
10.	Hale	<i>Wrightia tinctoria</i>	25 - 45	500 - 1000
11.	Uded	<i>Steriospermum chelanoides</i>	25 - 45	500 -2000
12.	Dhupa	<i>Boswellia Serrata</i>	20 - 40	500 - 2000
13.	Nelli	<i>Emblica Officinalis</i>	20 - 50	500 -1500
14.	Honne	<i>Pterocarpus marsupium</i>	20 - 40	500 - 2000
Moist Deciduous Species			Temp (°C)	Rainfall (mm)
15.	Teak	<i>Tectona grandis</i>	20 - 50	500-5000
16.	Nandi	<i>Legarstroemia lanceolata</i>	20 - 40	500 - 4000
17.	Honne	<i>Pterocarpus marsupium</i>	20 - 40	500 - 3000
18.	Mathi	<i>Terminalia alata</i>	20 -50	500 - 2000
19.	Shivane	<i>Gmelina arborea</i>	20 -50	500 -2000
20.	Kindal	<i>T.Paniculata</i>	20 - 40	500 - 1500
21.	Beete	<i>Dalbargia latifolia</i>	20 - 40	500 - 1500
22.	Tare	<i>T. belerica</i>	20 - 40	500 - 2000
23.	Bamboo	<i>Bambusa arundinaria</i>	20 - 40	500 - 2500
24.	Bamboo	<i>Dendrocalamus strictus</i>	20 – 40	500 – 2500
25.	Muthuga	<i>Butea monosperma</i>	20 - 40	400 - 1500
26.	Hippe	<i>Madhuca latifolia</i>	20 - 40	500 - 2000
27.	Sandal	<i>Santalum album</i>	20 - 50	400 - 1000
28.	Nelli	<i>Emblica officinalis</i>	20 - 40	500 - 2000
29.	Nerale	<i>Sisyzium cumini</i>	20 - 40	500 - 2000
30.	Dhaman	<i>Grevia tilifolia</i>	20 - 40	500 - 2000
31.	Kaval	<i>Careya arborea</i>	20 - 40	500 - 2000
32.	Harada	<i>Terminalia chebula</i>	20 - 40	500 - 2000

References

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Appendix I
Adavalli-5 Microwatershed
Soil Phase Information

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservati on Plan
Alavandi	342	0.63	RNKmB2	LMU-3	Moderately shallow (50-75 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	Iles	Graded bunding
Alavandi	349	0.07	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Maize+Current fallow (Mz+Cf)	Not Available	IIs	Field bunds
Alavandi	350	0.42	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	354	0	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	383	0.87	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	384	3.48	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	385	4.34	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	386	9.35	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	387	5.65	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	388	3.64	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	389	6.34	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	390	1.6	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	391	5.13	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	392	4.85	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	393	5.91	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	394	5.91	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	395	9.4	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	396	5.96	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	397	2.63	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	398	2.56	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	399	3.39	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	400	2.91	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Alavandi	401	6.9	KDTmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Sunflower (Sf)	Not Available	IIs	Field bunds
Alavandi	402	12.72	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Sparse vegetation (Cf+Sv)	Not Available	IIs	Graded bunding
Alavandi	403	2.06	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	404	4.15	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	405	7.31	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	406	6.21	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	407	9.88	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	408	4.79	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	409	5.64	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	410	7.82	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	411	5	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	412	2.64	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIs	Graded bunding
Alavandi	413	2.44	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIIs	Graded bunding
Alavandi	414	8.46	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIIs	Graded bunding
Alavandi	415	7.03	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	416	7.54	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	417	5.75	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	419	4.8	KDTmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation+Current fallow (Sv+Cf)	Not Available	IIs	Graded bunding
Alavandi	420	1.64	MLRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	421	1.65	MLRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	422	3.22	MLRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	423	3.7	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIIs	Graded bunding
Alavandi	424	3.31	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIs	Graded bunding
Alavandi	425	2.76	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIIs	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservation Plan
Alavandi	426	5.66	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	427	3.45	MTLmB2	LMU-5	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	428	1.73	MTLmB2	LMU-5	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Not Available (NA)	Not Available	IIes	Graded bunding
Alavandi	429	7.32	MTLmB2	LMU-5	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	430	1.49	MLRmB1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	435	2.34	MTLmB2	LMU-5	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	436	6.8	MTLmB2	LMU-5	Shallow (25-50 cm)	Clay	Non gravelly (<15%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	437	2.65	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Current fallow (Mz+Cf)	Not Available	IIes	Graded bunding
Alavandi	438	6.1	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Jowar (Jw)	Not Available	IIes	Graded bunding
Alavandi	439	5.76	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	440	34.77	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparsevegetation+Currentfallow+Maize+Jowar (Sv+Cf+Mz+Jw)	Not Available	IIes	Graded bunding
Alavandi	441	7.92	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation+Current fallow (Sv+Cf)	Not Available	IIes	TCB
Alavandi	442	0.72	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Alavandi	443	0.61	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Alavandi	444	0.48	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Alavandi	445	0.04	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize (Mz)	Not Available	IIes	TCB
Alavandi	457	0.51	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Maize+Bajra+Ground nut (Mz+Bj+Gn)	Not Available	IIes	TCB
Alavandi	458	5.1	LKRcB2g2	LMU-4	Moderately shallow (50-75 cm)	Sandy loam	Very gravelly (35-60%)	Very Low (<50 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra (Bj)	Not Available	IIes	TCB
Alavandi	459	6.48	RNKmB1g1	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize+Current fallow (Mz+Cf)	Not Available	IIs	Graded bunding
Alavandi	460	7.37	RNKmB1g1	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Alavandi	461	7.03	DRLmB2g1	LMU-1	Moderately deep (75-100 cm)	Clay	Gravelly (15-35%)	Medium (101-150 mm/m)	Very gently sloping (1-3%)	Moderate	Bajra+Maize+Cotton (Bj+Mz+Ct)	Not Available	IIs	Graded bunding
Alavandi	462	3.67	RNKmB1g1	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Maize (Mz)	Not Available	IIs	Graded bunding
Alavandi	463	6.97	MTLmB2g1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparsevegetation+Current fallow (Sv+Cf)	Not Available	IIes	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservati on Plan
Alavandi	465	4.38	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIes	Graded bunding
Alavandi	466	11.41	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation (Sv)	Not Available	IIes	Graded bunding
Alavandi	467	7.63	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation+Eucalyptus (Sv+Eu)	Not Available	IIes	Graded bunding
Alavandi	468	4.28	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	IIes	Graded bunding
Alavandi	469	10.01	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Sparse vegetation+Current fallow (Sv+Cf)	Not Available	IIes	Graded bunding
Alavandi	470	2.78	RNKMb1g ₁	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	471	3.78	RNKMb1g ₁	LMU-3	Moderately shallow (50-75 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIs	Graded bunding
Alavandi	472	4.58	NGPiB1g ₁	LMU-2	Deep (100-150 cm)	Sandy clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Slight	Current fallow (Cf)	Not Available	IIIs	TCB
Alavandi	473	20.37	MTLmB2g ₁	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Maize (Cf+Mz)	Not Available	IIes	Graded bunding
Alavandi	474	4.79	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Sparsevegetation+Cu rrent fallow (Sv+Cf)	Not Available	Iles	Graded bunding
Alavandi	475	9.68	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	Iles	Graded bunding
Alavandi	476	3.38	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	477	6.56	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	478	3.34	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	479	2.77	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	480	4.95	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	481	0.11	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	482	0.01	BDRmA1	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Nearly level (0-1%)	Slight	Current fallow (Cf)	Not Available	IIs	Field bunds
Alavandi	513	0	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	Iles	Graded bunding
Alavandi	514	0.05	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	Iles	Graded bunding
Alavandi	516	0.04	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Maize (Cf+Mz)	Not Available	Iles	Graded bunding
Alavandi	517	0.02	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	Iles	Graded bunding
Alavandi	518	0.27	BDRmB2	LMU-1	Very deep (>150 cm)	Clay	Non gravelly (<15%)	Very high (>200 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow (Cf)	Not Available	Iles	Graded bunding

Village	Survey Number	Area (ha)	Soil Phase	LMU	Soil Depth	Surface Soil Texture	Soil Gravelliness	Available Water Capacity	Slope	Soil Erosion	Current Land Use	WELLS	Land Capability	Conservati on Plan
Alavandi	522	0.26	MTLmB2g 1	LMU-5	Shallow (25-50 cm)	Clay	Gravelly (15-35%)	Low (51-100 mm/m)	Very gently sloping (1-3%)	Moderate	Current fallow+Maize (Cf+Mz)	Not Available	IIes	Graded bunding

Appendix II

Adavalli-5 Microwatershed Soil Fertility Information

[illegible]

Appendix III
Adavalli-5 Microwatershed
Soil Suitability Information

Village	Sy No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crsndra	Drumstick	Mulberry
Alavandi	342	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	349	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	350	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	354	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	383	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	384	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	385	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	386	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	387	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	388	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	389	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	390	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	391	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	392	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	393	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	394	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	395	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	396	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	397	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	398	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	399	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	400	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	401	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	402	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	403	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t

Village	Sy No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crsndra	Drumstick	Mulberry
Alavandi	404	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	405	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	406	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	407	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	408	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	409	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	410	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	411	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	412	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	413	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	414	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	415	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	416	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	417	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	419	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S2t
Alavandi	420	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	421	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	422	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	423	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	424	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	425	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	426	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	427	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	428	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	429	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	430	S3tz	S3tz	S3tz	S2z	S3tz	S2z	S2tz	S2z	S2z	S2z	S2tz	S2tz	S3tz	S2z	N1tz	S2tz	S2z	S3tz	S3tz	S3tz	S2tz	S2tz	S2tz	S3tz	S3tz	S3tz	S2tz	S3tz
Alavandi	435	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	436	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz

Village	Sy No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crsndra	Drumstick	Mulberry
Alavandi	437	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	438	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	439	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	440	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	441	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	442	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	443	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	444	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	445	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	457	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	458	N1rg	S3rg	S3rg	S3rg	S3rg	S3g	N1rg	S3rg	S2rt	S3rg	S3rg	S2rg	S3rg	S2rg	S3rg	S3rg	S3rg	S3rg	S3g	S3g	S3g	S3g	S3rg	S2rg	S3g	S3g	S3rg	S3rg
Alavandi	459	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	460	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	461	S3rz	S3tz	S3tz	S2nz	S3tz	S2rz	S3rz	S2rz	S2rz	S2rz	S3rz	S2tz	S3tz	S2z	N1tz	S3rz	S2rz	S3tz	S3tz	S3tz	S2tz	S2tz	S2rt	S3tz	S3tz	S2z	S2rz	S2tz
Alavandi	462	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	463	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	465	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	466	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	467	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	468	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	469	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	470	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	471	N1rz	S3tz	S3rz	S2rz	S3tz	S2rz	N1rz	S3rz	S2rz	S3rz	S3rz	S2rz	S3tz	S2rz	N1tz	S3tz	S3rz	S3tz	S3tz	S3tz	S2rz	S2rz	S3rz	S3tz	S2rz	S3rz	S3rz	S3rz
Alavandi	472	S3rg	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S3g	S2g	S3g	S3rg	S3g	S2g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S3g	S2g	S2g
Alavandi	473	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz
Alavandi	474	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	475	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	476	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t

Village	Sy No.	Mango	Maize	Sapota	Sorgham	Guava	Cotton	Tamarind	Lime	Bengalgram	Sunflower	Redgram	Amla	Jackfruit	Custard-apple	Cashew	Jamun	Musambi	Groundnut	Chilly	Tomato	Marigold	Chrysanthemum	Pomegranate	Bajra	Jasmine	Crsndra	Drumstick	Mulberry
Alavandi	477	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	478	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	479	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	480	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	481	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	482	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	513	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	514	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	516	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	517	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	518	S3t	S3t	S3t	S1	S3t	S1	S2t	S1	S1	S1	S2t	S2t	S3t	S1	N1t	S2t	S1	S3t	S3t	S3t	S2t	S2t	S2t	S3t	S3t	S2t	S2t	S3t
Alavandi	522	N1rt	S3tz	N1rz	S3rz	N1rt	S3rz	N1rz	N1rz	S3rz	N1rz	N1rz	S3tz	N1rt	S3zg	N1rt	N1rt	N1rz	S3tz	S3rz	S3rz	S3rz	S3rz	N1rz	S3rz	S3rz	S3rz	N1rz	N1rz

