LAND USE / LAND COVER MAPPING IN THE COASTAL AREA OF NORTH KARNATAKA USING REMOTE SENSING DATA

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Land is the most important natural resource, which embodies soil, water and associated flora and fauna involving the total ecosystem. The growing pressure of population coupled with increasing demands made on land resources have brought extra pressure on the available land (Rao *et al.,* 1996). Remote sensing has been used for environmental monitoring including forest cover (Foody and Curran 1994; Sader *et al.*, 2002; Hayes and Sader, 2002; Chauhan *et al.*, 2003) and is helpful to obtain data on land use /land cover for inaccessible dense forest on mountains and in the marshy lowlands of the coastal region. The present study aims to obtain the information on the land use pattern in Kumata taluk, by using remote sensing data.

The study area is Kumta taluka of Uttar Kannada district of Karnataka. It lies between 14° 36' 12.48" to 14 ° 36' 31.56" N latitude and 74° 17' 24.75" to 74 ° 41' 46.71" E longitudes. The total area of the study area is 582 km². The area close to the coast is grouped as agro-ecological sub region 19.3 and the hinterland away from it under 19.2 by Sehgal *et al.* (1992). Kumta receives a mean annual rainfall of 3521.7 mm. The maximum temperature is 33.0°C recorded in May and the minimum temperature is 20.9°C in January. The area is drained by Aghnashini river and its tributaries. The elevation of the study area ranges from 0-800 m above MSL.

The IRS 1D LISS III images were geocoded using polyconic projection, mosaiced and then a subset was created coinciding with administrative boundaries of the study area from the toposheets. False colour composites of the study area were generated using bands 2, 3 and 4 and (Fig. 1). Signatures for the training sets were collected by ground truthing. Supervised maximum likelihood method was used to classify the imagery (Fig. 2). The accuracy of the classification was then assessed using stratified sampling method to determine whether it served useful purpose. The physiographic map prepared using toposheets was digitized. Physiography and soil vectors were overlaid on the image.

The physiographic units on which agriculture is practiced are pediments, river alluvial plain and coastal alluvial plain. They appear in light red to darker red tone regular shape in the imagery. The
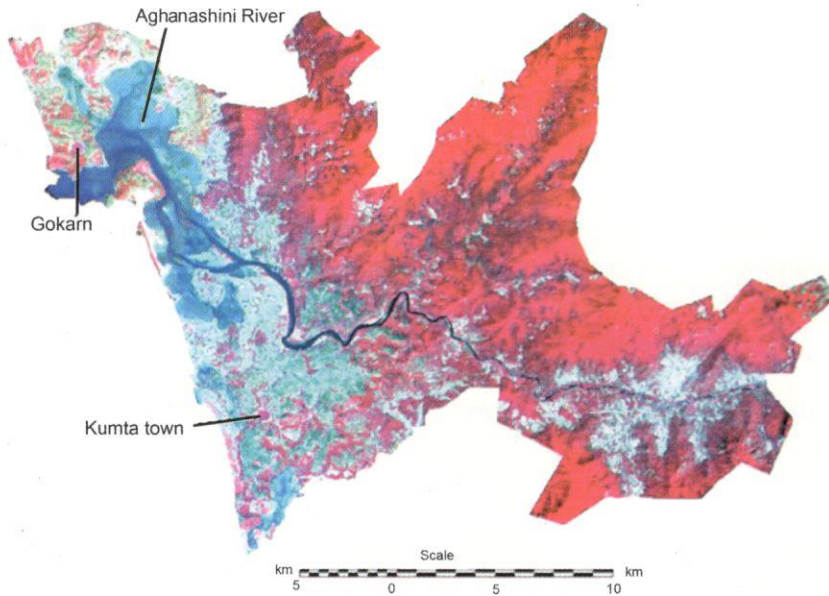
Fig. 1. False color composite of IRS 1D LISS III image of Kumta taluk
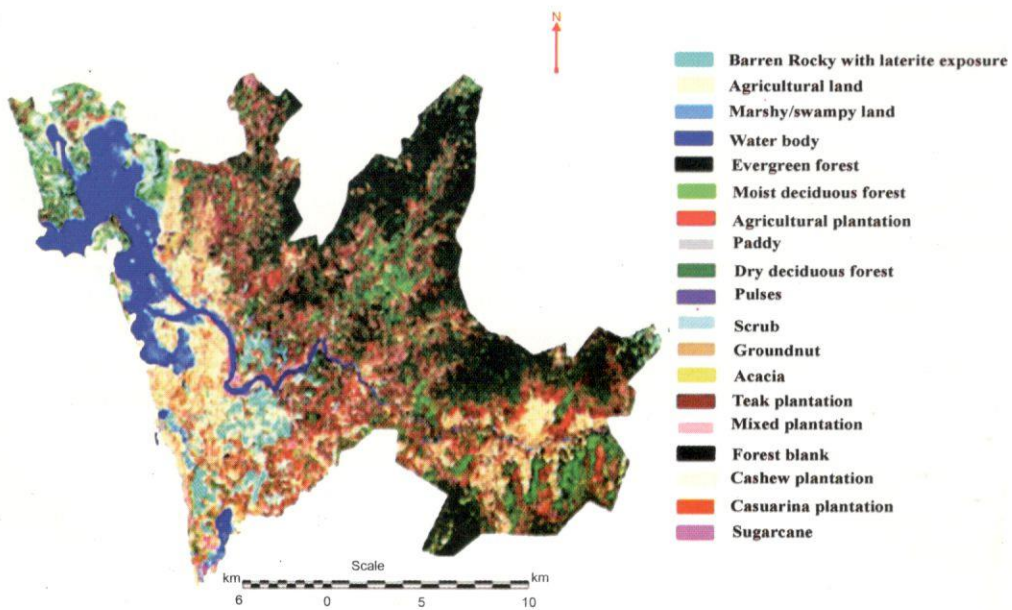

