An Asian Journal of Soil Science, (December 2009 to May-2010) Vol. 4 No. 2 : 179-182

Research Paper :

A study on the paddy area in relation to soil properties and physiography using remote sensing in upper Krishna command project to Karnataka

I.RASHMI, G.S. DASOG, V.M. DHANYA , N.K. BINITHA **AND** U.H. BHANUPRAKASH

Accepted : *July, 2009*

See end of the article for authors' affiliations

Correspondence to :

I. RASHMI
Krishi Vigyan Kendra,
DHAMTARI (C.G.) INDIA

ABSTRACT

A study was undertaken in Shorapur taluka of upper Krishna Command (UKP) to know the impact of paddy cultivation on the soil properties. Physico-chemical properties of auger samples at different physiographic units were studied indicating alkaline to strongly alkaline reaction , while ESP values of auger samples ranged from 13.36 to 29.11 per cent and organic carbon of samples was spread between 0.26 to 0.65 per cent . Supervised maximum likelihood method was used to classify IRS P6 LISS-III imagery using ground truth data which indicated the land use statistics for the year 2005 where paddy covered the maximum cultivated area followed by groundnut, cotton and jowar. In confusion matrix the overall accuracy for the year 2005 was 86.99 per cent. Both the user and the producer accuracy were found above 78 per cent for all categories.

Key words : UKP, Soil properties, IRS P 6 LISS III, Classification, Paddy, Physiography

The upper Krishna Project is a major project taken up to irrigate drought prone areas of Gulbarga, Bijapur and Raichur districts of northern Karnataka. Shorapur taluka of Gulbarga district offers itself as a best study area as it has highest salt affected area before irrigation and considerable secondary salinized areas, has highest area under paddy crop. The Krishna and Devapur Halla are the major river/streams draining the area.

A number of national and state level projects like land use/land cover, soil resources inventory, waste land mapping, watershed development etc. using remote sensing technique have been carried out generating enormous database on the present natural resources scenario. These projects have greatly helped in establishing the rationality of operationalisation of remote sensing techniques in mapping and monitoring of information on natural recourses. Keeping these in view, a study had been carried out to interpret the soil properties and to determine land use/ land cover of UKP with special reference to paddy.

MATERIALS AND METHODS

The study area is located between longitudes $76^0$15' to $76^0$56' E longitudes $16^0$10 N to $16^0$35 and covers an area of 1,66,951.05 hectares comprising of 162 villages in Shorapur taluka of Gulabarga district of Karnataka state. The survey of India toposheets of 56 D_6, D_7, D_8, D_9, D_{10}, D_{11}, D_{14}, D_{15} on 1:50,000 were scanned and geocoded using ERDAS imagine 8.7. Finally all were mosaiced and subset was created demarcating talukaa boundary.

Digital image analysis :

Cloud free satellite data from IRS P6 LISS III imagery corresponding to path 98 and row 61 for the study area of Shorapur taluka procured on 27th February 2005 was registered and then subset was created as per the vector layer. Preliminary interpretation of the satellite data was conducted and GCPs, which were distributed uniformly throughout the image with minimum root mean square (rsm) error of less than 0.5 were selected. The administrative boundaries of the Shorapur taluka were digitized. False coloured composites of the study area were generated using bands 2, 3, 4 in blue, red and green filters

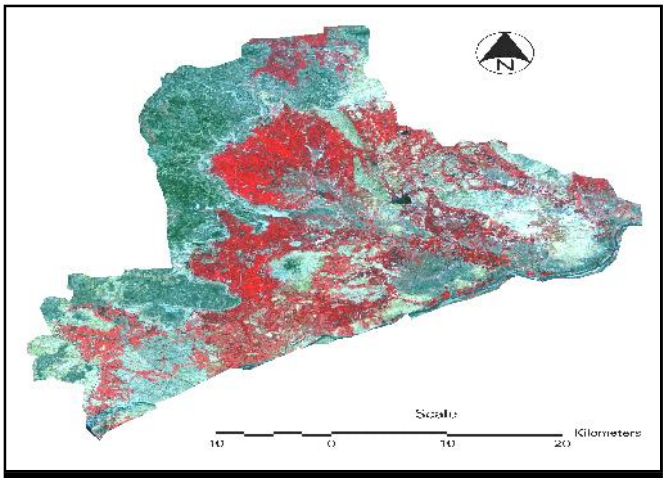

Fig. 1 : False colour composite of IRS P6 LISS image of Shorapur taluka, Gulbarga district, Karnataka (Feb 2005)

