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Land resource inventory of Kalmali north-2 micro-watershed for assessment of land capability class and land suitability for horticulture crops using geospatial technology

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Abstract
A detailed land resources inventory of Kalmali North-2 micro watershed was carried out at 1:8000 scale for deriving land capability and crop suitability classes. The micro watershed is located in Lingasugur taluk, Raichur district, Karnataka, India. Ten soil phase units with five soil series were identified through detailed soil resource study. The soil phase unit "RCRmB2" covered maximum area of 136 ha (20.14%) with very gently sloping and moderate erosion in the micro-watershed. Land capability classes in the study area are II*es*, III*es* and IV*es* with limitations of soil erosion, texture, soil drainage, soil fertility and topography. Suitability assessment in micro-watershed showed that an area of 673 ha (99.95 %) was highly suitable (S1) for growing Custard apple and Musambi, marginally suitable (S3) for Mango, Sapota, Guava and Jackfruit 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 resource inventory, land capability classification, land suitability and geospatial technology

Introduction
Judicious use of land can support the needs of the growing population. Detailed characterization and mapping of all the existing land resources like soils, climate, water, minerals and rocks, vegetation, land use pattern, socio-economic conditions, infrastructure, marketing facilities and convergence of various developmental works of the government are quint essential for planning and implementation at farm level. Site 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 to the farmer and other land users of the area (Manoharachari *et al,* 2017) [3].

Assessing the extent and degree of suitability of the land resources in the micro watershed for various crops is necessary to choose the right crop and suitable variety for the area. In this regard, a detailed land resource inventory and its evaluation were undertaken using geospatial technology in Kalmali North-2 micro watershed of North Eastern Dry Zone of Karnataka, to characterizes land capability and crop suitability.

Materials and Methods
Kalmali North-2 micro watershed (Fig.1) is located in Raichur taluk of Raichur district, Karnataka state which lies between the latitude and longitude of $77^0 12'$ -$77^0 14'$ E and $16^0 12'$ - $16^0 14'$N, having total area of 673.18 hectares. Kalamali north-2 is surrounded by Kalmali, Venkatapur, Murharpur and Gonpad villages, at the altitude of 525 m above mean sea level (MSL). The average rainfall of the region is 560 mm. geologically 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, Using rapid traversing based on geology, drainage pattern, surface features, slope characteristics and land use, landforms, the soil physiographic units were identified (Soil Survey Staff 1999) [6]. Cadastral map overlaid with IRS LISS-IV merged Cartosat-1 imagery, having 2.5 m spatial resolution (Fig. 2). Five soil series were derived and further mapped into ten soil phase units (Fig. 3; Table 1).

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Soil-site characteristics of different soil units were obtained from standard laboratory analytical procedure (Jackson 1973). These data have been used to evaluate the land capability classification (Sehgal 1996) [5]. The land suitability of horticultural crops was developed using the specific requirements of a crop are compared with the characteristics of land, climatic regime and soil regime the suitability of the area for the crop can be arrived (Sys *et al*, 1991) [7]. Mapping of soil phase, land capability class and land suitability were carried out using ArcGIS 10.4 software.

Results and Discussion

Soil phase: The soil phase unit "RCRmB2" and "FTPmB2" covered an area of 136 ha (20.14%) and 92 ha (13.6%) respectively with very gently sloping and moderate erosion. "FTPmC2" covering 98 ha (14.51%) area with gently sloping. The rest seven mapping units covered 51.70% area with gently slope in the micro-watershed. All ten soil phase mapping units covering entire micro watershed has clay texture (Table 1).

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 site characteristics of soil units (Table 2) are matched with the criteria for land capability classification (Sehgal 1996) [5]. The land capability classification of mapping units and their extent in watershed is presented in Fig.4.

Based on soil properties, the soils of Kalmali North-2 micro-watershed of Raichur taluk have been classified into three land capability classes *viz.,* II*es*, III*es* and IV*es* (Fig 3). The Fatapur, Kalamali and Venkatapur series were grouped under land capability class III*es*. These soils were marginally cultivable lands, due to severe limitations of erosion, Slope, texture, soil depth limitations. Whereas, Raichur and Gonal were classified into II*es* which are moderately cultivable lands with limitations of depth, erosion, slope and texture limitations. The area under III*es*, II*es* and IV*es* was 227, 394 and 51 ha, respectively (Fig.4). Major proportion of the area

belongs to class III*es* and least portion of the area belongs to class II*es*. Similar findings were also reported by (N.L. Rajesh *et al*., 2018) [4].

Land suitability of horticultural crops

The optimum requirements of a crop are always region specific. Climate and soil-site parameters play significant role to maximize the crop yields. The soil-site properties from the study area were matched with land suitability criteria for different crops (Sehgal 1966), to drive land suitability for various horticulture crops based on the current land use.

The suitability assessment for horticultural crops in Kalamali north-2 MWS showed that an area of 673 ha (99.95 %) was highly suitable (S1) for growing Custard apple and Musambi and marginally suitable (S3) for Mango, Sapota, Guava and Jackfruit with limitations of rooting condition and topography. In case of Lime cultivation, an area of 540 ha (80.16 %) found to be highly suitable (S1) (Fig. 5, 6, 9, 10, 12 and 11). Similar findings were also reported by (Maheshkumar *et al*., 2017) [2].

Jamun and Pomogranate in Kalamali north-2 village showed that about 539 ha (80.16 %) area is moderately suitable (S2) with limitation to topography and texture (Fig. 7 and 13). Mango, Sapota, Guava and Jack fruit in Kalamali north-2 village showed that an area of about 673 ha (99.95 %) was found to be marginally suitable (S3) with limitation of rooting depth. (Fig, 5, 6, 8 and 10).