Fig. 2. Supervised classification of IRS 1D LISS image of Kumta

major crops grown in the region are paddy, groundnut, sugarcane and pulses. They occupy an area of 11,315.6 ha, accounting about 19.4% of the study area (Table 1). Groundnut is the major field crop closely followed by paddy during *rabi* confined to coastal .alluvial plain. However, it must be

mentioned that paddy is the most extensive field crop during *kharif* season extending to midlands as well. Pulses are grown generally after paddy on residual moisture and cover 667.1 ha area mostly on coastal plains. Sugarcane is the other cash crop occupying an area of 118 ha in the coastal alluvial plain.

Table 1: Land cover/ land cover classification of Kumta taluk

No.	Land cover	Area Ha	Soil type	Physiography
1	**Agricultural land**	**11315.6**		
1.1	Groundnut	1538.9	Ustifluvents	
1.2	Paddy	1503.2	Ustifluvents and Fluvaquents	Coastal alluvial plain
1.3	Pulses	667.1	Ustifluvents	
1.4	Sugarcane	118.3	Ustifluvents, Plinthustults and Haplustults	Coastal alluvial plain and pediments
1.5	Uncultivated land	7488.1	Haplustults, Plinthustalfs	Pediments
2	**Plantation crops**	**5347.0**		
2.1	Cashew	1302.7	Plinthustults and Kandiustults	Alluvial plain
2.2	Other Plantation crops	4044.3	Haplustalfs	Valley
3	**Waste Land**	**2060.0**		
3.1	Barren rocky with laterite exposures	1118.5	Kanhaplustults and Plinthustults	Plateau and Pediments
3.2	Marshy/Swampy	941.6	Ustifluvents	River alluvial plain/ coastal alluvial plain
4	**Forest plantation**	**12581.9**		
4.1	Teak plantation	5263.2	Haplustults and Plinthustalfs	Hills
4.2	Casurina	1137.3	Haplustalfs and Kanhaplustalf	Valley
4.3	Acacia	599.2	Kanhaplustalf and Haplustults	Escarpments
4.4	Mixed plantation	2114.2	Haplustalfs and Typic Plinthustulfs	Escarpments, Valley
5	**Forests**	**17151.4**		
5.1	Evergreen forest	9282.0	Haplustults	Hills
5.2	Dry deciduous forest	1649.0	Dystrustepts and Haplustults	Hills
5.3	Moist deciduous forest	4111.2	Haplustults and Haplustalfs	Hills and valleys
6	**Degraded forest**	**5848.7**		
6.1	Forest Blank	2960.2	Haplustults, and Kanhaplustalts	Valley and Alluvial plain
6.2	Shrub/Scrub	2888.5	Haplustults	River alluvial plain
7	**Water bodies**	**3964.5**		
	Total	58269.2		

Uncultivated lands occupy relatively uplands and appear in greenish blue or brown tone in the imagery due to surface moisture and plant cover. They occupy a considerable area (7488 ha). Majority of this area would be under paddy during *kharif* and are left fallow during *rabi* due to insufficient water supply.

Plantation crops include cashew, coconut, arecanut citrus and other horticultural crops. These occur on both uplands and foothills and occasionally on alluvial river plains also. They appear in red to dark red tone and have smooth texture in the imagery. The difference in tone may signify different types of plantations or same plantation in different stages of growth or foliage cover or due to seasons. They occupy an area accounting about 9.2% of the study area; the cashew being the most predominant. Wastelands mainly categorized as barren and rocky, account for about 3.5% to the study area. These lands are defined as the rock exposures of varying lithology often barren and devoid of soil cover and vegetation. They occur amidst hill forests as openings or scattered as isolated exposures or loose fragments, boulders or as sheet rocks on plateau and plains. They appear in light to dark greenish blue tone and also light yellow tone and are irregular in shape. Among this category laterite exposures are predominant comprising an area of 1118.5 ha. Marshy lands are permanently or periodically submerged with water and have grasses and reeds as vegetation. The water may be brackish or fresh depending on the situation and they appear in light blue to green patches in the imagery.

