

Impact of Urbanization on Natural Heritage with Special Reference to Wetland Depletion in Thiruvananthapuram City, Kerala

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Abstract: *Wetlands are referred to as nature's kidneys and they are a part of the natural heritage of a place. The world today is undergoing rapid change and the process of urbanization is putting immense pressure on the wetland ecosystem. This paper focuses on wetland depletion due to urbanization and its effects on the city's natural heritage and urban landscape with the help of SOI Topographical maps and satellite images. Both primary and secondary data have been used in this study. In the urban areas of Thiruvananthapuram City, due to the increase in population and the consequent demand for housing, the wetlands are now being intensively converted for other purposes. The study indicated that between 1965 and 2019, the area under wetlands in the city has been decreased by about 70 percent. The wetlands in the city are in great danger due to the uncontrolled urban activities and ruthless degradation of environment by anthropogenic activities.*

Keywords: Conservation, Natural Heritage, Urban Landscape, Urbanization, Wetland depletion.

1. Introduction

Urbanisation is a process of change from spread out pattern of human settlements to concentrated pattern. It is a progressive concentration of population in an urban unit [1]. Recent years have witnessed a growing concern for the need to conserve and manage wetland resources because of the pressures on the stability and survival of wetland areas [2]. Urbanization impact wetlands by causing direct habitat loss, suspended solid additions, hydrologic changes and altered water quality [3]. Wetlands are considered as one of the most productive ecosystems on earth from both environmental and socio-economic point of view. The essentiality of the wetlands is progressively getting apt attention globally as they add to a healthy and loveable environment in various ways [4]. The Ramsar Convention (1971) defines wetlands as "areas of marsh, fen, peat, land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty including areas of marine water, the depth of which at low tide does not exceed 6 metres"[5]. Wetlands have considerable impact on the water management of an area from the points of view of cleansing polluted waters, protecting shorelines and this ecosystem provides unique habitats for a wide variety of flora and fauna of commercial, aesthetic and environmental value. Wetlands have more life per hectare than any other habitat [6]. Wetlands often serve as sources, sinks and transformers of a multitude of chemical, biological and genetic materials [7]. Wetlands constitute an inevitable part of the natural heritage of a place and it helps in maintaining the

equilibrium of its landscape [8]. Hence, an attempt has been made in this paper to assess the depletion of wetlands in the Thiruvananthapuram Corporation between 1965 and 2019.

2. Study Area and Methodology

Thiruvananthapuram city is located at 8° 21' 44" N to 8° 36' 28" N and 76° 51' 21" E to 77° 01' 25" E on the west coast near the southern tip of mainland. Thiruvananthapuram Corporation is comprised in Thiruvananthapuram Taluk. It covers an area of 215.86 sq.km and there are 100 wards in the Corporation. The general slope of the city is from north east to southwest. The study has been done with the base of both primary and secondary data. The base map was prepared from the Survey of India (1965-66) Toposheets 58 H/3, 58 H/2, 58 D/14, 58 D/15 of scale 1:50000. The satellite images of the Thiruvananthapuram city in 2019 were downloaded using Google Earth. The toposheets as well as the images were digitized using Arc GIS 10.3.

3. Results and Discussion

The land use analysis of two years; 1965 and 2019 has been done to detect the changes that took place in Thiruvananthapuram City over a period of about 50 years. The development of urban areas to cope up with the increase in population has resulted in a massive reclamation of low lying areas in many parts of the state.