PART-B

SOCIO-ECONOMIC STATUS OF FARM HOUSEHOLDS

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SALIENT FINDINGS OF THE SURVEY

- ❖ *The data indicated that there were 73 (47.40%) men, 78 (50.65%) women and others 3(1.95%) among the sampled households.*
- ❖ *The average family size of marginal farmers' was 4.5, small farmers' was 5.06, semi medium farmers' was 3.6, medium farmers' was 5.25 and large farmers' was 3.*
- ❖ *The data indicated that, 22(14.29%) people were in 0-15 years of age, 66 (42.86%) were in 16-35 years of age, 48 (31.17%) were in 36-60 years of age and 18 (11.69%) were above 61 years of age.*
- ❖ *The results indicated that Adavalli-5 had 28.57 per cent illiterates, 21.43 per cent of them had primary school education, 6.49 per cent of them had middle school education, 14.94 per cent of them had high school education, 11.04 per cent of them had PUC education, 0.65 per cent had diploma and ITI, 11.04 per cent of them had degree education and 2.60 per cent of them did Masters.*
- ❖ *The results indicate that, 52.95 per cent of household heads were practicing agriculture, 29.41 per cent of the household heads were agricultural labourers and 5.88 per cent of the household heads were government service.*
- ❖ *The results indicate that agriculture was the major occupation for 48.70 per cent of the household members, 22.08 per cent were agricultural laborers, 0.65 per cent were in trade and business, 23.38 per cent were students and 0.65 per cent were housewives.*
- ❖ *The results show that, 0.65 per cent of the households participated in raitha sangha and 99.54 per cent of the population in the micro watershed has not participated in any local institutions.*
- ❖ *The results indicate that 5.88 per cent of the households possess thatched house, 85.29 per cent of the households possess katcha house and 8.82 per cent of them possess pucca/RCC house.*
- ❖ *The results show that 58.82 per cent of the households possess TV, 35.29 per cent of them possess mixer/grinder, 11.76 per cent of the households possess motor cycle, 41.18 per cent of the households possess motor cycle and 94.12 per cent of the households possess mobile phones.*
- ❖ *The results show that the average value of television was Rs 4,150, mixer grinder was Rs 1,183, bicycle was Rs 800 motor cycle was Rs. 30.928 and mobile phone was Rs. 2,615.*
- ❖ *About 8.82 per cent of the households possess bullock cart, 11.76 per cent of them possess plough, 2.94 per cent possess tractor, thresher and earth mover/duster, 5.88 per cent of them possess sprayer and sprinkler, 44.12 per cent of them possess weeder and 29.41 per cent of them possess chaff cutter.*
- ❖ *The results show that the average value of bullock cart was Rs. 17,666, plough was Rs. 1,000, tractor was Rs 300,000, sprayer was Rs. 2,450, average value of sprinkler*

was 100, average value of weeder was 72, average value of thresher was 506, average value of chaff cutter was 559 and the average value of earth mover/duster was Rs. 15,000.

- ❖ The results indicate that, 11.76 per cent of the households possess bullocks, 8.82 per cent of the households possess local cow and 2.94 per cent possess crossbreed cow, buffalo and poultry birds.
- ❖ The results indicate that, average own labour men available in the micro watershed was 1.61, average own labour (women) available was 1.50, average hired labour (men) available was 7.15 and average hired labour (women) available was 7.94. The results indicate that, 73.53 per cent of the households opined that the hired labour was adequate and 26.47 per cent of the households opined that the hired labour was inadequate.
- ❖ The results indicate that, households of the Adavalli-5 micro-watershed possess 57.49 ha (83.93%) of dry land and 11 ha (16.07%) of irrigated land. Marginal farmers possess 2.40 ha (100%) of dry land. Small farmers possess 18.65 ha (88.48%) of dry land and 2.43 ha (11.52%) of irrigated land. Semi medium farmers possess 22.22 ha (94.39%) of dry land and 1.32 ha (5.61%) of irrigated land. Medium farmers possess 4.09 ha (36.03%) of dry land and 7.26 ha (63.97%) of irrigated land. Large farmers possess 10.13 ha (100%) of dry land.
- ❖ The results indicate that, the average value of dry land was Rs. 182,576.56 and the average value of irrigated land was Rs. 408,789.99. In case of marginal famers, the average land value was Rs. 666,441.81 for dry land. In case of small famers, the average land value was Rs. 246,517.69 for dry land and Rs. 741,000.00 for irrigated land. In case of semi medium famers, the average land value was Rs. 161,967.21 for dry land and Rs. 227,300.61 for irrigated land. In case of medium farmers, the average land value was Rs. 73,366.33 for dry land and Rs. 330,619.07 for irrigated land. In case of large farmers it was Rs 39,472.63 for dry land.
- ❖ The results indicate that, there were 7 functioning bore wells in the micro watershed.
- ❖ The results indicate that, bore well was the major irrigation source in the micro watershed for 20.59 per cent of the farmers.
- ❖ The results indicate that, the depth of bore well was found to be 11.43 meters.
- ❖ The results indicate that small, semi medium and medium had an irrigated area of 4.06 ha, 3.24 ha and 1.21 ha respectively.
- ❖ The results indicate that, farmers have grown bajra (3.36 ha), bengal gram (0.81 ha), cotton (0.89 ha), green gram (15.97 ha), groundnut (2.17 ha), Horse gram (1.67 ha), maize (7.01 ha), sorghum (4.22 ha), sunflower (7.60 ha), pomegranate (0.89 ha) and jowar (7.83 ha). Marginal farmers have grown groundnut and maize while small farmers have grown bajra, Bengal gram green gram, groundnut, horse gram, maize, sorghum, sunflower, cotton and jowar. Semi medium farmers have grown green gram, groundnut, maize, sunflower and pomegranate. Medium farmers have grown cotton,

green gram, maize, sunflower and pomegranate. Large farmers have grown jowar. The results indicate that, the cropping intensity in Adavalli-5 micro-watershed was found to be 81.80 per cent.

- ❖ The results indicate that, 38.24 per cent of the households have bank account. . The results indicate that, 38.24 per cent of the households have availed credit from different sources.
- ❖ The results indicate that, the total cost of cultivation for bajra was Rs. 13110.34. The gross income realized by the farmers was Rs. 25061.46. The net income from maize cultivation was Rs 11951.13. Thus the benefit cost ratio was found to be 1:1.91.
- ❖ The total cost of cultivation for bengal gram was Rs. 31192.45. The gross income realized by the farmers was Rs. 54915.52. The net income from green gram cultivation was Rs. 23723.07. Thus the benefit cost ratio was found to be 1:1.76.
- ❖ The total cost of cultivation for cotton was Rs. 32022.31. The gross income realized by the farmers was Rs. 26629.69. The net income from mango cultivation was Rs. - 5392.62. Thus the benefit cost ratio was found to be 1:0.83.
- ❖ The total cost of cultivation for green gram was Rs. 17421.11. The gross income realized by the farmers was Rs. 39313.81. The net income from green gram cultivation was Rs. 21892.70. Thus the benefit cost ratio was found to be 1:2.26.
- ❖ The total cost of cultivation for groundnut was Rs. 31511.38. The gross income realized by the farmers was Rs. 70731.82. The net income from groundnut cultivation was Rs. 39220.44. Thus the benefit cost ratio was found to be 1:2.24.
- ❖ The total cost of cultivation for horse gram was Rs. 18216.86. The gross income realized by the farmers was Rs. 21582.52. The net income from horse gram cultivation was Rs. 3365.67. Thus the benefit cost ratio was found to be 1:1.18.
- ❖ The total cost of cultivation for jowar was Rs. 34849.05. The gross income realized by the farmers was Rs. 41202.04. The net income from jowar cultivation was Rs. 6352.99. Thus the benefit cost ratio was found to be 1:1.18.
- ❖ The total cost of cultivation for maize was Rs. 31245.23. The gross income realized by the farmers was Rs. 36920.20. The net income from maize cultivation was Rs. 5674.97. Thus the benefit cost ratio was found to be 1:1.18.
- ❖ The total cost of cultivation for pomegranate was Rs. 26582.66. The gross income realized by the farmers was Rs. 84204.54. The net income from pomegranate cultivation was Rs. 57621.89. Thus the benefit cost ratio was found to be 1:3.17.
- ❖ The total cost of cultivation for sorghum was Rs. 24727.79. The gross income realized by the farmers was Rs. 28545.34. The net income from sorghum cultivation was Rs. 3817.56. Thus the benefit cost ratio was found to be 1:1.15.
- ❖ The total cost of cultivation for sunflower was Rs. 21407.24. The gross income realized by the farmers was Rs. 22230. The net income from sunflower cultivation was Rs. 822.76. Thus the benefit cost ratio was found to be 1:1.04.

- ❖ *The results indicate that, 11.76 per cent of the households opined that dry fodder was adequate, 17.65 per cent of the households opined that green fodder was adequate and dry fodder was inadequate for 5.88 per cent of the households.*
- ❖ *The results indicate that the annual gross income was for marginal farmers it was Rs. 56,037.50, for small farmers it was Rs. 121,760.00, for semi medium farmers it was Rs. 163,420.00, for medium farmers it was Rs. 166,250.25 and for large farmers it was Rs. 602,800.00.*
- ❖ *The results indicate that the average annual expenditure is Rs. 602,800.00. For marginal farmers it was Rs 3,312.50, for small farmers it was Rs. 6,964.44, for semi medium farmers it was Rs. 3,770.00, for medium farmers it was Rs. 10,625.00 and for large farmers it was Rs. 225,000.00.*
- ❖ *The results indicate that, sampled households have grown 4 coconut trees and 20 mango trees in their field.*
- ❖ *The results indicate that, households have planted 51 neem and 4 banyan trees in their field and 13 neem trees and 1 neem and 1 peepul tree in their backyard.*
- ❖ *The results indicated that, bajra, Bengal gram, cotton, horse gram, jowar, sorghum and sunflower was sold to the extent of 100 per cent, green gram was sold to the extent of 99.26 per cent, groundnut was sold to the extent of 97.5 per cent, maize was sold to the extent of 97.2 per cent and pomegranate was sold to the extent of 93.33 per cent.*
- ❖ *The results indicated that, about 88.24 per cent of the farmers sold their produce to local/village merchants, 23.53 per cent of the farmers sold their produce to regulated market and 5.88 per cent of them sold their produce through contract marketing arrangement.*
- ❖ *The results indicated that 120.59 per cent of the households used tractor as a mode of transportation for their agricultural produce.*
- ❖ *The results indicated that, 79.41 per cent of the households have experienced soil and water erosion problems in the farm.*
- ❖ *The results indicated that, 70.59 per cent have shown interest in soil test.*
- ❖ *The results indicated that, 76.47 per cent of the households used firewood and 23.53 per cent of the households used firewood as a source of fuel.*
- ❖ *The results indicated that, piped supply was the major source of drinking water for 61.76 per cent of the households, bore well was the source of drinking water for 17.14 per cent and lake/tank was the major source of drinking water for 2.94 per cent of the households in micro watershed.*
- ❖ *Electricity was the major source of light for 100 per cent of the households in micro watershed.*
- ❖ *The results indicated that, 32.35 per cent of the households possess sanitary toilet facility. The results indicated that, 5.88 per cent of the sampled households possessed*

APL, 94.12 per cent of the sampled households possessed BPL card and 2.94 per cent of the households did not possess PDS card.

