

Impact of Population growth on Land Use / Land Cover changes and Environment - A case study of Tribal region of Visakhapatnam District

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Abstract: Land use and Land cover changes modify land surface characteristics and indirectly climatic process. Deforestation and conversion of forests to other type of land use, reduction in pasture land and fallow lands change surface heat budget and water budget. The study area has rich forests and about sixty percent of forest area is found and mostly distributed on the hilly region. But in the recent years the extent of forest cover is decreasing and also degrading of floral species. There are also changes in other categories of land use like pasture land, cultivable waste and other fallow lands. The present study is an attempt to analyze the population growth and to find out the land use changes and to assess the impact of these changes on rainfall distribution.

Keywords: Environment, Landuse / Landcover, Population, Rainfall

Introduction:

The world population grew from 1.6 billion in 1900 to 7.0 billion in 2012 and further grown to 7.7 billion in 2020. Population and environment are closely related through Socio-economic, cultural, political and developmental aspects whose role varies considerably from one context to other (Richards 1986). Land use / Land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. The rapid increase in world population has resulted in speedy alteration in the land use and land cover leading to forest deterioration and transformation of fertile land into other activities and also demand for food and land. Land use changes take place according to the needs of mankind, misuse and over exploitation of land. Thus increasing pressure of population and consequent raising demand for food and shelter are putting great pressure on forest areas, fallow lands. Deforestation affects climate in two main ways, first by altering the atmospheric composition and second by affecting hydrological cycle and local conditions (Barry.A&Chorley,1995). Forest degradation decreases evapo-transpiration, atmospheric humidity, local rainfall amounts, ground water table and surface roughness. Land cover changes may affect to various degrees, although mostly on a local scale, the atmospheric circulation pattern, the water balance and the energy balance. Land use and Land cover changes involve several processes which can be used assess climatic change (IPCC report, 2001).

Data Base and Methodology:

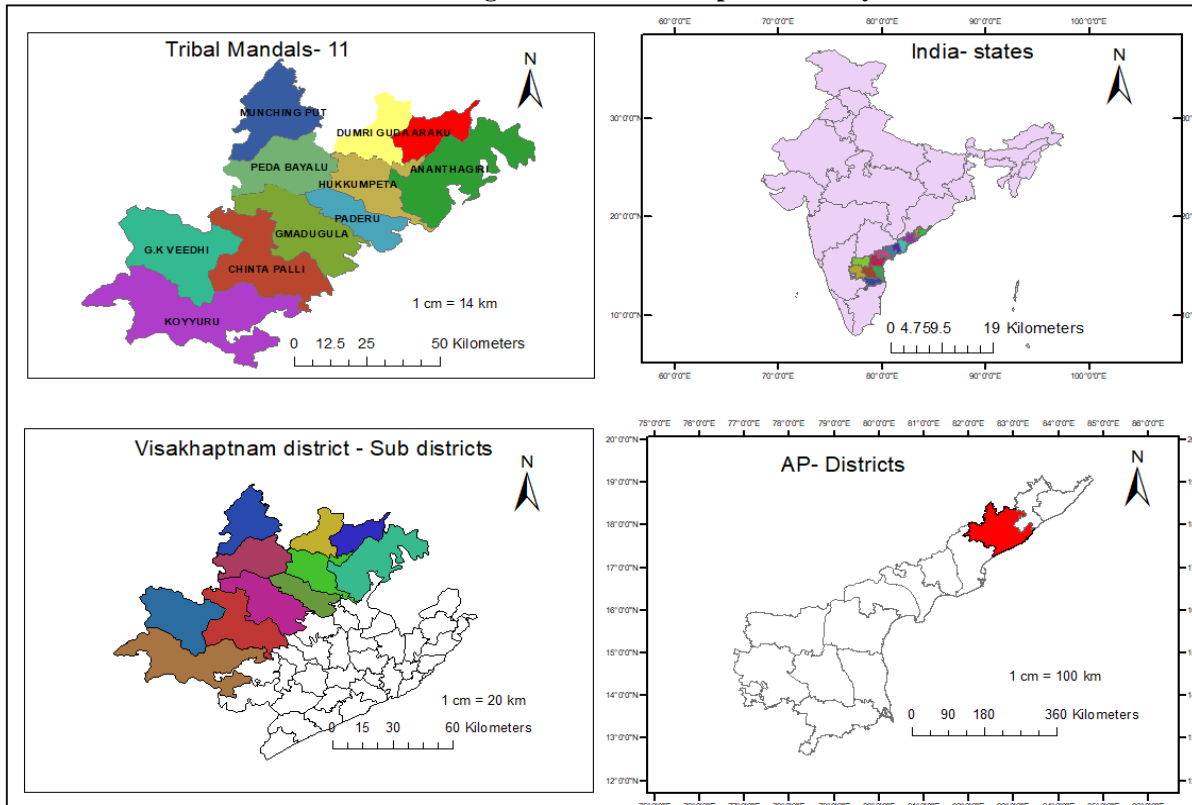
Data with regard population and land utilization have been collected from Visakhapatnam district hand book of Statistics 1981 and 2011. Topographical maps and multi-dated IRS-P6 LISS-3 imagery (Nov, 2004 and Feb, 2005) are used to map the spatial and temporal variability in land use and land cover. Changes detection and overlay techniques were applied to derive the land use/land cover map. The analysis is adequately supported with the field information and statistical records. Monthly rainfall data have been collected form eleven mandals for 20 years, from 2006 to 2019 from the records available in the district administrative office and also from rain gauge stations. Trend analysis of annual rainfall has been carried out to observe temporal variations in annual rainfall.

