Research Article

Spatio-Temporal Changes of Land Use/Land Cover of Pindrangi Village Using High Resolution Satellite Imagery

Gangaraju M[1]*, Anitha P[2], Krishna TV[3] and Sravan KA[3]

[1]Department of Geography, Andhra University, Visakhapatnam, Andhra Pradesh, India

[2]Dr. Lankapalli Bullayya College (UG), Visakhapatnam, Andhra Pradesh, India

[3]Department of Geo-Engineering, Andhra University, Visakhapatnam, Andhra Pradesh, India

***Corresponding author:** Gangaraju M, Department of Geography, Andhra University, Visakhapatnam, Andhra Pradesh, India, Tel: +918985376234; E-mail: mgangaraju36@gmail.com

Abstract

Interpretation of high resolution satellite imagery revealed various Land use/Land cover features in Pindrangi village, High resolution Satellite imagery was acquired from the goggle earth through Sas planet software, the data were acquired for the years 1984, 1994, 2004 and 2014. High resolution Satellite imagery was processed in Arc Map 10.4.1. Further an analysis of the decadal sequence imagery pertaining to decadal aimed at detecting the land use/land cover change has indicated that the plantation has phenomenally increased by 235.20 ha during the study period, at the same period, Crop land (Paddy) which occupied about 66.41 acres in 1984 has been reduced to 17.29 ha by 2014 mainly due to encroachment of plantation like Casurina/Eucalyptus and mango Scrubs area has decreased by 35.52 ha. The present study with the help of GIS and remote sensing (RS) is also a similar attempt in recording and quantifying change in land use and land cover in village level as spatial and temporal extents. The conversion of fallow land and Crop land into plantation around 12.91% in study area.

Keywords: Land use; Land cover; Temporal changes; Arc GIS 10.4.1

Introduction

A rational assessment of land and its scientific utilization has become important. It is possible only if the whole complex of land use is studied at the district, tahsil or even village level by taking into account the local physical and socio-economic conditions [1]. The present study is mainly micro level in Pindrangi village has identified Plantation boom and decreasing trend of paddy, has transformed into physical and socio-economic conditions of study area within the four decades. Land use mapping is important for evolution, management and conservation of natural resources of an area. Hence, it is desirable to monitor the trends in land use/land cover. The modern techniques of remote sensing and geographic information systems(GIS) are very useful tools for analysing the trends in land use/land cover through time. Remote sensing and GIS applications in the identification of aquaculture hotspots at village level [2]. It is also useful for planners to evolutes the possibilities and limitations of further spatial development to avoid or restrict undesirable trends of land exploitation to adjust the forms of land use to the land capability and to direct the expansion of intensive land utilization into suitable areas [3]. Impact of human land use practices on the occurrence of droughts – a case study of Godhavari delta region. Land use/land cover inventories form essential component in land resources evolution and environmental studies (NRSA). Land use is any kind of permanent or cyclic human intervention on the environment to satisfy human needs and the land use capability or land suitability is the potential capability of given tract and to support different types of land utilization under given cultural and socioeconomic conditions [4]. The study of land use pattern is of prime concern to geographers to know the relationship between man and natural environment [5]. In this paper, an attempt is made to study the extent of changing land use practices due to the plantation (Casurina, Mango) boom in study area.

Study Area

The Study area has witnessed a large-scale Plantation (casurina, Eucalyptus and Mango) development during the recent years, as evident from the satellite imagery of the area. While the Plantation (Casurina, Eucalyptus and Mango) has encroached on to the paddy area in the north-western parts of the study area, its spread is mainly into the fallow lands in the south, western and eastern parts. In order to achieve the stated objective of identifying the plantation growth' in this village, due encroaching predominantly on to the cropland as well as fallow land, is selected for the study.

The study area situated between the latitude of 17°56'N and longitude is 83°05', and bounded by on the north Lankavanipalem, on the east Srungavaram, on the west D. Agraharam and on the south Marrivalasa. It consists of 2327 population according to 2011 census (Figure 1). Pindrangi village also panchayati in K. Kotapadu mandal Visakhapatnam district of Andhra Pradesh spread over an area of about 473.04 ha. Most of the people of this area working in mining like quary which was situated near to this village, that's why most of the study area has fallow land in this village during the period of 1984 to 2004 later on due to decreasing of mining activity simultaneously the fallow land converted into Planation. The major crops in this area is plantation such as Casurina, Eucalyptus and Mango followed by paddy and Vegetable crops in monsoon season.