- ❖ The results indicated that, 44.12 per cent of the households participated in NREGA programme.*
- ❖ The results indicated that, cereals were adequate for 97.06 per cent of the households, pulses were adequate for 79.41 per cent, oilseeds were adequate for 17.65 per cent, and vegetables were adequate for 61.76 per cent and milk were adequate for 76.47 per cent.*
- ❖ The results indicated that, cereals were inadequate for 2.94 per cent of the households, pulses were inadequate for 23.53 per cent of the households, oilseeds were inadequate for 52.94 per cent, vegetables were inadequate for 11.76 per cent, fruits were inadequate for 82.35 per cent, milk was inadequate for 17.65 per cent, eggs were inadequate for 94.12 per cent and meat was inadequate for 76.47 per cent of the households.*
- ❖ The results indicated that, lower fertility status of the soil was the constraint experienced by 73.53 per cent of the households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (100%), inadequacy of irrigation water (14.71%), high cost of fertilizers and plant protection chemicals (82.35%), high rate of interest on credit (79.41%), low price for the agricultural commodities (67.65%), lack of marketing facilities in the area (73.53%) and lack of transport for safe transport of the agricultural produce to the market (67.65%).*

INTRODUCTION

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

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

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

Scope and importance of survey

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

METHODOLOGY

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

Description of the study area

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

Geographers are very particular about the physiography or relief of a region. It plays a very important role in the spatial analysis of agricultural situation of the study area. The undulating topography with black cotton soil shrips, cut across by numerous nalas or streams is the major characteristic feature of the study region. Three physiographic divisions have made considering the local conditions of landforms and crops grown in the district. On the basis of physiography, Koppal district can be divided into three major divisions. They are (a) Koppal & Yelburga plateau, (b) Maidan division, (c) Tungabhadra valley. The district is part of Krishna basin the main streams draining the area are Maskinala, Ilkal-nadi and Hirenala. These are Ephemeral in nature, these come under Tungabhadra sub-basin. The drainage exhibit dentritic to subdentritic with drainage density varies from 1.4 to 7.0 kms/sq.km.

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

Description of the micro watershed

Adavalli-5 micro-watershed in Bannikoppa sub-watershed (Koppal taluk and district) is located in between 15°19'45.414'' to 15°18'5.701'' North latitudes and 75°59'41.741'' to 75°58'0.701'' East longitudes, covering an area of about 585.70 ha, bounded by Kavalura and Thalakalla villages.

Methodology followed in assessing socio-economic status of households

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyse the data. About 34 households located in the micro-watershed were interviewed for the survey.

SALIENT FEATURES OF THE SURVEY

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

Households sampled for socio-economic survey: The data on households sampled for socio economic survey in Adavalli-5 micro-watershed is presented in Table 1 and it indicated that 34 farmers were sampled in Adavalli-5 micro-watershed among them 4 (11.76%) were marginal farmers, 15 (44.12%) were small farmers, 10 (29.41%) were semi medium farmers, 4 (11.76%) were medium farmers and 1 (2.94%) were large farmers.

Table 1: Households sampled for socio economic survey in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Farmers	4	11.76	15	44.12	10	29.41	4	11.76	1	2.94	34	100.00

Population characteristics: The population characteristics of households sampled for socio-economic survey in Adavalli-5 micro-watershed is presented in Table 2. The data indicated that there were 73 (47.40%) men, 78 (50.65%) women and others 3(1.95%) among the sampled households. The average family size of marginal farmers' was 4.5, small farmers' was 5.06, semi medium farmers' was 3.6, medium farmers' was 5.25 and large farmers' was 3.

Table 2: Population characteristics of Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (18)		SF (76)		SMF (36)		MDF (21)		LF (3)		All (154)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Men	6	33.33	39	51.32	17	47.22	9	42.86	2	66.67	73	47.40
2	Women	12	66.67	35	46.05	18	50.00	12	57.14	1	33.33	78	50.65
3	Other	0	0.00	2	2.63	1	2.78	0	0.00	0	0.00	3	1.95
	Total	18	100.00	76	100.00	36	100.00	21	100.00	3	100.00	154	100.00
	Average		4.5		5.06		3.6		5.25		3		4.5

Age wise classification of population: The age wise classification of household members in Adavalli-5 micro-watershed is presented in Table 3. The data indicated that, 22(14.29%) people were in 0-15 years of age, 66 (42.86%) were in 16-35 years of age, 48 (31.17%) were in 36-60 years of age and 18 (11.69%) were above 61 years of age.

Table 3: Age wise classification of household members in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (18)		SF (76)		SMF (36)		MDF(21)		LF (3)		All (154)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	0-15 years of age	3	16.67	13	17.11	3	8.33	3	14.29	0	0.00	22	14.29
2	16-35 years of age	9	50.00	35	46.05	12	33.33	9	42.86	1	33.33	66	42.86
3	36-60 years of age	3	16.67	20	26.32	18	50.00	7	33.33	0	0.00	48	31.17
4	> 61 years	3	16.67	8	10.53	3	8.33	2	9.52	2	66.67	18	11.69
	Total	18	100.00	76	100.00	36	100.00	21	100.00	3	100.00	154	100.00

Education level of household members: Education level of household members in Adavalli-5 micro-watershed is presented in Table 4. The results indicated that Adavalli-5 had 28.57 per cent illiterates, 21.43 per cent of them had primary school education, 6.49 per cent of them had middle school education, 14.94 per cent of them had high school education, 11.04 per cent of them had PUC education, 0.65 per cent had diploma and ITI, 11.04 per cent of them had degree education and 2.60 per cent of them did Masters.

Table 4. Education level of household members in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (18)		SF (76)		SMF (36)		MDF (21)		LF (3)		All (154)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Illiterate	4	22.22	28	36.84	7	19.44	5	23.81	0	0.00	44	28.57
3	Primary School	4	22.22	16	21.05	6	16.67	5	23.81	2	66.67	33	21.43
4	Middle School	0	0.00	9	11.84	1	2.78	0	0.00	0	0.00	10	6.49
5	High School	2	11.11	6	7.89	9	25.00	6	28.57	0	0.00	23	14.94
6	PUC	4	22.22	7	9.21	3	8.33	2	9.52	1	33.33	17	11.04
7	Diploma	0	0.00	0	0.00	1	2.78	0	0.00	0	0.00	1	0.65
8	ITI	0	0.00	1	1.32	0	0.00	0	0.00	0	0.00	1	0.65
9	Degree	3	16.67	6	7.89	5	13.89	3	14.29	0	0.00	17	11.04
10	Masters	1	5.56	1	1.32	2	5.56	0	0.00	0	0.00	4	2.60
11	Others	0	0.00	2	2.63	2	5.56	0	0.00	0	0.00	4	2.60
Total		18	100.00	76	100.00	36	100.00	21	100.00	3	100.00	154	100.00

Occupation of household heads: The data regarding the occupation of the household heads in Adavalli-5 micro-watershed is presented in Table 5. The results indicate that, 52.95 per cent of household heads were practicing agriculture, 29.41 per cent of the household heads were agricultural labourers and 5.88 per cent of the household heads were government service.

Table 5: Occupation of household heads in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	2	50.00	9	60.00	5	50.00	1	25.00	1	100.00	18	52.94
2	Agricultural Labour	1	25.00	3	20.00	3	30.00	3	75.00	0	0.00	10	29.41
3	Government Service	1	25.00	1	6.67	0	0.00	0	0.00	0	0.00	2	5.88
4	Others	0	0.00	2	13.33	1	10.00	0	0.00	0	0.00	3	8.82
Total		4	100.00	15	100.00	9	100.00	4	100.00	1	100.00	33	100.00

Occupation of the household members: The data regarding the occupation of the household members in Adavalli-5 micro-watershed is presented in Table 6. The results indicate that agriculture was the major occupation for 48.70 per cent of the household members, 22.08 per cent were agricultural labourers, 0.65 per cent were in trade and business, 23.38 per cent were students and 0.65 per cent were housewives.

Institutional participation of the household members: The data regarding the institutional participation of the household members in Adavalli-5 micro-watershed is presented in Table 7. The results show that, 0.65 per cent of the households participated

in raitha sangha and 99.54 per cent of the population in the micro watershed has not participated in any local institutions.

Table 6: Occupation of family members in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (18)		SF (76)		SMF (36)		MDF (21)		LF (3)		All (154)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Agriculture	5	27.78	45	59.21	14	38.89	10	47.62	1	33.33	75	48.70
2	Agricultural Labour	4	22.22	10	13.16	15	41.67	3	14.29	2	66.67	34	22.08
3	Trade & Business	0	0.00	0	0.00	1	2.78	0	0.00	0	0.00	1	0.65
4	Student	8	44.44	17	22.37	3	8.33	8	38.10	0	0.00	36	23.38
5	Others	0	0.00	2	2.63	1	2.78	0	0.00	0	0.00	3	1.95
6	Housewife	0	0.00	0	0.00	1	2.78	0	0.00	0	0.00	1	0.65
Total		18	100.00	76	100.00	36	100.00	21	100.00	3	100.00	154	100.00

Table 7. Institutional Participation of household members in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (18)		SF (76)		SMF (36)		MDF (21)		LF (3)		All (154)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Raitha Sangha	0	0.00	1	1.32	0	0.00	0	0.00	0	0.00	1	0.65
2	No Participation	18	100.00	75	98.68	36	100.00	21	100.00	3	100.00	153	99.35
Total		18	100.00	76	100.00	36	100.00	21	100.00	3	100.00	154	100.00

Type of house owned: The data regarding the type of house owned by the households in Adavalli-5 micro-watershed is presented in Table 8. The results indicate that 5.88 per cent of the households possess thatched house, 85.29 per cent of the households possess katcha house and 8.82 per cent of them possess pucca/RCC house.

Table 8. Type of house owned by households in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Thatched	0	0.00	1	6.67	0	0.00	1	25.00	0	0.00	2	5.88
2	Katcha	3	75.00	13	86.67	10	100.00	2	50.00	1	100.00	29	85.29
3	Pucca/RCC	1	25.00	1	6.67	0	0.00	1	25.00	0	0.00	3	8.82
Total		4	100.00	15	100.00	10	100.00	4	100.00	1	100.00	34	100.00

Durable Assets owned by the households: The data regarding the Durable Assets owned by the households in Adavalli-5 micro-watershed is presented in Table 9. The results show that 58.82 per cent of the households possess TV, 35.29 per cent of them possess mixer/grinder, 11.76 per cent of the households possess motor cycle, 41.18 per cent of the households possess motor cycle and 94.12 per cent of the households possess mobile phones.

Table 9. Durable Assets owned by households in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Television	2	50.00	9	60.00	6	60.00	2	50.00	1	100.00	20	58.82
2	Mixer/Grinder	1	25.00	5	33.33	4	40.00	1	25.00	1	100.00	12	35.29
3	Bicycle	0	0.00	1	6.67	3	30.00	0	0.00	0	0.00	4	11.76
4	Motor Cycle	1	25.00	6	40.00	5	50.00	1	25.00	1	100.00	14	41.18
5	Mobile Phone	4	100.00	13	86.67	10	100.00	4	100.00	1	100.00	32	94.12

Table 10. Average value of durable assets owned by households in Adavalli-5 micro-watershed

		Average value (Rs.)						
Sl.No.	Particulars	LL (0)	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Television	0.00	6,000.00	4,000.00	3,666.00	5,000.00	3,000.00	4,150.00
2	Mixer/Grinder	0.00	3,000.00	1,000.00	900.00	2,000.00	600.00	1,183.00
3	Bicycle	0.00	0.00	900.00	766.00	0.00	0.00	800.00
4	Motor Cycle	0.00	35,000.00	29,166.00	31,000.00	35,000.00	33,000.00	30,928.00
5	Mobile Phone	0.00	5,250.00	2,447.00	2,000.00	3,300.00	2,000.00	2,615.00

Farm Implements owned: The data regarding the farm implements owned by the households in Adavalli-5 micro-watershed is presented in Table 11. About 8.82 per cent of the households possess bullock cart, 11.76 per cent of them possess plough, 2.94 per cent possess tractor, thresher and earth mover/duster, 5.88 per cent of them possess sprayer and sprinkler, 44.12 per cent of them possess weeder and 29.41 per cent of them possess chaff cutter .