Objectives:

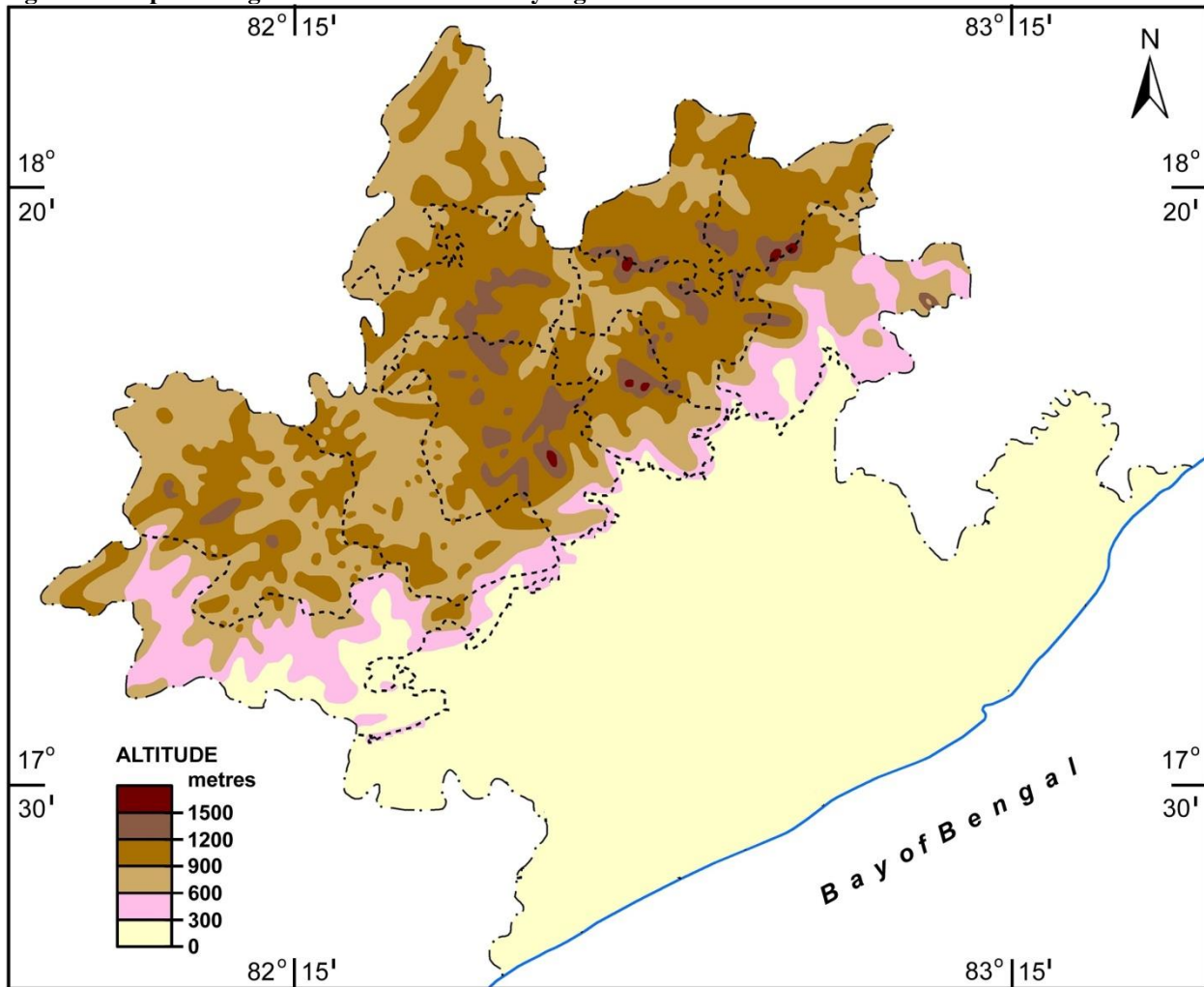
1. To study the population growth during 1981-2011 period.
2. To examine Land use/ Land cover changes during 1981-2011 period.
3. To find out rainfall changes during 2006-2019 period.