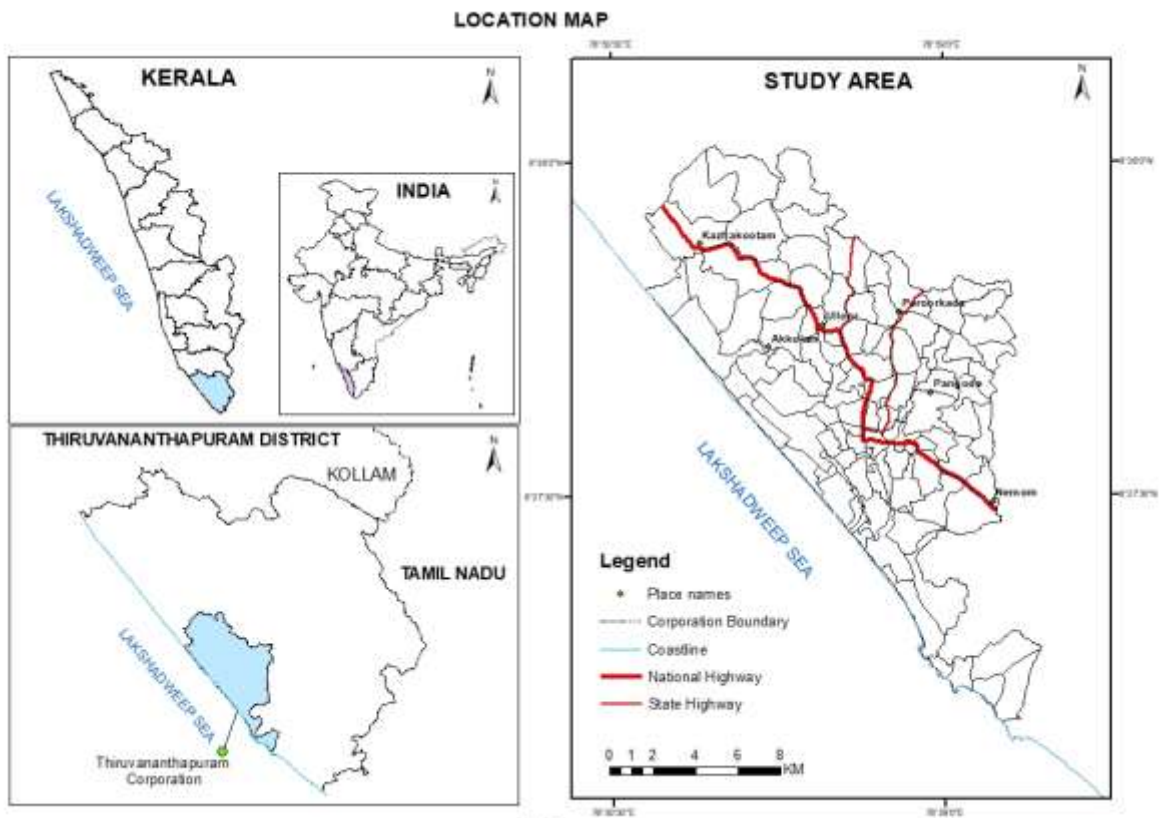


Fig 3.1

Figure 1: Study Area

Temporal Analysis of land use in Thiruvananthapuram City

The change in land use categories in 1965 and 2019 are shown in the Table 1 and Table 2. The land use maps of 1965 and 2019 are shown in Map 1 and Map 2 respectively. In 1965, area under paddy cultivation was 2229.06 ha. Paddy was used to be cultivated in between residential areas, contributing an important livelihood for the people in the city. In 2019, paddy fields has shrunk to 358.01ha.

Table 1: Change in Land Use Categories (1965-2019)

Land Use Category (in hectares)	Year		Percentage Change
	1965	2019	
Paddy	2229.06	358.01	-83
Water body	310.37	283.3	-8.72
Settlements	3997	8501.18	+112
Settlements with trees	14233	11715	-17.69
Plantation	206.02	305.025	+48.05
Others	610.656	423.56	-30.6

Source: Compiled from SOI Toposheets and satellite images

There is a considerable decrease in the actual paddy fields which has now converted to other purposes. Water bodies constituted an area of 3.10 sq. km in 1965. The area under water bodies shrunk to 2.83 sq.km in 2019. The major water Bodies in the city include Karamana River, Killi River and Akkulam Lake. The water bodies have undergone a decrease both in extension and their carrying capacity. This has ended up in the frequent occurrence of floods in the city during rainy season. Settlement is the single major land use category which has seen a tremendous change over the past years registering an increase of 112 percent. In 1965, settlements were largely confined only to the central and

coastal areas of the city. Green spaces covered vast areas in the peripheral portions. In 2019, drastic changes occurred in the land use categories. Settlements took over almost the entire core area of the city. The increase in population creates demand for urban land for various activities, especially for residential purposes. The construction activities in the city show an increasing trend with the increasing population. The commercial areas are increasing along the transport corridor. The highest concentrations of commercial activity are seen in the wards of Kazhakootam, Nemom and Vizhinjam.