The proposed crop plan

Suitable interventions for GNLmC3, KLMmC3 and VKPmC3 mapping units include deep and wider size furrows and staggered pits, drip irrigation with suitable soil and water conservation measures to control severe erosion, cultivation on raised bunds with mulches and drip irrigation for maximizing yields of proposed field and horticulture crops. Whereas, FTPmC2 KLMmC2, RCRmC2, VKPmC2, GNLmC2, FTPmB2 and RCRmB2 mapping units has necessary interventions like cultivation on raised bunds and ridge furrows with mulches and drip irrigation system with suitable soil and water conservation measures (Table 3).
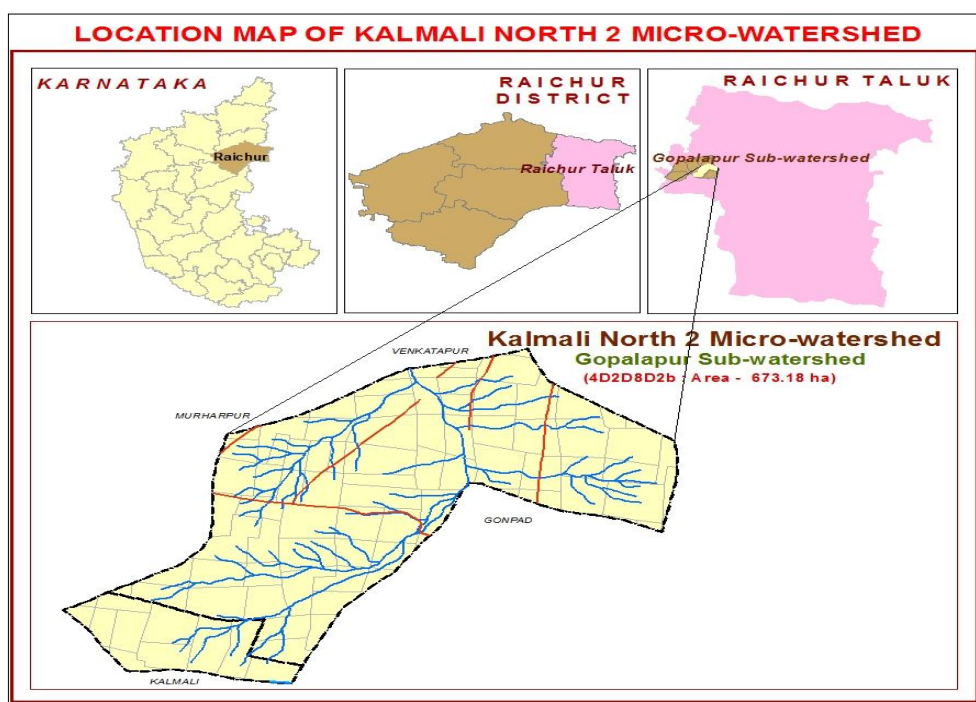

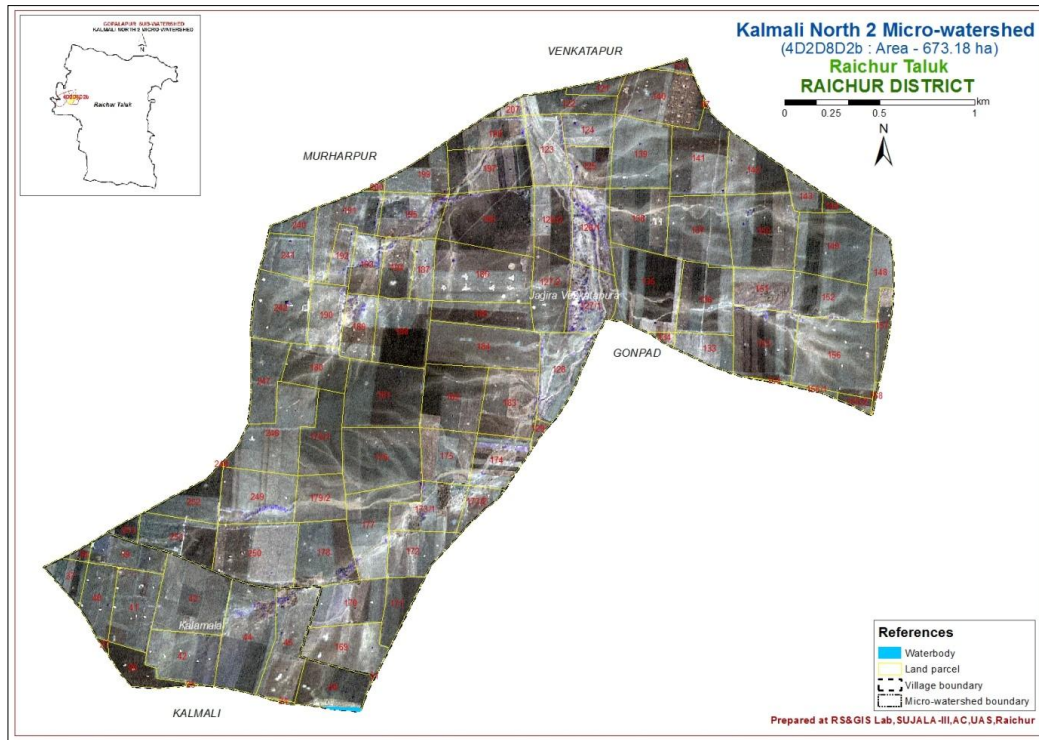**Fig 1:** Location map of Kalmali North-2 micro watershed