The general climate of the area is tropical type mostly the rainfall occurred during southwest monsoon season (June-September), while the retreating monsoon season (October-November) accounts for the rest of the rainfall. October is the rainiest month. Hottest month of the

study area is May Mean monthly temperatures range from 25°C to 39°C. Coldest month is December.
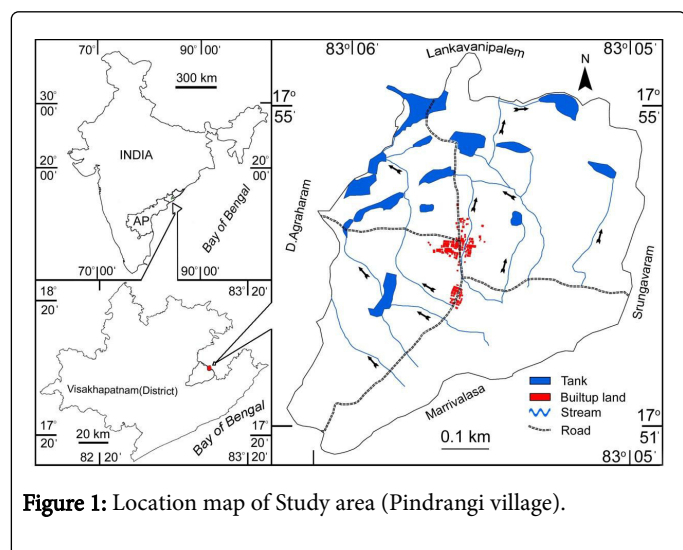

Figure 1: Location map of Study area (Pindrangi village).

Methodology

In the present study, we used the four high resolution datasets which we acquire from the google earth in distinct years on decadal, they are 1984, 1994, 2004 and 2014. We rectified these datasets with base map of Arc GIS 10.4.1, further they were digitally processed and the various geomorphological and land use/land cover features were interpreted, supplemented by field observations. In order to understand the trends in land use/land cover changes in the area. on-screen digitization was made to map land use land cover based on their geometric boundaries. The land use/land cover datasets of 1984, 1994, 2004 and 2014 were 'unioned' in the GIS to extract (by 'querying'), the data on conversion of each land use/land cover category into other types in the study area as a whole. Change matrices were prepared for the study area, separately. Further, based on the magnitude of conversion of fallow land and agriculture land into plantation at each dataset shows the drastic change in study area during 1984, 1994, 2004 and 2014.

Results and Discussion

The term land use is more commonly referred to the human activity on the Earth's surface. The main reason behind the LU/LC changes includes lack of water availability and low fetile soils, In the study area have experienced so many significant changes in land use pattern during the period socio-economic development plays very important role in bringing changes in land use pattern, in the time span of study period Scrubs, Paddy, fallow land has shown the negative trend (Table 1) out of total geographical area of study area. we used modern technologies like remote sensing and GIS to enumerate LU/LC. On the basis of interpretation of remote sensing imagery, field surveys, and existing study area conditions, we have classified the study area into seven categories, they are Paddy, built-up area, scrubs, plantation (Casurina, eucalyptus and mango) fallow land, water body (Table 1). We used multiple datasets (1984, 1994, 2004 and 2014) to enumerate land use/land cover changes in study period (Figure 2).
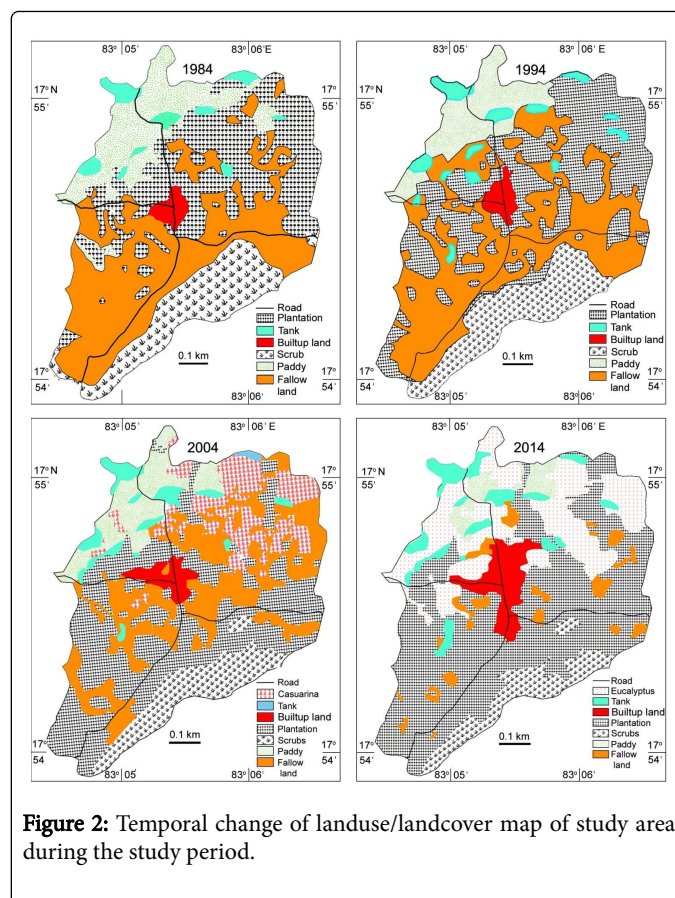