Study area:

Fig. No.1 Location Map of the Study area.



The study area lies in Northern and Western part of Visakhapatnam district and it contains eleven mandals. They are 1.Munchingput, 2. Pedabayalu, 3.Dumriguda, 4.AraKu, 5.Hukumpeta, 6.Anantagiri, 7.Paderu, 8.G.Madugula, 9.G.K.veedhi,10. Koyyaru,11. Chintapalli.These eleven mandals are situated between 300 mt msl to 600mt msl and above and are occupied by forest vegetation and Scheduled cast population (ST). This region lies between 17^o 30' to 18^o 30' North latitude and 81^o 54' to 83^o 30' East longitude. Physiographical it is a part of Eastern Ghats region and receives about 1300 mm of average annual rainfall per annum and hence about 60% of the total geographical occupied by forest vegetation and about 17.6% arable land and the remaining land distributed among barren, uncultivable land and fallow lands etc., Further, about 90.7% o

Fig. no.2 -Map showing relief feature of the study region

The total population belongs to Scheduled Tribe (ST) population. About 69% of population growth recorded during 1981 to 2011 period whereas about 73% ST population growth recorded during 1981-2011 period. As this region recorded huge population among general population and ST population, it would have lot of impact on Land use/ Land cover and changes may occur. Further it would have impact on environment of the study region. In this context an attempt is made in this paper to study the impact of population growth on Land use / Land cover changes and on environment of the study region.

(1) Changes in Population growth:

Table no -1, showing changes in population growth in the study region. The total population recorded during 1981 in the study area was about 3,57,140 in which about 88.5% population belong to ST category and the remaining 11.5% population belong to Oc, Bc & Sc-categories whereas largest number of population present in Chintapalli mandal (40,244) and lowest Population present in Munchingput mandal (29,341). Regarding percentage of ST population to the total population of each mandal, highest percentage about 98.5% of Pedabayalu mandal population belong to ST category, followed by Hukumpeta mandal (94.2%), Dumbriguda mandal(94.0%), G.Madugula mandal (93.4%), Munchingput mandal (92.5%), Anantagiri mandal(88%), Araku mandal (87.5%), Chintapalli mandal (86.4%), Paderu mandal (85.2%), G.K. Veedhi mandal (80%) and lowest percentage of ST population present in Koyyuru mandal (75.4%).

Table no:1-Changes in Population growth during 1981-2011 period in the study area.