Table 11. Farm Implements owned by households in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock Cart	0	0.00	1	6.67	1	10.00	0	0.00	1	100.00	3	8.82
2	Plough	0	0.00	1	6.67	1	10.00	1	25.00	1	100.00	4	11.76
3	Tractor	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	1	2.94
4	Sprayer	0	0.00	0	0.00	1	10.00	0	0.00	1	100.00	2	5.88
5	Sprinkler	0	0.00	2	13.33	0	0.00	0	0.00	0	0.00	2	5.88
6	Weeder	1	25.00	8	53.33	4	40.00	1	25.00	1	100.00	15	44.12
7	Thresher	0	0.00	1	6.67	0	0.00	0	0.00	0	0.00	1	2.94
8	Chaff Cutter	0	0.00	5	33.33	2	20.00	2	50.00	1	100.00	10	29.41
9	Earth remover/Duster	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	1	2.94

Average value of farm implements: The data regarding the average value of farm Implements owned by the households in Adavalli-5 micro-watershed is presented in Table 12. The results show that the average value of bullock cart was Rs. 17,666, plough was Rs. 1,000, tractor was Rs 300,000, sprayer was Rs. 2,450, average value of sprinkler was 100, average value of weeder was 72, average value of thresher was 506, average value of chaff cutter was 559 and the average value of earth mover/duster was Rs.15,000.

Table 12. Average value of farm implements owned by households in Adavalli-5 micro-watershed

		Average Value (Rs.)					
Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Bullock Cart	0	20,000	20,000	0	13,000.00	17,666.00
2	Plough	0.00	500.00	2,000.00	500.00	2,000.00	1,000.00
3	Tractor	0.00	0.00	0.00	0.00	300,000.00	300,000.00
4	Sprayer	0.00	0.00	3,000.00	0.00	1,900.00	2,450.00
5	Sprinkler	0.00	100.00	0.00	0.00	0.00	100.00
6	Weeder	25.00	32.00	215.00	25.00	33.00	72.00
7	Thresher	0.00	506.00	0.00	0.00	0.00	506.00
8	Chaff Cutter	0.00	258.00	1,075.00	325.00	1,800.00	559.00
9	Earth remover/Duster	0.00	0.00	0.00	0.00	15,000.00	15,000.00

Livestock possession by the households: The data regarding the Livestock possession by the households in Adavalli-5 micro-watershed is presented in Table 13. The results indicate that, 11.76 per cent of the households possess bullocks, 8.82 per cent of the households possess local cow and 2.94 per cent possess crossbreed cow, buffalo and poultry birds.

Table 13. Livestock possession by households in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bullock	0	0.00	1	6.67	1	10.00	1	25.00	1	100.00	4	11.76
2	Local cow	0	0.00	1	6.67	1	10.00	0	0.00	1	100.00	3	8.82
3	Crossbred cow	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	1	2.94
4	Buffalo	0	0.00	1	6.67	0	0.00	0	0.00	0	0.00	1	2.94
5	Poultry birds	0	0.00	1	6.67	0	0.00	0	0.00	0	0.00	1	2.94
6	blank	4	100.00	11	73.33	7	80.00	3	75.00	0	0.00	25	76.47

Average Labour availability: The data regarding the average labour availability in Adavalli-5 micro-watershed is presented in Table 14. The results indicate that, average own labour men available in the micro watershed was 1.61, average own labour (women) available was 1.50, average hired labour (men) available was 7.15 and average hired labour (women) available was 7.94.

In case of marginal farmers, average own labour men available was 1.25, average own labour (women) was 1.5, average hired labour (men) and average hired labour (women) available was 4.25. In case of small farmers, average own labour men available was 1.79, average own labour (women) was 1.60, average hired labour (men) was 7.07 and average hired labour (women) available was 7.47. In case of semi medium farmers, average own labour men available and average own labour (women) was 1.50, average hired labour (men) was 8 and average hired labour (women) available was 10. In case of medium farmers, average own labour men available was 2, average own labour (women) was 1, average hired labour (men) and average hired labour (women) available was 20. In case of large farmers, average own labour men available was 2, average own labour (women) was 1, average hired labour (men) and average hired labour (women) available was 20.

Table 14. Average Labour availability in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Hired labour Female	4.25	7.47	10.00	5.00	20.00	7.94
2	Own Labour Female	1.50	1.60	1.40	1.50	1.00	1.50
3	Own labour Male	1.25	1.79	1.50	1.50	2.00	1.61
4	Hired labour Male	4.25	7.07	8.00	5.00	20.00	7.15

Adequacy of Hired Labour: The data regarding the adequacy of hired labour in Adavalli-5 micro-watershed is presented in Table 15. The results indicate that, 73.53 per cent of the households opined that the hired labour was adequate and 26.47 per cent of the households opined that the hired labour was inadequate.

Table 15. Adequacy of Hired Labour in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate	3	75.00	12	80.00	6	60.00	4	100.00	0	0.00	25	73.53
2	Inadequate	1	25.00	3	20.00	4	40.00	0	0.00	1	100.00	9	26.47

Distribution of land (ha): The data regarding the distribution of land (ha) in Adavalli-5 micro-watershed is presented in Table 16. The results indicate that, households of the Adavalli-5 micro-watershed possess 57.49 ha (83.93%) of dry land and 11 ha (16.07%) of irrigated land. Marginal farmers possess 2.40 ha (100%) of dry land. Small farmers possess 18.65 ha (88.48%) of dry land and 2.43 ha (11.52%) of irrigated land. Semi medium farmers possess 22.22 ha (94.39%) of dry land and 1.32 ha (5.61%) of irrigated land. Medium farmers possess 4.09 ha (36.03%) of dry land and 7.26 ha (63.97%) of irrigated land. Large farmers possess 10.13 ha (100%) of dry land.

Table 16. Distribution of land (Ha) in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1	Dry	2.40	100	18.65	88.48	22.22	94.39	4.09	36.03	10.13	100	57.49	83.93
2	Irrigated	0	0	2.43	11.52	1.32	5.61	7.26	63.97	0	0	11	16.07
	Total	2.40	100	21.08	100	23.54	100	11.34	100	10.13	100	68.49	100

Average land value (Rs./ha): The data regarding the average land value (Rs./ha) in Adavalli-5 micro-watershed is presented in Table 17. The results indicate that, the average value of dry land was Rs. 182,576.56 and the average value of irrigated land was Rs. 408,789.99. In case of marginal famers, the average land value was Rs. 666,441.81 for dry land. In case of small famers, the average land value was Rs. 246,517.69 for dry land and Rs. 741,000.00 for irrigated land. In case of semi medium famers, the average land value was Rs. 161,967.21 for dry land and Rs. 227,300.61 for irrigated land. In case of medium farmers, the average land value was Rs. 73,366.33 for dry land and Rs. 330,619.07 for irrigated land. In case of large farmers it was Rs 39,472.63 for dry land.

Table 17. Average land value (Rs./ha) in Adavalli-5 micro-watershed

Sl. No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
		N	N	N	N	N	N
1	Dry	666,441.81	246,517.69	161,967.21	73,366.33	39,472.63	182,576.56
2	Irrigated	0.00	741,000.00	227,300.61	330,619.07	0.00	408,789.99

Status of bore wells: The data regarding the status of bore wells in Adavalli-5 micro-watershed is presented in Table 18. The results indicate that, there were 7 functioning bore wells in the micro watershed.

Table 18. Status of bore wells in Adavalli-5 micro-watershed

Sl.No.	Particulars	LL (0)	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Functioning	0	0	4	2	1	0	7

Source of irrigation: The data regarding the source of irrigation in Adavalli-5 micro-watershed is presented in Table 19. The results indicate that, bore well was the major irrigation source in the micro water shed for 20.59 per cent of the farmers

Table 19. Source of irrigation in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Bore Well	0	0.00	4	26.67	2	20.00	1	25.00	0	0.00	7	20.59

Depth of water (Avg in meters): The data regarding the depth of water in Adavalli-5 micro-watershed is presented in Table 20. The results indicate that, the depth of bore well was found to be 11.43 meters.

Table 2. Depth of water (Avg in meters) in Adavalli-5 micro-watershed

Sl.No.	Particulars	LL (0)	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Bore Well	0.00	0.00	15.44	12.65	7.62	0.00	11.43

Irrigated Area (ha): The data regarding the irrigated area (ha) in Adavalli-5 micro-watershed is presented in Table 21. The results indicate that small, semi medium and medium had an irrigated area of 4.06 ha, 3.24 ha and 1.21 ha respectively.

Table 21. Irrigated Area (ha) in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Kharif	0.00	4.06	3.24	1.21	0.00	8.52
	Total	0.00	4.06	3.24	1.21	0.00	8.52

Cropping pattern: The data regarding the cropping pattern in Adavalli-5 micro-watershed is presented in Table 22. The results indicate that, farmers have grown bajra (3.36 ha), bengal gram (0.81 ha), cotton (0.89 ha), green gram (15.97 ha), groundnut (2.17 ha), Horse gram (1.67 ha), maize (7.01 ha), sorghum (4.22 ha), sunflower (7.60 ha), pomegranate (0.89 ha) and jowar (7.83 ha). Marginal farmers have grown groundnut and maize while small farmers have grown bajra, Bengal gram green gram, groundnut, horse gram, maize, sorghum, sunflower, cotton and jowar. Semi medium farmers have grown green gram, groundnut, maize, sunflower and pomegranate. Medium farmers have grown cotton, green gram, maize, sunflower and pomegranate. Large farmers have grown jowar.

Table 22. Cropping pattern in Adavalli-5 micro-watershed (Area in ha)

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Kharif - Bajra	0.00	3.36	0.00	0.00	0.00	3.36
2	Kharif - Bengal gram	0.00	0.81	0.00	0.00	0.00	0.81
3	Kharif - Cotton	0.00	0.00	0.00	0.89	0.00	0.89
4	Kharif - Greengram	0.89	5.05	5.94	4.09	0.00	15.97
5	Kharif - Groundnut	0.00	0.81	1.36	0.00	0.00	2.17
6	Kharif - Horsegram	0.00	1.67	0.00	0.00	0.00	1.67
7	Kharif - Maize	1.51	1.32	0.81	3.37	0.00	7.01
8	Kharif - Sorghum	0.00	0.40	3.82	0.00	0.00	4.22
9	Kharif - Sunflower	0.00	3.04	3.75	0.81	0.00	7.60
10	Kharif - Pomegranate	0.00	0.00	0.00	0.89	0.00	0.89
11	Kharif-Jowar	0.00	2.97	0.00	0.00	4.86	7.83
	Total	2.40	22.67	24.41	9.16	10.12	68.77

Cropping intensity: The data regarding the cropping intensity in Adavalli-5 micro-watershed is presented in Table 23. The results indicate that, the cropping intensity in Adavalli-5 micro-watershed was found to be 81.80 per cent.

Table 23. Cropping intensity (%) in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Cropping Intensity	100.00	94.91	94.69	78.06	49.94	81.80

Possession of Bank account and savings: The data regarding the possession of bank account and saving in Adavalli-5 micro-watershed is presented in Table 24. The results indicate that, 38.24 per cent of the households have bank account.

Table 24. Possession of Bank account and savings in Adavalli-5 micro-watershed

Sl.No.	Particulars	LL (0)		MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Account	0	0.00	2	50.00	5	33.33	3	30.00	3	75.00	0	0.00	13	38.24

Borrowing status: The data regarding the borrowing status in Adavalli-5 micro-watershed is presented in Table 25. The results indicate that, 38.24 per cent of the households have availed credit from different sources.

Table 25. Borrowing status in Adavalli-5 micro-watershed

Sl.No.	Particulars	LL (0)		MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Credit Availed	0	0.00	2	50.00	5	33.33	3	30.00	3	75.00	0	0.00	13	38.24

Cost of cultivation of Bajra: The data regarding the cost of cultivation of Bajra in Adavalli-5 micro-watershed is presented in Table 26. The results indicate that, the total cost of cultivation for bajra was Rs. 13110.34. The gross income realized by the farmers was Rs. 25061.46. The net income from maize cultivation was Rs 11951.13. Thus the benefit cost ratio was found to be 1:1.91.

