



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(2): 160-172

© 2019 IJCS

Received: 01-01-2019

Accepted: 05-02-2019

**Rajesh NL**Department of Soil Science, UAS  
Raichur, Karnataka, India**Rajesh V**Department of Soil Science, UAS  
Raichur, Karnataka, India**Meenkshi R Bai**Department of Soil Science, UAS  
Raichur, Karnataka, India**Sathishkumar U**Department of SWE, CAE, UAS,  
Raichur, Karnataka, India**HV Rudramurthy**Department of Soil Science, UAS  
Raichur, Karnataka, India**RB Hiremat**Department of Soil Science, UAS  
Raichur, Karnataka, India

## Land evaluation of Adavibhavi micro-watershed to derive land capability and its suitability for field crops and horticulture crops

**Rajesh NL, Rajesh V, Meenkshi R Bai, Sathishkumar U, HV Rudramurthy and RB Hiremat**

### Abstract

A detailed study was conducted to assess the land capability and land suitability of Adavibhavi micro watershed. The micro watershed is located in Lingasugur taluk, Raichur district, Karnataka, India, which lies between the latitude and longitude of 16° 9' - 16° 8' North and 76° 27' - 76° 29' East. Initially, land resource survey was carried out at 1:8000 scale to derive soil phase units based on land surface and profile characters. Three soil series were identified and further mapped into nine soil phases units were identified. The soil phase unit "ADBhD2g1S1R1" covered maximum area of 154 ha (30.44%) with moderate slope (5-10%) and moderate erosion in Adavibhavi micro-watershed. Land capability with subclasses in the study area was III<sub>es</sub> and IV<sub>es</sub> having limitations of soil erosion, texture, soil drainage, soil fertility and topography. Suitability for agricultural crops showed that, an area of 259 ha (52.80%) was moderately suitable (S2) for Green gram, Ragi, Bengal gram and Black gram with limitation to topography and texture. In case of horticultural crops, about 312 ha (61.60 %) was marginally suitable (S3) for Custard Apple and Amla with limitations of rooting condition and topography. Soil phase unit wise crop plan with suitable interventions for field crops, horticultural crops, vegetables, millets and pulses were developed.

**Keywords:** land evaluation, land resource inventory, land capability classification and land suitability

### Introduction

The balance between economic viability and destruction of a nation often depends on how the land resource base is managed. Proper land management cannot be done without land use planning. An essential part of land use planning is land evaluation. Land evaluation is the assessment of the potential of land for alternative uses using systematic comparison of the land use requirements (LURs) with land quality / characteristics (Dent and Young, 1981) [4]. There are several methods of physical land evaluation. These methods aim at assessing land qualities or suitability for a specific land use as conditioned by biophysical parameters (Beek, 1978) [3]. The land resources inventory in the micro watershed for various crops is necessary to choose the right crop and suitable variety for the area. In order to assess, a detailed land resource inventory and its evaluation were undertaken using geospatial technology. The geospatial techniques are essential for the investigation of spatial variations of soil and crop parameters across agricultural fields, which can lead to the efficient implementation of site-specific management systems (Asma Najafian *et al.*, 2012) [2].

Therefore, the study was undertaken to evaluate land capability and crop suitability in relation to land resource characteristics of Adavibhavi micro watershed of North Eastern Dry Zone of Karnataka.

### Materials and Methods

Adavibhavi micro watershed is located (Fig.1) in Raichur taluk of Raichur district, Karnataka state, which lies between the latitude and longitude of 16° 9' - 16° 8' North and 76° 27' - 76° 29' East and having total area of 505.14 hectares. The Adavibhavi micro-watershed is surrounded by Kesararti, Adavibhavi, Rampur and Karadagal villages. The average rainfall of this region is 560 mm. geologically the study area is characterized by granite and gneiss.

The detailed land resource survey (at 1:8000 scale) of the entire micro-watershed was carried out in the year 2016,

**Correspondence****Rajesh NL**Department of Soil Science, UAS  
Raichur, Karnataka, India

with the help of cadastral map overlaid on IRS LISS-IV merged Cartosat-1 imagery having 2.5 m spatial resolution (Fig.2). Rapid traversing was carried out to record soils at varying physiographic position. Based on geology, drainage pattern, surface features, slope characteristics and land use, landforms and soil profile were identified (Soil Survey Staff 1999)<sup>[9]</sup>. Three soil series were identified and further mapped into nine soil phase units and their area distribution and description were mapped in fig.3 (Table 1). Soil morphological characteristics of different soil are shown in table 2. These data have been used to evaluate the land capability classification (Sehgal 1996)<sup>[7]</sup> and land suitability. For various field crops and horticultural crops based on the soil limitations, climatic regimes and land characteristics the suitable interventions with crop plan were developed by NBSS & LUP.

## Results and Discussion

**Land capability classification:** Land capability classification is an interpretive grouping of soils mainly based on the inherent soil characteristics, external land features and environmental factors that limits the use of the land. Soil morphological characteristics of soil units (Table 2) are matched with land capability classification (Sehgal 1996)<sup>[7]</sup>. Based on soil properties, the soils of Adavibhavi micro-watershed of Raichur taluk have been classified into two land capability classes viz., III<sub>es</sub> and IV<sub>es</sub> (Fig. 4). The Adavibhavi series was grouped under IV<sub>es</sub> class which is fairly good land for cultivation. Chatra and Vyakaranal series were grouped under land capability class III<sub>es</sub>. These soils were marginally cultivable lands due to severe limitations of erosion, Slope, texture, soil depth limitations. The area under III<sub>es</sub> and IV<sub>es</sub> was 311 and 154 ha, respectively. Major proportion of the area belongs to class III<sub>es</sub> and least portion of the area belongs to class IV<sub>es</sub>. Similar findings were also reported by (Leelavathi *et al.*, 2009)<sup>[5]</sup>.

**Land suitability for Field crops:** The optimum requirements of a crop are always region specific. Climate and soil-site characteristics play significant role to maximize the crop yields. The soil morphological characteristics from the study area (Table 2) and climatic regimes were matched with land

suitability criteria for different crops (NBSS & LUP staff 1984)<sup>[1]</sup>. The land suitability assessment for field crops in Adavibhavi MWS showed that an area of 267ha (52.80%) was moderately suitable (S2) and 198 ha (39.24%) was marginally (S3) suitable for Green gram, Ragi, Bengal gram and Black gram with limitation to rooting condition, gravel, slope and texture (Fig.8, 9, 14 and 15 respectively). In case of Bajra Groundnut, Redgram, Sorghum and Maize cultivation, 312 ha (52.8%) of major land area was found to be marginally suitable (S3) and remain area 154 ha (30.44%) was not suitable with limitations of rooting condition, texture, slope and gravel (Fig. 5,7,11,12 and 13 respectively). An area about 267 ha was marginally suitable for Bajra and paddy (Fig.6 and 10). Similar findings were also reported by (Rajesh N.L. *et al.*, 2018)<sup>[6]</sup>.

**Land suitability for Horticultural crops:** The suitability assessment for horticultural crops in Adavibhavi MWS showed that an area of 312 ha (61.60 %) was marginally suitable (S3) and 154 ha (30.44%) was currently not suitable (N1) for Custard Apple and Amla with limitations of rooting condition, slope and gravel (Fig. 20 and 26). In case of Mango, Sapota, Jamun, Guava, Jackfruit, Musambi, Lime, Pomogranate and Tamrind covering an area of 465 ha (92.14 %) of the total micro watershed was found to be currently not suitable (N1) due to severe limitations of rooting condition slope, texture and gravel (Fig. 16,17,18,19,21,22,23,24 and 25 respectively).

## Proposed crop plan

Crop plan for field crops and horticulture crops for ADBhD2g1S1R1 soil phase unit has suitable interventions such as, deep and wider size pit for fruit crops, drip irrigation with suitable soil and water conservation measures along with cultivation on raised bunds with mulches along with drip irrigation for vegetables and field crops with crescent bunds. Whereas, CHRhC2g1, CHRhC2g1S1, CHRhC2g1S1R1, VKRhC2g1S1 and VKRhD2g1S1R1 soil phase units has interventions like deep and wider size pit for fruit crops, drip irrigation with suitable soil and water conservation measures and cultivation on raised beds with mulches and drip irrigation for vegetables (Table.3).

