

Demographic Characteristics and Changing Land Use in the Coastal Zone of Kozhikode

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Abstract: *Every part of the world is significantly altered by natural or being altered by anthropogenic forces. Nowadays human induced anthropogenic forces are much more active over the earth surface, especially due to population pressure and related developmental activities. Almost all the coastal nations in all the continents face threats from growing population. In this paper an attempt is made to depict the demographic characteristics of the coastal zone of Kozhikode and land use change scenarios in a geographic perspective. Study area witnessed rapid development in the recent past due to a set of factors. Population growth drives the urbanization process and that leads to related land use and landscape modification. The main objective of this paper is to detect and quantify the LU/LC in the coastal zone, Kozhikode district (figure1) from 1991 to 2020 using satellite imagery and topographic map, in the light of growing population.*

Keywords: coastal zone; land use; landcover; demographic characteristics; GIS

1. Introduction

Global land use has significantly changed during the past decades. Historically, the driving force for most of land use changes is population growth. (Ramankutty1999). A major goal of today's geographers is to better understand how land use change affects and shapes the environment. Land use/cover change (LUCC) is an important parameter in assessing regional and global environmental changes. It also affects the quality of human life and socio economic development (Lambin & Geist, 2006, Matson, Parton, 1997) from the ancient time itself coastal zone is attracted by human population owing to pleasant climate, higher natural resource potential and the easy transportation facilities. Coastal zones are constantly undergoing drastic changes due to both the natural and anthropogenic causes. Population growth drives the process of urbanization and associated land use and landscape changes. The conversion of natural landscape to anthropogenic landscape represents the most visible and pervasive form of human impact on the environment. Objectives for land use change differ between the developed and developing countries. In developed countries, land use change is based on economic reasons such as large scale farming or urban development and an increasing need to conserve biodiversity and environmental quality for current and future generations (Bouma, 1998), whereas in the developing countries, rapid population growth, poverty and the economic situation are the main driving forces (Lambin 2003, Meertens 1996, Ramankutty1999).

2. Study Area

Kozhikode, one of the fourteen districts of Kerala State is situated on the south west coast of Indian sub - continent and located on the northern part of Kerala. The district is bounded in the north by Kannur district in the east by Wayanad, in the south by Malappuram district and West by the Arabian Sea. It is on the southern part of the peninsular shield having a gently sloping terrain, from the Wayanad plateau to the east to the coastal plain in the west. Topographically the district has three distinct regions, the sandy coastal belt, the rocky highlands formed by the hilly position of the Western Ghats and Laterite Midland. Out of the total land area the sandy coastal belt occupies an area of 362.85 sqkms, laterite midlands 1, 343.50 sq. kms and rocky highlands 637.65 sq. kms. From this it is evident that 26.8% of the total area forming the coastal, 57.65% the midland and rest the high land respectively. Coastal area of Kozhikode district is 72.5 km. long and it stretches from Kadalundikadavu in south to Aliyur in the north near Mahi covering an area of 91 sq. km, excluding the backwater areas. In this paper, we selected the coastal plain of Kozhikode district as the study area to provide a case study for understanding the relationship between spatial - temporal pattern of the land use change and population dynamics from 1991 - 2020, and for demographic analysis, all the administrative units that lies under coastal plain is considered.

