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Mapping of Crop Growing Soils in Kannur Micro Watershed Kollegal Taluk, Chamarajnagar District, Karnataka

Ravindra Naik M.[1], Anilkumar K. S.[2]

[1]Department of Soil Science and Agricultural Chemistry, UAS, Bangalore-560 065, Karnataka, India

[2]ICAR-National Bureau of Soil Science and Land Use Planning, R.C. Bangalore-560 024, Karnataka, India

Abstract: ***The selected microwatershed belongs to Kollegal taluk of Chamarajanagar district. The microwatershed lies 20 km away from Kollegal taluk head quarter. The Micro-watershed is located between 12^0 6' 34.5" and 12^0 7' 49.6" N latitude, 77^0 15' 30.9" and 77^0 14' 20.2" E longitude, with an average elevation of 775 m above Mean Sea Level (MSL). It occupies a part of the four villages viz., Kannuru, Anapura, Mangala, and Kamgare. Composite soil surface sample in strategic manner to cover all farming systems of the watershed. Upland soils was slightly acidic to neutral, lowlands soil reaction was neutral to slightly alkaline. The electrical conductivity of all the fertility points was negligible, The organic carbon content vary between low to medium, The cation exchange capacity of the soil varied from low to medium. The available nitrogen, phosphorus and potassium were low, low to medium and medium respectively and fertility maps of all nutrients prepared.***

Keywords: Microwatershed, Remote Sensing (RS) tools, cation exchange capacity, GPS, physiographic units

1. Introduction

The ability of the land to produce crops is limited and the limits to produce crops are set by soil, climate and landform conditions. However, the capacity of a soil to produce crops is limited and the limits to production are set by intrinsic characteristics, agro-ecological settings, use and management (FAO, 1993a). Despite the significant growth in production, the sustainability of some cropping systems has been showing signs of fatigue. Therefore, comprehensive account of our land resource and ascertain its potential and problems towards optimizing land use on sustainable basis is necessary. Keeping these considerations in view, an investigation was carried out for Kannur micro watershed in Kollegal taluk of Chamarajanagar.

Objective: To assess fertility status and preparation of fertility maps of major soils of the Kannur microwatershed using RS tools

2. Materials and Methods

Remotely sensed data from IRS P6 was collected from Karnataka State Remote Sensing application Centre, Bangalore. Sensor used in this satellite is LISS IV MX. The imagery scale is 1:12,500 scales, the imaginary collected on 5th July 2013. Toposheets used in this study are 57B/4,57C/4,57F/4.The imaginary was interpreted in conjunction with the toposheet based on the tonal variations, texture and pattern. Permanent structures like roads, settlements, and lakes were marked on the trace sheet mounted on the imagery. Soil samples (0-30 cm) at random were collected during 21-25th July 2013. The exact sample location was recorded using GPS Collected and analyzed for physical and chemical properties. GPS reading were taken at respective sampling site. Standard analytical methods as described by Richards (1954) and Jackson (1953) were followed for measuring various soils attributes like pH, ECe, soluble cations and anions, CEC and exchangeable cations, organic carbon content. From the satellite imaginaries and cadastral map, fertility maps on surface soil reaction, organic carbon, available nitrogen, phosphorus, potassium and available micronutrients were prepared to study the problems and potentials of study area(fig.1).

3. Results and Discussion

The pH values in the study area ranged from 5.04 to 8.60 with mean and SD values of 7.08 and 1.16, respectively. Most of the study area was under neutral to moderately alkaline range. The acidic nature of red soils was due to acidic nature of parent material of the study area. The reaction was alkaline neutral to alkaline nature of black soils which was mainly due to high exchangeable bases (Bhadrapur and Sheshagiri Rao 1979). The EC values in watershed area ranged from 0.01 to 1.15 dS m^{-1}. The black soils which exhibited brown layers were relatively free from salts. The brown layer seems to be controlled salinity and exchangeable sodium (Dasog and Hadimani 1980 and Anon 1969).The organic carbon content in the study area ranged from 0.04 to 1.0 per cent of soil. Majorly soils of the study area fall under low to medium category. The low organic carbon content of the soils may be attributed to the prevalence of high temperature (Table 1). The organic matter degradation and removal taken place at faster rate coupled with low vegetation cover, thereby leaving less chances of accumulation of organic matter in the soil (Govindarajan and Datta Biswas 1968). The available nitrogen status in study area ranged from 56.5 to 240 kg per ha with mean. All the soils of micro watershed fall under low category. All the study area was low in available nitrogen. Major portion of the nitrogen pool is contributed by organic matter (Table4.15). Low organic matter content in this area due to low rainfall and low vegetation cover facilitated faster degradation and removal of organic matter