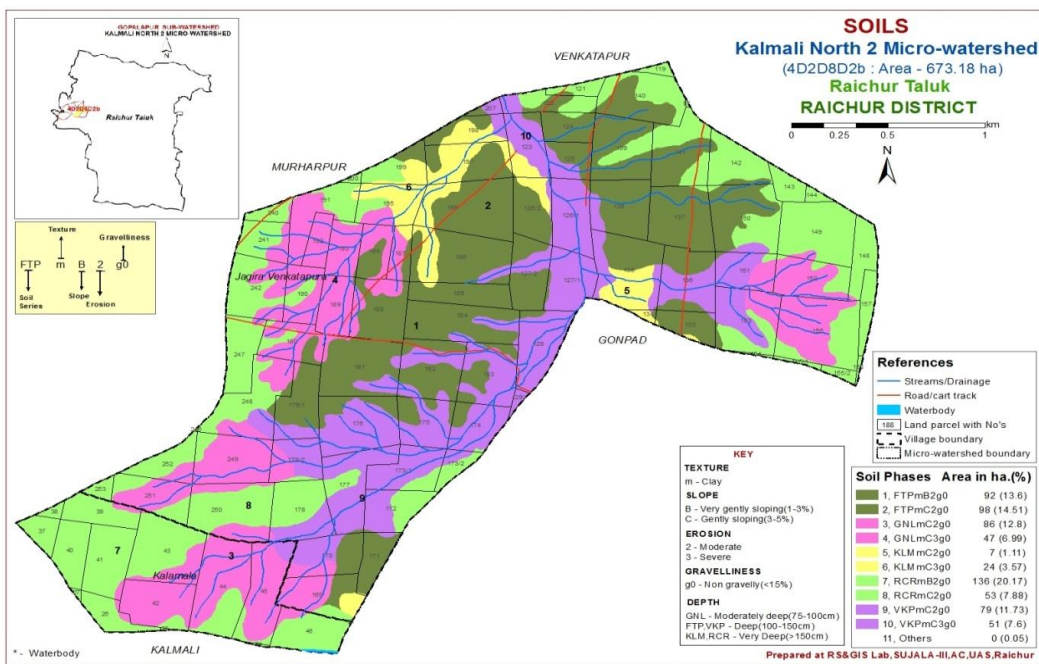**Fig 2:** Cadastral map of Kalmali North-2 micro watershed

Fig 3: Soil series mapping unit of Kalmali North-2 micro watershed

Table 1: Area distribution of Soil mapping units of Kalmali North-2 micro-watershed

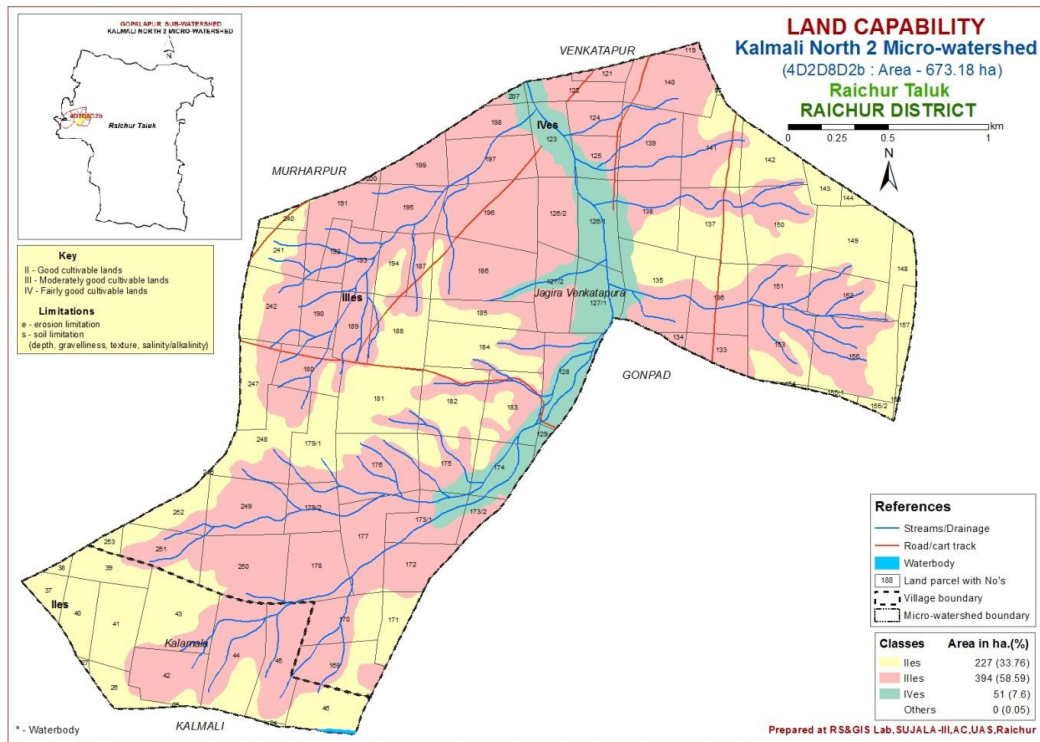| Name of the series	Mapping units	Area(ha)	Area cover (%)
Fatepur	FTPmB2	92	13.6
	FTPmC2	98	14.51
Gonala	GNLmC2	86	12.8
	GNLmC3	47	6.99
Kalmali	KLMmC2	7	1.11
	KLMmC3	24	3.57
Raichur	RCRmB2	136	20.14
	RCRmC2	53	7.88
Venkatapur	VKPmC2	79	11.73
	VKPmC3	51	7.6
Others*	Waterbody	0	0.05
Total area		673.18	100