Table 26. Cost of Cultivation of bajra in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	35.34	6196.52	47.26
2	Bullock	Pairs/day	0.29	147.02	1.12
3	Tractor	Hours	2.38	1785.80	13.62
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	5.95	714.32	5.45
7	FYM	Quintal	0.00	0.00	0.00
8	Fertilizer + micronutrients	Quintal	1.19	952.43	7.26
14	Land revenue and Taxes		0.00	4.94	0.04
II	Cost B1				
16	Interest on working capital			200.01	1.53
17	Cost B1 = (Cost A1 + sum of 15 and 16)			10001.63	76.29
III	Cost B2				
18	Rental Value of Land			400.00	3.05
19	Cost B2 = (Cost B1 + Rental value)			10401.63	79.34
IV	Cost C1				
20	Family Human Labour		7.73	1516.86	11.57
21	Cost C1 = (Cost B2 + Family Labour)			11918.49	90.91
V	Cost C2				
22	Risk Premium			0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)			11918.49	90.91
VI	Cost C3				
24	Managerial Cost			1191.85	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			13110.34	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	17.86	25001.22	
		b) Main Crop Sales Price (Rs.)		1400.00	
	By Product	e) Main Product (q)	1.20	60.24	
b.	Gross Income (Rs.)			25061.46	
c.	Net Income (Rs.)			11951.13	
d.	Cost per Quintal (Rs./q.)			734.14	
e.	Benefit Cost Ratio (BC Ratio)			1:1.91	

Cost of Cultivation of Bengal gram: The data regarding the cost of cultivation of bengal gram in Adavalli-5 micro-watershed is presented in Table 27. The results indicate that, the total cost of cultivation for bengal gram was Rs. 31192.45. The gross income realized by the farmers was Rs. 54915.52. The net income from green gram cultivation was Rs. 23723.07. Thus the benefit cost ratio was found to be 1:1.76.

Table 27. Cost of Cultivation of bengal gram in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	23.96	3897.97	12.50
2	Bullock	Pairs/day	0.67	369.15	1.18
3	Tractor	Hours	1.89	1417.16	4.54
4	Machinery	Hours	0.04	22.80	0.07
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	77.42	7621.30	24.43
7	FYM	Quintal	21.26	6930.28	22.22
8	Fertilizer + micronutrients	Quintal	1.48	2373.49	7.61
9	Pesticides (PPC)	Kgs / liters	0.86	646.54	2.07
13	Depreciation charges		0.00	288.36	0.92
14	Land revenue and Taxes		0.00	0.99	0.00
II	Cost B1				
16	Interest on working capital			2109.55	6.76
17	Cost B1 = (Cost A1 + sum of 15 and 16)			25677.59	82.32
III	Cost B2				
18	Rental Value of Land			183.33	0.59
19	Cost B2 = (Cost B1 + Rental value)			25860.92	82.91
IV	Cost C1				
20	Family Human Labour		12.43	2487.85	7.98
21	Cost C1 = (Cost B2 + Family Labour)			28348.78	90.88
V	Cost C2				
22	Risk Premium			8.00	0.03
23	Cost C2 = (Cost C1 + Risk Premium)			28356.78	90.91
VI	Cost C3				
24	Managerial Cost			2835.68	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			31192.45	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	11.30	54915.52	
		b) Main Crop Sales Price (Rs.)		4860.00	
b.	Gross Income (Rs.)			54915.52	
c.	Net Income (Rs.)			23723.07	
d.	Cost per Quintal (Rs./q.)			2760.52	
e.	Benefit Cost Ratio (BC Ratio)			1:1.76	

Cost of Cultivation of Cotton: The data regarding the cost of cultivation of cotton in Adavalli-5 micro-watershed is presented in Table 28. The results indicate that, the total cost of cultivation for cotton was Rs. 32022.31. The gross income realized by the farmers was Rs. 26629.69. The net income from mango cultivation was Rs. -5392.62. Thus the benefit cost ratio was found to be 1:0.83.

Table 28. Cost of Cultivation of cotton in Adavalli-5 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1					
1	Hired Human Labour		Man days	24.08	4106.38	12.82
2	Bullock		Pairs/day	3.09	1543.75	4.82
3	Tractor		Hours	0.93	694.69	2.17
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	10.50	9910.88	30.95
7	FYM		Quintal	12.35	1482.00	4.63
8	Fertilizer + micronutrients		Quintal	1.54	2223.00	6.94
9	Pesticides (PPC)		Kgs/liters	0.93	849.06	2.65
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	14.82	0.05
14	Land revenue and Taxes			0.00	3.71	0.01
II	Cost B1					
16	Interest on working capital				1736.39	5.42
17	Cost B1 = (Cost A1 + sum of 15 and 16)				22564.67	70.47
III	Cost B2					
18	Rental Value of Land				783.33	2.45
19	Cost B2 = (Cost B1 + Rental value)				23348.00	72.91
IV	Cost C1					
20	Family Human Labour			28.71	5758.19	17.98
21	Cost C1 = (Cost B2 + Family Labour)				29106.19	90.89
V	Cost C2					
22	Risk Premium				5.00	0.02
23	Cost C2 = (Cost C1 + Risk Premium)				29111.19	90.91
VI	Cost C3					
24	Managerial Cost				2911.12	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)				32022.31	100.00
VII	Economics of the Crop					
a.	Main Product	a) Main Product (q)		7.10	26629.69	
		b) Main Crop Sales Price (Rs.)			3750.00	
b.	Gross Income (Rs.)				26629.69	
c.	Net Income (Rs.)				-5392.62	
d.	Cost per Quintal (Rs./q.)				4509.39	
e.	Benefit Cost Ratio (BC Ratio)				1:0.83	

Cost of cultivation of Green gram: The data regarding the cost of cultivation of green gram in Adavalli-5 micro-watershed is presented in Table 29. The results indicate that, the total cost of cultivation for green gram was Rs. 17421.11. The gross income realized by the farmers was Rs. 39313.81. The net income from green gram cultivation was Rs. 21892.70. Thus the benefit cost ratio was found to be 1:2.26.

Table 29. Cost of Cultivation of green gram in Adavalli-5 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1					
1	Hired Human Labour		Man days	27.95	5066.37	29.08
2	Bullock		Pairs/day	0.86	455.39	2.61
3	Tractor		Hours	2.24	1680.19	9.64
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	11.30	1349.84	7.75
7	FYM		Quintal	13.54	1784.08	10.24
8	Fertilizer + micronutrients		Quintal	1.69	1833.71	10.53
9	Pesticides (PPC)		Kgs/liters	0.66	651.70	3.74
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	23.53	0.14
14	Land revenue and Taxes			0.00	3.53	0.02
II	Cost B1					
16	Interest on working capital				674.66	3.87
17	Cost B1 = (Cost A1 + sum of 15 and 16)				13522.98	77.62
III	Cost B2					
18	Rental Value of Land				438.10	2.51
19	Cost B2 = (Cost B1 + Rental value)				13961.08	80.14
IV	Cost C1					
20	Family Human Labour			9.37	1873.44	10.75
21	Cost C1 = (Cost B2 + Family Labour)				15834.52	90.89
V	Cost C2					
22	Risk Premium				2.86	0.02
23	Cost C2 = (Cost C1 + Risk Premium)				15837.38	90.91
VI	Cost C3					
24	Managerial Cost				1583.74	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)				17421.11	100.00
VII	Economics of the Crop					
a.	Main Product	a) Main Product (q)	8.68		39313.81	
		b) Main Crop Sales Price (Rs.)			4528.57	
b.	Gross Income (Rs.)				39313.81	
c.	Net Income (Rs.)				21892.70	
d.	Cost per Quintal (Rs./q.)				2006.74	
e.	Benefit Cost Ratio (BC Ratio)				1:2.26	

Cost of cultivation of Groundnut: The data regarding the cost of cultivation groundnut in Adavalli-5 micro-watershed is presented in Table 30. The results indicate that, the total cost of cultivation for groundnut was Rs. 31511.38. The gross income realized by the farmers was Rs. 70731.82. The net income from groundnut cultivation was Rs. 39220.44. Thus the benefit cost ratio was found to be 1:2.24.

Table 30. Cost of Cultivation of groundnut in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	29.75	5110.28	16.22
2	Bullock	Pairs/day	0.00	0.00	0.00
3	Tractor	Hours	4.83	3620.80	11.49
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	76.72	7353.86	23.34
7	FYM	Quintal	24.70	2964.00	9.41
8	Fertilizer + micronutrients	Quintal	2.60	2458.77	7.80
9	Pesticides (PPC)	Kgs / liters	0.75	748.48	2.38
10	Irrigation	Number	2.47	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	14.21	0.05
14	Land revenue and Taxes		0.00	4.94	0.02
II	Cost B1				
16	Interest on working capital			1623.01	5.15
17	Cost B1 = (Cost A1 + sum of 15 and 16)			23898.36	75.84
III	Cost B2				
18	Rental Value of Land			433.33	1.38
19	Cost B2 = (Cost B1 + Rental value)			24331.69	77.22
IV	Cost C1				
20	Family Human Labour		20.73	4315.02	13.69
21	Cost C1 = (Cost B2 + Family Labour)			28646.71	90.91
V	Cost C2				
22	Risk Premium			0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)			28646.71	90.91
VI	Cost C3				
24	Managerial Cost			2864.67	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			31511.38	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)		18.86	70731.82
		b) Main Crop Sales Price (Rs.)		3750.00	
b.	Gross Income (Rs.)			70731.82	
c.	Net Income (Rs.)			39220.44	
d.	Cost per Quintal (Rs./q.)			1670.64	
e.	Benefit Cost Ratio (BC Ratio)			1:2.24	

Cost of cultivation of Horsegram: The data regarding the cost of cultivation of horse gram in Adavalli-5 micro-watershed is presented in Table 31. The results indicate that, the total cost of cultivation for horse gram was Rs. 18216.86. The gross income realized by the farmers was Rs. 21582.52. The net income from horse gram cultivation was Rs. 3365.67. Thus the benefit cost ratio was found to be 1:1.18.

Table 31. Cost of Cultivation of horse gram in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	31.17	5935.19	32.58
2	Bullock	Pairs/day	3.60	1798.54	9.87
3	Tractor	Hours	0.00	0.00	0.00
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	9.59	959.22	5.27
7	FYM	Quintal	11.99	1438.83	7.90
8	Fertilizer + micronutrients	Quintal	2.40	1918.45	10.53
10	Irrigation	Number	0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	253.59	1.39
14	Land revenue and Taxes		0.00	4.94	0.03
II	Cost B1				
16	Interest on working capital			517.98	2.84
17	Cost B1 = (Cost A1 + sum of 15 and 16)			12826.76	70.41
III	Cost B2				
18	Rental Value of Land			466.67	2.56
19	Cost B2 = (Cost B1 + Rental value)			13293.42	72.97
IV	Cost C1				
20	Family Human Labour		16.19	3267.35	17.94
21	Cost C1 = (Cost B2 + Family Labour)			16560.78	90.91
V	Cost C2				
22	Risk Premium			0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)			16560.78	90.91
VI	Cost C3				
24	Managerial Cost			1656.08	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			18216.86	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	7.19	21582.52	
		b) Main Crop Sales Price (Rs.)		3000.00	
b.	Gross Income (Rs.)			21582.52	
c.	Net Income (Rs.)			3365.67	
d.	Cost per Quintal (Rs./q.)			2532.17	
e.	Benefit Cost Ratio (BC Ratio)			1:1.18	

Cost of cultivation of Jowar: The data regarding the cost of cultivation of jowar in Adavalli-5 micro-watershed is presented in Table 32. The results indicate that, the total cost of cultivation for jowar was Rs. 34849.05. The gross income realized by the farmers was Rs. 41202.04. The net income from jowar cultivation was Rs. 6352.99. Thus the benefit cost ratio was found to be 1:1.18.