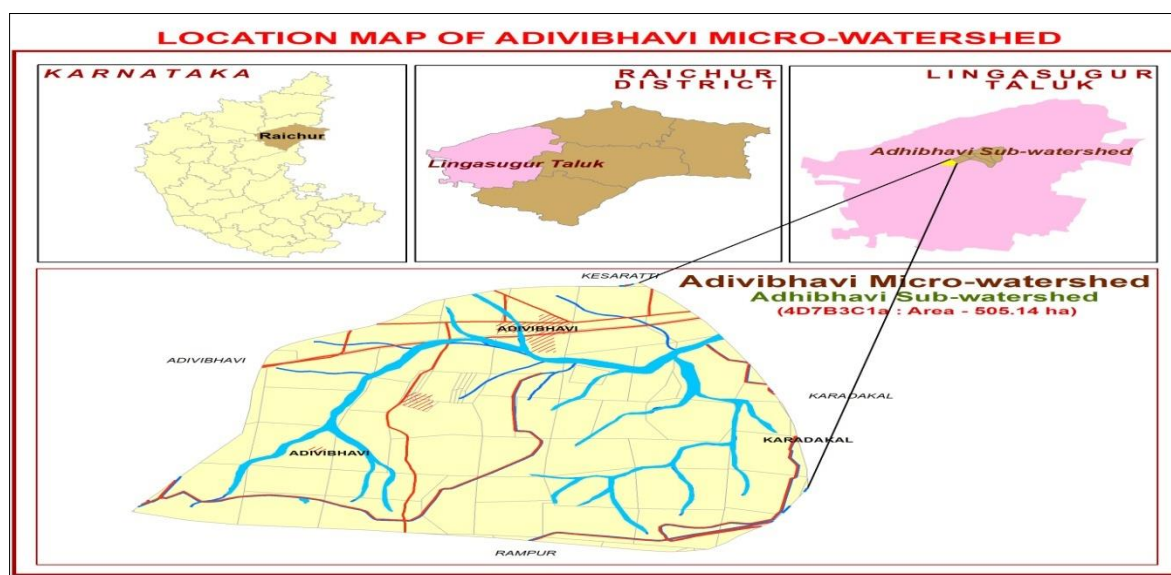


Fig 1: Location map of Adavibhavi micro watershed

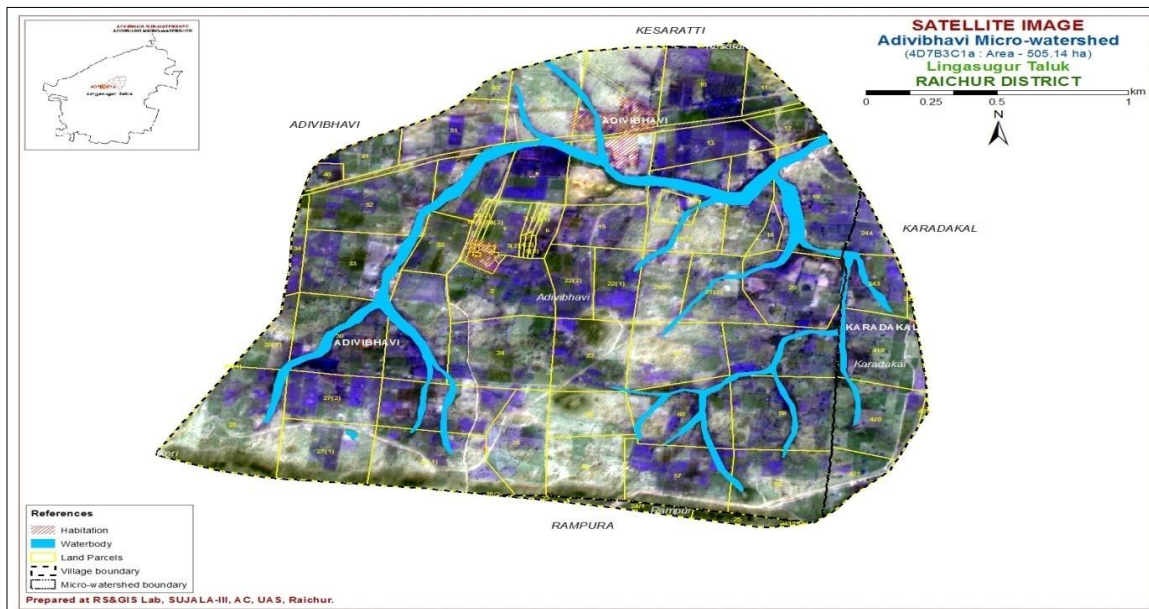


Fig 2: Cadastral map overlaid on Contrast-I merged with LISS IV covered by Adavibhavi micro watershed

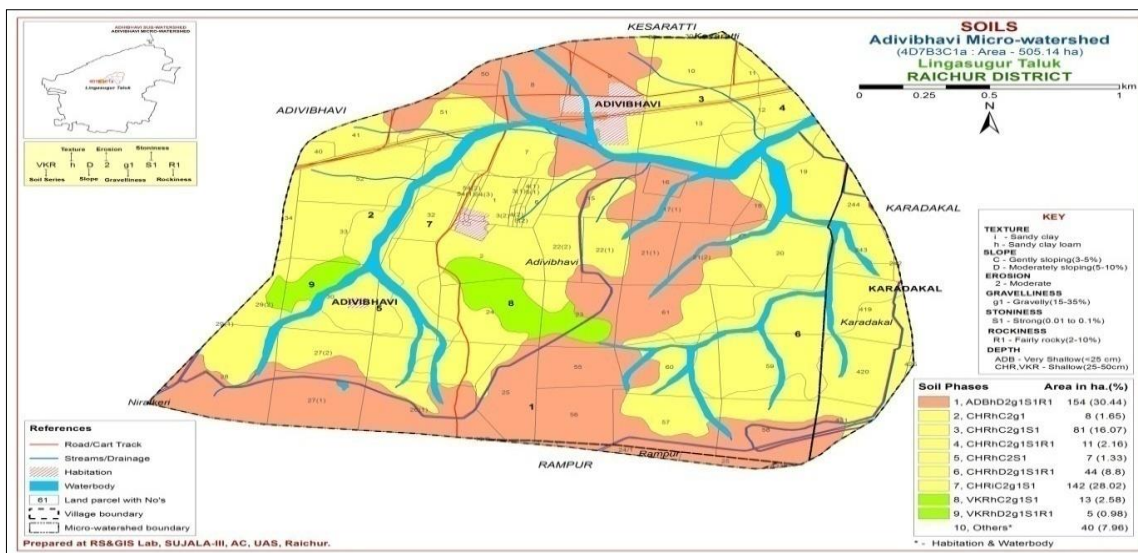


Fig 3: Area distribution of soil phase mapping unit of Adavibhavi micro watershed

Table 1: Area distribution of Adavibhavi micro-watershed and Soil phase unit description

S. No.	Soil Phase unit	Description	Area (ha)
1.	ADBhD2g1S1R1	Adavibhavi series, very shallow (<25 cm) having gravelly (15-35 %), sandy clay loam textured soils occurring on moderately sloping (5-10%) with moderate erosion, strong stoniness (0.01 to 0.1%) and fairly rocky (2-10%).	154 (30.44)
2.	CHRhC2g1	Chatra series, shallow (25-50 cm) having gravelly (15-35%), sandy clay loam textured soils occurring on gently sloping (3-5%) with moderate erosion.	8 (1.65)
3.	CHRhC2g1S1	Chatra series, shallow (25-50 cm) having gravelly (15-35%), sandy clay loam textured soils occurring on gently sloping (3-5%) with moderate erosion and strong stoniness (0.01 to 0.1%).	81 (16.07)
4.	CHRhC2g1S1R1	Chatra series, shallow (25-50 cm) having Gravelly (15-35%), sandy clay loam textured soils occurring on gently sloping (3-5%) with moderate erosion, strong stoniness (0.01 to 0.1%) and fairly rocky (2-10%).	11 (2.16)
5.	CHRhC2S1	Chatra series, shallow (25-50 cm) having sandy clay loam textured soils occurring on gently sloping (3-5%) with moderate erosion and strong stoniness (0.01 to 0.1%).	7 (1.33)
6.	CHRhD2g1S1R1	Chatra series, shallow (25-50 cm) having gravelly (15-35%), sandy clay loam textured soils occurring on Moderately sloping (5-10%) with moderate erosion, strong stoniness (0.01 to 0.1%) and fairly rocky (2-10%).	44 (8.8)
7.	CHRiC2g1S1	Chatra series, shallow (25-50 cm) having Gravelly (15-35%), sandy clay textured soils occurring on gently sloping (3-5%) with moderate erosion and strong stoniness (0.01 to 0.1%).	142 (28.02)
8.	VKRhC2g1S1	Vyakaranal series, shallow (25-50 cm) having gravelly (15-35%), sandy clay loam textured oils occurring on gently sloping (3-5%) with moderate erosion and strong stoniness (0.01 to 0.1%)	13 (2.58)
9.	VKRhD2g1S1R1	Vyakaranal series, shallow (25-50 cm) having gravelly (15-35%), sandy clay loam textured oils occurring on moderately sloping (5-10%) with moderate erosion, strong stoniness (0.01 to 0.1%) and fairly rocky (2-10%).	5 (0.98)
10.	Others*	Habitation & Waterbody	40 (7.96)
Total			505 (100.00)