Fig 4: Land capability classification map of Kalmali North-2 micro watershed

Table 2: Soil-site characteristics of Kalmali North-2 micro-watershed

Mapping unit	Climate (c)				Land form characteristics			Physico- chemical characteristics (f)				
	Rainfall (mm)	Max. Temp (⁰C)	Min. Temp (⁰C)	RH (%)	Slope (t) (%)	Erosion (e)	Drainage (w)	Depth (cm)	Texture	Ph (1:2.5) (soil: water)	EC (dS/m)	OC (g/kg)
FTPmB2	560	29.5	10	62	1-3	Moderate	Moderately well	100-150	Clay	Moderately alkaline	Non-saline	Low
FTPmC2	560	29.5	10	62	3-5	Moderate	Moderately well	100-150	Sandy loam	Moderately alkaline	Non-saline	Medium
GNLmC2	560	29.5	10	62	3-5	Moderate	Moderately well	75-100	Sandy loam	Moderately alkaline	Non-saline	Medium
GNLmC3	560	29.5	10	62	3-5	Severe	Moderately well	75-100	Sandy loam	Moderately alkaline	Non-saline	Low
KLMmC2	560	29.5	10	62	3-5	Moderate	Moderately well	<150	Sandy loam	Moderately alkaline	Non-saline	Medium
KLMmC3	560	29.5	10	62	3-5	Severe	Moderately well	<150	Sandy loam	Moderately alkaline	Non saline	Low
RCRmB2	560	29.5	10	62	1-3	Moderate	Moderately well	50-75	Clay	Strongly alkaline	Non saline	Medium
RCRmC2	560	29.5	10	62	3-5	Moderate	Moderately well	50-75	Sandy loam	Strongly alkaline	Non saline	Low
VKPmC2	560	29.5	10	62	3-5	Moderate	Moderately well	100-150	Clay	Moderately alkaline	Non saline	Medium
VKPmC3	560	29.5	10	62	3-5	Severe	Moderately well	100-150	Clay	Moderately alkaline	Non saline	Low

Table 3: Proposed Crop Plan for Kalamali north-2 Micro watershed

| Proposed Land Use Class	Soil Map Units	Survey Number	Field Crops	Horticulture Crops	Suitable Interventions
1	GNLmC3,KLMmC3, VKPmC3,poorly to un managed	192,193,187,189,180 Kalamala:198,197,195,199 Venkatapur:123,207,126/1, 127/2,127/1,128,129,174, 173/2	Sole crop; sorghum, Bajra, Navni, green gram, cotton, red gram, Sun flower Bengal gram, …etc major crop is red gram and cotton followed by sorghum.	Fruits: Guava, Custard apple, Tamarind, sapota, jamun, Ber, Vegetables: Onion, Tomato, Brinjal, Chilli, Bhendi, Lab lab, Coriander, and green leafs, curry leaf. Flowers-Gaillardia, marigold, Chrysanthemum, lilly	Deep and wider size furrows with drip and staggered pits for fruit crops, Drip irrigation with suitable soil and water conservation measures to control severe erosion, cultivation on raised bunds with mulches and drip for vegetables and flower crops.
2	FTPmC2 KLMmC2, RCRmC2, VKPmC2, Moderately to poorly managed	Fatepur: 122,111,124,13 9,125,196,126/2,138,186,141 , 133,127/2 Kalamala: 135,134 Raichur119,121,140,200,191, 139,242,195,190,250,178,17 7 Venkatapur:179/2,176,170, 172,173/1,175,136,151,153	Sole crop; sorghum, Bajra, Navni, green gram, cotton, red gram, Sun flower Bengal gram, …etc major crop is red gram and cotton followed by sorghum	Fruits: Guava, custard apple, Tamarind, sapota,jamun,Ber, Vegetables: Onion, Tomato, Brinjal, Chilli, Bhendi, lab lab, coriander, and green leafs, curry leaf. Flowers-Gaillardia,	Cultivation on raised bunds and ridge furrows, with mulches and drip irrigation system for fruit crops. Drip irrigation with suitable soil and water conservation measures.