leading to nitrogen deficiency The available phosphorus content in the study area ranged from 7.3 to 63.0 kg per ha. The lowlands were medium in status, whereas uplands and midlands fall under low category. The red soils shown low values of available phosphorus which may be due to low CEC, clay content and soil reaction of <6.5 The available potassium content in the study area ranged from 62.9 to 264.8 kg per ha. Majority of the area falls under low category. The lowland showed relatively high in available potassium than uplands and midlands (Table 1). Black soils shown high values due to predominance of K rich micaceous and feldspars minerals in parent material. The exchangeable Ca and Mg content in micro-watershed ranged from 30.3 to 197.6 ppm and 12.2 to 97.8 ppm. The upland soils are relatively less base saturated than lowlands and midlands Due to leaching of bases like Ca and Mg (Table 2). The available sulphur content of micro-watershed ranged from 0.6 to 18.0 ppm. The available sulphur content in lowlands was higher (Table 2) than that of uplands and midlands (Balanagoudar, 1989). The available copper content of micro-watershed ranged from 0.42 to 4.32 ppm. The available Iron content of micro-watershed ranged from 2.1 to 26.1 ppm. The available Manganese content of micro-watershed ranged from 2.1 to 26.1 ppm. The available Manganese content in lowlands was higher than that of uplands and midlands, available Manganese was 7.2 and 4.7 ppm, respectively. The available Zinc content of micro-watershed ranged from 2.1 to 26.1 ppm. (Table 3) Soil available micronutrients showed sufficient presence in most of the soils studied (Anil Kumar *et al* 2010).

4. Summary

Soil reaction of upland soils was slightly acidic to neutral which is attributed to the presence of leaching of bases from the soil along with runoff and drainage water due to moderately high rainfall existing in the area. In lowlands, the soil reaction was neutral to slightly alkaline (fig2) due to deposition of bases from the upland physiographic units. The electrical conductivity of all the samples was negligible, which indicates non-saline nature of soil and good leaching. The organic carbon content in all the samples to vary between low to medium due to low vegetative/cropping cover. The soil erosion and warmer climate leading to low accumulation of organic carbon in the study area. The cation exchange capacity of the soil varied from low to medium. The upland physiographic units were low in cation exchange capacity values than midlands and lowlands owing to their low clay content, low organic matter and the predominance of 1:1 type of clay minerals, whereas lowlands exhibited moderate CEC values due to higher clay content. The available nitrogen, phosphorus and potassium were low, low to medium and medium respectively (fig2). The low nitrogen content is attributed to the low organic carbon due to warmer climate and low vegetative cover coupled with little nitrogen fertilization. Soil available micronutrients showed sufficient presence in most of the soils studied except in case of available zinc confirming the study of Anil Kumar *et al.* (2010). Present Study noticed that study area was adequate in iron, manganese, copper. Study area was low in available zinc status(fig3).

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Author Profile

M.RAVINDRA NAIK received the B.Sc(Agri). and M.Sc(Agri). Degrees in Agriculutural sciences and specialization in Soilscience And Agricultural chemistry as National research scholar from University Of Agricultural Sciences, Banglore. 2012 and 2014, respective degrees. During 2012-2014, he done research in Aplication of RS tools and charecterization, taxonomical classification of soils with collaboration of [2]ICAR-National Bureau of Soil Science and Land Use Planning, R.C. Bangalore-560 024, Karnataka, India (NBSS &LUP). He now working with NBSS&LUP.