Status of Wetlands in Thiruvananthapuram City

The northern and eastern limits of the city consists of a number of hills viz. Pulayanarkotta hills, Mudavanmukal hills, Thirumala hills etc. running in various directions. The main area of wetlands in the Thiruvananthapuram city are by the side of Karamana River, Killi River, Amaizhanchan thodu, Ulloor thodu, Pattom thodu, Parvathi Puthan Ar etc. The place where the hills meet the river valleys or the flood plains of the rivers, the flood plains broaden into river valleys, known as elas or wetlands.

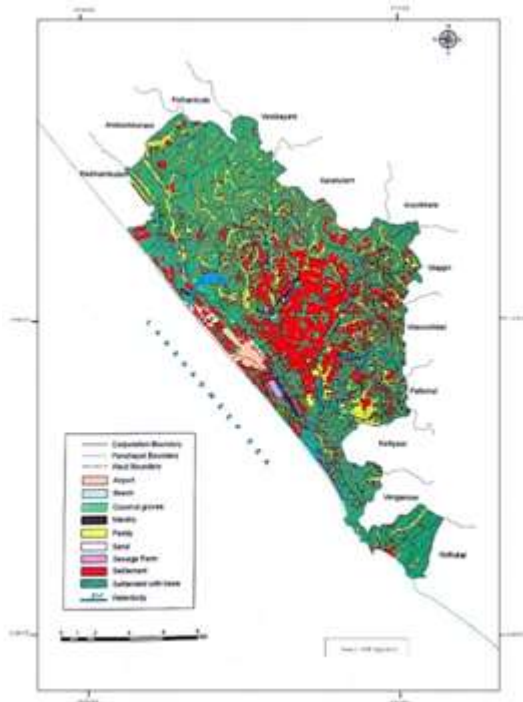


Figure 2: Land Use in Thiruvananthapuram city (1965)

Wetlands by the side of Karamana River: Karamana River has its origin in the Chemmunji Mottai and Athrumala of Nedumangad Taluk. It runs about 67 km and falls into the Arabian Sea near Edayar. The major elas by the side of the Karamana River are Nellikonam Ela, Arayanoor Ela, Thamalam Ela, Chempookari Ela, Peroorkunath Ela, Changaloor Ela.

Wetlands by the side of Killi River: The Killi River starts from the Nedumangad hills and joins the Karamana River at Ambalathara and flows to the Arabian Sea. The major elas by the side of Killi River are Kokkotu Ela, Attukal Ela, Maruthankuzhi Ela, Edapazhinji Ela etc.

The change in wetlands over the period of 1965 and 2019 are shown in Table 3.2 and Fig 3.4.

Table 2: Change in Wetland Category (1965- 2019)

Wetland Category (in hectares)	Year		Percentage Change
	1965	2019	
Paddy	2229.06	358.01	-83.93
Water body	310.37	283.01	-8.721
Marshy	15.2	17.3	+13.907
Beach	67.096	65.83	-1.88
Total	2621.726	724.42	-72.3

Source: Compiled from SOI Toposheets and satellite images

Wetlands by the side of Ulloor thodu, Pattom thodu and Amaizhanchan thodu: Ulloor thodu originates from the drainage basin of the hill near Nalanchira. The Pattom thodu has Pattom, Kesavadasapuram and Nanthencode as its catchment area in the city. A portion of the drain from Pulayanarkotta flows directly to Amaizhanchan Thodu, Ulloor thodu, Pattom thodu and joins at Kannanmoola to flow towards the Akkulam Lake.

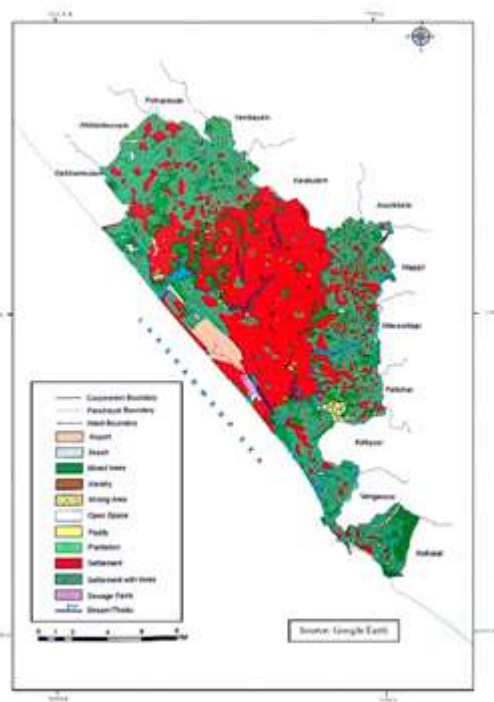


Figure 3: Land Use in Thiruvananthapuram city (2019)

