



Remote Sensing studies on Land use / Land cover of Peddavanka Watershed, Anantapur District, Andhra Pradesh

S. Srinivasa Gowd

Dept. of Geology, Yogi Vemana University, Kadapa-516 005
E-mail: ssgowd@gmail.com

Abstract

Land use / land cover studies have been carried out by using remote sensing data of Peddavanka Watershed, Anantapur District, Andhra Pradesh. Peddavanka, a tributary to river Pennar, rises from Mutchukota hills of Erramalai hill ranges flows southerly and joins the Pennar River near Tadipatri of Anantapur district. This originates in the southern part of Kurnool district and drains through north-eastern part of Anantapur district covering an area of about 298 Km², located in the Survey of India Toposheet numbers 57 E/16, F/13, J/1, and I/4 on a scale of 1:50,000. The study area lies between Latitudes 14°55'24" - 15°12'50" N and Longitudes 77°51'20" - 78°03'26" E. The present classification is done with the help of IRS-1C Geo-coded imageries on 1:50,000 scale by visual interpretation techniques considering the elements of image interpretation such as shape, size, tone, texture, pattern and association, the satellite images were interpreted to delineate various land use / land cover categories. It is inferred that the land use / land cover pattern of the area is controlled by the local topography and the climate.

Key Words: Remote Sensing; Land use / land cover; Peddavanka watershed; Anantapur District; India.

1. Introduction

Land is non-renewable resource and hence assessment of land use / land cover in temporal sequence is essential for planning and development of land and water resources. Land is the ultimate asset fixed in aerial extent and is the basic natural resource of any nation. Its use or misuse has a remarkable impact on the activities of life (Stamp, 1962). Although agriculture is the predominant use to which the land is put in any country, other uses are also quite important. Proper planning and management of natural resources of an area is a prime necessity for the overall development of the area. Today availability of high resolution data



from remote sensing satellites has opened up new areas of applications and are gradually replacing the use of aerial photographs. Variations in spectral signatures of objects are sensed by the sensors on board and give explicit details of land use / land cover in different levels. The land use maps drawn from these sources can be considered as original information in the sense that they are generalised by first hand examination of direct evidence of land use patterns, rather than by compiling from secondary sources (Fox, 1991).

The purpose of developing a land use map is to present available data in a simple and practical way for application, to land use planning and to indicate the most intensive, profitable and safe way to which the land could be put to use, various hydrological processes such as infiltration, evapotranspiration, soil moisture status etc. are influenced by land use characteristics of the area (Kumar et al., 1986, Choubey et al, 1989, Alak Roy et al., 1994)). The concept of land use is complex and dynamic and changes over space and through time. One basic requirement for planning is the availability of timely, accurate, and up-to-date information on land use. This can be achieved by various satellite -based and remotely sensed data. Although, the conventional land use statistics data available today are inadequate, it can be integrated with satellite data to evolve agriculture, urban land use, forests, extent of waste lands, pastures, and land suitability for optimum use.

The terms land use and land cover are closely related and inter changeable. Land use is any kind of permanent or cyclic intervention on the environment to satisfy human needs (Vink, 1975). Land cover refers to " natural vegetation, water bodies, rock / soil, artificial cover and others resulting due to land transformation" (NRSA, 1990). Land utilization commonly associated with different types of cover including forest, agriculture, waste land or water bodies. The interactions between different land uses on different parcels of land are ever changing and it is essentially dynamic. Further, to accommodate the changing land use / land cover patterns it becomes essential to develop a standardised classification system that is not only flexible in nomenclature and definitions but also capable of incorporating information obtained from Satellite data and other different sources.

1.1 Study Area

Peddavanka, a tributary to river Pennar, rises from Mutchukota hills of Erramalai hill ranges flows southerly and joins the Pennar River near Tadipatri of Anantapur district. This originates in the southern part of Kurnool district and drains through north-eastern part of Anantapur district covering an area of about 298 Km², located in the Survey of India Toposheet numbers 57 E/16, F/13, J/1, and I/4 on a scale of 1:50,000. The study area lies between Latitudes 14°55'24" - 15°12'50" N and Longitudes 77°51'20" - 78°03'26" E.