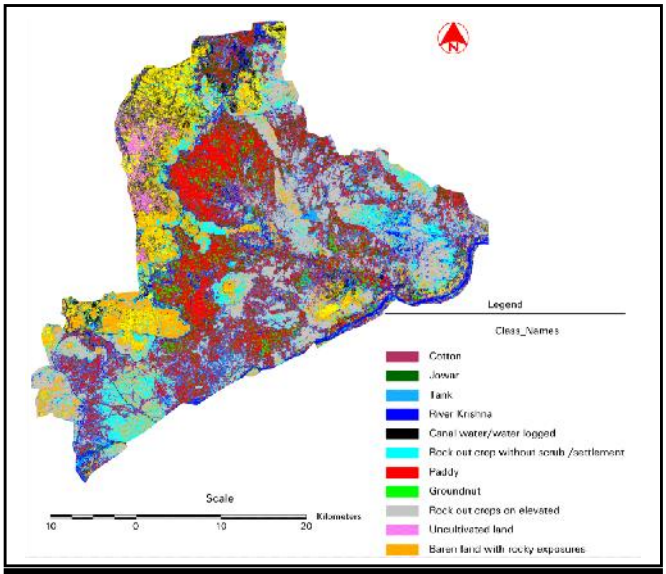

Fig. 2 : Supervised maximum likelihood classification of IRS P6 LISS III image for February 2005

of the image data (Fig. 3). Physiography and soil vector layers were overlaid on IRS imagery.

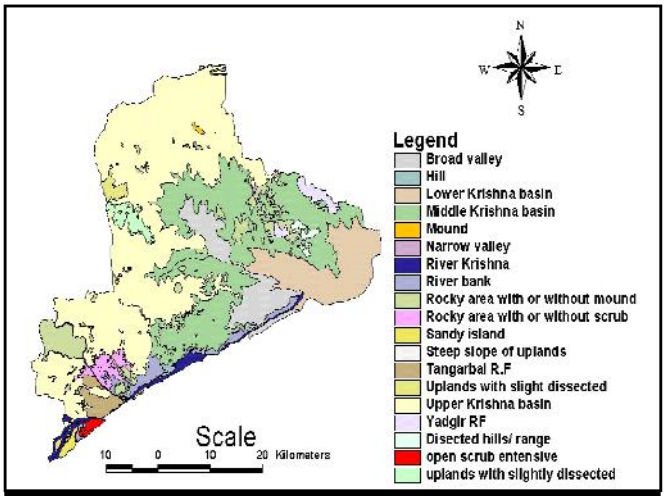

Fig. 3 : Physiography map of Shorapur taluka, Gulbarga district, Karnataka

Accuracy assessment :

Classification error matrix was prepared as this is one of the most common means of expressing classification accuracy, which compares each class on a category-by-category basis, the relationship between known reference data and the corresponding results of an automated classification. Overall accuracy was computed by dividing the number of correctly classified pixels by the total number of reference pixels. The crop acreage estimation was made on the basis of supervised classification.

Collection of soil samples :

Forty-nine soil samples at three different depth (0 to 0.15 m, 0.15 to 0.30 m and 0.30 to 0.60 m) were collected from paddy fields in Shorapur taluka during February 2005 and the chemical properties namely pH, EC, organic carbon, exchangeable cations (Ca^{2+}, Mg^{2+}, Na^{+} and K^{+}), CEC and ESP were estimated by adopting standard method (Jackson, 1973).

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Physiography :

The physiography map showed upper Krishna basin occupies the highest area followed by middle Krishna basin (Table1).