S. No	Name of Mandal	Total population		% of change	ST - Population		% of change	Other Category Population		
		1981	2011		1981	2011		1981	2011	% of change
1	MUNCHINGPUT	29,341	47,418	61.60%	27,189	44,538	63%	2,152	2,880	33.80%
2	PEDABAYULU	33,122	51,890	56.70%	32,608	49,937	53%	514	1,953	280.00%
3	DUMBRIGUDA	30,251	49,029	62.10%	28,433	46,479	63.50%	1,818	2,550	40.30%
4	ARAKU	30,364	56,674	86.60%	26,574	51,876	95.20%	3,790	4,798	26.60%
5	HUKUMPETA	34,570	51,697	49.50%	32,549	49,594	52.50%	2,021	2,103	4.10%
6	ANANTAGIRI	30,125	49,019	62.70%	26,518	44,190	66.60%	3,607	4,829	33.90%
7	PADERU	32,366	58,983	82.20%	27,567	48,694	76.60%	4,799	10,289	114.40%
8	G.MADUGULA	30,199	53,884	78.40%	28,190	49,970	77.30%	2,009	3,914	45.00%
9	G.K. VEEDHI	31,912	63,174	98%	25,548	56,757	122.20%	6364	6,417	0.80%
10	KOYYURU	34,646	50,639	46.20%	26,120	41,213	57.80%	8,526	9,426	10.60%
11	CHINTAPALLI	40,244	71,640	78%	34,752	64,703	86.20%	5,492	6,937	26.30%
	Total	3,57,140	6,04,047	69.10%	3,16,048	5,47,951	73.40%	41,092	56,096	36.50%

(Source: computed from the hand book of statistics of Visakhapatnam dist,1981&2011)

According to 2011 census the total population present in the study area was 6,4,047 in which about 90.7% belong to ST category population where as highest population recorded in Chintapalli (71,640) and lowest population recorded in Munchingputt mandal (47,418) and the remaining 9.3% belong to other categories. Regarding percentage of ST population to the total population of each mandal, highest percentage about 96.2% of Pedabayalu mandal population belong to ST category followed by Hukumpeta mandal (96%), Dumbriguda mandal (95%), Munchingputt mandal (94%), G.Madugula mandal (92.7%), Araku mandal (91.5%), Chintapalli mandal(90.3%), Anantagiri mandal (90%), G.K. Veedhi mandal(89.8%), Paderu mandal (82.6%), Koyyuru mandal (81.4%).

Regarding changes in total population during 1981-2011 period, about 69.1% population growth recorded in the entire study region. Further, highest population growth about 98% recorded in G.K. Veedhi mandal over the study period, followed by Araku mandal (86.6%), Paderu mandal (82.2%), G. Madugula mandal (78.4%), Chintapalli mandal (78%), where as lowest growth recorded in Koyyuru mandal(46.2%) .

Regarding changes in ST population during 1981-2011 period, about 73.4% of ST population growth recorded in the entire study region. Further, highest ST population growth, about 122.2% recorded in G.K. Veedhi mandal, followed by Araku Valley (95.2%), Chintapalli mandal(86.2%), G. Madugula mandal (77.3%), Paderu mandal (76.6%) where as lowest growth recorded in Hukumpeta mandal (52.4%). Regarding changes in other categories population during 1981-2011 period about 36.5% of other category (OC, BC, SC) population growth recorded in the entire study region. Highest population growth rate recorded in Pedabayalu mandal (280%), followed by Paderu mandal(114.4%). Further, G. Madugula mandal recorded 45% growth rate followed by Dumbriguda mandal(40.3%), Anantagiri mandal (33.9%), Munchingputt mandal (33.8%), Araku mandal (26.6%), Chintapalli mandal (26.3%), Koyyuru mandal(10.6%), Hukumpeta mandal (4.1%) and G.K. Veedhi mandal (0.8%). It is observed from the above discussion that the total study region recorded about 69% in total population growth and 73% in ST population growth and also 36% in other category population growth during 1981-2011 period.