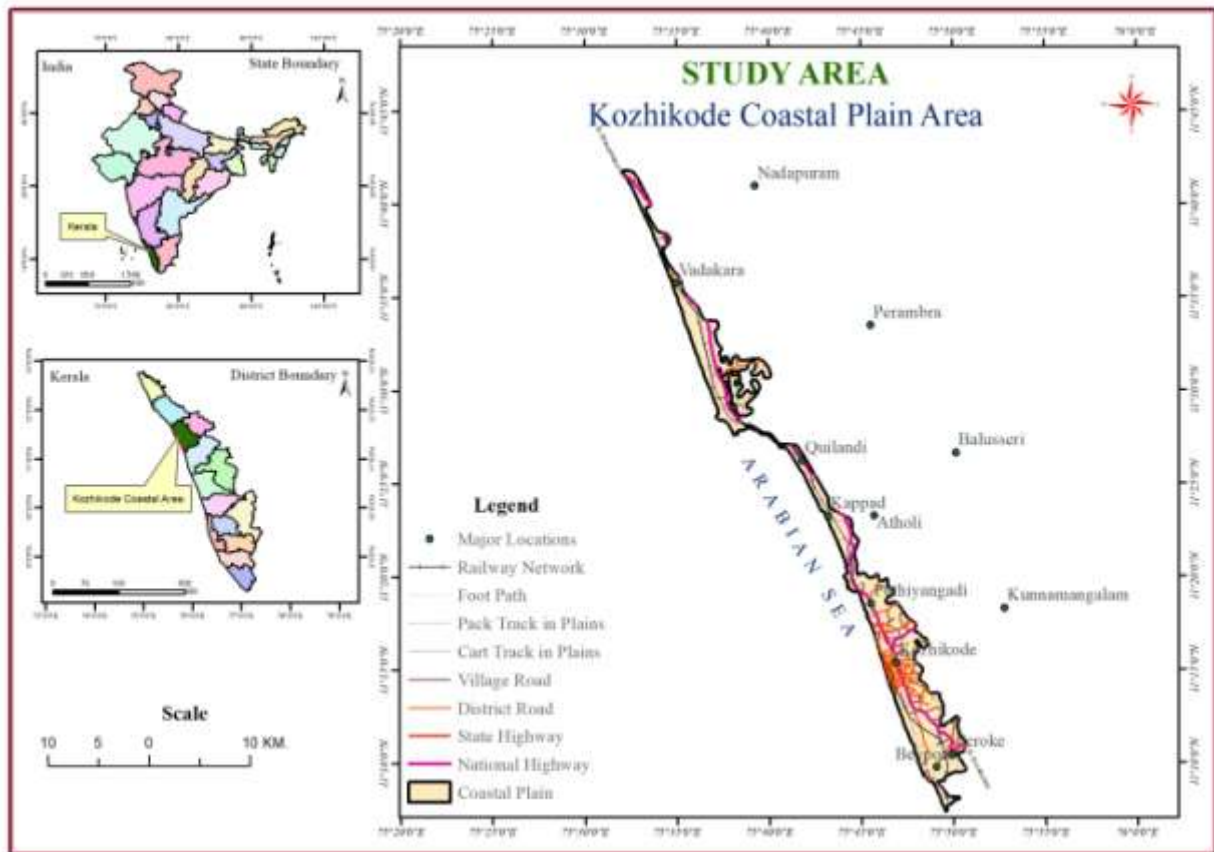


Figure 1: Study Area

Geographical extend of the study area lies between the longitude $75^{\circ}32'2.09''\text{E}$ to $75^{\circ}50'59.071''\text{E}$ and the latitude $11^{\circ}41'46.384''\text{N}$ to $11^{\circ}7'22.333''\text{N}$.

The coastal belt extends narrow stretch of lowland with major settlements namely Kozhikode, Quilandy, Elathur, Beypore and Faroke and many other rural settlements. The study area is densely populated and is considered as a hub of urban and rural settlements. Physiographically, the study area consists of lowland with coastal belt, tidal flats and salt marshes within the elevation less than 7.6 m from MSL. The midland of alluvial plains with the elevation between 7.6 m and 76 m; and the highland with above 76 m elevation of lateritic cliffs and sedimentary rocks (Nazimuddin and Basak 1983; Baba 1986; Nazimuddin 1993) the present analysis is based on the land use land cover analysis of the coastal plain area. The coastal plain is very narrow, 5 - 10km wide, gently sloping with a maximum height of about 10m in the East. It consists of depositional landforms of marine, fluvial and fluvial - marine origin. The soils of the district are classified in to sandy, laterite and hilly or forest soil. The sandy soils covering all along the western side of vadakara, quilandy, and Kozhikode taluk. The study area has humid climate with very hot season extending from March to May. Humidity is very high in the coastal region.

The historical scenarios revealed that the existing land use & land cover of the entire study region has undergone tremendous and dramatic changes, precisely in the last three decades or so the entire scenario of the study region has gradually shown a miraculous change. The structure of the paper is mainly twofold. The first part explains the

population distribution, its growth and characteristics of population while the second part deals with the land use scenarios of the study area from 1991 - 2020.