Table 1 : Physiography of Shorapur taluka

Sr. No.	Physiographic units	Area (ha)
1	Dissected hills/ranges	985.48
2	Hill	561.10
3	Mound	719.40
4	Open scrub extensive	699.83
5	Rocky area with or without mountain	17135.19
6	Rocky area with or without scrub	2841.55
7	Steep slopes of uplands	178.10
8	Uplands slightly dissected	1283.85
9	Tangarbal R.F.	2675.60
10	Yadgir RF	2286.44
11	Broad valley	11,414.45
12	Narrow valley	288.44
13	Lower Krishna Basin	17301.30
14	Middle Krishna Basin	28046.40
15	Upper Krishna basin	81782.31
16	River bank	3805.22
17	River Krishna	3738.91
18	Sandy island	995.38
	Total	2953333.00

Auger samples:

The chemical properties of the forty nine auger samples namely pH, EC, exchangeable cations (Ca^{++}, Mg^{++}, K^{+}, Na^{+}), organic carbon, $CaCO_3$, CEC and ESP are given in the (Table 2). The pH of the soils indicated that the soils are alkaline to strongly alkaline in reaction ranging between 7.99 to 9.09 In many soil bodies an increase in soil pH with depth was evident, reaction of exchangeable sodium and $CaCO_3$ under low CO_2 and low salt content, leads to higher concentration of sodium carbonate and consequently, high pH, could be the cause

Table 2 : Table showing mean values of chemical properties of paddy growing soils of Shorapur taluka

Depth (cm)	pH (1:2.5)	EC (dSm^{-1})	OC (%)	$CaCO_3$ (%)	Exchangeable cations (cmol(+) kg^{-1})				CEC (cmol (+) kg^{-1})	ESP (%)
					Ca	Mg	Na	K		
Gently sloping plain										
0-15	8.41	0.48	0.59	11.60	11.35	4.38	5.25	0.20	35.34	18.14
15-30	8.36	0.38	0.43	13.00	11.83	4.85	6.49	0.22	38.49	18.14
30-60	8.03	0.28	0.26	15.28	13.08	5.78	7.46	0.24	40.45	18.82
Moderately sloping plain										
0-15	8.58	0.86	0.53	11.12	13.58	6.64	6.39	0.37	39.64	17.14
15-30	8.77	0.64	0.44	12.00	15.13	7.28	8.14	0.36	42.60	19.44
30-60	8.44	0.54	0.37	14.61	16.33	8.12	8.86	0.31	45.01	20.98
Steepy slope										
0-15	8.52	0.80	0.56	9.54	10.01	3.99	5.64	0.31	34.90	16.36
15-30	8.56	0.55	0.46	12.25	11.10	4.68	7.17	0.38	38.34	13.47
30-60	8.23	0.35	0.33	13.78	12.48	5.24	8.19	0.31	41.26	18.82
Rocky hills without scrub										
0-15	9.09	0.72	0.65	9.50	12.8	8.2	8.50	0.40	40.05	21.23
15-30	8.68	0.48	0.45	10.50	14.3	9.0	10.47	0.35	42.26	24.78
30-60	7.99	0.28	0.46	12.50	14.5	9.1	12.27	0.33	45.50	26.97
River alluvial plain										
0-15	8.82	2.04	0.47	12.02	11.02	6.28	7.67	0.19	36.86	20.87
15-30	8.83	1.40	0.38	13.78	12.72	6.92	9.63	0.20	42.72	22.88
30-60	8.49	0.98	0.40	15.52	13.66	7.66	9.13	0.23	43.97	22.86
Broad valley										
0-15	8.87	0.82	0.56	12.58	14.15	5.60	6.92	0.23	37.58	18.31
15-30	8.59	0.64	0.43	15.25	15.20	7.15	8.65	0.22	41.43	20.89
30-60	8.25	0.81	0.37	15.58	16.48	7.22	9.00	0.24	45.40	20.67
Rocky hills with scrub										
0-15	8.56	0.47	0.55	8.7	18.5	4.6	5.24	0.07	18.00	29.11
15-30	8.40	0.35	0.40	10.2	20.7	7.5	8.56	0.08	22.00	25.57
30-60	8.04	0.30	0.37	13.1	23.9	6.0	8.02	0.17	25.03	22.06

for this trend (Cruz-Romero and Coleman, 1975). For the same reason, it appears that, the soils of Shorapur taluka under UKP command were associated with relatively higher pH. Similar observations were made in salt affected soils of upper Krishna Project area (Kotur, 1985 and Yeresheemi, 1996). Free $CaCO_3$ generally tended to accumulate at lower depth showing an increasing trend of its distribution down the soil bodies. Such a study in vertisol had also been observed by Krishnamoorthy and Govindrajan (1977). The general order of preponderance of cations was Ca>Mg>Na>K. However, exchangeable calcium, magnesium and sodium content was more in black soil.