				marigold, Chrysanthemum, lilly
3	GNLmC2, Poorly managed	Goonal:249,251,42,44,45,169,152,156	Sole crop; sorghum, Bajra, Navni, green gram, cotton, red gram, Sun flower Bengal gram, …etc major crop is red gram and cotton followed by sorghum	Fruits: Guava, custard apple, Tamarind, sapota,jamun,Ber, Vegetables: Onion, Tomato, Brinjal, Chilli, Bhendi, lab lab, coriander, and green leafs, curry leaf. Flowers-Gaillardia, marigold, Chrysanthemum, lilly
4	FTPmB2, RCRmB2, Moderately managed	Fatepur,: 137,194,188, 184,185,181,179/1,182,183,171 Raichur:97,142,143,144, 240,150,149,148,241,157,158, 155/2,155/1,154,247,248, 246,252,253,39,38,37,40,41, 26,27,43,25,46,24,51	Sole crop; sorghum, Bajra, Navni, green gram, cotton, red gram, Sun flower Bengal gram, …etc major crop is red gram and cotton followed by sorghum	Fruits: Guava, custard apple, Tamarind, sapota,jamun,Ber, Veg: Onion, Tomato, Brinjal, Chilli, Bhendi, lab lab, coriander, and green leafs, curry leaf. Flowers-Gaillardia, marigold, Chrysanthemum, lilly
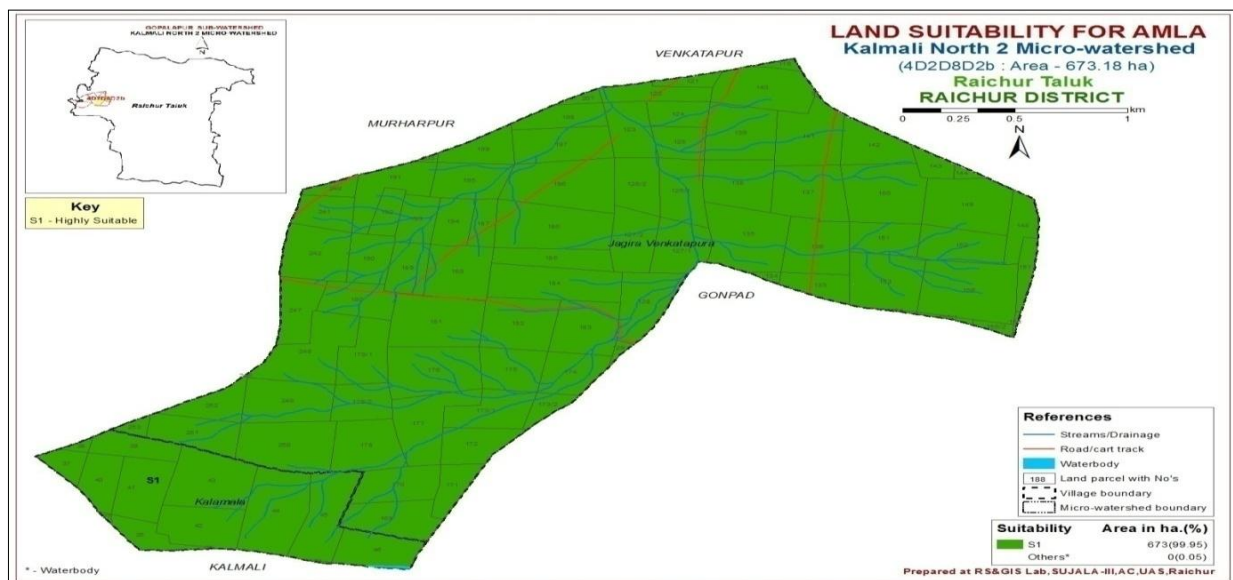
Fig 5: Land suitability map for Mango in Kalmali North-2 MWS
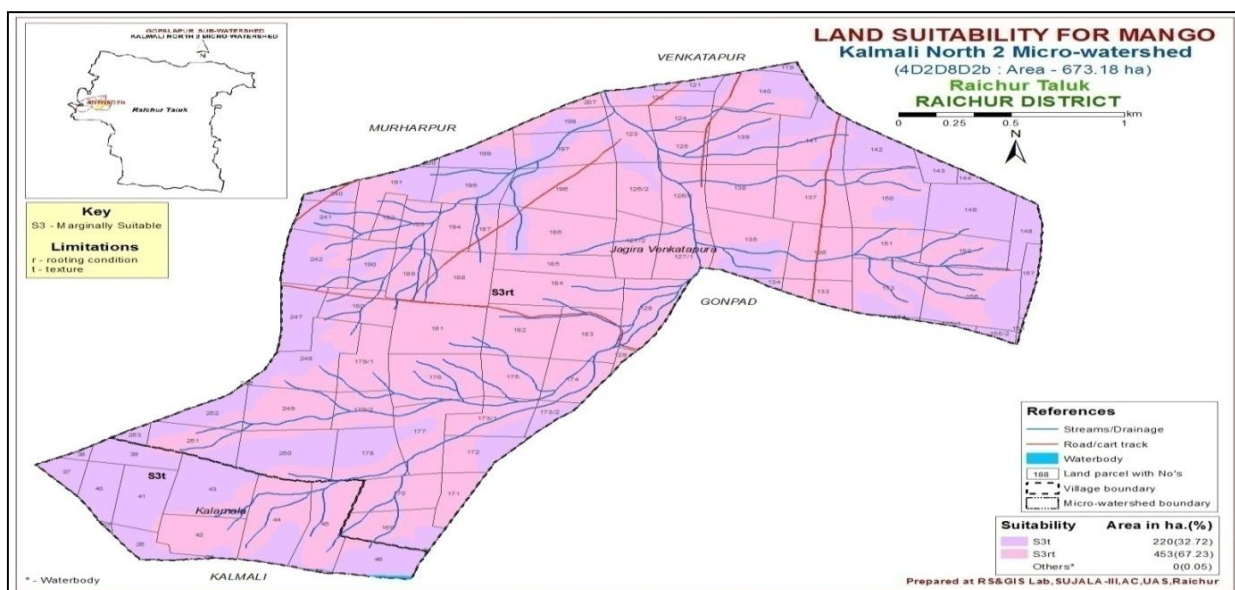
Fig 6: Land suitability map for Sapota in Kalmali North-2 MWS
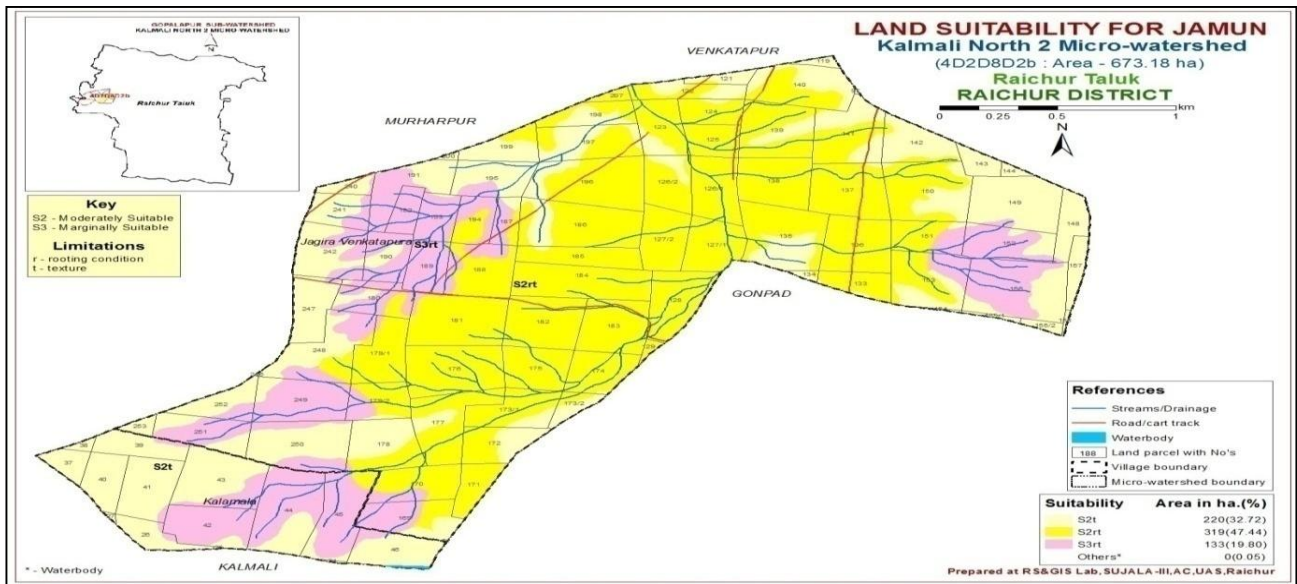
Fig 7: Land suitability map for Jamun in Kalmali North-2 MWS
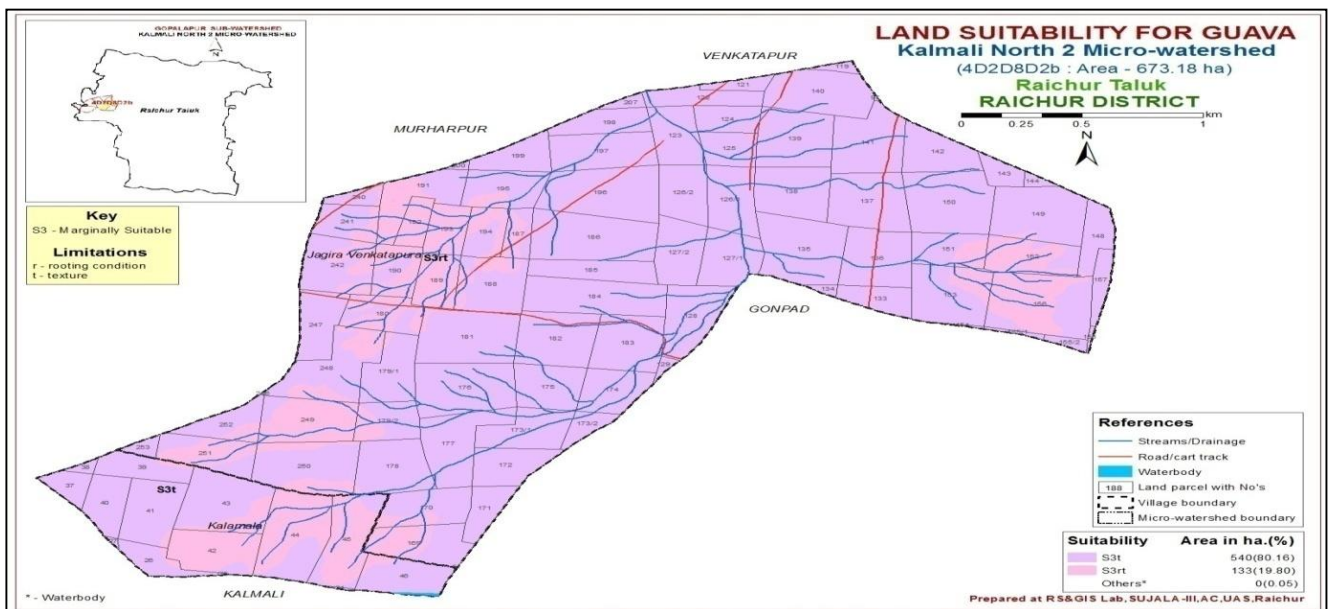