2. Data and Methodology

The present framework of land use / land cover classification system has been primarily developed for use with remote sensing data to meet the required basic information need on land use for agro-climatic zone planning. The land use / land cover classification system amenable for use with remote sensing data developed by the National Remote Sensing Centre, Hyderabad, Andhra Pradesh was modified on the suggestions made by the Planning commission of India has been adopted in the present study. The present classification is done with the help of IRS-1C Geo- coded imageries on 1:50,000 scale by visual interpretation techniques considering the elements of image interpretation such as shape, size, tone, texture, pattern and association, the satellite images were interpreted (Compbell, 1987).

3. Results and Discussion

Map depicting various land use / land cover have been generated, using ground truth data and the details of the area have been presented in Table 1. Based on the information which could be obtained from imageries, five major land use / land cover categories were identified which were further sub-divided into a total of 12 sub-classes.

Table. 1. Land Use / Land Cover Classification

	Area in Km ²	Percentage
Built-up land	0.69	0.23

Agricultural land

Kharif irrigated	1.16	0.39
Kharif unirrigated	126.29	42.37
Rabi unirrigated	21.16	7.10
Double crop	20.72	6.95
Fallow	4.06	1.36

Forest

Deciduous forest	17.14	5.75
Fuelwood species	5.23	1.76

Wastelands

Land with or without scrub	76.97	25.83
Barren rocky / stony waste / sheet rock area	16.47	5.53
Mining industrial waste	3.81	1.28

Water bodies

River / stream	3.63	1.22
Tank	0.67	0.23

3.1 Built-up Land

It is that area occupied by human habitation encompassing buildings, transport, and communications associated with water in addition to vegetation and vacant lands.

The size or built-up sprawl with transport network can be used to classify settlements as urban or rural. It is identifiable on the imagery by its dark bluish green to bluish tone, definite size, shape, and texture. Often, built-up land with high density of buildings etc., appear in dark tone at the centre and lighter on the peripheries, because of being less dense and less developed. They appear distinctly amid crop lands of Kharif and Rabi seasons. As there are no urban areas, the rural settlements present in the study area which cannot be identified in satellite imageries as they are very negligible extent comprising a total area of about 0.69 km² accounting 0.23 per cent to the watershed area.

3.2 Agricultural Land

It is the land used primarily for farming and for production of food, fibre, other commercial and horticultural crops. It includes land under crops (irrigated and unirrigated), fallows, plantations etc.



The total contrast of crop land varies from bright red to red that may signify greenness of the foliage during different stages of crop growth and phonological condition (healthy or infected) besides the nature of soil (moist or dry) and the type of terrain etc. Its spatial extent varies in size and shape, with smooth texture (when the crop is in full matured stage) to coarse or mottled (at the early stages of planting and growth). It is contiguous under irrigated (canal, tank or well etc.) areas and non-contiguous in unirrigated or rain-fed dry lands. Very often contiguity of croplands is punctuated by harvested fields or fallow lands. Crop lands occur on a variety of terrain, often in association with the terrain patterns as observed in river plains, valleys, coastal lowlands etc. Cropping season and cropping pattern (single, double or mixed) varies from season to season, terrain conditions, farming and tenural systems, occurrence and distribution of rainfall etc. The major crop cultivated in the study area is groundnut. In Kharif crops like paddy, bajra, jowar, cotton, pulses are grown and in Rabi groundnut, paddy and black gram are grown with the help of supplemental irrigation. The irrigated area covered under Kharif is 1.16 km² while the unirrigated area is 126.29 km². The unirrigated area in Rabi contributes about 21.16 km² and the double cropped area occupies 20.72 km².

3.3 Fallow land

It is described as agricultural land which is used for irrigation but is temporarily allowed to rest, uncropped for one or more-seasons, not exceeding one year. These lands are particularly those identified without crops at the time when the imagery was taken in both the seasons. Fallow lands appear yellow to greenish blue in tone depending on the topography, nature of soil and moisture content on ground. It appears light in tone in sandy red soils and in coastal soils, and dark in tone in alluvial black soils rich in clay. The fallow lands cover an area of about 4.06 km² in the study area.

3.4 Forest

Forest is an area bearing an association predominantly of trees and other vegetation types capable of producing timber and other forest products. These appear dark red to red in tone throughout the year due to very dense canopy of the foliage associated with moisture all-round the year. They vary in size and shape, and are smooth in texture and contiguous in spread but



occasionally non-contiguous due to forest clearing. These occur on the higher reaches of hill-slopes coinciding with zones of very high rainfall.