An attempt is made in this study to examine the changes in total workers (cultivators, agricultural laborers, House hold industry, other than house hold industry, and marginal workers) and total non-workers in the study region during 1981-2011 period.

Table no:2-Changes in number of workers and non-workers during 1981-2011 period in the study area:

S. No	Name of Mandal	No.of Workers		% of change	No.of Non - Workers		% of change
		1981	2011		1981	2011	
1	MUNCHINGPUT	14,419	27,775	92.60%	14,922	19,643	31.60%
2	PEDABAYULU	16,374	31,477	92.20%	16,748	20,413	21.90%
3	DUMBRIGUDA	13,829	29,717	115.00%	16,422	19,312	17.60%
4	ARAKU	12,996	29,750	129.00%	17,368	26,924	55.00%
5	HUKUMPETA	15,808	30,917	95.60%	18,762	20,780	10.80%
6	ANANTAGIRI	13,989	30,282	116.50%	16,136	18,737	16.10%
7	PADERU	14,335	31,461	119.20%	18,031	27,522	52.60%
8	G.MADUGULA	14,601	33,905	132.20%	15,598	19,979	28.10%
9	G.K. VEEDHI	17,045	36,850	116%	14,867	26,324	77%
10	KOYYURU	16,424	29,553	80.00%	18,222	21,086	15.70%
11	CHINTAPALLI	21,580	42,650	98%	18,664	28,990	55%
	Total	1,71,400	3,54,337	48.40%	1,85,740	2,49,710	34.40%

(Source: computed from the hand book of statistics of Visakhapatnam dist,1981&2011)

According to 1981 Census, about 47% were workers and 53% were non-workers (Table.no-2) recorded in the study region where as according to 2011 census about 58.7% recorded as workers category and 41.3% as non-workers category in the study region. Regarding changes among workers during 1981-2011 period about 48.4% growth recorded whereas about 34.4% growth recorded under non-workers category during 1981-2011 period which indicate workers category growth is higher than the non-workers growth rate. The above discussion clearly showing that, about 69.1% population growth recorded during 1981-2011 period in the study region. Further, about 73.4% ST population growth recorded during 1981-2011 period and only 36.5% other category population growth recorded during 1981-2011. Moreover about 48.4% growth rate recorded under workers category during 1981-2011 period, where as a very low growth rate about 34.4% recorded under non-workers category during the study period. All these anthropogenic changes would have impact on land use /land cover changes of the study region during the study period.

(2)Land Use / Land Cover changes during 1985-2017 period in the study region:

Table no: 3-Land use/Land cover changes during 1985-2017 in the study area.

S.No.	Type of Land use & Land cover	Percentage of Land use in- 1985	Percentage of Land use in -2017	Changes during 1985-2017 periods
1.	Forest	65%	60.1%	-4.9%
2.	Barren & Uncultivable land	19.2%	8.6%	-10.6%
3.	Land put non-agricultural uses	1.2%	2.8%	+1.6%
	Cultivable waste	0.7%	0.3%	-0.4%
4.	Permanent pastures & other grazing lands	0.4%	0.1%	-0.3%
5.	Miscellaneous land under three crops and grooves	0.7%	1.3%	+0.6%
6.	Other fallow lands	0.3%	3.3%	+3%
7.	Current fallow lands	2.0%	5.9%	+3.9%
8.	Net area sown	10.5%	17.6%	+7.1%

(Source: computed from the hand book of statistics of Visakhapatnam dist,1985&2017)