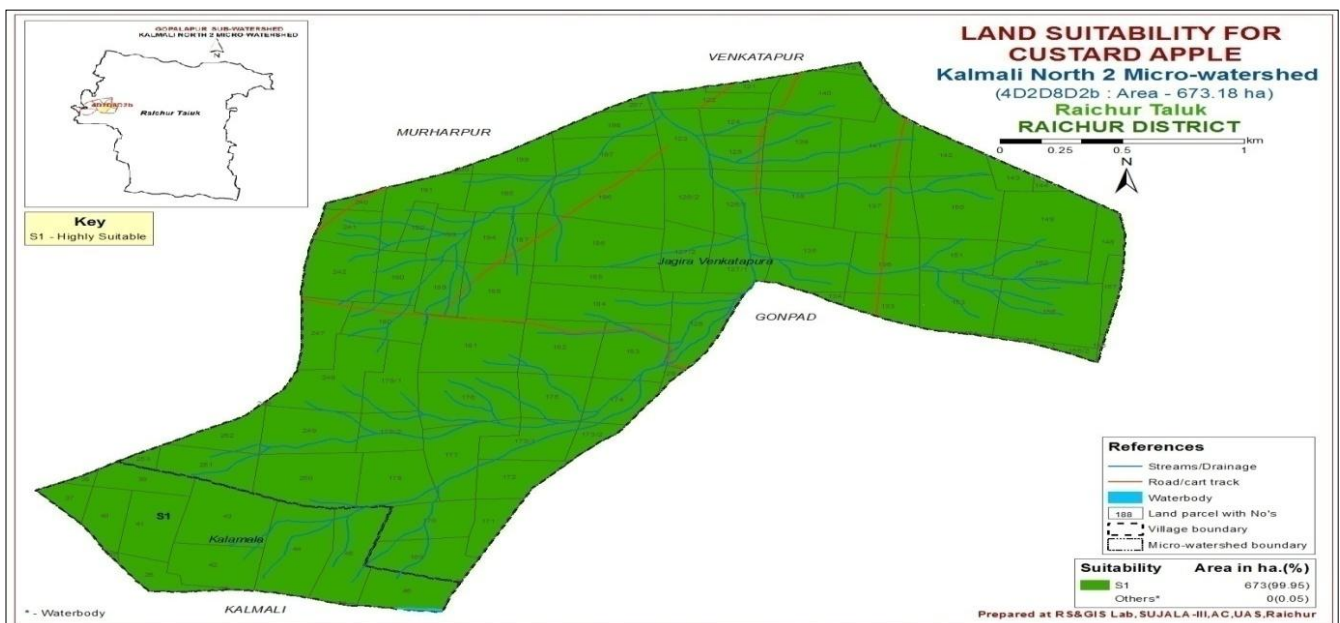**Fig 8:** Land suitability map for Guava in Kalmali North-2 MWS