3. Materials and methods

The present study is investigated to assess the land use change scenarios and the temporal analysis of population dynamics. GIS software was used as a platform for data analyses. first phase of the study involved the collection of data that includes the coastal plain area of Kozhikode district. All land use land cover map prepared from Landsat datasets. Supervised classification - parallel piped maximum likelihood algorithm was adopted for generating all the land uses. The year 1991 land use prepared from Landsat - 5 Thematic Mapper (24 meter resolution) data. 2001 and 2011 land use classified from Landsat - 7 Enhanced Thematic Mapper (15 meter) resolution data. Here data has been converted from 24 meter to 15 meter by merging high resolution PAN data (15 meter) and multispectral (24 meter) data with the help of resolution merge technique. The same method has been employed in the year 2020 land use preparation. Landsat - 8 Operational Land Imagery (OLI) data has been used for 2020 land use preparation. Field visits were carried out to validate the results of land cover interpretation and for description of the characteristics of each land cover class and land use. Another part of the study based on the demographic data taken from Census publications (Registrar General of India) for different time periods under study (1991, 2001, and 2011).

The present study adopted a land use classification which is a modified version of the different schemes described in the methodology part to reflect the local scenario of coastal zone of Kozhikode district. It is because of the fact that all the land use types given in different classification schemes may not be present everywhere. Therefore it is inevitable to develop a classification scheme to suit to the scenario of the district. The present study adopted a six fold classification scheme as follows;

- 1) **Barren land**→ it includes Barren Rocky, Stony waste and Sheet Rock Area.
- 2) **Built up land**→ Areas having dense concentration of buildings. It includes the towns and cities in the district like Kozhikode Corporation, various municipalities, small towns and other concentrated buildings. It represents the urban character of the district.
- 3) **Agricultural land** → It encompasses paddy and the areas supporting thick growth of rubber, tea, coffee, and forest plantations like teak, acacia, manjium and eucalyptus.

- 4) **Settlement with Mixed Trees (SMT)** → It is also called settlement with mixed crops. It includes scattered settlements along with miscellaneous trees/crops like coconut, arecanut, tapioca, jackfruit tree, mango tree
- 5) **Waterbody** → This class of land use encompasses lakes, kayals, backwaters, estuary, rivers, ponds, and reservoirs and so on.
- 6) **Wetlands**→ it consists of inland wetlands and coastal wetlands. Water logged area, swampy, marshy vegetation and mud flats also included in this category.

4. Results and Discussion

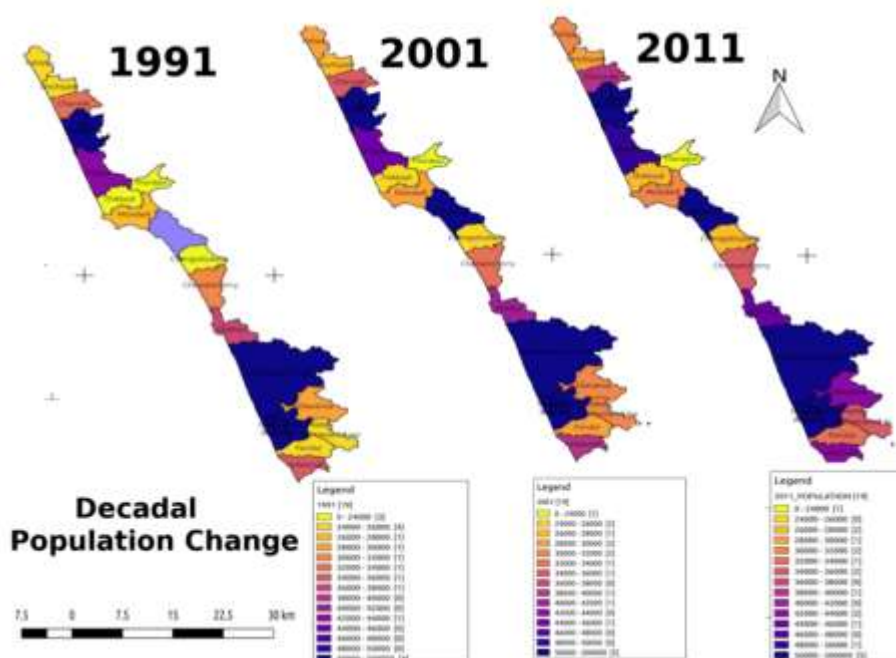
Trend of population growth

In 2011, Kozhikode district remains fifth in the state in population size, as in the previous decades, with 3086293 persons. Besides it ranks second in north Kerala, just behind Malappuram. Present paper includes all the administrative units lies in the coastal plain region,