Forest plantations comprises mainly of teak, casuarina, acacia, timber, bamboo which are tall and have good density in the Kumta forest range. They are mainly on hill slopes and valley appearing in dark red tone, smooth texture and irregular in shape. The forest plantation covers an area of 17151 ha, account for about 21% of the study area. Teak plantations are found on hills adjoining the evergreen forest and occupy an area of 5263.19 ha followed by the mixed forest plantation comprising of evergreen and

deciduous tree covers an area of about 4,983 ha. predominantly found on the slope hills.

The forest cover consists of evergreen, dry deciduous and moist deciduous vegetation. The evergreen and deciduous forest covers an area of 17151.4 ha, accounting for 29.4% of the study area. Evergreen forest includes areas in which more than 67% of the trees remain green throughout the year. Both coniferous and broad-leaved evergreens are included in this category. The evergreen forest has different densities between 40-60% and more than 60% which covers and area of about 1724.5 ha and 7557.5 ha respectively, on hilly terrain. The imagery shows shadow cast on the hills where the spectral reflectance turns from red to dark red colour smooth texture and appears irregular in shape. The moist deciduous forest is found on the lower reaches of the alluvial plains of the Aghnashini river. The lower reaches of the plains are marshy as the rain water drained from the hills gets accumulated. The moist deciduous forest covers an area of 4111.2 ha. The dry deciduous forests cover an area of 1649 ha and are found on hills.

The vegetation density of the degraded forest is less than 20%. It is the result of both biotic and abiotic influences. The degraded forest appears light red to dark brown in tone subject to amount of foliage cover and season. The denuded forest covers an area of about 5848.7 ha, accounting for 10% of the study area. Forest Blank appear yellowish brown and occur in close proximity to the other forest areas comprising an area of 2960.2 ha. The scrub /shrub include true shrubs, young trees; weeds that are small or stunted because of environmental conditions cover an area of 2888.5 ha. They appear light yellow in tone, and appear throughout. The Aghanashini river forms a lagoon on the west giving scope for aquaculture.

The major land use classes were agriculture crops, plantations and horticulture crops, forests and their types, forest plantations and their types, water bodies, degraded forests and their types. The

major classes like forests and forest plantations were classified with more than 80% accuracy. The overlapping trends of classes like evergreen with different densities were due to hill shadow and that of the forest plantations with mixed plantations and deciduous forests as the plant species of forest and agricultural plantations are scattered and gives misleading spectral reflectance. Shadows and reflection within the canopy can reduce reflection that returns to the satellite sensor by as much as 50% of the single leaf reflection in the visible to 70% in the near infrared (Gibson and Power, 2000). An overall accuracy of 75% was obtained and the findings are in tune with similar studies (Schreier *et al.*, 1994; Gautam *et al.*, 2002).

The study highlights that a considerable forest area is degraded and is marshy/swampy that merits attention of planners and administrators. Undertaking massive aforestation in degraded forest area and promoting aquaculture in the marshy land would seem to be better land management options. The detailed forest cover type and density classes are important parameters to assess the natural resource accounting and biodiversity. The phenological developments of the vegetation depend on the type of vegetation, environmental factors, topography, background soil and also with forest management practices.

References

Chauhan, P.S, Porwal, M.C., Sharma, L. and Negi, J.S. (2003). Change detection in Sal forest in Dehradun forest division using remote sensing and GIS. *J. of Indian Soc. of Remote Sensing*, **31(3)**: 211-218.

Foody, G.M. and Curran, P.J. (1994). Estimation of tropical forest extent and regenerative stage using remotely sensed data. *J. of Biogeography*, **21(3)**: 223-244.

Gautam, A.P., Webb, E.L. and Eiumnoh, A. (2002). GIS assessment of land use-land cover changes associated with community forestry implementation in the Middle Hills of Nepal. *Mountain Research and Development*, **22(1)**: 63-69.

Gibson, P.J. and Power, C.H. (2000). Introductory remote sensing digital image processing and applications. Routledge, London.

Hayes, D.J. and Sader, S.A. (2002). Change detection techniques for monitoring forest clearing and regrowth in a tropical moist forest. http://www.ghcc.msfc.nasa.gov/corredor/change_detection.pdf March 27, 2002

Rao, D.P., Gautam, N.C, Nagaraja, R. and Ram Mohan, P. (1996). IRS – IC applications in land use mapping and planning. *Current Science*, **70(7)**: 575-581.

Sader, S.A., Hayes, D.J., Irwin, D.E. and Saatchi, S.S. (2002). Preliminary Forest cover change estimates for Central America (1990's) with reference to the proposed Mesoamerica Biological Corridor. April 12, 2002. http://www.ghcc.msfc.nasa.gov/corredon/change_detection.pdf.

Schreier, H., Brown, S., Schmidt, M., Shah, P., Shrestha, B., Nakarmi, G., Subba, K. and Wymann, S. (1994). Gaining forest but losing ground: A GIS evaluation in a Himalayan watershed. *Environmental Management*, **8(1)**: 139-150.

Sehgal, J.L., Mandal, D.K., Mandal, C. and Vadivelu, S. (1992). Agro-ecological regions of India, NBSS and LUP (ICAR) publication 24, *Technical bulletin*, Nagpur, 94p.