Fig 9: Land suitability map for Custard Apple in Kalmali North-2 MWS
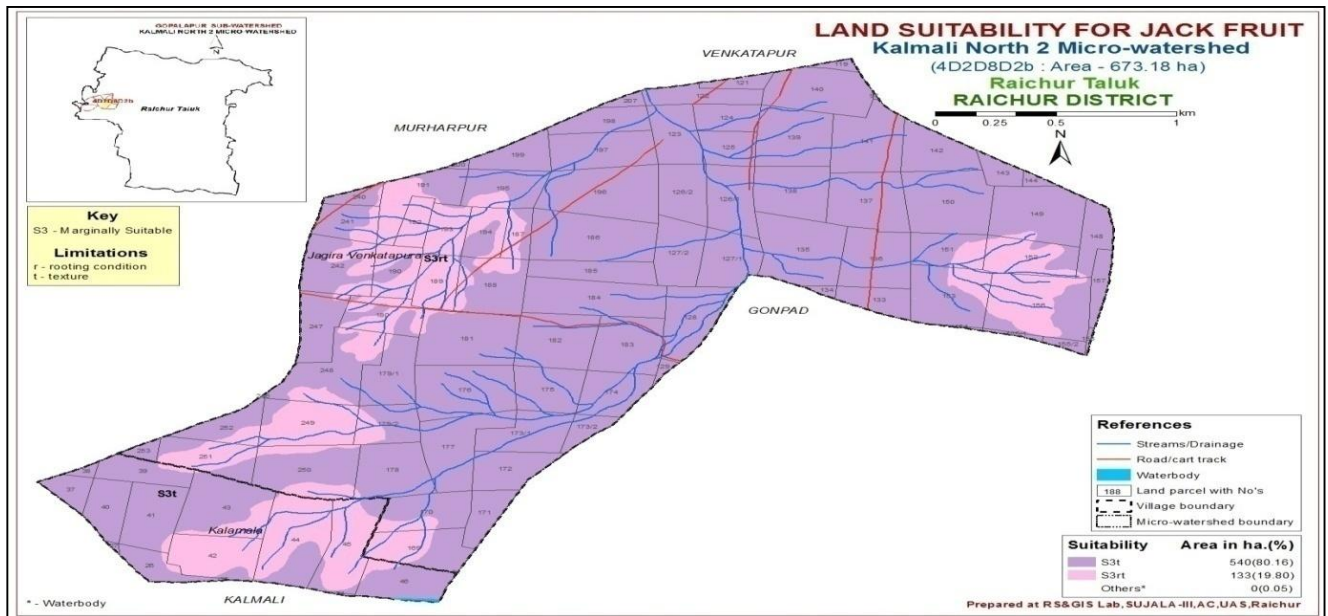
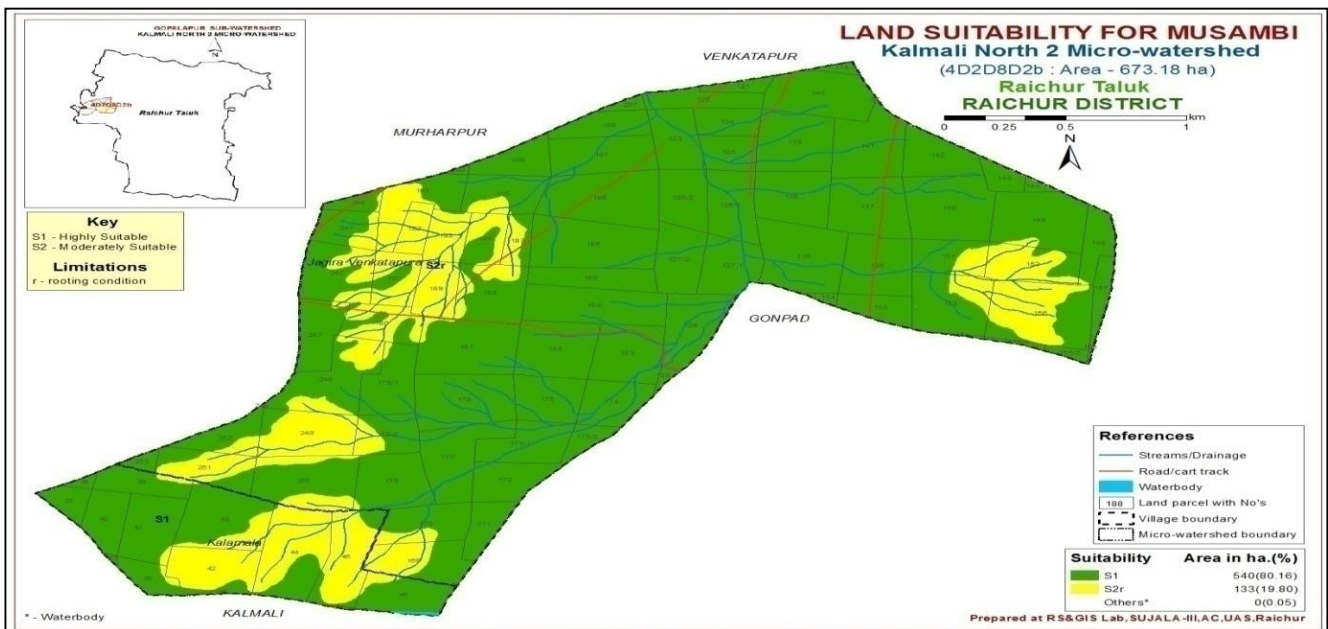**Fig 10:** Land suitability map for Jackfruit in Kalmali North-2 MWS