Table 32. Cost of Cultivation of jowar in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	30.86	5035.72	14.45
2	Bullock	Pairs/day	0.14	75.47	0.22
3	Tractor	Hours	1.60	1083.56	3.11
4	Machinery	Hours	0.45	269.34	0.77
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	7.72	776.26	2.23
7	FYM	Quintal	77.63	15525.44	44.55
8	Fertilizer + micronutrients	Quintal	2.30	3856.70	11.07
9	Pesticides (PPC)	Kgs / liters	0.81	605.05	1.74
11	Repairs		0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	458.98	1.32
14	Land revenue and Taxes		0.00	0.00	0.00
II	Cost B1				
16	Interest on working capital			2492.81	7.15
17	Cost B1 = (Cost A1 + sum of 15 and 16)			30179.34	86.60
III	Cost B2				
18	Rental Value of Land			166.67	0.48
19	Cost B2 = (Cost B1 + Rental value)			30346.01	87.08
IV	Cost C1				
20	Family Human Labour		6.30	1324.94	3.80
21	Cost C1 = (Cost B2 + Family Labour)			31670.95	90.88
V	Cost C2				
22	Risk Premium			10.00	0.03
23	Cost C2 = (Cost C1 + Risk Premium)			31680.95	90.91
VI	Cost C3				
24	Managerial Cost			3168.10	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			34849.05	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	15.76	28369.54	
		b) Main Crop Sales Price (Rs.)		1800.00	
	By Product	e) Main Product (q)	16.04	12832.49	
		f) Main Crop Sales Price (Rs.)		800.00	
b.	Gross Income (Rs.)			41202.04	
c.	Net Income (Rs.)			6352.99	
d.	Cost per Quintal (Rs./q.)			2211.11	
e.	Benefit Cost Ratio (BC Ratio)			1:1.18	

Cost of cultivation of Maize: The data regarding the cost of cultivation of maize in Adavalli-5 micro-watershed is presented in Table 33. The results indicate that, the total cost of cultivation for maize was Rs. 31245.23. The gross income realized by the farmers was Rs. 36920.20. The net income from maize cultivation was Rs. 5674.97. Thus the benefit cost ratio was found to be 1:1.18.

Table 33. Cost of Cultivation of Maize in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	52.53	9645.39	30.87
2	Bullock	Pairs/day	0.14	68.87	0.22
3	Tractor	Hours	4.71	3533.67	11.31
4	Machinery	Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	25.65	3675.80	11.76
7	FYM	Quintal	14.41	1729.00	5.53
8	Fertilizer + micronutrients	Quintal	2.95	2634.17	8.43
9	Pesticides (PPC)	Kgs/liters	0.62	617.50	1.98
10	Irrigation	Number	0.00	0.00	0.00
11	Repairs		0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	6.00	0.02
14	Land revenue and Taxes		0.00	4.45	0.01
II	Cost B1				
16	Interest on working capital			1038.90	3.32
17	Cost B1 = (Cost A1 + sum of 15 and 16)			22953.74	73.46
III	Cost B2				
18	Rental Value of Land			426.67	1.37
19	Cost B2 = (Cost B1 + Rental value)			23380.41	74.83
IV	Cost C1				
20	Family Human Labour		24.96	5023.35	16.08
21	Cost C1 = (Cost B2 + Family Labour)			28403.76	90.91
V	Cost C2				
22	Risk Premium			1.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)			28404.76	90.91
VI	Cost C3				
24	Managerial Cost			2840.48	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			31245.23	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	29.68	36357.54	
		b) Main Crop Sales Price (Rs.)		1225.00	
	By Product	e) Main Product (q)	3.18	562.67	
		f) Main Crop Sales Price (Rs.)		177.00	
b.	Gross Income (Rs.)			36920.20	
c.	Net Income (Rs.)			5674.97	
d.	Cost per Quintal (Rs./q.)			1052.75	
e.	Benefit Cost Ratio (BC Ratio)			1:1.18	

Cost of cultivation of Pomegranate: The data regarding the cost of cultivation of pomegranate in Adavalli-5 micro-watershed is presented in Table 34. The results indicate that, the total cost of cultivation for pomegranate was Rs. 26582.66. The gross income realized by the farmers was Rs. 84204.54. The net income from pomegranate cultivation was Rs. 57621.89. Thus the benefit cost ratio was found to be 1:3.17.

Table 34. Cost of Cultivation of Pomegranate in Adavalli-5 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1					
1	Hired Human Labour		Man days	56.14	11002.73	41.39
2	Bullock		Pairs/day	2.25	1122.73	4.22
3	Tractor		Hours	4.49	3143.64	11.83
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	56.14	1122.73	4.22
7	FYM		Quintal	22.45	2694.55	10.14
8	Fertilizer + micronutrients		Quintal	2.25	1796.36	6.76
9	Pesticides (PPC)		Kgs / liters	1.12	1122.73	4.22
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	0.02	0.00
14	Land revenue and Taxes			0.00	4.94	0.02
II	Cost B1					
16	Interest on working capital				808.36	3.04
17	Cost B1 = (Cost A1 + sum of 15 and 16)				22818.78	85.84
III	Cost B2					
18	Rental Value of Land				0.00	0.00
19	Cost B2 = (Cost B1 + Rental value)				22818.78	85.84
IV	Cost C1					
20	Family Human Labour			8.98	1347.27	5.07
21	Cost C1 = (Cost B2 + Family Labour)				24166.05	90.91
V	Cost C2					
22	Risk Premium				0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)				24166.05	90.91
VI	Cost C3					
24	Managerial Cost				2416.61	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)				26582.66	100.00
VII	Economics of the Crop					
a.	Main Product	a) Main Product (q)		16.84	84204.54	
		b) Main Crop Sales Price (Rs.)			5000.00	
b.	Gross Income (Rs.)				84204.54	
c.	Net Income (Rs.)				57621.89	
d.	Cost per Quintal (Rs./q.)				1578.46	
e.	Benefit Cost Ratio (BC Ratio)				1:3.17	

Cost of cultivation of Sorghum: The data regarding the cost of cultivation of sorghum in Adavalli-5 micro-watershed is presented in Table 35. The results indicate that, the total cost of cultivation for sorghum was Rs. 24727.79. The gross income realized by the farmers was Rs. 28545.34. The net income from sorghum cultivation was Rs. 3817.56. Thus the benefit cost ratio was found to be 1:1.15.

Table 35. Cost of Cultivation of Sorghum in Adavalli-5 micro-watershed

Sl.No	Particulars		Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1					
1	Hired Human Labour		Man days	14.82	2833.02	11.46
2	Bullock		Pairs/day	2.47	1235.00	4.99
3	Tractor		Hours	3.22	2413.86	9.76
4	Machinery		Hours	0.00	0.00	0.00
5	Seed Main Crop (Establishment and Maintenance)		Kgs (Rs.)	8.68	1041.89	4.21
7	FYM		Quintal	14.97	1796.36	7.26
8	Fertilizer + micronutrients		Quintal	3.22	2627.18	10.62
9	Pesticides (PPC)		Kgs / liters	0.75	748.48	3.03
10	Irrigation		Number	0.00	0.00	0.00
11	Repairs			0.00	0.00	0.00
12	Msc. Charges (Marketing costs etc)			0.00	0.00	0.00
13	Depreciation charges			0.00	3.71	0.02
14	Land revenue and Taxes			0.00	4.94	0.02
II	Cost B1					
16	Interest on working capital				745.67	3.02
17	Cost B1 = (Cost A1 + sum of 15 and 16)				13450.12	54.39
III	Cost B2					
18	Rental Value of Land				433.33	1.75
19	Cost B2 = (Cost B1 + Rental value)				13883.46	56.15
IV	Cost C1					
20	Family Human Labour			41.62	8596.35	34.76
21	Cost C1 = (Cost B2 + Family Labour)				22479.80	90.91
V	Cost C2					
22	Risk Premium				0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)				22479.80	90.91
VI	Cost C3					
24	Managerial Cost				2247.98	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)				24727.79	100.00
VII	Economics of the Crop					
a.	Main Product	a) Main Product (q)		21.14	28545.34	
		b) Main Crop Sales Price (Rs.)			1350.00	
b.	Gross Income (Rs.)				28545.34	
c.	Net Income (Rs.)				3817.56	
d.	Cost per Quintal (Rs./q.)				1169.46	
e.	Benefit Cost Ratio (BC Ratio)				1:1.15	

Cost of cultivation of Sunflower: The data regarding the cost of cultivation of sunflower in Adavalli-5 micro-watershed is presented in Table 36. The results indicate that, the total cost of cultivation for sunflower was Rs. 21407.24. The gross income realized by the farmers was Rs. 22230. The net income from sunflower cultivation was Rs. 822.76. Thus the benefit cost ratio was found to be 1:1.04.

Table 36. Cost of Cultivation of Sunflower in Adavalli-5 micro-watershed

Sl.No	Particulars	Units	Phy Units	Value(Rs.)	% to C3
I	Cost A1				
1	Hired Human Labour	Man days	30.42	5431.51	20.74
2	Bullock	Pairs/day	0.77	383.60	1.46
3	Tractor	Hours	3.01	2255.10	8.61
4	Machinery	Hours	0.14	102.92	0.39
5	Seed Main Crop (Establishment and Maintenance)	Kgs (Rs.)	8.96	4033.24	15.40
7	FYM	Quintal	17.22	2065.82	7.89
8	Fertilizer + micronutrients	Quintal	1.68	1644.08	6.28
9	Pesticides (PPC)	Kgs / liters	1.12	1117.13	4.27
10	Irrigation	Number	3.09	0.00	0.00
12	Msc. Charges (Marketing costs etc)		0.00	0.00	0.00
13	Depreciation charges		0.00	12.98	0.05
14	Land revenue and Taxes		0.00	5.21	0.02
II	Cost B1				
16	Interest on working capital			1063.23	4.06
17	Cost B1 = (Cost A1 + sum of 15 and 16)			18114.82	69.18
III	Cost B2				
18	Rental Value of Land			438.89	1.68
19	Cost B2 = (Cost B1 + Rental value)			18553.71	70.86
IV	Cost C1				
20	Family Human Labour		25.46	5250.70	20.05
21	Cost C1 = (Cost B2 + Family Labour)			23804.41	90.91
V	Cost C2				
22	Risk Premium			0.00	0.00
23	Cost C2 = (Cost C1 + Risk Premium)			23804.41	90.91
VI	Cost C3				
24	Managerial Cost			2380.44	9.09
25	Cost C3 = (Cost C2 + Managerial Cost)			26184.85	100.00
VII	Economics of the Crop				
a.	Main Product	a) Main Product (q)	14.83	61811.68	
		b) Main Crop Sales Price (Rs.)		4166.67	
b.	Gross Income (Rs.)			61811.68	
c.	Net Income (Rs.)			35626.83	
d.	Cost per Quintal (Rs./q.)			1765.10	
e.	Benefit Cost Ratio (BC Ratio)			1:2.36	

Adequacy of fodder: The data regarding the adequacy of fodder in Adavalli-5 micro-watershed is presented in Table 37. The results indicate that, 11.76 per cent of the households opined that dry fodder was adequate, 17.65 per cent of the households opined that green fodder was adequate and dry fodder was inadequate for 5.88 per cent of the households.

Table 37. Adequacy of fodder in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Adequate-Dry Fodder	0	0.00	3	20.00	1	10.00	0	0.00	0	0.00	4	11.76
2	Inadequate-Dry Fodder	0	0.00	0	0.00	1	10.00	0	0.00	1	100.00	2	5.88
3	Adequate-Green Fodder	0	0.00	3	20.00	2	20.00	0	0.00	1	100.00	6	17.65

Annual gross income: The data regarding the annual gross income in Adavalli-5 micro-watershed is presented in Table 38. The results indicate that the annual gross income was for marginal farmers it was Rs. 56,037.50, for small farmers it was Rs. 121,760.00, for semi medium farmers it was Rs. 163,420.00, for medium farmers it was Rs. 166,250.25 and for large farmers it was Rs. 602,800.00.

Table 38. Annual gross income in Adavalli-5 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Service/salary	0.00	20,000.00	0.00	0.00	0.00	8,823.53
3	Wage	18,000.00	24,800.00	33,000.00	57,500.25	0.00	29,529.44
4	Agriculture	22,037.50	67,493.33	108,620.00	108,750.00	602,800.00	94,839.71
5	Non Farm income	6,000.00	2,800.00	19,800.00	0.00	0.00	7,764.71
6	Dairy Farm	10,000.00	6,666.67	2,000.00	0.00	0.00	4,705.88
	Income(Rs.)	56,037.50	121,760.00	163,420.00	166,250.25	602,800.00	145,663.26

Average annual expenditure: The data regarding the average annual expenditure in Adavalli-5 micro-watershed is presented in Table 39. The results indicate that the average annual expenditure is Rs. 602,800.00. For marginal farmers it was Rs 3,312.50, for small farmers it was Rs. 6,964.44, for semi medium farmers it was Rs. 3,770.00, for medium farmers it was Rs. 10,625.00 and for large farmers it was Rs. 225,000.00.