Table 1: Surface Samples Available Primary Nutrients

Village	GPS reading	Soil type	Crop	pH (1:2.5)	EC (1:2.5) (dS m^{-1})	O.C (%)	Available Macronutrients (kg ha^{-1})		
							N	$P2O_5$	K_2O
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	5.56	0.22	0.90	125.0	40.0	94.0
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	7.05	0.18	0.42	96.0	31.2	79.1
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	7.60	0.95	0.13	142.5	33.0	62.9
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	5.50	0.86	0.15	139.0	11.5	120.0
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	8.23	0.34	0.11	106.0	37.3	110.9
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	8.44	0.54	0.25	140.8	37.9	95.7
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	5.23	0.04	0.31	135.8	33.4	68.2
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (inter crop)	5.72	0.05	0.38	128.1	72.7	84.4
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	7.40	0.04	0.16	119.0	7.5	98.8
10) Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	7.03	0.29	0.18	168.0	40.0	96.0
11) Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	8.04	1.05	0.13	125.4	31.2	350.0
12) Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	8.60	0.32	0.53	136.7	21.5	246.3
13) Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	8.25	0.24	0.44	159.0	23.8	264.80
14) Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	8.64	0.36	0.25	240.9	29.3	170.5
15) Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	6.71	0.10	0.61	116.0	62.9	141.2
16) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	8.26	0.23	0.64	146.0	25.2	121.9
17) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	8.29	0.29	0.66	94.8	43.4	99.7
18) Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	6.35	0.13	0.71	79.7	9.1	206.4
19) Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	5.04	0.14	0.82	89.4	18.3	184.5
20) Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	7.55	0.12	0.66	69.6	46.6	74.0
21) Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	6.13	0.02	0.81	150.8	36.0	117.0
22) Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	6.12	0.02	0.46	99.5	78.2	130.0
23) Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	5.29	0.02	0.45	79.5	39.0	112.6
24) Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	6.00	0.01	1.00	84.5	42.3	91.50
25) Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	8.47	0.87	0.43	97.8	36.	104.8
26) Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	6.50	0.02	0.46	77.8	13.6	85.1
27) Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	8.11	0.13	0.45	122.0	29.9	105.7
Village	GPS reading	Soil type	Crop	pH (1:2.5)	EC (1:2.5) (dS m^{-1})	O.C (%)	Available Macronutrients (kg ha^{-1})	Village	GPS reading
28) Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	6.20	0.05	0.65	110.5	24.6	85.5
30) Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	8.37	0.06	0.62	56.5	20.4	16.0
Mean				7.07	0.25	0.48	119.95	33.60	129.19
S.D				1.16	0.29	0.25	35.19	19.93	21.40
Range (Min- Max)				5.04-8.64	0.01-1.05	0.11-1.00	69.60-240.9	7.5-78.2	21.40-350

Table 2: Surface samples available Secondary Nutrients

VILLAGE	GPS Reading	SOIL TYPE	CROP	Available secondary nutrients (ppm)		
				Ca	Mg	S
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	160.4	64.8	4.1
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	133.0	75.8	12.1
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	112.0	16.0	15.9
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	148.8	58.4	11.1
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	152.2	97.8	0.6
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	46.0	12.2	11.3
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	173.8	87.8	8.1
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (Inter crop)	102.2	66.4	12.4
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	197.6	63.2	11.4
10) Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	138.4	35.0	14.9
11) Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	117.8	60.2	17.0
12) Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	165.0	69.2	14.9
13) Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	150.8	69.0	10.1
14) Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	108.4	60.6	15.6
15) Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	138.0	35.4	18.0
VILLAGE	GPS Reading	SOIL TYPE	CROP	Available secondary nutrients (ppm)		
				Ca	Mg	S
16) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	183.8	45.4	17.0
17) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	117.0	36.4	10.4
18) Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	130.8	26.2	8.3
19) Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	179.2	40.0	17.3
20) Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	102.2	48.0	13.8
21) Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	160.4	44.8	12.9
22) Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	127.8	33.0	13.8
23) Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	128.2	28.8	8.3
24) Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	156.0	21.0	6.2
25) Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	165.0	28.8	7.6
26) Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	134.4	15.0	17.3
27) Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	140.0	31.0	10.8
28) Mangala	12°7'18.2" N 77°14'35.2" E	Red soil	Ragi-Maize	107.4	32.2	12.2
29) Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	106.0	36.4	6.9
30) Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	146.6	39.0	12.0
Mean				**137.64**	**45.92667**	**11.74333**
S.D				**30.35867**	**21.389**	**4.147022**
Range (Min- Max)				**30.35-197.6**	**12.2-97.8**	**0.60-18**