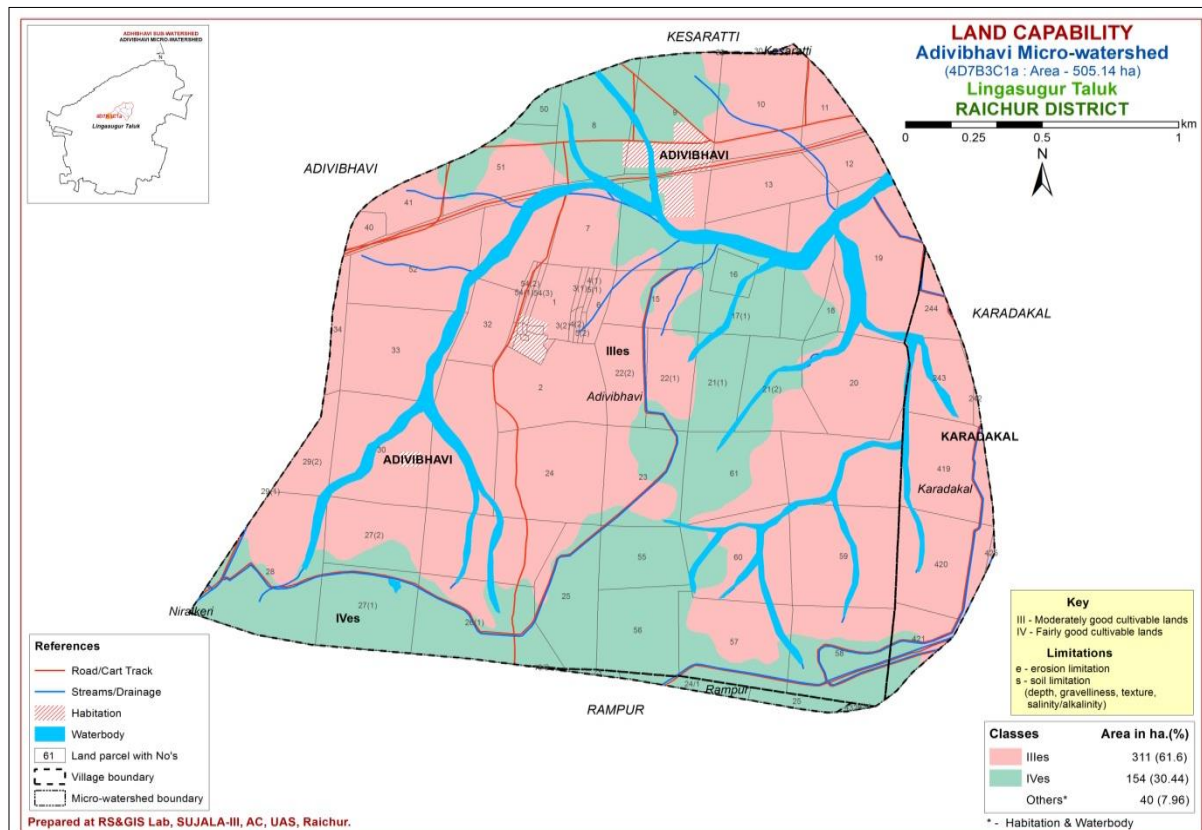


Fig 4: Land capability classification map of Adavibhavi micro watershed

Table 2: Soil Morphological features of Adavibhavi MWS

Name of Soil series	Mapping unit	Geology	Colour		Soil depth (cm)		Slope (%)	Physiography	Texture	
			Surface	Subsurface	Surface	Sub surface			Surface	Sub surface
Adavibhavi	ADBhD2g1S1R1	Granite	7.5YR 4/4 (D) & 3/3 (M)	7.5YR 3/4(D) & 4/3(M)	0-20	20-30	5-10	Mid upland, Upland	Sandy clay loam	Sandy clay loam
Chatra	CHRhC2g1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
	CHRhC2g1S1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
	CHRhC2g1S1R1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
	CHRhC2S1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
	CHRhD2g1S1R1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
	CHRiC2g1S1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-10	20-40	3-5	Mid upland, Upland	Sandy clay	Sandy clay
Vyakarnal	VKRhC2g1S1	Granite	7.5YR 4/4 (D) & 3/3 (M)	7.5YR 3/4(D) & 4/3(M)	0-16	25-50	3-5	Upland	Sandy clay loam	Sandy clay loam
	VKRhD2g1S1R1	Granite	2.5YR 3/4 (D) & 4/3 (M)	2.5YR 4/4(D) & 3/4(M)	0-16	25-50	3-5	Upland	Sandy clay loam	Sandy clay loam

Cont...

Name of Soil series	Mapping units	Structure		Consistency		Effervescences	Gravelliness		Erosion	Rooting size		Stoniness	Drainage
		Surface	Sub surface	Surface	Sub surface		Surface	Sub surface		Surface	Sub-surface		
Adavibhavi	ADBhD2g1S1R1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
Chatra	CHRhC2g1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
	CHRhC2g1S1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
	CHRhC2g1S1R1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained

	CHRhC2S1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
	CHRhD2g1S1R1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
	CHRiC2g1S1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Well drained
Vyakaranal	VKRhC2g1S1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Moderately well
	VKRhD2g1S1R1	1 mabk	2 mabk	sh, fr, ss, sp	sh, fr, ss, sp	Nil	Nil	Nil	Moderate	fc	fc	Strong	Moderately well

Note: sh – slightly hard, fr – friable, ss – slightly sticky, sp – slightly plastic, fi – firm, vs – very sticky, v p – very plastic, h – hard, m – medium, sbk – sub angular blocky, abk-angular bloky, gr-granular, c – coarse, fc – few common roots, f-fine root

Table 3: Proposed crop plan for Adavibhavi micro watershed

Proposed Land Use Class	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	ADBhD2g1S1R1	<b>Adavibhavi:</b> 50,9,8,16,17(1),18,21(1),21(2),61,55,56,25,58,27(1) <b>Rampura:</b> 24/1,25 <b>Karadakal:</b> 421	<b>Sole crop:</b> Sorghum, Bajra, Navni, Red gram, Green gram, Cotton, Maize, Sun flower	<b>Fruit crops:</b> Custard apple, Tamarind, Amla, Ber, and Amla <b>Vegetables:</b> Onion, Tomato, Brinjal, Chilli, Bhendi, Green leaf, Cury leaf, <b>Flowers:</b> Gaillardia, Marigold, Chrysanthemum, Lilly	Deep and wider size pit, drip irrigation with suitable soil and water conservation measures, cultivation on raised bunds with mulches and drip. Soil and land manage needs with Crescent bunds
2	CHRhC2g1S1R1	<b>Adavibhavi:</b> 40,41,51,52,7,34,33,32,29(2),29(1),27(2),24,54(2),54(1),54(3),1,3(1),4(1),22(2),22(1),60,57,59,20,19,12,13,10,11 <b>Kesaratti:</b> 30 <b>Karadakal:</b> 420,425,419,243,244,242	<b>Sole crop:</b> Sorghum, Bajra, Navni, Red gram, Green gram, Cotton, Maize, Sun flower, Black gram, Bengal gram, Ground nut, Maize	<b>Fruit crops:</b> Custard apple, Tamarind, Amla, Ber, and Amla <b>Vegetables:</b> Onion, Tomato, Brinjal, Chilli, Bhendi, Green leaf, Cury leaf, <b>Flowers:</b> Gaillardia, Marigold, Chrysanthemum, Lilly	Deep and wider size pit, Drip irrigation with suitable soil and water conservation measures. Cultivation on raised beds with mulches and drip.
3	VKRhC2g1S1R1	-	<b>Sole crop:</b> Sorghum, Bajra, Navni, Red gram, Green gram, Cotton, Maize, Sun flower, Black gram, Bengal gram, Ground nut, Maize	<b>Fruit crops:</b> Custard apple, Tamarind, Amla, Ber, and Amla <b>Vegetables:</b> Onion, Tomato, Brinjal, Chilli, Bhendi, Green leaf, Cury leaf, <b>Flowers:</b> Gaillardia, Marigold, Chrysanthemum, Lilly	