Table 1

LOCAL BODY	AREA			Total population			Population density		
	1991	2001	2011	1991	2001	2011	1991	2001	2011
Azhiyur	9.76	9.77	9.77	25700	28731	30023	2633.1967	2940.7369	3072.9785
Onchiam	8.72	8.73	8.73	24856	26697	28650	2848.9558	3058.0756	3281.7869
Chorode	13.41	13.41	13.41	32947	35437	38245	2456.8978	2642.5802	2851.9761
Payyoli	22.34	22.34	22.34	42261	45917	49470	1891.7189	2055.3715	2214.4136
Thikkody	14.14	14.14	14.14	22998	25015	27051	1626.4498	1769.0948	1913.0835
Moodadi	16.01	16.01	16.01	27653	29607	30170	1727.233	1849.2817	1884.4472
Chengottukavu	13.60	13.60	13.60	23702	25293	26791	1742.7941	1859.7794	1969.9265
Chemancheri	16.76	16.76	16.76	31326	32532	34819	1869.0931	1941.0501	2077.506
Thalakkulathur	21.54	17.43	17.43	23708	26687	29388	1100.65	1531.0958	1686.0585
Kozhikode (C)	82.68	167.62	124.57	419831	4, 36, 556	431560	5077.7818	2604.4386	3464.3975
Beyepore (CT)	10.42	10.41	10.41	56505	66, 895	69752	5422.7447	6426.0327	6700.4803
Feroke (CT)	7.58	7.60	7.60	25511	29, 505	32122	3365.5673	3882.2368	4226.5789
Kadalundi (CT)	11.83	12.02	12.02	35171	39099	42516	2973.0347	3252.8286	3537.1048
Vadakara (M)	21.33	21.32	21.32	72434	75, 847	75295	3395.8744	3557.5516	3531.6604
Cheruvannur (CT)	10.31	10.31	10.31	50556	57, 110	61614	4903.5887	5539.2823	5976.1397
QUILANDY	21.61			57797			2674.5488		
QUILANDY (M)		29.05	29.05		68, 982	71873		2374.5955	2474.1136
Thurayur (CT)	10.48	10.48	10.48	12830	14009	14176	1224.2366	1336.7366	1352.6718
Elathur	13.54	13.54	13.54	36410	40923	45329	2689.0694	3022.3781	3347.7843
Olavanna (CT)	11.33	11.33	11.33	25672	30915	43895	2265.8429	2728.5966	3874.2277
Ramanattukara (CT)	11.71	11.71	11.71	28382	30440	35937	2423.7404	2599.4876	3068.9155