Table 3: Surface samples available Micro nutrients

VILLAGE	GPS Reading	SOIL TYPE	CROP	AVAILABLE MICRO NUTRIENTS (ppm)			
				Cu	Fe	Mn	Zn
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	2.34	7.56	11.7	0.04
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	2.08	10.22	14.24	0.56
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	2.56	7.08	9.36	0.62
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	2.82	6.56	10.4	0.12
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	2.00	2.76	5.60	0.04
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	1.20	5.10	5.16	0.82
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	2.88	5.82	9.60	0.56
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (inter crop)	2.96	26.18	8.20	0.48
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	2.70	7.34	8.40	2.14
10) Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	2.20	5.02	5.80	0.88
11) Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	2.44	4.96	7.00	5.08
12) Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	2.70	7.5	7.20	0.22
13) Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	0.42	2.08	6.80	0.10
14) Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	3.12	13.08	8.60	0.30
15) Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	3.30	14.44	18.20	0.20
16) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	3.02	3.10	7.80	0.16
17) Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	1.52	4.6	8.64	3.80
18) Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	1.46	5.34	9.00	0.48
19) Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	2.84	5.16	8.60	0.96
20) Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	1.64	5.60	10.5	0.30
21) Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	3.38	7.08	11.5	0.22
22) Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	3.02	12.68	9.70	1.32
23) Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	2.76	6.08	5.70	0.16
24) Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	2.30	4.80	19.04	0.96
25) Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	4.32	13.62	5.16	0.88
26) Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	2.60	3.16	9.50	0.08
27) Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	3.68	6.06	9.30	0.12
28) Mangala	12°7'18.2" N 77°14'35.2" E	Red soil	Ragi-Maize	2.14	3.56	9.26	0.14
29) Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	2.90	3.56	4.96	0.22
30) Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	3.34	7.52	10.44	0.24
Mean				**2.55**	**7.254**	**9.17**	**0.74**
S.D				**0.77**	**4.74**	**3.29**	**1.09**
Range (Min- Max)				**0.42-4.32**	**2.08-26.18**	**4.96-19.04**	**0.04-5.08**