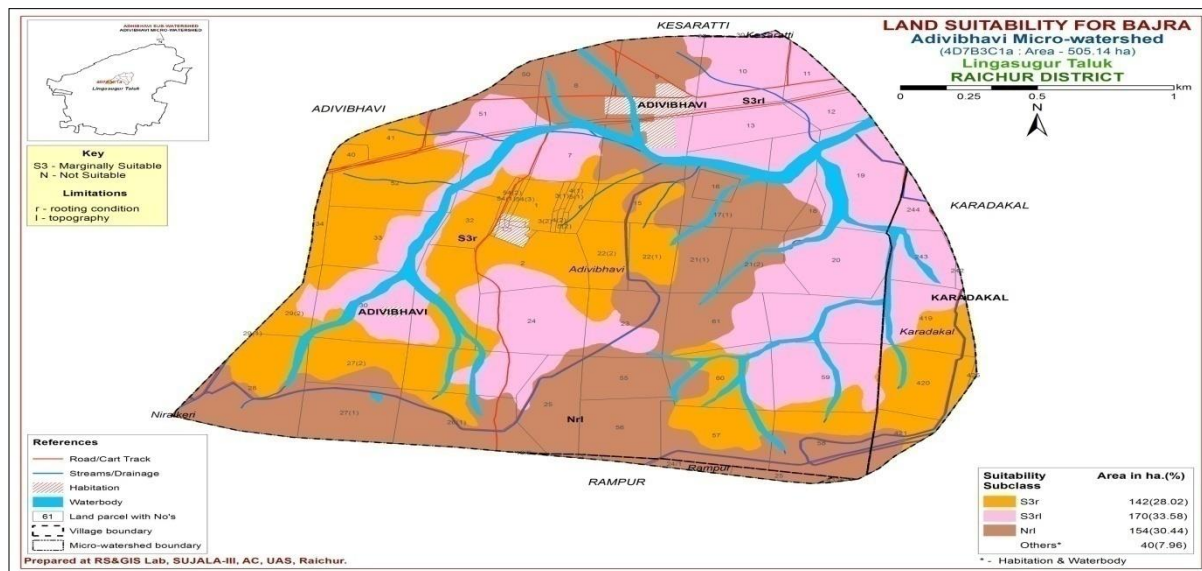


Fig 5: Land suitability map for Bajra in Adavibhavi village

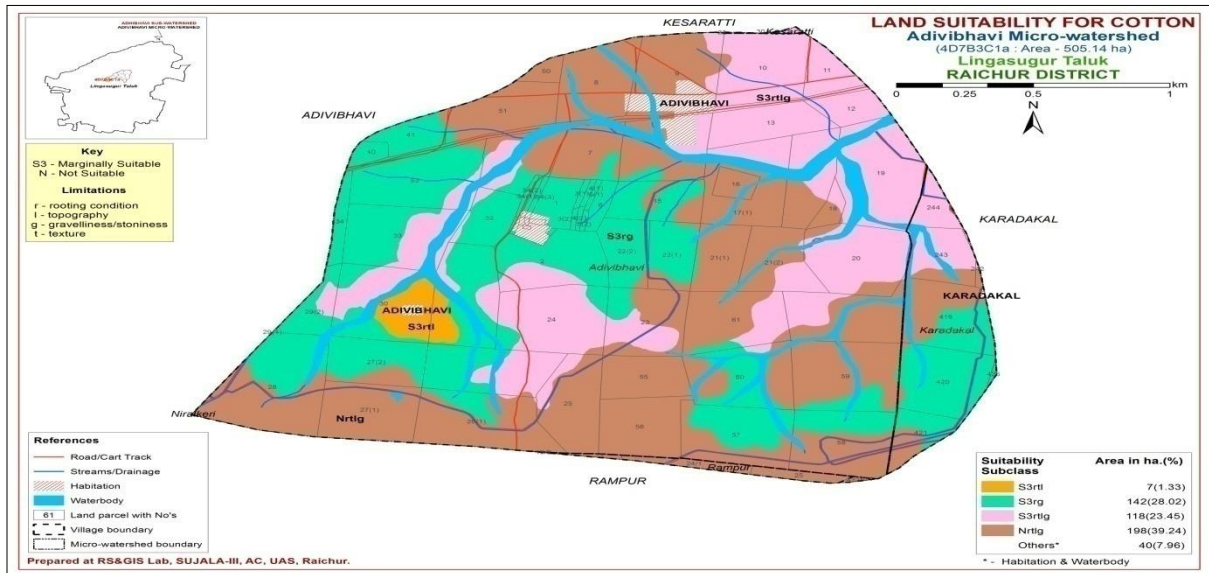


Fig 6: Land suitability map for Cotton in Adavibhavi village

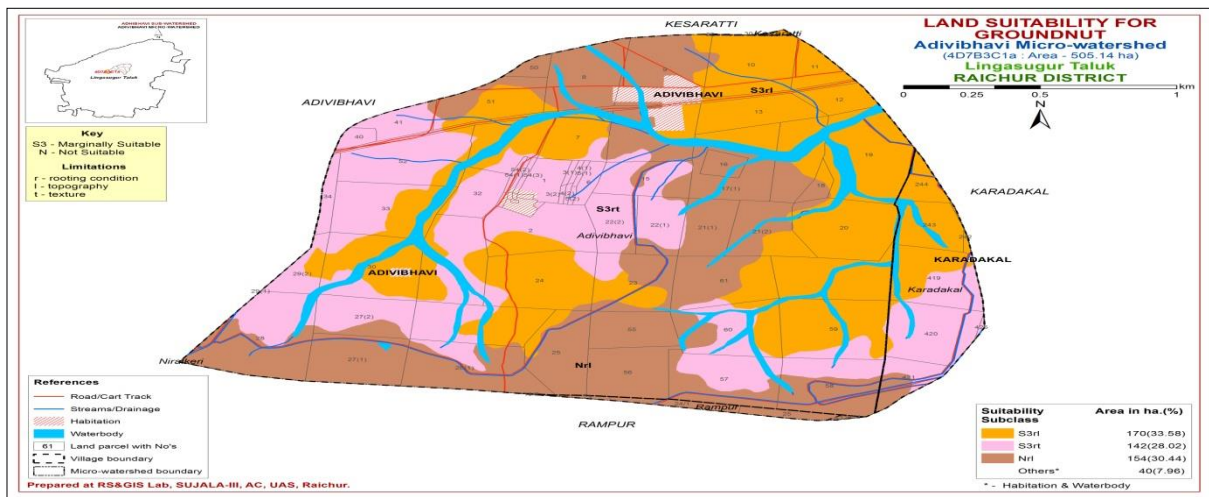


Fig 7: Land suitability map for Groundnut in Adavibhavi village

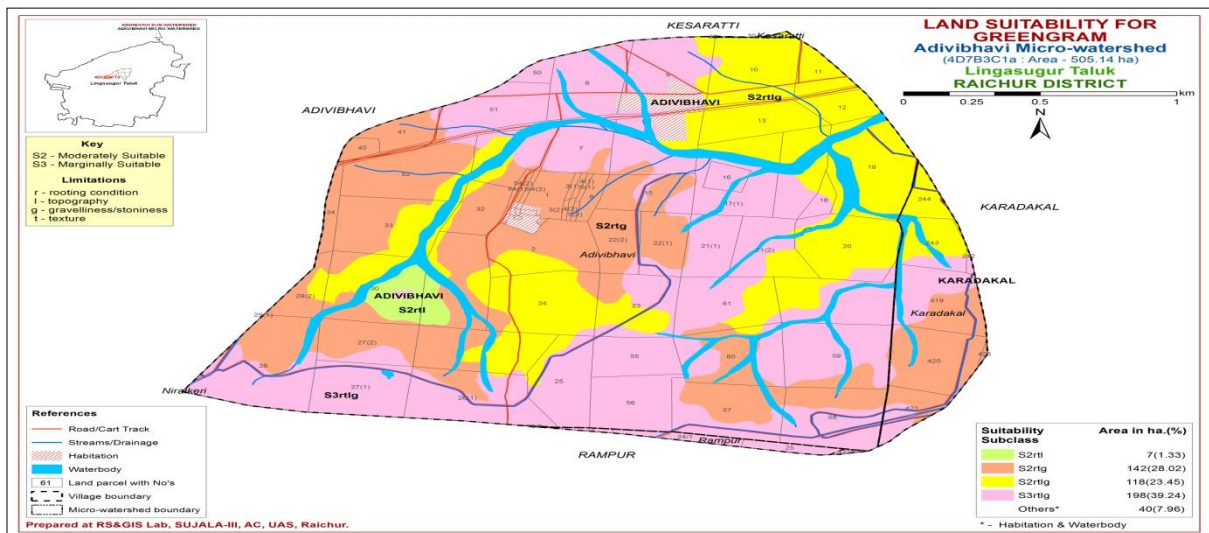


Fig 8: Land suitability map for Greengram in Adavibhavi village



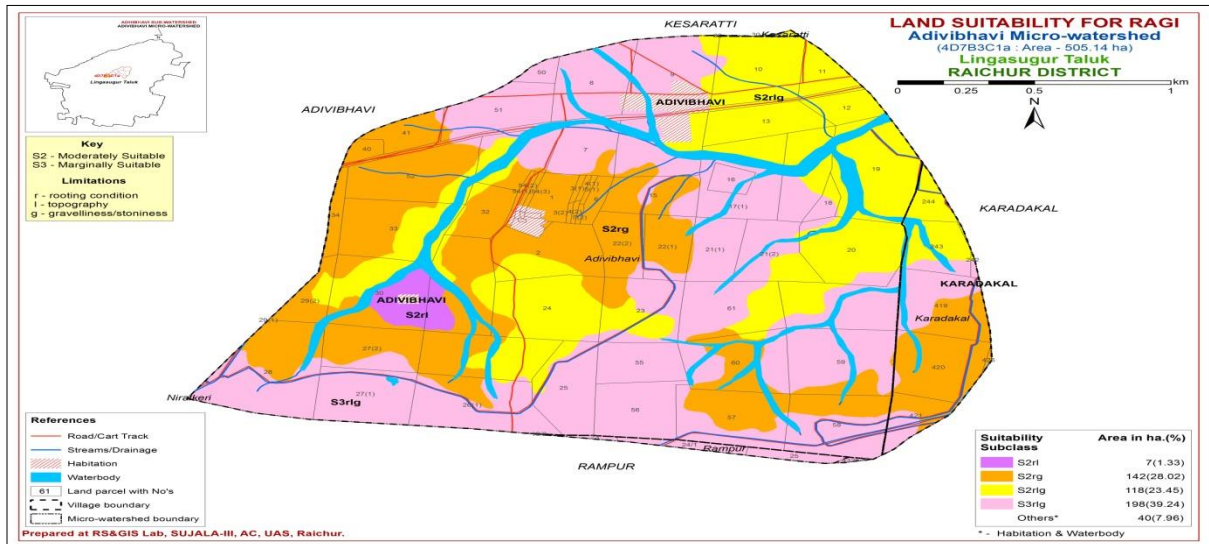


Fig 9: Land suitability map for Ragi in Adavibhavi village

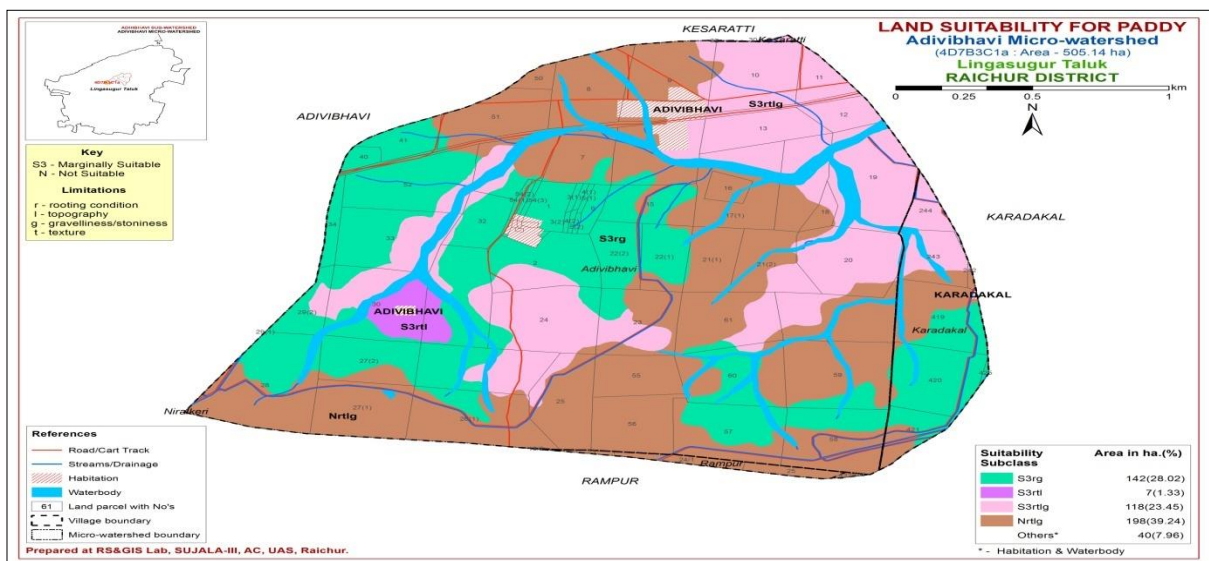


Fig 10: Land suitability map for Paddy in Adavibhavi village

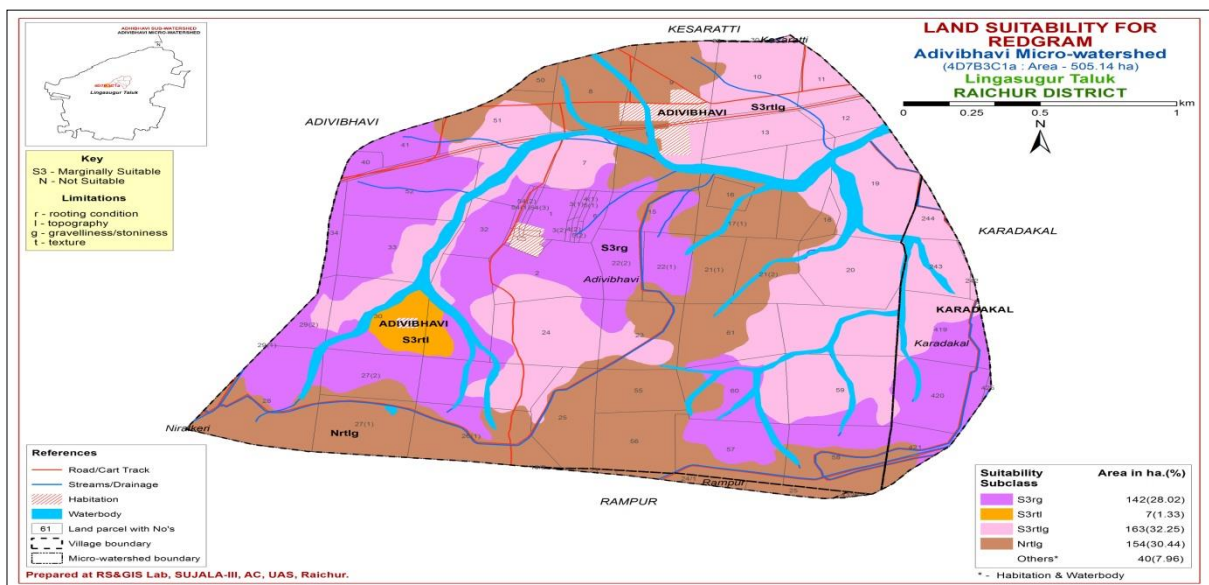


Fig 11: Land suitability map for Redgram in Adavibhavi village