Figure 2: Temporal change of landuse/landcover map of study area during the study period.

Conversion of land use/landcover and change detection between 1984–1994

The categories of land use landcover of study area showed both positive and negative growth in area of total geographical area (473.48 ha, Table 1). The built-up area occupies an area of 1.6% in 1984, it could be shown the positive trend in 1994 around 2.0%. Whereas the rest of the categories like plantation (31.0%-33.6%) tanks (3.0%-3.5%) are shown positive trend some of the categories are shown the negative trend such as scrubs (14.9%-14.6%), paddy (13.5%-10.7%) and uncultivated land (36.1%-35.6%) during the period of 1984-1994. In the change detection of the land use landcover plantation shows the positive trend (+2.59%) followed by tanks (0.55%) and built-up area (0.38%) during the period of 1984-9194. While 13.3 hectares paddy, uncultivated land 2.29 hectares and 1.18 hectares scrubs of area were converted into plantation (Figure 2).

Conversion of land use/land cover and change detection between 1994-2004

During the study period, all the categories showed both positive and negative growth in total geographical area (473.48 ha, Table 1). The built-up area occupies an area of 2.0% in 1994, consequently the built-up area has shown the increasing in 2004 around 2.51% because built-up area increased due to the gradual constructional development and isolated settlements are gradually increased.
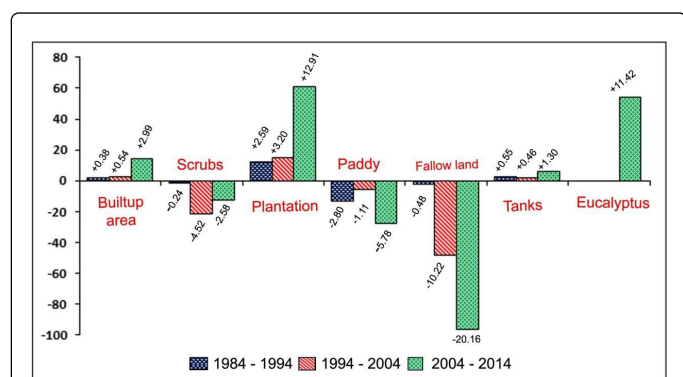
| LU/LC Categories | 1984 | | 1994 | | 2004 | | 2014 | | Change Detection | | | | | |
| | | | | | | | | | 1984-1994 | | 1994-2004 | | 2004-2014 | |
	Hectares	%	Hectares	%	Hectares	%	Hectares	%	Hectares	%	Hectares	%	Hectares	%
Builtup area	7.55	1.6	9.38	2	11.93	2.51	26.08	5.5	+1.83	+0.38	+2.55	+0.54	+14.15	+2.99
Scrubs	70.36	14.9	69.18	14.6	47.76	10.08	35.52	7.5	-1.18	-0.24	-21.42	-4.52	-12.24	-2.58
Plantation	146.61	31	158.89	33.6	174.06	36.76	235.2	49.67	+12.28	+2.59	+15.17	+3.16	+61.14	+12.91
Paddy	63.98	13.5	50.68	10.7	45.41	9.59	18.06	3.81	-13.3	-2.8	-5.27	-1.11	-27.35	-5.78
Uncultivated Land	170.85	36.1	168.56	35.6	120.17	25.38	24.72	5.22	-2.29	-0.48	-48.39	-10.22	-95.45	-20.16
Tanks	14.13	3	16.78	3.5	18.78	3.96	24.92	5.26	+2.65	+0.55	+2.0	+0.46	+6.14	+1.30
Casurina/ Eucalyptus	-				54.83	11.58	108.92	23	-		+11.58	+11.58	+54.09	+42.51
Total Geographical area	473.48	100	473.48	100	473.48	100	473.48	100	1					