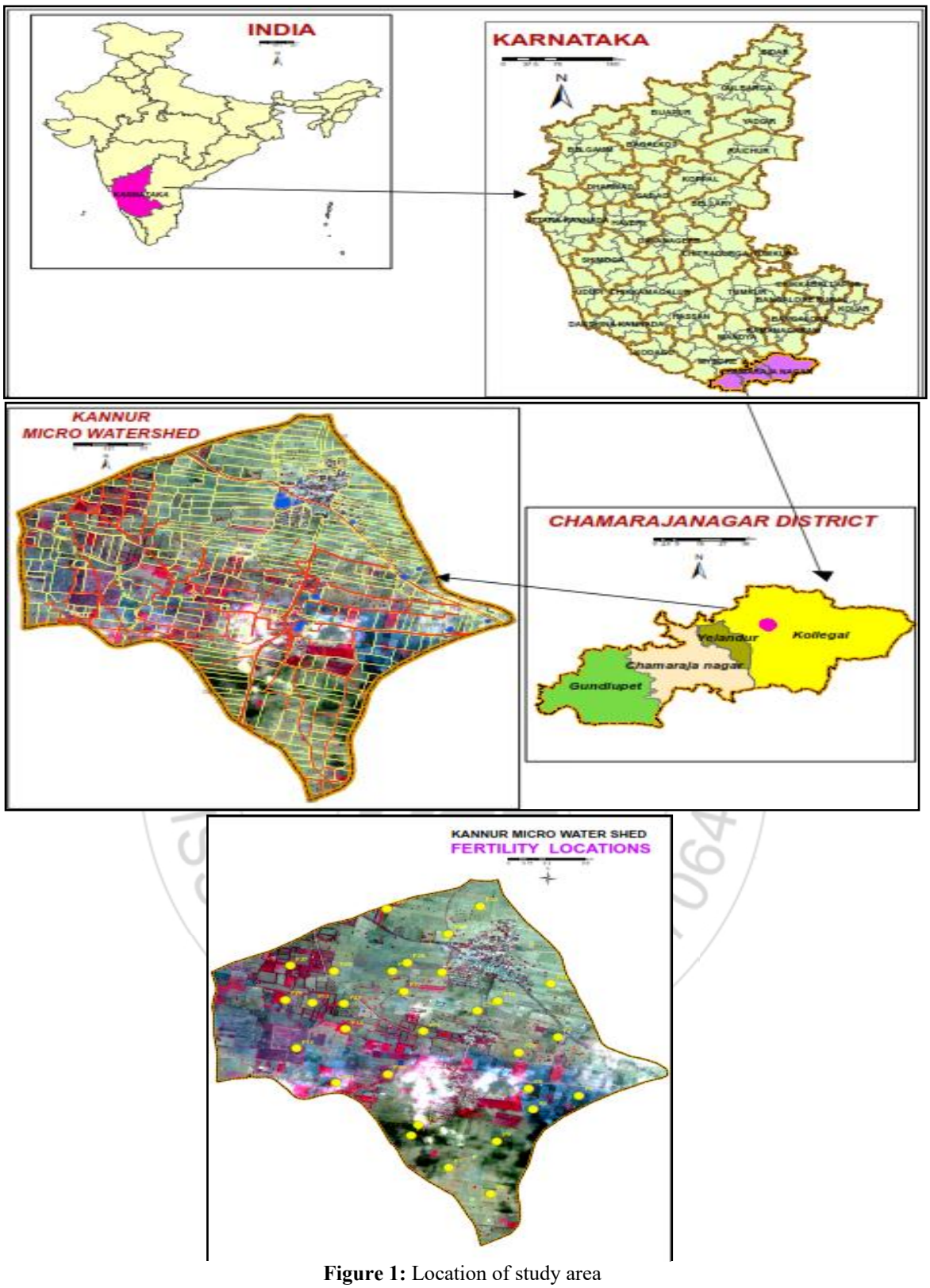

Figure 1: Location of study area

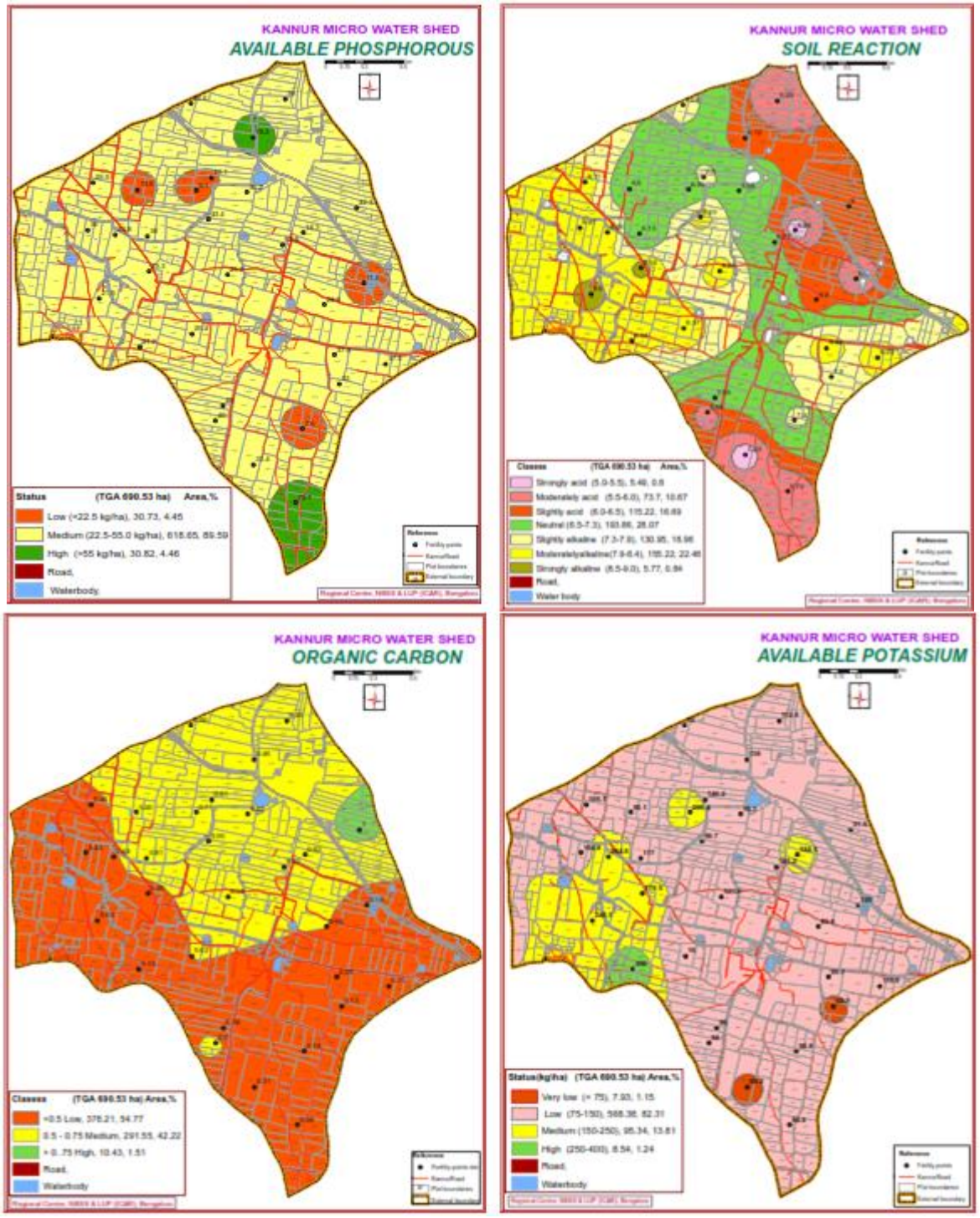

Figure 2: Maps showing soil reaction,organic carbon,avalible potassium,avalible phosphorus.