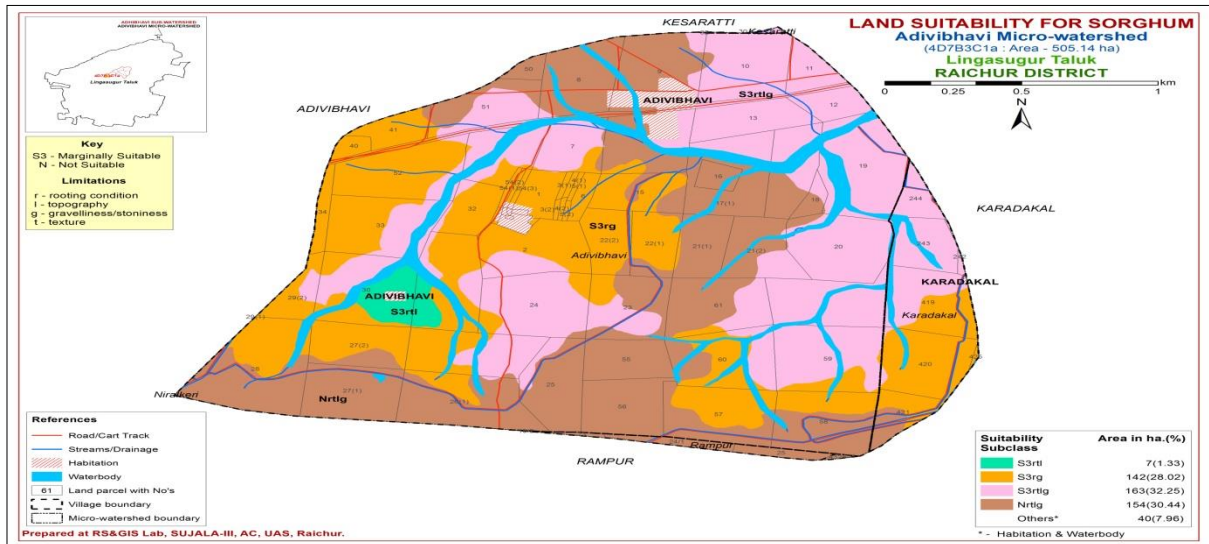


Fig 12: Land suitability map for Sorghum in Adavibhavi village

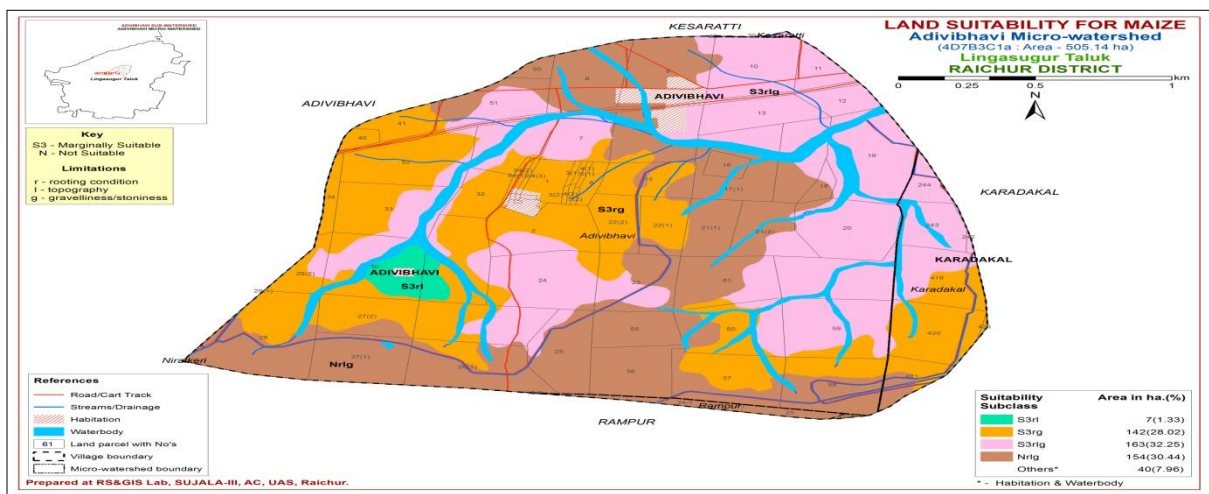


Fig 13: Land suitability map for Maize in Adavibhavi village

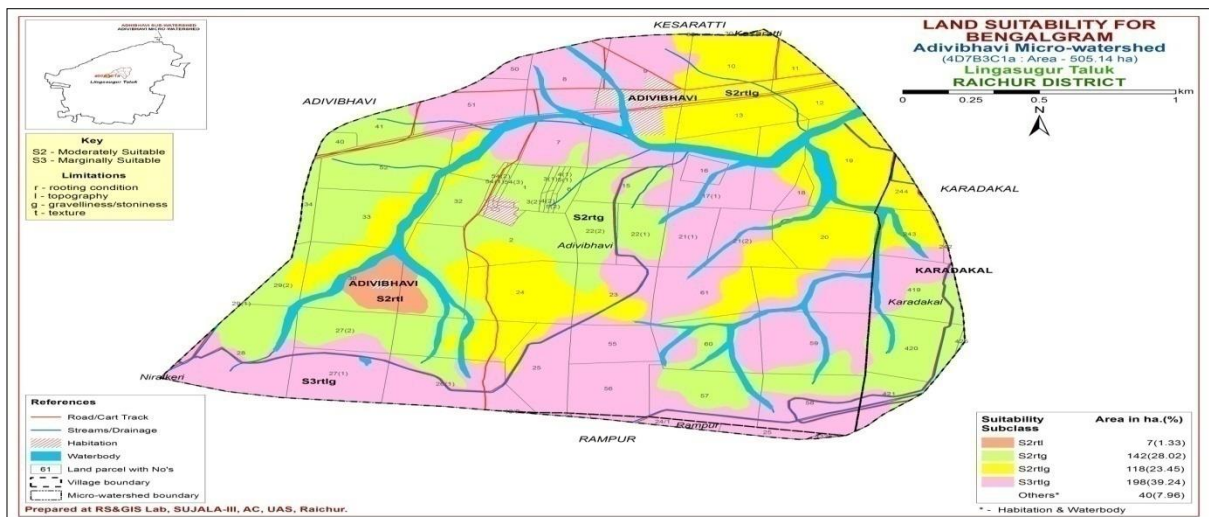


Fig 14: Land suitability map for Bengal gram in Adavibhavi micro-watershed



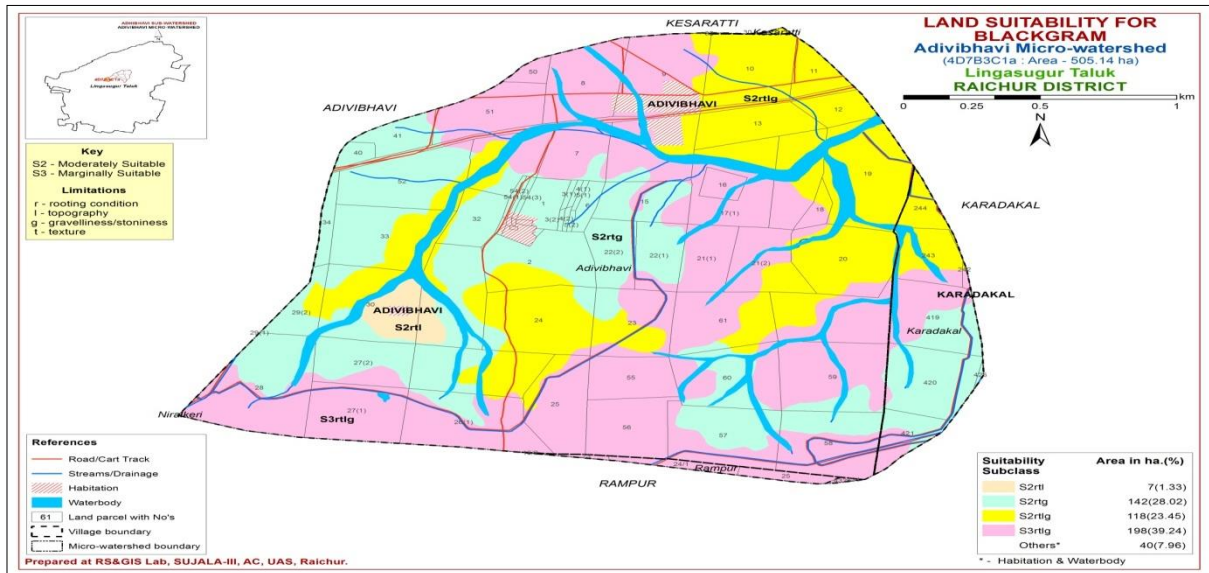


Fig 15: Land suitability map for Black gram in Adavibhavi micro-watershed

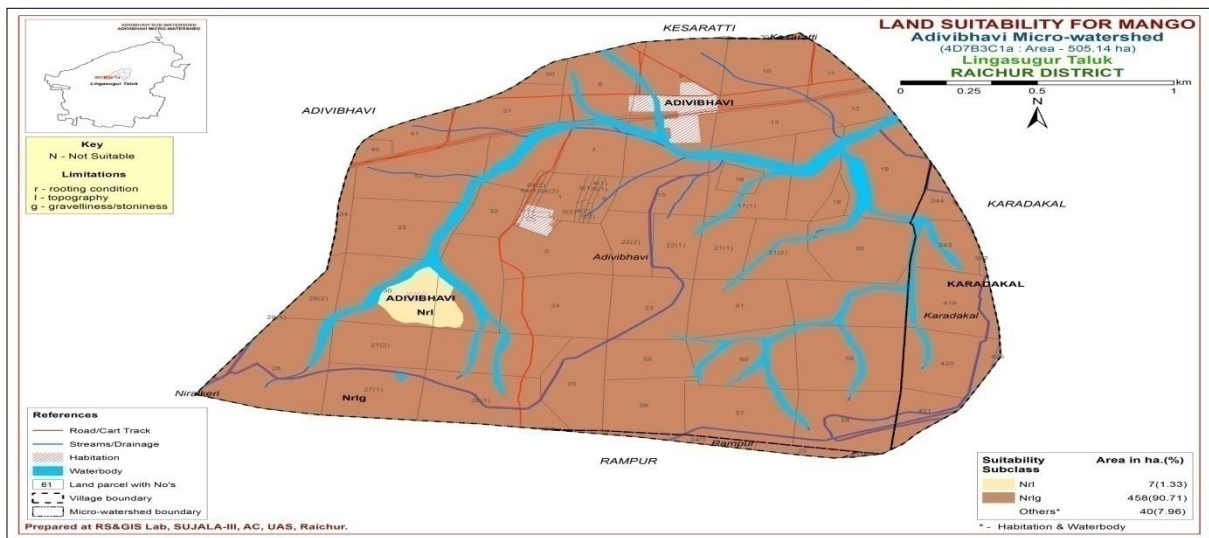


Fig 16: Land suitability map for Mango in Adavibhavi MWS

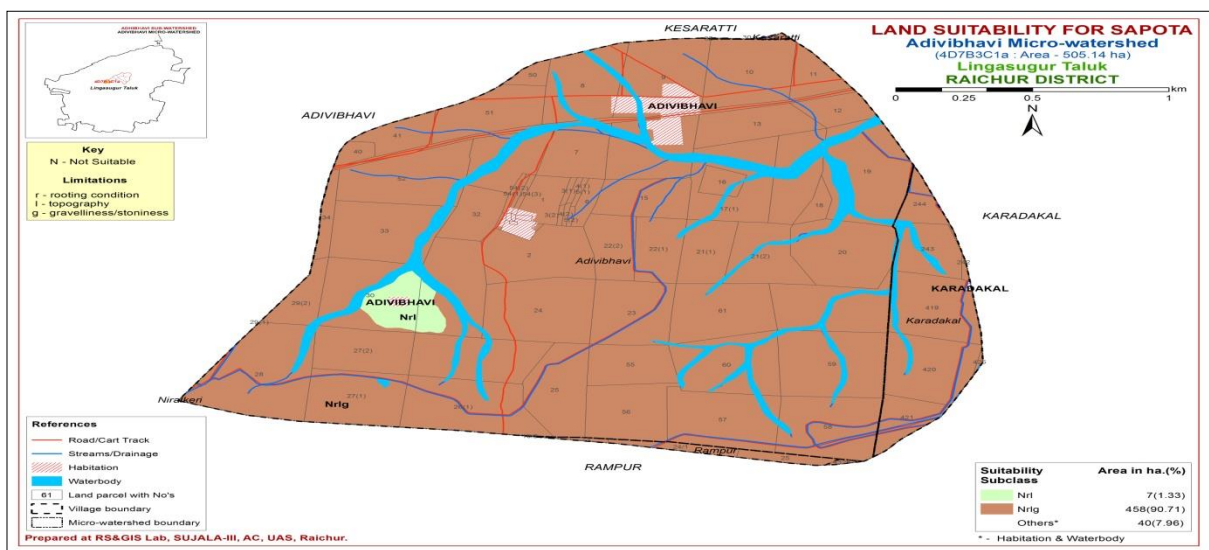


Fig 17: Land suitability map for Sapota in Adavibhavi MWS

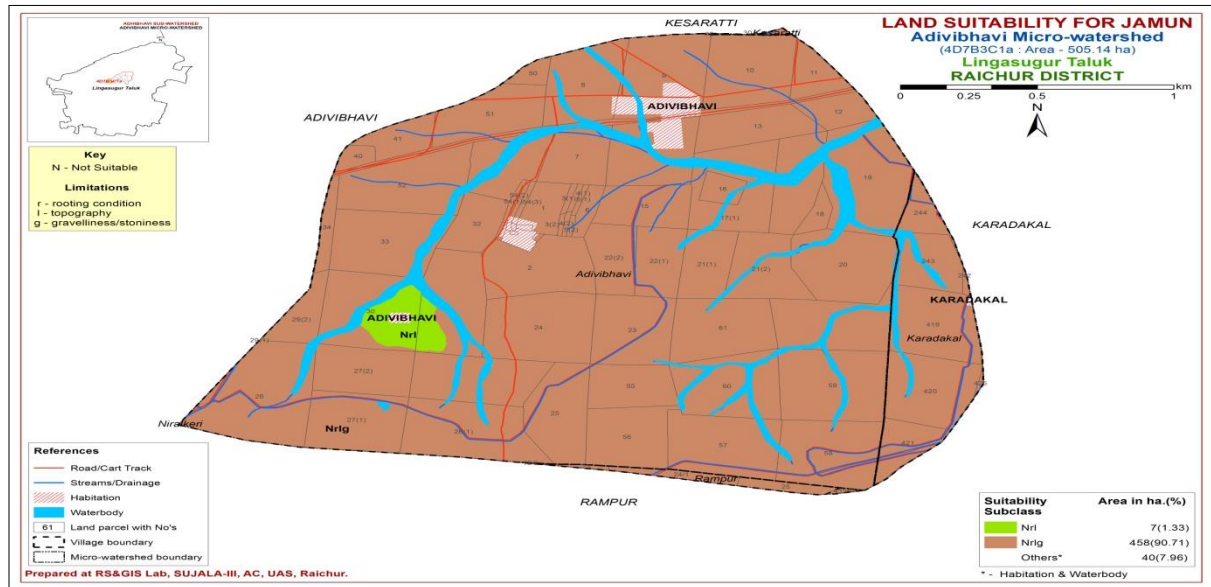


Fig 18: Land suitability map for Jamun in Adavibhavi MWS