Table 1: Land use Land cover changes and detection of Pindrangi village among 1984-1994, 1994-2004 and 2004-2014.

However, the rest of the categories like plantation (33.6%-36.67%) tanks (3.5%-3.95%) are shown positive trend some of the categories shows the negative trend such as scrubs (14.09-10.08%), paddy (10.07-9.59%) and uncultivated land (35.6-25.38%) during the period of 1994-2004. In the change detection of the land use landcover plantation shows the positive trend (+3.16%) followed by builtup area (+0.54%) and tanks (+0.46%) (Figure 2).

Conversion of land use/landcover and change detection between 2004–2014

The categories of landuse landcover of study area showed both positive and negative growth in total geographical area (473.48 ha). In Figure 3 the built-up area occupies an area of 2.51% in 2004, it could be shown the positive trend in 2014 around 5.5% because built-up area increased due to the gradual constructional development and isolated settlements are gradually increased. and 2004 (2.52%) to 2014 (2.99%) (Figure 3) study period.

Figure 3: Land use land cover change detection among 1984-1994, 1994-2004 and 2004-2014.

However, the rest of the categories like plantation (31.0%-33.6%) tanks (3.0%-3.5%) are shown positive trend some of the categories are shown the negative trend such as scrubs (10.08%-7.50%), paddy (9.59%-3.81%) and uncultivated land (25.38%-5.22%) during the period of 2004-2014. In the change detection of the land use landcover plantation shows the positive trend (+12.91%) followed by built-up area (2.99%) and tanks (+1.30%). In 2010 paddy area converted into Casurina around 11.58% consequently northern eastern and the plantation area and paddy converted into Eucalyptus 23.00% in 2014 because of lack water speciality in study area one more thing is most of the people are moving to Visakhapatnam for employment.

Conclusion

The present study undertaken for the detection of possible land use and land cover changes, monitoring and evaluation in Pindrangi village high resolution land sat images temporally like 1984, 1994, 2004 and 2014 which we downloaded from the sas planet software. The result of present work indicates there have been important land use land cover changes in between 1984 to 1994 and 2004-2014 time periods in the study area. The statistical analysis shows that the major changes have been occurred in uncultivated land, paddy and plantation, mostly we find out positive and negative variations in land use/landcover. The positive change detection occurred in plantation, paddy and tanks Similarly the rest of the categories such as scrubs, paddy uncultivated land shows negative trend (Figure 3). So that lack of water specialty for cultivation paddy could decline and plantation improves the rest of the categories also shows change like uncultivated land decline but it can be converted into plantation (Casurina, Eucalyptus and Mango) specially between 2004 to 2014 land change occurred within the plantation area they are casurina and eucalyptus, casurina converted into eucalyptus due to insufficient water in study area.

Acknowledgment

References

1. Mohammed A (1978) Studies in Agricultural Geography. Rajesh Publications, New Delhi, India, pp: 1-6.
2. Rao KN, Krishna GM, Naik DR, Malini BH (2003) Remote sensing and GIS applications in the identification of aquaculture hotspots at village level. J Indian Soc Remote Sens 31: 71-80.
3. Rao KN, Vaidyanadhan R (1981) Land use capability studies from Arial Photo-Interpretation -A case study from Krishna Delta India. Geogr Rev India 43: 226-236.
4. Vink APA (1975) Land use in Advancing Agricultural. Springer Verlag Berlin, Heidelberg, New York, USA.
5. Kumar J (1986) Land use Analysis: A case study of Nalanda District. Bihar Inter-India Publications, New Delhi, India.