Status of Paddy Cultivation in Thiruvananthapuram City

The paddy cultivation in the city can be divided into two core areas. (i) North and North-east region: The major concentration of paddy fields are in the wards of Chanthavila, Attipra and Poundukadavu (ii) South and South-east region: The major concentration of paddy fields are situated near Vellayani Lake comprising the wards of Ponnumangalam, Melamcode and Punjakkari. The details of Paadashekharams (Paddy Fields) in Thiruvananthapuram are as follows:

Table 3: List of Paadashekharams in Thiruvananthapuram City (2018)

Paadashekharams	Area (in acres)
Nilamakari	200
Melamcode- Mangilikari	50
Pappanmcode	7.5
Koliyakode	50
Ponnumangalam	12.5

Source: Kerala Agricultural Department

Wetland Depletion due to Urbanization

There is a huge pressure on the urban land for conversion and fragmentation of the green open space and wetlands. In the year 1965, the area under wetlands was 2620.656 ha which was reduced to 724.93 ha in 2019. In 1965, the built up area was around 3997 ha which was increased into 8501.18 ha in 2019. The two major factors affecting causing wetland depletion in the city are population pressure and increase in the built-up area. It can be said that the wetlands and built-up area are negatively correlated. When population pressure increases, there is a chance of depletion of wetlands since increasing population demands larger built-up area. The areas supporting large population have created a demand for more residential areas and other construction activities.

Causes of degradation of wetlands

- **Wetland reclamation for housing:** The large scale increase in population especially household population has exerted pressure for the need of more houses. The traditional human settlement has a legacy of concentrating around the river valleys and wetlands and the process is still going on.
- **Changing pattern of Agriculture:** Agriculture expansion accompanied by intensive use of chemicals has become a major reason for the pollution, eutrophication and biodiversity loss of wetlands.
- **Waste Disposal:** Municipal solid waste and sewage are the major pollutants of almost all wetlands in the state and are the main sources of pathogens in the system. The urban wastes include wastes from hospitals, markets and other commercial and residential areas including overflow from latrines. The people living near the wetlands also deposit the household wastes into the system. The infrastructural development activities in the state along the sides of the wetlands generate a huge quantity of debris which consists of organic and inorganic materials and toxic compounds. A considerable quantity of these materials is directly dumped into the wetlands.
- **Land Use Change:** Encroachment into the wetlands are creating various environmental pressures on the landscape and habitat transformation and reduction in the biodiversity. The human intervention on the wetlands has resulted in flooding and water logging in many parts of the city, especially in the Karamana river system. Floods affecting Kerala since 2018 clearly shows the intensity of the adverse effects of reclamation.

4. Conclusion

The present study reveals the anthropogenic pressure on the environment of the city through the analysis of relation between physical and social aspects. The study indicates that the about 11 percent of the city were paddy fields during 1965 and it has shrunk to 1 percent in 2019. The encroachment on the sides of the channels has resulted in the width of these channels, thereby affecting the quick disposal of sewage water. Excavation of hillocks and levelling of low lying land occurring in and around Thiruvananthapuram city is another major concern. The wetlands and paddy fields are ruthlessly reclaimed for erecting buildings causing an increase in run-off, affecting the natural drainage system. The green areas in the city are disappearing at an alarming rate.

There are a number of trough areas not connected with water bodies within the city causing flooding. This causes triggered floods in different areas and main transit centres like Thampanoor and East Fort. This area covering Sree Padmanabha Swamy Temple precincts constitutes the prime heritage centre in the city. The ponds are being neglected and getting filled up for developing built up areas for the ever expanding population in the city. All the water bodies are dumped with solid waste materials which in addition with natural silting is affecting the carrying capacity of the same. There is a large scale reclamation, encroachment, pollution, degradation and over exploitation of water bodies

which finally end up in the degradation of the most important ecosystem; the wetlands.

Wetlands constitute a major part of the natural heritage of a place. According to the Historic Urban Landscape approach of the World Heritage Centre, not only the cultural heritage but the natural heritage should also be given due importance while considering the protection of heritage in a city. The wetlands in the city are in great danger due to the uncontrolled urban activities and ruthless degradation of environment by anthropogenic activities. The wetlands have to be protected in a well manner; otherwise it will result in the deterioration of the environmental quality of the ecosystem.

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