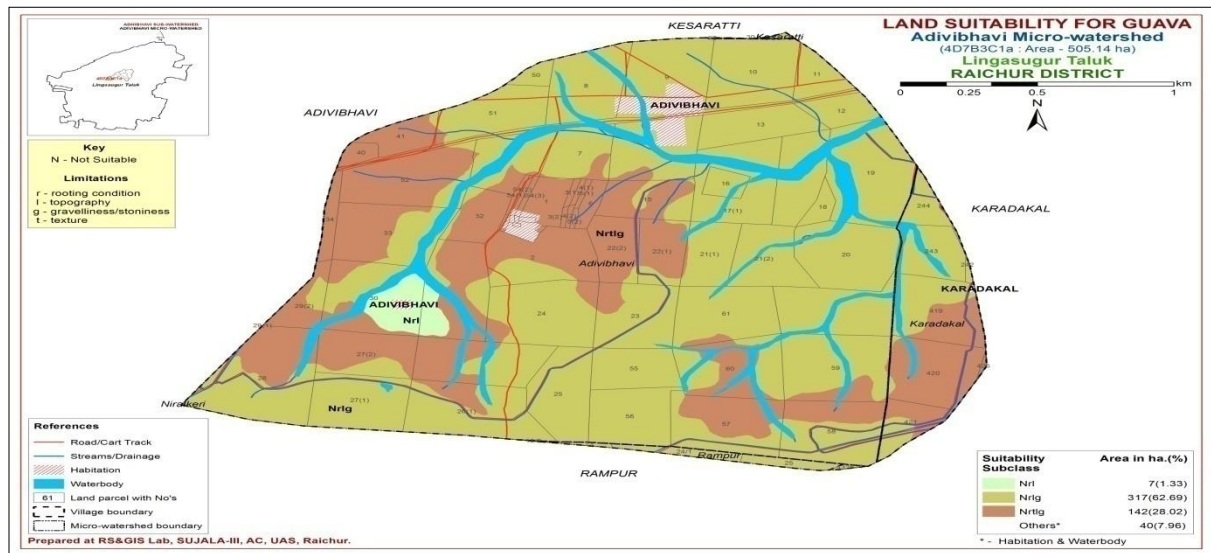


Fig 19: Land suitability map for Guava in Adavibhavi MWS

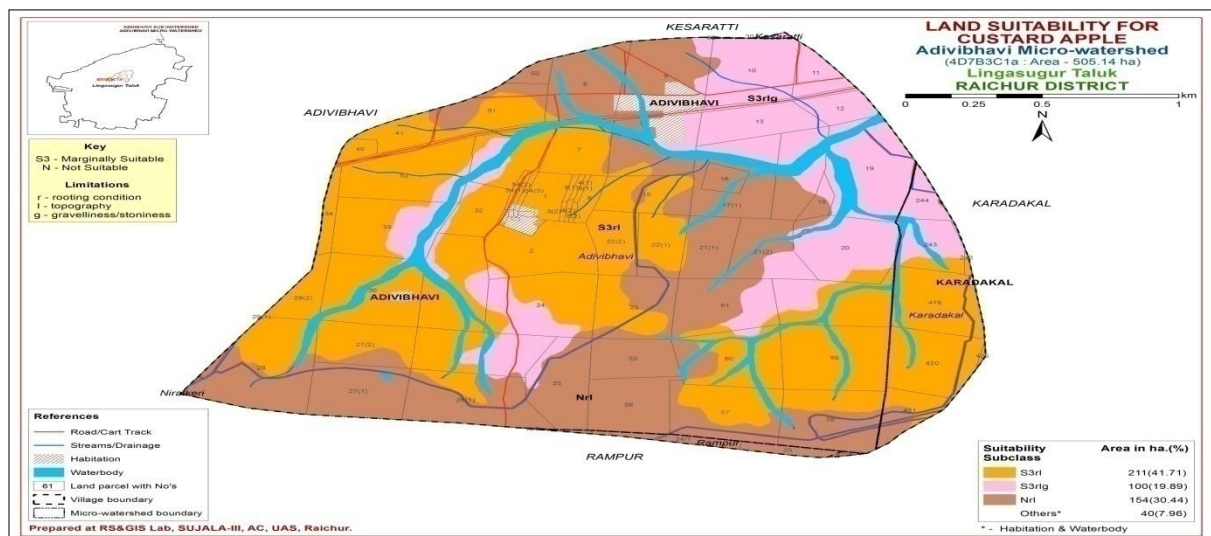


Fig 20: Land suitability map for Custard Apple in Adavibhavi MWS



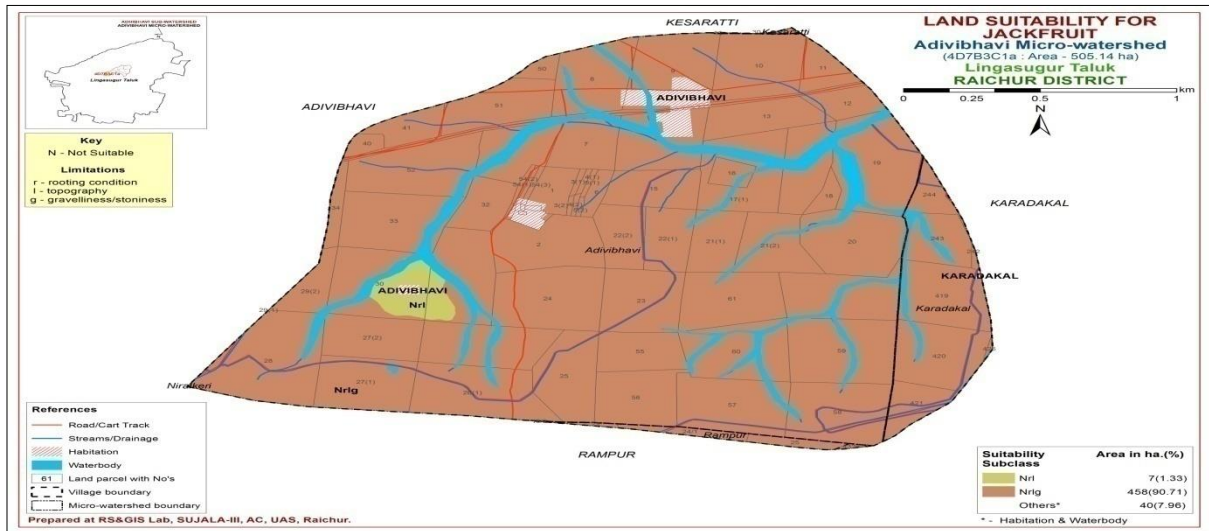


Fig 21: Land suitability map for Jackfruit in Adavibhavi MWS

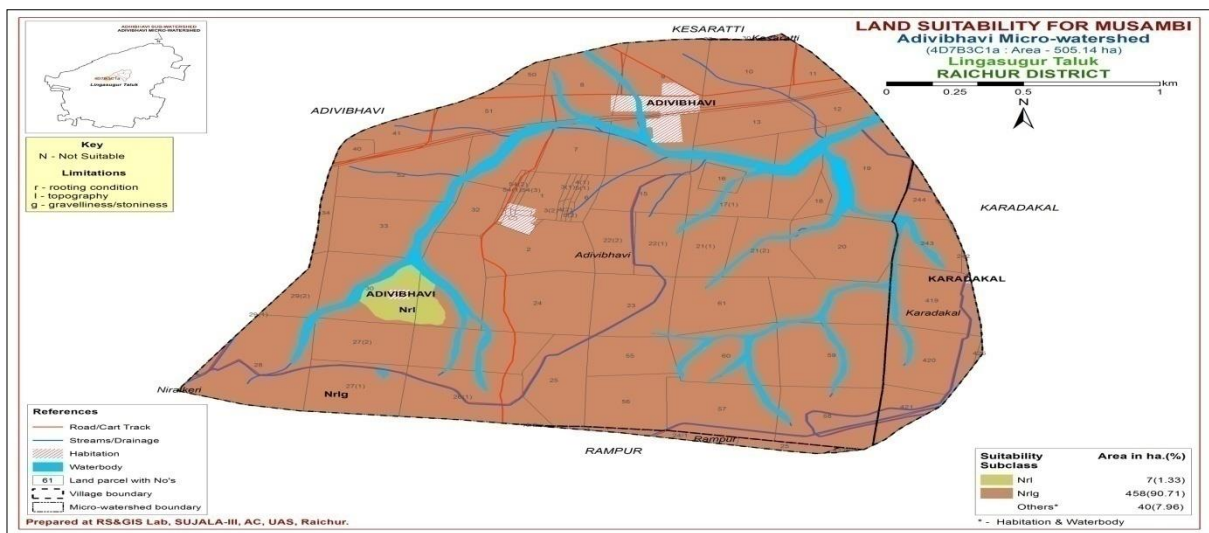


Fig 22: Land suitability map for Musambi in Adavibhavi MWS

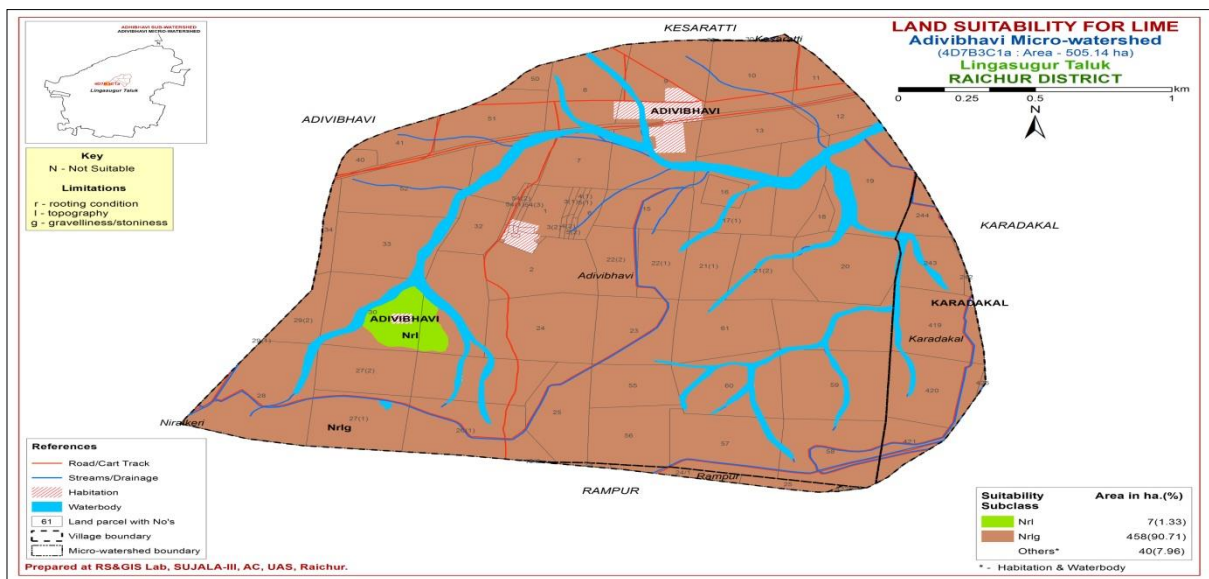


Fig 23: Land suitability map for Lime in Adavibhavi MWS



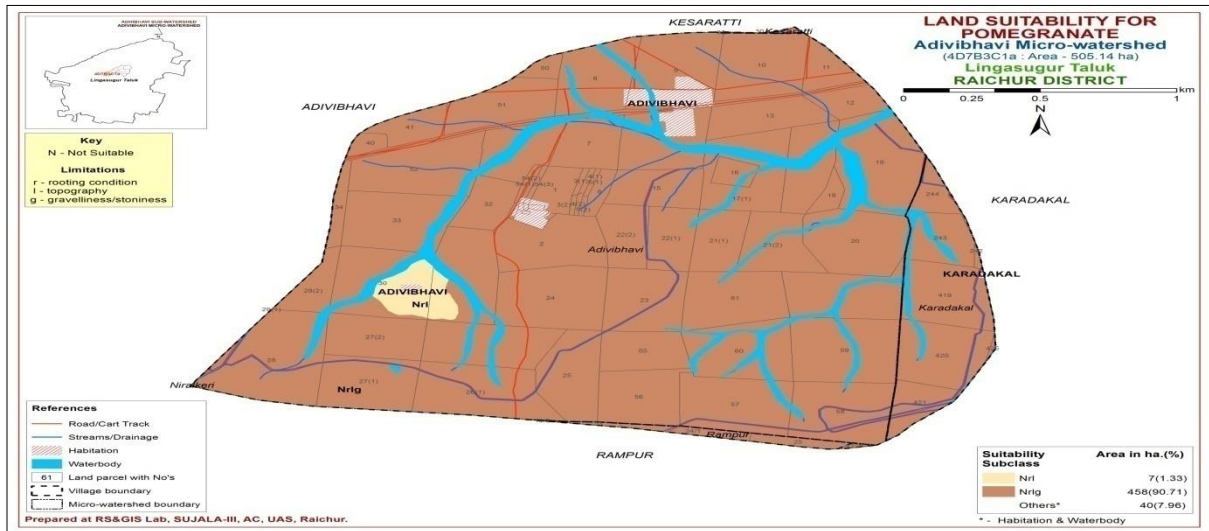


Fig 24: Land suitability map for Pomogranate in Adavibhavi MWS

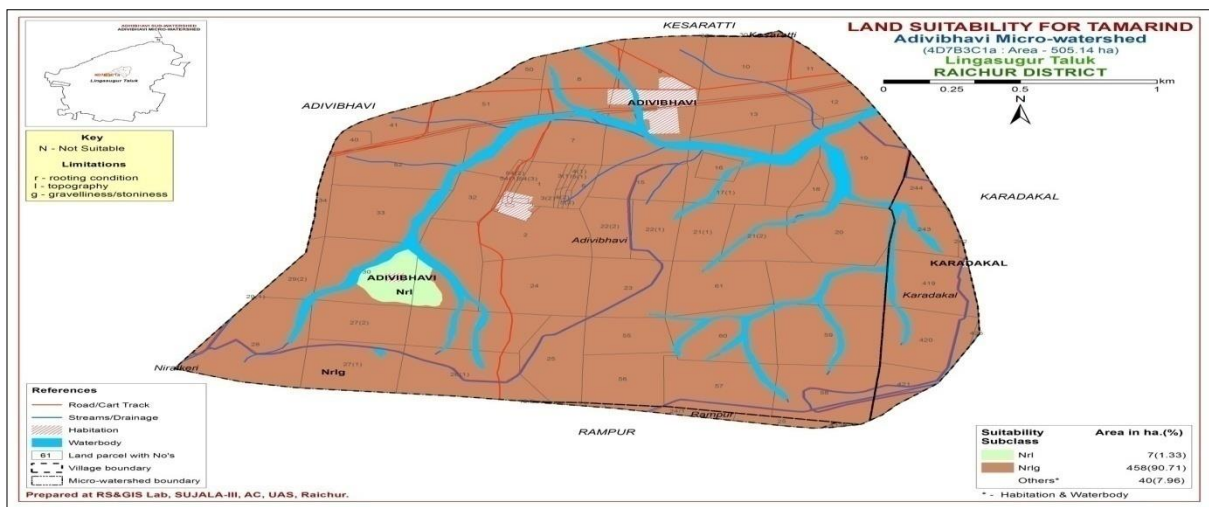


Fig 25: Land suitability map for Tamarind in Adavibhavi micro-watershed