Accuracy assessment for supervised classification :

The main crops for the *rabi* season were paddy, groundnut, jowar and cotton. The land use statistics for the year 2005 shows that a major part was under paddy covering 30,541.63 ha indicating increase by 11,066 ha. There was a considerable decrease in the groundnut-growing region by 6,487.09 ha. Cotton another cash crop apart from groundnut covers an area of 11,988.86 ha and Jowar being the staple crop covers an area of 8114.45 ha.

The overall accuracy for the year 2005 is 86.99 per cent. In confusion matrix percentage of pixels were classified for supervised classification for the year 2005 (Table 3). The user and the producer accuracy are the two widely used measures of class accuracy. The producer accuracy refers to the probability that a certain land-cover of an area on the ground is classified as such, while the user's accuracy refers to the probability that a

Table 3 : Confusion matrix in percentage of pixels classified for Supervised classification 2005

Sr. No	Data	1 Canal	2 Settlement	3 Waterlogged	4 Groundnut	5 Rock out crops with mount	6 Jowar	7 Cotton	8 Rock out crops without mount	9 Uncultivated land	10 Granitic exposure	11 Paddy	12 Water bodies	13 Producer accuracy
1.	Canal	84.6	2.5	0.0	0.0	3.5	0.0	0.0	0.0	0.6	0.0	0.0	0.7	91.9
2.	Settlement	7.7	82.7	0.0	0.0	1.2	0.7	0.0	0.0	0.0	5.2	0.0	8.4	105.8
3.	Waterlogged	0.0	0.0	100.0	7.7	0.0	0.0	0.0	33.3	0.0	0.0	6.7	0.3	148.0
4.	Ggroundnut	0.0	0.0	0.0	92.3	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.5	99.5
5.	Rock out crops with mountain	0.0	1.3	0.0	0.0	94.3	0.1	0.0	0.0	0.0	14.6	0.0	0.1	110.4
6.	Jowar	0.0	0.0	0.0	0.0	0.0	79.1	0.0	0.0	0.0	0.0	0.0	0.0	79.1
7.	Cotton	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0
8.	Rock out crops without mount	7.7	8.3	0.0	0.0		0.0	0.0	66.7	0.6	1.9	0.0	7.1	92.2
9.	Uncultivated land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.8	0.0	0.0	0.0	97.8
10.	Granitic exposure	0.0	4.7	0.0	0.0	1.2	20.1	0.0	0.0	0.0	77.9	0.0	0.0	103.8
11.	Paddy	0.0	0.0	0.0	0.0	0.0	0.1			0.0	0.0	86.7	1.1	87.9
12.	Waterbodies	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.5	0.0	81.8	83.8
13.	User accuracy	92.1	78.2	67.6	92.8	85.4	100.0	100.0	72.3	100.0	75.1	98.6	97.6	

pixel labeled as a certain land cover class in the map is really this class. Both the user and the producer accuracy were found above 78 per cent for all categories.

Authors' affiliations:
G.S. DASOG, Department of Soil Science and Agricultural Chemistry, Krishi Vigyan Kendra, DHAMTARI (C.G.) INDIA
V.M. DHANYA, GVHSS, TRIVANDRUM (KERELA), INDIA
N.K. BINITHA, Agriculture Office, KANNUR (KERELA), INDIA
U.H. BHANUPRAKASH, Indian Farmers Fertilizers Coopprative Ltd. (IFFCO), COCHIN (KERALA), INDIA

REFERENCES

Cruz-Romero, G. and Coleman, N.T. (1975). Reactions responsible for high pH of Na-saturated soils and days. *J. Soil Sci.*, **26**: 169-175.

Jackson, M.L. (1973). *Soil Chemical Analysis*, Prentice Hall of India Private Limited, New Delhi.

Kotur, S.C.(1985). Chemical investigations of salt affected soils in Malaprabha and Ghataprabha river valley projects with empahsis on genesis. Ph.D. Thesis, University of Agricultural Sciences, Bangalore.

Krishnamoorthy, P. and Govindrajan, S.V. (1977). Genesis and classification of association red and black soils under Rajatibanda diversion irrigation scheme (Andhra Pradesh). *J. Indian Soc. Soil Sci.*, **25**; 239-246.

Yeresheemi, A.N.(1996). Studies on salt affected soils of upper Krishna Project Command area. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.

****
******
****