Table 39. Average annual expenditure in Adavalli-5 micro-watershed

(Avg value in Rs.)

Sl.No.	Particulars	MF (4)	SF (15)	SMF (10)	MDF (4)	LF (1)	All (34)
1	Service/salary	0.00	25,000.00	0.00	0.00	0.00	1,470.59
2	Agriculture	8,250.00	29,466.67	37,700.00	42,500.00	225,000.00	36,676.47
3	Dairy Farm	5,000.00	50,000.00	0.00	0.00	0.00	1,617.65
	Total	13,250.00	104,466.67	37,700.00	42,500.00	225,000.00	422,916.67
	Average	3,312.50	6,964.44	3,770.00	10,625.00	225,000.00	12,438.73

Horticulture species grown: The data regarding horticulture species grown in Adavalli-5 micro-watershed is presented in Table 40. The results indicate that, sampled households have grown 4 coconut trees and 20 mango trees in their field.

Table 40. Horticulture species grown in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Coconut	0	0	2	0	0	0	2	0	0	0	4	0
2	Mango	0	0	0	0	0	0	20	0	0	0	20	0

*F= Field B=Back Yard

Forest species grown: The data regarding forest species grown in Adavalli-5 micro-watershed is presented in Table 41. The results indicate that, households have planted 51 neem and 4 banyan trees in their field and 13 neem trees and 1 neem and 1 peepul tree in their backyard.

Table 41: Forest species grown in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		F	B	F	B	F	B	F	B	F	B	F	B
1	Neem	6	0	15	1	23	0	7	0	0	0	51	1
2	Banyan	0	0	2	0	1	0	0	0	1	0	4	0
3	Peepul Tree	0	0	0	1	0	0	0	0	0	0	0	1

*F= Field B=Back Yard

Marketing of the agricultural produce: The data regarding marketing of the agricultural produce in Adavalli-5 micro-watershed is presented in Table 42. The results indicated that, bajra, Bengal gram, cotton, horse gram, jowar, sorghum and sunflower was sold to the extent of 100 per cent, green gram was sold to the extent of 99.26 per cent, groundnut was sold to the extent of 97.5 per cent, maize was sold to the extent of 97.2 per cent and pomegranate was sold to the extent of 93.33 per cent.

Table 42. Marketing of the agricultural produce in Adavalli-5 micro-watershed

Sl.No	Crops	Output obtained (q)	Output retained (q)	Output sold (q)	Output sold (%)	Avg. Price obtained (Rs/q)
1	Bajra	60.0	0.0	60.0	100.0	1400.0
2	Bengal gram	169.0	0.0	169.0	100.0	4860.0
3	Cotton	18.0	0.0	18.0	100.0	3750.0
4	Green gram	136.0	1.0	135.0	99.26	4528.57
5	Groundnut	40.0	1.0	39.0	97.5	3750.0
6	Horse gram	12.0	0.0	12.0	100.0	3000.0
7	Jowar	130.0	0.0	130.0	100.0	1800.0
8	Maize	322.0	9.0	313.0	97.2	1225.0
9	Pomegranate	15.0	1.0	14.0	93.33	5000.0
10	Sorghum	45.0	0.0	45.0	100.0	1350.0
11	Sunflower	102.0	0.0	102.0	100.0	4166.67

Marketing Channels used for sale of agricultural produce: The data regarding marketing channels used for sale of agricultural produce in Adavalli-5 micro-watershed is presented in Table 43. The results indicated that, about 88.24 per cent of the farmers sold their produce to local/village merchants, 23.53 per cent of the farmers sold their produce

to regulated market and 5.88 per cent of them sold their produce through contract marketing arrangement.

Table 43. Marketing Channels used for sale of agricultural produce in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Local/village merchant	3	75.00	15	100.00	7	70.00	5	125.00	0	0.00	30	88.24
2	Regulated Market	1	25.00	2	13.33	5	50.00	0	0.00	0	0.00	8	23.53
3	Contract marketing arrangement	0	0.00	1	6.67	0	0.00	0	0.00	1	100.00	2	5.88

Mode of transport of agricultural produce: The data regarding mode of transport of agricultural produce in Adavalli-5 micro-watershed is presented in Table 44. The results indicated that 120.59 per cent of the households used tractor as a mode of transportation for their agricultural produce.

Table 44. Mode of transport of agricultural produce in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Tractor	4	100.00	18	120.00	12	120.00	5	125.00	2	200.00	41	120.59

Incidence of soil and water erosion problems: The data regarding incidence of soil and water erosion problems in Adavalli-5 micro-watershed is presented in Table 45. The results indicated that, 79.41per cent of the households have experienced soil and water erosion problems in the farm.

Table 45. Incidence of soil and water erosion problems in Adavalli-5 micro-watershed

Sl. No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%
1	Soil and water erosion problems in the farm	3	75.00	13	86.67	7	70.00	4	100.00	27	79.41

Interest shown towards soil testing: The data regarding Interest shown towards soil testing in Adavalli-5 micro-watershed is presented in Table 46. The results indicated that, 70.59 per cent have shown interest in soil test.

Table 46. Interest shown towards soil testing in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		All (34)	
		N	%	N	%	N	%	N	%	N	%
1	Interest in soil test	2	50.00	12	80.00	6	60.00	4	100.0	24	70.59

Usage pattern of fuel for domestic use: The data regarding usage pattern of fuel for domestic use in Adavalli-5 micro-watershed is presented in Table 47. The results indicated that, 76.47 per cent of the households used firewood and 23.53 per cent of the households used firewood as a source of fuel.

Table 47. Usage pattern of fuel for domestic use in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Fire Wood	4	100.00	12	80.00	7	70.00	3	75.00	0	0.00	26	76.47
2	LPG	0	0.00	3	20.00	3	30.00	1	25.00	1	100.00	8	23.53

Source of drinking water: The data regarding source of drinking water in Adavalli-5 micro-watershed is presented in Table 48. The results indicated that, piped supply was the major source of drinking water for 61.76 per cent of the households, bore well was the source of drinking water for 17.14 per cent and lake/tank was the major source of drinking water for 2.94 per cent of the households in micro watershed.

Table 48. Source of drinking water in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Piped supply	3	75.00	12	80.00	6	60.00	4	100.00	0	0.00	25	73.53
2	Bore Well	1	25.00	3	20.00	4	40.00	0	0.00	1	100.00	9	26.47

Source of light: The data regarding source of light in Adavalli-5 micro-watershed is presented in Table 49. The results indicated that, Electricity was the major source of light for 100 per cent of the households in micro watershed.

Table 49. Source of light in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Electricity	4	100.00	14	100.00	10	100.00	5	125.00	1	100.00	34	100.00

Existence of Sanitary toilet facility: The data regarding existence of sanitary toilet facility in Adavalli-5 micro-watershed is presented in Table 50. The results indicated that, 32.35 per cent of the households possess sanitary toilet facility.

Table 50. Existence of Sanitary toilet facility in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Sanitary toilet facility	2	50.00	3	20.00	3	30.00	2	50.00	1	100.00	11	32.35

Possession of PDS card: The data regarding possession of PDS card in Adavalli-5 micro-watershed is presented in Table 51. The results indicated that, 5.88 per cent of the sampled households possessed APL, 94.12 per cent of the sampled households possessed BPL card and 2.94 per cent of the households did not possess PDS card.

Table 51. Possession of PDS card in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	APL	0	0.00	0	0.00	1	10.00	0	0.00	1	100.00	2	5.88
2	BPL	4	100.00	14	93.33	9	90.00	5	125.00	0	0.00	32	94.12
3	Not Possessed	0	0.00	1	6.67	0	0.00	0	0.00	0	0.00	1	2.94

Participation in NREGA program: The data regarding participation in NREGA programme in Adavalli-5 micro-watershed is presented in Table 52. The results indicated that, 44.12 per cent of the households participated in NREGA programme.

Table 52. Participation in NREGA programme in Adavalli-5 micro-watershed

Sl. No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Participation in NREGA programme	2	50.00	5	33.33	2	20.00	5	125.00	1	100.00	15	44.12

Adequacy of food items: The data regarding adequacy of food items in Adavalli-5 micro-watershed is presented in Table 53. The results indicated that, cereals were adequate for 97.06 per cent of the households, pulses were adequate for 79.41 per cent, oilseeds were adequate for 17.65 per cent, and vegetables were adequate for 61.76 per cent and milk were adequate for 76.47 per cent.

Table 53. Adequacy of food items in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	4	100.00	14	93.33	10	100.00	4	100.00	1	100.00	33	97.06
2	Pulses	3	75.00	14	93.33	6	60.00	4	100.00	0	0.00	27	79.41
3	Oilseed	0	0.00	5	33.33	1	10.00	0	0.00	0	0.00	6	17.65
4	Vegetables	3	75.00	9	60.00	5	50.00	4	100.00	0	0.00	21	61.76
6	Milk	3	75.00	13	86.67	5	50.00	4	100.00	1	100.00	26	76.47

Response on Inadequacy of food items: The data regarding inadequacy of food items in Adavalli-5 micro-watershed is presented in Table 54. The results indicated that, cereals were inadequate for 2.94 per cent of the households, pulses were inadequate for 23.53 per cent of the households, oilseeds were inadequate for 52.94 per cent, vegetables were inadequate for 11.76 per cent, fruits were inadequate for 82.35 per cent, milk was inadequate for 17.65 per cent, eggs were inadequate for 94.12 per cent and meat was inadequate for 76.47 per cent of the households.

Table 54. Response on Inadequacy of food items in Adavalli-5 micro-watershed

Sl.No.	Particulars	MF (4)		SF (15)		SMF (10)		MDF (4)		LF (1)		All (34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Cereals	0	0.00	1	6.67	0	0.00	0	0.00	0	0.00	1	2.94
2	Pulses	1	25.00	2	13.33	4	40.00	0	0.00	1	100.00	8	23.53
3	Oilseed	3	75.00	6	40.00	5	50.00	4	100.00	0	0.00	18	52.94
4	Vegetables	0	0.00	3	20.00	1	10.00	0	0.00	0	0.00	4	11.76
5	Fruits	4	100.00	13	86.67	7	70.00	4	100.00	0	0.00	28	82.35
6	Milk	1	25.00	2	13.33	3	30.00	0	0.00	0	0.00	6	17.65
7	Egg	3	75.00	14	93.33	10	100.00	4	100.00	1	100.00	32	94.12
8	Meat	3	75.00	13	86.67	6	60.00	4	100.00	0	0.00	26	76.47

Farming constraints: The data regarding farming constraints experienced by households in Adavalli-5 micro-watershed is presented in Table 55. The results indicated that, lower fertility status of the soil was the constraint experienced by 73.53 per cent of the

households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (100%), inadequacy of irrigation water (14.71%), high cost of fertilizers and plant protection chemicals (82.35%), high rate of interest on credit (79.41%), low price for the agricultural commodities (67.65%), lack of marketing facilities in the area (73.53%) and lack of transport for safe transport of the agricultural produce to the market (67.65%).

Table 55. Farming constraints Experienced in Adavalli-5 micro-watershed

Sl. No.	Particulars	MF(4)		SF(15)		SMF(10)		MDF(4)		LF(1)		All(34)	
		N	%	N	%	N	%	N	%	N	%	N	%
1	Lower fertility status of the soil	3	75	12	80	6	60	4	100	0	0	25	73.53
2	Wild animal menace on farm field	3	75	12	80	8	80	4	100	0	0	27	79.41
3	Frequent incidence of pest and diseases	4	100	15	100	10	100	4	100	1	100	34	100
4	Inadequacy of irrigation water	1	25	1	6.67	1	10	2	50	0	0	5	14.71
5	High cost of Fertilizers and plant protection chemicals	3	75	13	86.67	7	70	4	100	1	100	28	82.35
6	High rate of interest on credit	4	100	13	86.67	6	60	4	100	0	0	27	79.41
7	Low price for the agricultural commodities	2	50	10	66.67	7	70	4	100	0	0	23	67.65
8	Lack of marketing facilities in the area	3	75	13	86.67	6	60	3	75	0	0	25	73.53
10	Lack of transport for safe transport of the Agril produce to the market.	3	75	11	73.33	6	60	2	50	1	100	23	67.65

SUMMARY

In order to assess the socio-economic condition of the farmers in the watershed a comprehensive questionnaire was prepared. Major components such as demographic conditions, migration details, food consumption and family expenditure pattern, material possession, land holding, land use management, cropping pattern, cost of cultivation of crops, livestock management. The statistical components such as frequency and percentage were used to analyse the data. About 34 households located in the micro watershed were interviewed for the survey.