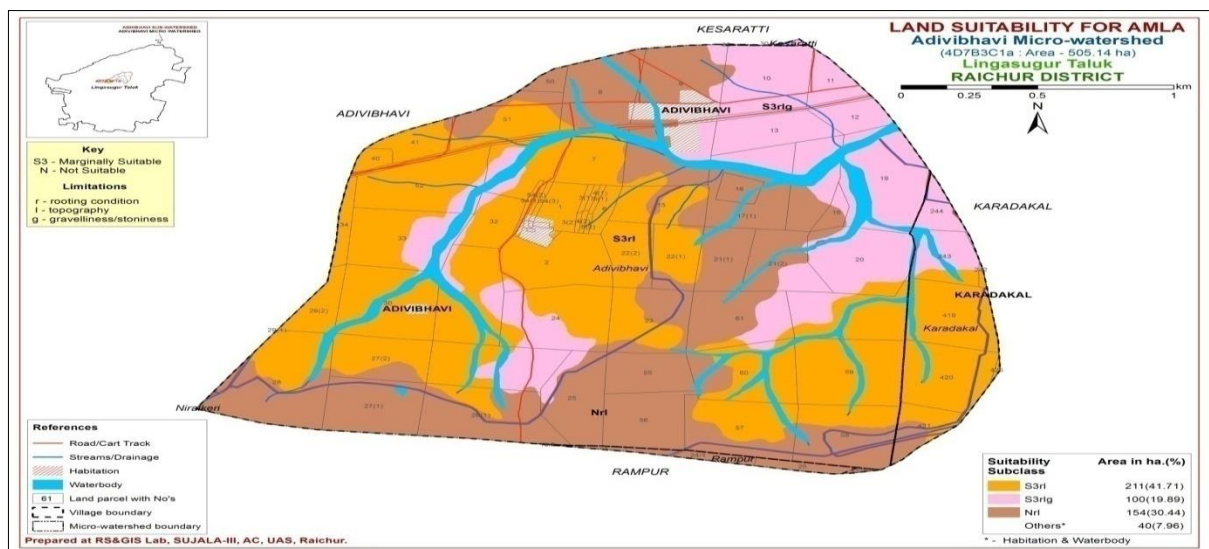


Fig 26: Land suitability map for Amla in Adavibhavi micro-watershed

References

1. Anonymous. NBSS and LUP staff, 1984, 5-14.
2. Asma Najafiana, Mahmood Dayani, bHamid Reza Motaghian, Habibolah Nadiana. Geostatistical Assessment of the Spatial Distribution of Some Chemical Properties in Calcareous Soils. Journal of Integrative Agriculture, 2012, 1729-1737.
3. Beek KJ. Land evaluation for agricultural development. ILRI Publication 23. ILRI, Wageningen, 1978.
4. Dent G, Young A. Soil survey and land evaluation. George Allen and Unwin London, 1981.

5. Leelavathi GP, Naidu MVS, Ramavatharam N, Karuna Sagar G. Studies on genesis, classification and evaluation of soils for sustainable land use planning in yerpedu mandal of Chittoor district, Andhra Pradesh. Journal of Indian society of Soil Science. 2009; 57:109-120.
6. Rajesh NL, Rajesh V, Meenkshi Bai R, Sathishkumar U, Bhat SN, Rudramurthy HV. Land resource inventory of kalmali north-1 micro watershed to derive land capability and land suitability for field crops. International Journal of Chemical Studies. 2018-2019; 7(1):245-249.
7. Sehgal JL. Pedology - Concepts and applications. Kalyani Publishers, New Delhi, 1996, 488.
8. Soil Survey Staff. Soil Taxonomy - A basic system of soil classification for making and interpreting soil surveys. Second edition. Agricultural Hand Book No. 436, United States Department of Agriculture, Washington, D.C., USA, 1999.