3.4.1 Deciduous forest

It is described as a forest, which predominantly comprises of deciduous species. They appear as dark red to red in tone except during fall of foliage in dry season/ autumn when the total changes occur. Its aerial spread is contiguous and non-contiguous wherever the forest clearing occurs. They vary in size with irregular and discontinuous boundaries and smooth texture wherever the canopy cover is uniform. Deciduous forests are present in north-western part of the study area. The area occupied by the deciduous forest is 22.37 km².

3.5 Waste Lands

Waste lands are described as degraded lands which can be brought under vegetative cover with reasonable efforts which are currently underutilized and lands that are deteriorating for want of water and appropriate soil management or because of natural causes. Waste lands can result from inherent or imposed disabilities, such as, location, environment, and physical properties of the soil or financial or management constraints. Waste lands are classified as salt affected land, land with or without scrub, barren rocky or stony waste or sheet areas.

3.6 Land with or without scrub

The land cover with soil that is too shallow, skeletal, concretionary or otherwise chemically degraded, lands with extremes of slopes, sheet eroded lands and lands subject to excessive aridity etc. are included in this category. They appear in light yellow to brown to greenish blue tone (subject to surface moisture and vegetal cover). Wherever the occurrence of scrub on the uplands is more, reddish tint appears in dots and patches. They vary in size with irregular and discontinuous shapes, coarse to mottled texture (subject to surface lithology and vegetation cover

on the top) contiguous and dispersed in patches. Land with or without scrub occupy an area of about 76.97 km² in the study area.

3.7 Barren / Rocky / Stony sheet rock area

These are the lands characterised by exposures of massive rocks, sheet rocks, stony pavements or land with excessive surface accumulation of stones that render them unsuitable for production of any green biomass. Such lands are easily discriminated from other categories of waste lands because of their characteristic spectral response. This appears in greenish blue to yellow to brownish tone (subject to varying rock type), vary in size with irregular and discontinuous shapes, very coarse to coarse medium texture, linear to contiguous and dispersed in pattern. It occurs as steep hill slopes, crest, isolated hillocks, plateau and eroded plains in association with barren and exposed rocks. Barren rock outcrops cover an area of about 16.47 km² in the study area.

3.8 Mining / industrial waste

These are the areas, which contains mining and industrial waste mainly comes from the open cast mined areas of limestone, these are barren and are devoid of soil cover and vegetation. Mining industrial waste cover occupies a small area of about 3.81 km² on the northern part of the watershed.

3.9 Water Bodies

This class comprises areas of surface water either impounded as ponds, lakes, reservoirs or flowing bodies as streams, rivers, canals etc. These are clearly seen on satellite false colour imagery in blue colour.

3.10 River / Stream

It is a natural course of water flowing on the land surface along a definite channel. It may be seasonal or perennial. River / Streams appear in light blue to dark blue tone (subject to shallow

surface water spread, deep and more volume of water, turbidity etc.), long and narrow to wide in size with irregular and sinuous shape, smooth to medium in texture (in case of high turbidity), contiguous, nonlinear to dendritic / sub-dendritic pattern. The river / streams occupy 3.63 km² areas in the watershed.

3.11 Tanks

The impounded water bodies appear in light blue to dark blue tone (subject to shallow surface water spread, volume of water, turbidity etc.). The presence of weed/ vegetation contributes to patches of red tone amid them. They are small / medium to large with regular to irregular shapes, smooth to mottled in texture (subject to vegetation cover) non-contiguous and dispersed in pattern, except canals which show a linear pattern. Tanks occur in lowlands of plains, uplands and valleys. These are associated with agricultural lands, dam sites, built-up areas as a source for irrigation, power and supply of water for domestic and industrial consumption etc. The tanks occupy an area of about 0.67 km² in the watershed.

4. Conclusions

Land use / land cover classification of the Peddavanka Watershed includes agricultural land (58%), forest land (7.5%), waste land (32%), land occupied by water bodies (1.5%) and mining area and built-up land (< 1.0%). It is inferred that the land use / land cover pattern of the area is controlled by the local topography, resources and the climate.

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