The data indicated that there were 73 (47.40%) men, 78 (50.65%) women and others 3(1.95%) among the sampled households. The average family size of marginal farmers' was 4.5, small farmers' was 5.06, semi medium farmers' was 3.6, medium farmers' was 5.25 and large farmers' was 3. The data indicated that, 22(14.29%) people were in 0-15 years of age, 66 (42.86%) were in 16-35 years of age, 48 (31.17%) were in 36-60 years of age and 18 (11.69%) were above 61 years of age.

The results indicated that Adavalli-5 had 28.57 per cent illiterates, 21.43 per cent of them had primary school education, 6.49 per cent of them had middle school education, 14.94 per cent of them had high school education, 11.04 per cent of them had PUC education, 0.65 per cent had diploma and ITI, 11.04 per cent of them had degree education and 2.60 per cent of them did Masters.

The results indicate that, 52.95 per cent of household heads were practicing agriculture, 29.41 per cent of the household heads were agricultural labourers and 5.88 per cent of the household heads were government service. The results indicate that agriculture was the major occupation for 48.70 per cent of the household members, 22.08 per cent were agricultural labourers, 0.65 per cent were in trade and business, 23.38 per cent were students and 0.65 per cent were housewives.

The results show that, 0.65 per cent of the households participated in raitha sangha and 99.54 per cent of the population in the micro watershed has not participated in any local institutions. The results indicate that 5.88 per cent of the households possess thatched house, 85.29 per cent of the households possess katcha house and 8.82 per cent of them possess pucca/RCC house.

The results show that 58.82 per cent of the households possess TV, 35.29 per cent of them possess mixer/grinder, 11.76 per cent of the households possess motor cycle, 41.18 per cent of the households possess motor cycle and 94.12 per cent of the households possess mobile phones. The results show that the average value of television was Rs 4,150, mixer grinder was Rs 1,183, bicycle was Rs 800 motor cycle was Rs. 30.928 and mobile phone was Rs. 2,615.

About 8.82 per cent of the households possess bullock cart, 11.76 per cent of them possess plough, 2.94 per cent possess tractor, thresher and earth mover/duster, 5.88 per cent of them possess sprayer and sprinkler, 44.12 per cent of them possess weeder and 29.41 per cent of them possess chaff cutter. The results show that the average value of bullock cart was Rs. 17,666, plough was Rs. 1,000, tractor was Rs 300,000, sprayer was Rs. 2,450, average value of sprinkler was 100, average value of weeder was 72, average value of thresher was 506, average value of chaff cutter was 559 and the average value of earth mover/duster was Rs. 15,000.

The results indicate that, 11.76 per cent of the households possess bullocks, 8.82 per cent of the households possess local cow and 2.94 per cent possess crossbreed cow, buffalo and poultry birds.

The results indicate that, average own labour men available in the micro watershed was 1.61, average own labour (women) available was 1.50, average hired labour (men) available was 7.15 and average hired labour (women) available was 7.94. The results indicate that, 73.53 per cent of the households opined that the hired labour was adequate and 26.47 per cent of the households opined that the hired labour was inadequate.

The results indicate that, households of the Adavalli-5 micro-watershed possess 57.49 ha (83.93%) of dry land and 11 ha (16.07%) of irrigated land. Marginal farmers possess 2.40 ha (100%) of dry land. Small farmers possess 18.65 ha (88.48%) of dry land and 2.43 ha (11.52%) of irrigated land. Semi medium farmers possess 22.22 ha (94.39%) of dry land and 1.32 ha (5.61%) of irrigated land. Medium farmers possess 4.09 ha (36.03%) of dry land and 7.26 ha (63.97%) of irrigated land. Large farmers possess 10.13 ha (100%) of dry land.

The results indicate that, the average value of dry land was Rs. 182,576.56 and the average value of irrigated land was Rs. 408,789.99. In case of marginal famers, the average land value was Rs. 666,441.81 for dry land. In case of small famers, the average land value was Rs. 246,517.69 for dry land and Rs. 741,000.00 for irrigated land. In case of semi medium famers, the average land value was Rs. 161,967.21 for dry land and Rs. 227,300.61 for irrigated land. In case of medium farmers, the average land value was Rs. 73,366.33 for dry land and Rs. 330,619.07 for irrigated land. In case of large farmers it was Rs 39,472.63 for dry land.

The results indicate that, there were 7 functioning bore wells in the micro watershed. The results indicate that, bore well was the major irrigation source in the micro water shed for 20.59 per cent of the farmers. The results indicate that, the depth of bore well was found to be 11.43 meters.

The results indicate that small, semi medium and medium had an irrigated area of 4.06 ha, 3.24 ha and 1.21 ha respectively. The results indicate that, farmers have grown bajra (3.36 ha), bengal gram (0.81 ha), cotton (0.89 ha), green gram (15.97 ha),

groundnut (2.17 ha), Horse gram (1.67 ha), maize (7.01 ha), sorghum (4.22 ha), sunflower (7.60 ha), pomegranate (0.89 ha) and jowar (7.83 ha). Marginal farmers have grown groundnut and maize while small farmers have grown bajra, Bengal gram green gram, groundnut, horse gram, maize, sorghum, sunflower, cotton and jowar. Semi medium farmers have grown green gram, groundnut, maize, sunflower and pomegranate. Medium farmers have grown cotton, green gram, maize, sunflower and pomegranate. Large farmers have grown jowar. The results indicate that, the cropping intensity in Adavalli-5 micro-watershed was found to be 81.80 per cent.

The results indicate that, 38.24 per cent of the households have bank account. . The results indicate that, 38.24 per cent of the households have availed credit from different sources.

The results indicate that, the total cost of cultivation for bajra was Rs. 13110.34. The gross income realized by the farmers was Rs. 25061.46. The net income from maize cultivation was Rs 11951.13. Thus the benefit cost ratio was found to be 1:1.91. The total cost of cultivation for bengal gram was Rs. 31192.45. The gross income realized by the farmers was Rs. 54915.52. The net income from green gram cultivation was Rs. 23723.07. Thus the benefit cost ratio was found to be 1:1.76. The total cost of cultivation for cotton was Rs. 32022.31. The gross income realized by the farmers was Rs. 26629.69. The net income from mango cultivation was Rs. -5392.62. Thus the benefit cost ratio was found to be 1:0.83. The the total cost of cultivation for green gram was Rs. 17421.11. The gross income realized by the farmers was Rs. 39313.81. The net income from green gram cultivation was Rs. 21892.70. Thus the benefit cost ratio was found to be 1:2.26. The the total cost of cultivation for groundnut was Rs. 31511.38. The gross income realized by the farmers was Rs. 70731.82. The net income from groundnut cultivation was Rs. 39220.44. Thus the benefit cost ratio was found to be 1:2.24. The total cost of cultivation for horse gram was Rs. 18216.86. The gross income realized by the farmers was Rs. 21582.52. The net income from horse gram cultivation was Rs. 3365.67. Thus the benefit cost ratio was found to be 1:1.18. The total cost of cultivation for jowar was Rs. 34849.05. The gross income realized by the farmers was Rs. 41202.04. The net income from jowar cultivation was Rs. 6352.99. Thus the benefit cost ratio was found to be 1:1.18. The total cost of cultivation for maize was Rs. 31245.23. The gross income realized by the farmers was Rs. 36920.20. The net income from maize cultivation was Rs. 5674.97. Thus the benefit cost ratio was found to be 1:1.18. The total cost of cultivation for pomegranate was Rs. 26582.66. The gross income realized by the farmers was Rs. 84204.54. The net income from pomegranate cultivation was Rs. 57621.89. Thus the benefit cost ratio was found to be 1:3.17. The total cost of cultivation for sorghum was Rs. 24727.79. The gross income realized by the farmers was Rs. 28545.34. The net income from sorghum cultivation was Rs. 3817.56. Thus the benefit cost ratio was found to be 1:1.15. The total cost of cultivation for sunflower was Rs. 21407.24. The gross

income realized by the farmers was Rs. 22230. The net income from sunflower cultivation was Rs. 822.76. Thus the benefit cost ratio was found to be 1:1.04.

The results indicate that, 11.76 per cent of the households opined that dry fodder was adequate, 17.65 per cent of the households opined that green fodder was adequate and dry fodder was inadequate for 5.88 per cent of the households.

The results indicate that the annual gross income was for marginal farmers it was Rs. 56,037.50, for small farmers it was Rs. 121,760.00, for semi medium farmers it was Rs. 163,420.00, for medium farmers it was Rs. 166,250.25 and for large farmers it was Rs. 602,800.00. The results indicate that the average annual expenditure is Rs. 602,800.00. For marginal farmers it was Rs 3,312.50, for small farmers it was Rs. 6,964.44, for semi medium farmers it was Rs. 3,770.00, for medium farmers it was Rs. 10,625.00 and for large farmers it was Rs. 225,000.00.

The results indicate that, sampled households have grown 4 coconut trees and 20 mango trees in their field. The results indicate that, households have planted 51 neem and 4 banyan trees in their field and 13 neem trees and 1 neem and 1 peepul tree in their backyard.

The results indicated that, bajra, Bengal gram, cotton, horse gram, jowar, sorghum and sunflower was sold to the extent of 100 per cent, green gram was sold to the extent of 99.26 per cent, groundnut was sold to the extent of 97.5 per cent, maize was sold to the extent of 97.2 per cent and pomegranate was sold to the extent of 93.33 per cent.

The results indicated that, about 88.24 per cent of the farmers sold their produce to local/village merchants, 23.53 per cent of the farmers sold their produce to regulated market and 5.88 per cent of them sold their produce through contract marketing arrangement.

The results indicated that 120.59 per cent of the households used tractor as a mode of transportation for their agricultural produce.

The results indicated that, 79.41 per cent of the households have experienced soil and water erosion problems in the farm. The results indicated that, 70.59 per cent have shown interest in soil test.

The results indicated that, 76.47 per cent of the households used firewood and 23.53 per cent of the households used firewood as a source of fuel. The results indicated that, piped supply was the major source of drinking water for 61.76 per cent of the households, bore well was the source of drinking water for 17.14 per cent and lake/tank was the major source of drinking water for 2.94 per cent of the households in micro watershed.

Electricity was the major source of light for 100 per cent of the households in micro watershed. The results indicated that, 32.35 per cent of the households possess

sanitary toilet facility. The results indicated that, 5.88 per cent of the sampled households possessed APL, 94.12 per cent of the sampled households possessed BPL card and 2.94 per cent of the households did not possess PDS card. The results indicated that, 44.12 per cent of the households participated in NREGA programme.

The results indicated that, cereals were adequate for 97.06 per cent of the households, pulses were adequate for 79.41 per cent, oilseeds were adequate for 17.65 per cent, and vegetables were adequate for 61.76 per cent and milk were adequate for 76.47 per cent.

The results indicated that, cereals were inadequate for 2.94 per cent of the households, pulses were inadequate for 23.53 per cent of the households, oilseeds were inadequate for 52.94 per cent, vegetables were inadequate for 11.76 per cent, fruits were inadequate for 82.35 per cent, milk was inadequate for 17.65 per cent, eggs were inadequate for 94.12 per cent and meat was inadequate for 76.47 per cent of the households.

The results indicated that, lower fertility status of the soil was the constraint experienced by 73.53 per cent of the households, wild animal menace on farm field (79.41%), frequent incidence of pest and diseases (100%), inadequacy of irrigation water (14.71%), high cost of fertilizers and plant protection chemicals (82.35%), high rate of interest on credit (79.41%), low price for the agricultural commodities (67.65%), lack of marketing facilities in the area (73.53%) and lack of transport for safe transport of the agricultural produce to the market (67.65%).