Table No.3, showing Land Use /Land Cover changes during 1985-2017 in the study region. It is observed that, there is considerable deterioration in forest land use and it decreased from 65% in 1985 to 60.1% in 2017 (-4.9% decrease). Barren and unclutivable decreased from 19.2% in 1985 to 8.6% in 2017 (-10.6% decrease) while land put to non-agriculture uses increased from 1.2% in 1985 to 2.8% in 2017 (+1.6% increase). Cultivable waste decreased from 0.7% in 1985 to 0.3% in 2017 (-0.4% decrease) whereas permanent pastures & other grazing lands decreased from 0.4% in 1985 to 0.1% in 2017 (-0.3% decrease). Land under miscellaneous tree crops and grooves increased from 0.7% in 1985 to 1.3% in 2017 (+0.6% increase) while other fallow lands increased from 0.3% in 1985 to 3.3% in 2017 (+3% increase). Current fallow lands also increased from 2.0 % in 1985 to 5.9% in 2017 (+3.9% increase) and Net Sown land area increased from 10.5% in 1985 to 17.6% in 2017 (+7.1% increase). The decrease in forest land area and degradation of forest vegetation into scrub vegetation and increase in land put to non- agricultural uses and also increase in Net area sown will have impact on Environment. The decrease in greenery and increase in Agricultural and Non-agricultural uses has direct effect on hydrological conditions and topography of the study region. It is also observed that forest vegetation degrading as sparse, deciduous, and scrub vegetation type but forest land area remained same without any changes in revenue records. Further, the abnormal increase of net sown land area shows the intensity of agricultural activity in this region

(3) Impact on Environment :

Changes in rainfall distribution during 2006-2012 & 2013-2019 periods:

Table no: 4-Changes in average rainfall during 2006-2012&2013-2019 period in the study area.

S. No	Name of Mandal	Average Rainfall 2006 – 2012(mm)	Average Rainfall 2013 – 2019(mm)	Rainfall variation (mm)
1	MUNCHINGPUT	1,639	2,092	453
2	PEDABAYULU	1,433	1,444	11
3	DUMBRIGUDA	1,264	933	-331
4	ARAKU	1,543	1,082	-461
5	HUKUMPETA	1,389	997	-392
6	ANANTAGIRI	1,845	1,152	-693
7	PADERU	1,323	1,309	-14
8	G.MADUGULA	1,512	1,308	-204
9	G.K. VEEDHI	1,770	1,408	-362
10	KOYYURU	1,565	1,158	-407
11	CHINTAPALLI	1,480	1,135	-345
	Total	16,763	14,018	-2,745

(source: collected and computed from hand book of statistics of Visakhapatnam dist)

Climate is the main factor determining the type of plants that can grow in an area and the micro-climate of any forest zone is determined by prevailing vegetation. The effects of forests on climate are mostly proportional to the density of cover. The replacement of forests by agriculture and other activities degrades the environment of forest ecosystem and decrease in forest cover reduces precipitation. In this context, an attempt is made to study the rainfall trends to assess the population growth and impact of land use changes on rainfall distribution. Rainfall analysis is one aspect to make comparison of mean rainfall values. Average rainfall for all stations for two periods, 2006-2012 & 2013-2019 were computed and the values are compared to identify the trends (Table no-4). Most of the stations have shown decreasing trend of rainfall, and trend is insignificant. Further, Munchingput mandal showed positive trend of rainfall and the change in rainfall is quiet significant whereas Pedabayalu mandal also showed positive trend which was not much significant. Very significant negative trend of rainfall noticed in Anantagiri mandal (-693) followed by Araku mandal(-461), Koyyuru mandal(-407), Hukumpeta mandal (-392), G.K.veedh mandal (-362), Chintapalli mandal(-345), Dumbriguda mandal(-331), G.Madugula mandal(-204), recorded moderately significant negative trend of rainfall, whereas very low negative trend of rainfall noticed in Paderu mandal(-14), and the entire study area recorded negative trend of rainfall about -2,745 mm during 2006-2012&2013-2019 period. Climatic data for a long period at least 50 years might have given better results. Though there are drastic changes in land use pattern particularly areas covered by forests, significant positive correlation was not observed between deforestation and rainfall changes.

Conclusion:

The study area is a tribal region and occupied by 60% different kinds of forests. This region experienced growth about 69% in total population and also experienced growth about 73% in ST population during the study period. When the study examined changes in LU/LC, it found that lot of changes occurred and also observed lot of stress on the available land. Hence, it is concluded that, the abnormal growth in population brought changes in Land use/ Land Cover and all these changes further has influence on rainfall variation and distribution.

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