Source: prepared by Researcher, based on census of India abstract

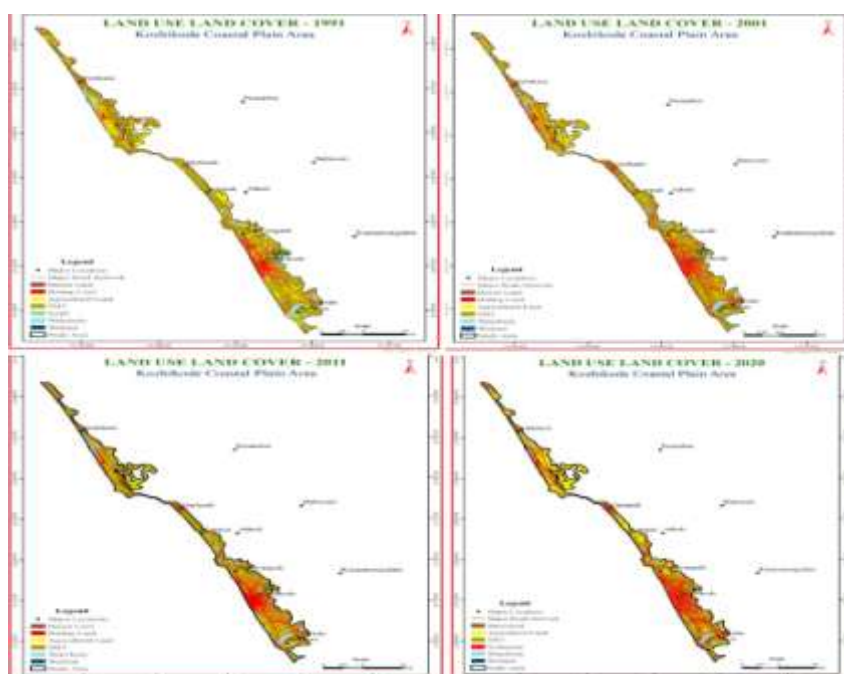


Significant changes registered in the areas of high population density, which depicts the role of population growth in the land use changes. Some of the pockets of koyilandi municipality areas, and the core part of the Kozhikode city possessed high proportion of built up land, but the greater changes experienced in the peripheral regions of coastal zone; vadakara, koyilandy and payyoli. And the growth of human settlements is a continuous phenomenon. An important feature found in the development of human settlement, during the last decades; the rapid expansion of population and built up land in the fringes, especially in the parts of vadakara and koyilandi that shows the urban development recorded in the recent days. Consequently imprints of urbanization are found in the corporation and the municipality limits and these imprints are clearly visible in the urban pockets of the study area. and it is quite difficult to

conclude that these areas are purely rural or urban in nature, because some of the pockets resembles with the city/urban characters even though these areas lie in the rural area.

Major highlight of the demographic analysis is shown in figure 2. remarkably Kozhikode corporation shows a negative growth rate in the last decades, as per census in 2011. among the corporation of the state kollam and trisur also show a similar trend, with trisur having a slightly higher growth rate than Kozhikode and kollam. It is observed that the coastal areas are highly dense especially in koyilandi municipality.

Dynamics of land use land cover change six land use land cover classes are considered for the present study (figure 3)



Source: Generated from Landsat images

land use land cover classes	1991	In %	2001	In %	2011	In %	2020	In%
Barren land	0.13	0.09	0.16	0.11	0.01	0.01	0.01	0.01
Built - up land	16.42	10.95	27.86	18.57	38.67	25.78	41.09	27.39
Agricultural land	39.02	26.01	29.52	19.68	32.88	21.92	38.33	25.55
SMT	82.10	54.73	81.48	54.32	67.84	45.23	61.38	40.92
Waterbody	10.06	6.71	9.32	6.21	9.00	6.00	8.24	5.49
wetlands	2.27	1.51	1.66	1.11	1.60	1.07	0.95	0.63
total	150	100	150	100	150	100	150	100

The above mentioned table (1.3) clearly shows the trend of land use changes experienced in the coastal zone during the period 1991 - 2020. The natural environment of the study area has had boost as well as a decline can be seen from the increases and decreases recorded in the study period. The drastic changes recorded in the land use category: built up growth, that depicts the development that took place in the recent past. The urban limits especially parts of Kozhikode corporation, municipality regions of koyilandy, vadakara, payyoli also showing the clustered type of built up growth in the last decades. The percentage share increases from 10.95 to 27.39, that means the area expansion in the built up land use is showing a remarkable growth in the coastal zone. By analyzing the historical factors, Kozhikode plays a vital role in the development of northern region of Kerala state and still which plays as a hub of northern districts of Kerala.

The land use analysis of study area in the year 1991 was dominated by settlement with mixed crops and followed by agricultural land which constitutes 39.02 sqkms. the growth of population in the area influences the land use pattern. And these influences are observed on entire areas of the coastal zone of Kozhikode. The growing pressure of population on land resources have brought extensive burden on land use. so it is necessary to monitor the dynamics of land use in the area of study for maintaining sustainability.

It is evident from the above diagram that built up land is expanding constantly, indicating that built up land growth has outpaced population growth and these changes are not evenly distributed in the study area, and one notable point is that the changes in the last decade (2011) is much more significant than the 2001. all these characters shows that the overall impact of economic and social growth in the coastal zone. The built up land extracted from the remote sensing images clearly depicts the dimension and direction of its growth. And for the entire study area, population density also increased.

5. Conclusion

Temporal analysis of population and land use data for the last decades demonstrates that population growth and its impact on land use trend is quite distressing. The changes inland use obviously reflect the pressure on land resources due to rising population. Demographic changes was thought to be the major driver behind the land use change there were several interacting factors involved, especially in the developing countries. in this paper, we selected the coastal plain as the boundary, for demographic analysis, all the administrative units that lies under coastal plain is included for the analysis. The most densely parts of the coastal plain of Kozhikode is also showing the dramatic changes in land

use, built up growth and settlement with mixed crops is increasing in the last decades of the study.

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