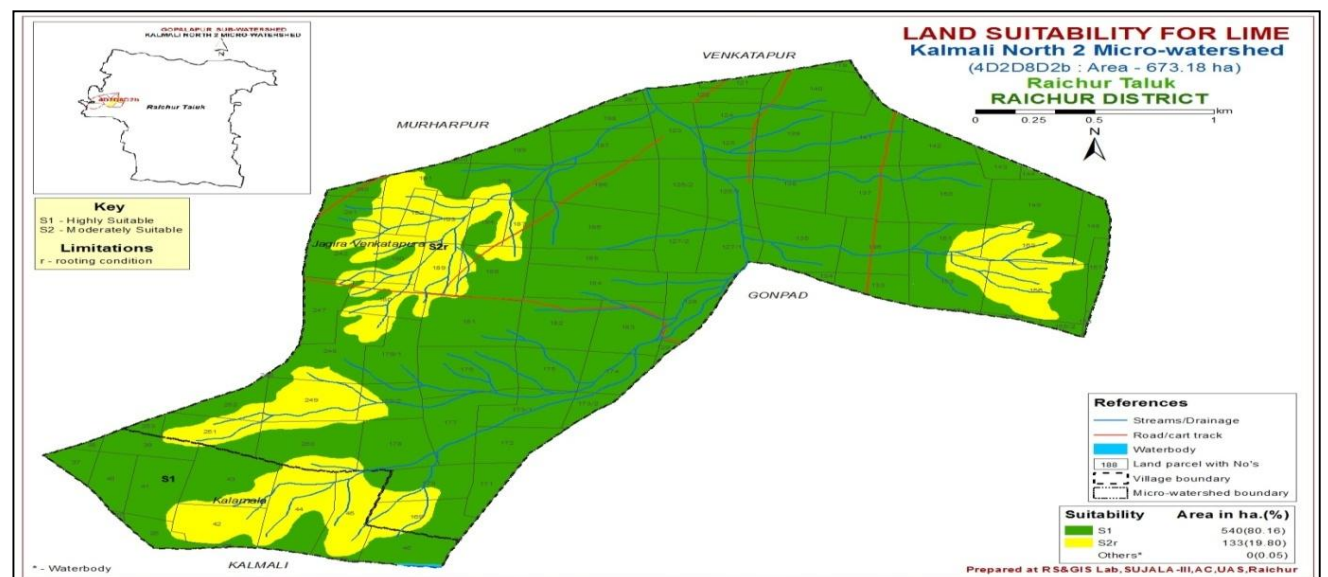**Fig 11:** Land suitability map for Musambi in Kalmali North-2 MWS
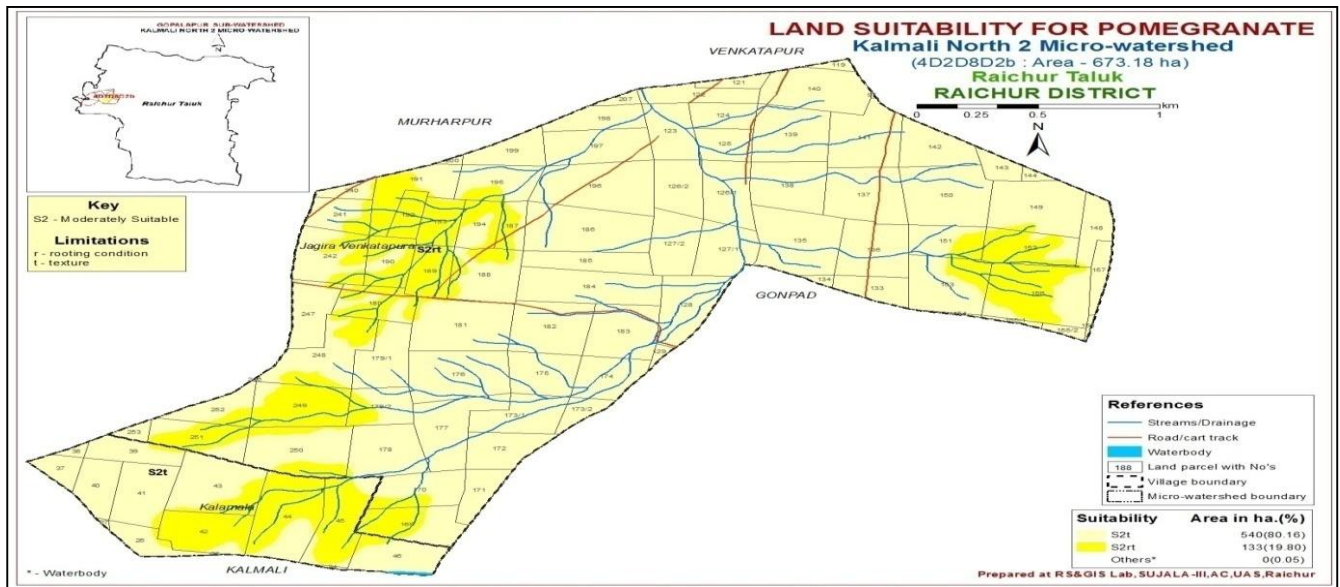

Fig 12: Land suitability map for lime in Kalmali North-2 MWS

Fig 13: Land suitability map for Pomogranate in Kalmali North-2 MWS

References
1. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd. New Delhi, 1973.
2. Maheshkumar Basavaraj K, Sharanbhoopal R, Rudramurthy HV, Rajesh NL. Land evaluation of Dongaragaon micro-watershed in North Eastern Dry Zone of Karnataka for Sustainable Land Use Planning. Research Journal of Agricultural Science. 2017; 8(5):1110-1114.
3. Manoharachari D, Kuligod VB, Gundlur SS, Patil PL, Hosmath JA. Land Capability, Irritability Classification and GIS Mapping in Asoti-4 Micro-watershed of Gadag District (Karnataka), India. Int. J Curr. Microbiol. App. Sci. 2017; 4:131-141.
4. Rajesh NL, Satishkumar U, Shankergouda I, Bhat SN, Basavaraj K, Rudramurthy HV *et al*. Detailed LRI for Assessment of Land Capability and Land Suitability of Amarapura-2 Micro-Watershed Using RS and GIS. Int. J Curr. Microbiol. App. Sci. 2018; 7(10):2370-2381.
5. Sehgal JL. Pedology - Concepts and applications. Kalyani Publishers, New Delhi, 1996, 488.
6. 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.
7. Sys C, Van Ranst E, Debaveye J. Land Evaluation Part 1 & 2, Agricultural Publication 7, Brussels, Belgium, 1991.