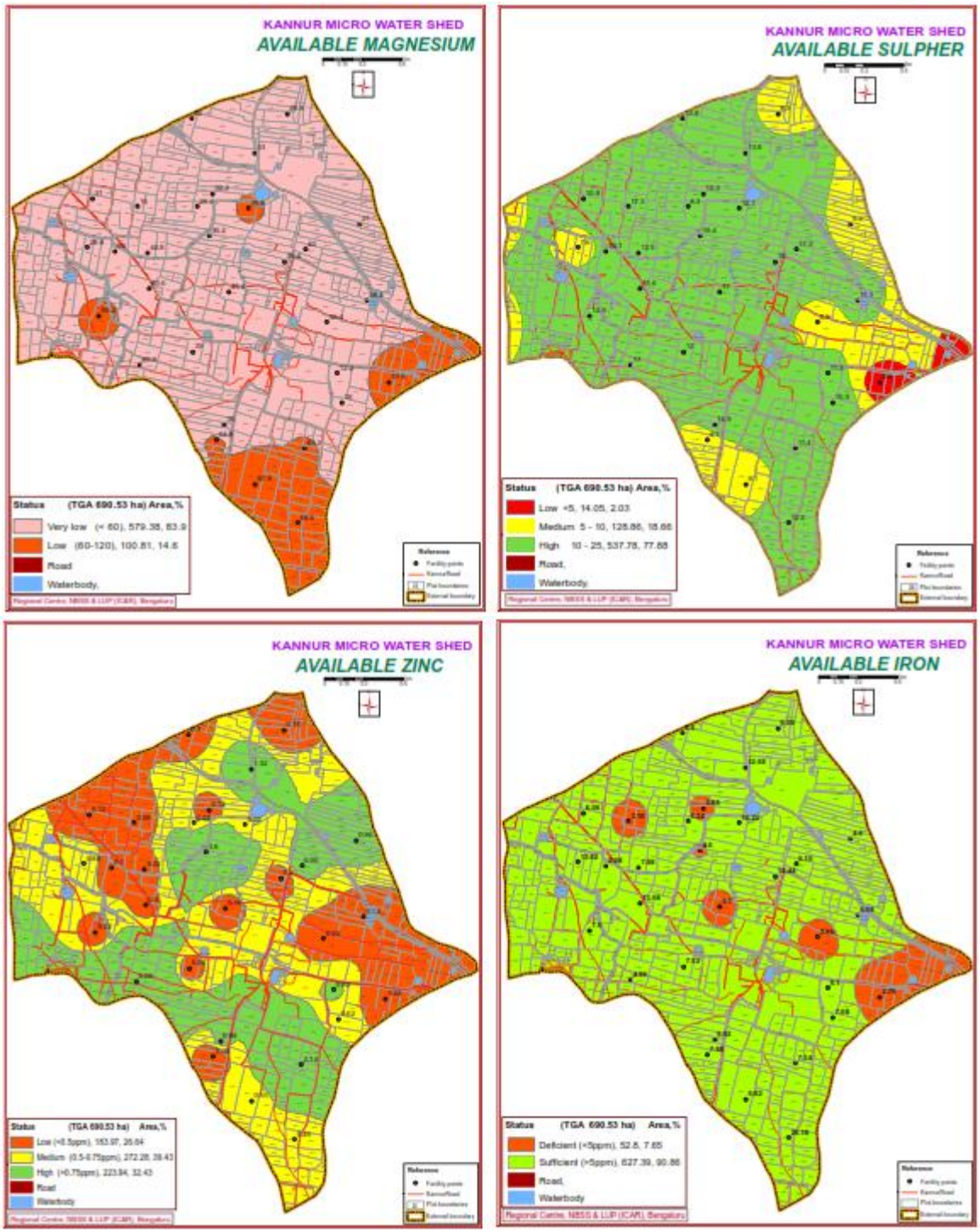

Figure 2: Maps showing avalible secondary nutirients and micronutrients.