

IMPACT OF URBANISATION ON THE ECOLOGICAL CORRIDOR OF THAMIRABARANI RIVER AT TIRUNELVELI STRETCH, TAMILNADU.

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Abstract— Rivers plays a major role in people's living and in agricultural production, since the human started their settlement, however the crucial behavior of the human is now destroying the river structure and its ecology. Ecological corridor is the main thing that strengthens the rivers. In order to protect the river, the ecological corridors must be protected from the damages that caused by human activities. This paper discuss about the impacts faced by the ecological corridors of Thamirabarani River due to urbanization at Tirunelveli stretch. This river covers from Tirunelveli district to Thoothukudi district. This river is famous for its ecological and cultural value. Due to urbanization the river started facing problems like water pollution, decrease in ecological corridors, Loss of vegetation. This paper shows the result of conservation of ecological corridors of the Thamirabarani River.

Index Terms— Urbanisation, Ecological corridor, Riparian edges, Encroachments, Pollution, Eco sensitive zone, Conservation, Afforestation, Socio-cultural relationship.

1 INTRODUCTION

The aim of the paper is to discuss about the impact of urbanization that affects the ecological corridor of Thamirabarani River at Tirunelveli stretch, which is facing urbanization presently. To have better understanding about the ecological corridors of Thamirabarani River. To know the importance of ecological corridors of the river. To understand the ways, urbanization affects the ecological corridors of the river.

The Thamirabarani or Tamraparni or Porunai is a perennial river that originates from the Agastyarkoodam peak of Pothigai hills of the Western Ghats, above Papanasam in the Ambasamudram taluk. It flows through Tirunelveli and Thoothukudi districts of the Tamil Nadu state of southern India into the Gulf of Mannar. It was called the Tamraparni River in the pre-classical period, a name it lent to the island of Sri Lanka. The old Tamil name of the river is Porunai. From the source to sea, the river is about 128 kilometres (80 mi) long and is the only perennial river in Tamil Nadu. This river flows towards north direction initially. However, it changes to east direction later. The Thamirabarani is a symbol of Tamil culture and civilization and an identity of the far south of India. The river is the main source of water for the districts of Tirunelveli and Tuticorin as it is the only perennial river in the region and it runs through the heart of the cities. Thousands of people depend on the river for their routine activi-

ties and satisfying their basic needs. But Anthropogenic drivers such as the urbanization and economic dependence which being a major force in shaping the land scape of tirunelveli and Tuticorin has increased the pollution load in the river. Local complaints and news paper reports on the cleanliness less of the river have made the subject a major issue to discuss.

2 LITERATURE STUDY

2.1 General impacts of urbanization on river

River systems are valuable to human beings; meanwhile, they are intensively influenced by human activities, especially urbanization. Cities in India are developing at a faster rate, stimulating ever increasing demand for natural resources, resulting in various environmental & health stresses. One such environmental externality of rapid and haphazard urbanization is urban river pollution. One of the primary reasons for deterioration of river stretches across India is due to uncontrolled disposal of treated wastewater, especially domestic sewage disposal from urban areas. Significant difference in the sewage generation & treatment capacities within the cities, owing to increasing wastewater generation and insufficient sewerage and sanitation infrastructures, is leading to disposal of large amount of untreated domestic sewage into the rivers. Urbanization can affect the physical process of river growth, modify stream structure and further influence the functions of river system.

- 1) Deforestation and catchment degradation in the riverbasins.
- 2) Increased erosion of soil due to increased surface runoff.
- 3) Increased silting and sedimentation of the rivers.
- 4) Alterations in the hydrology due to increasing impervious-

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ness of the catchment area i.e. modifications in aquatic ecosystem.

- 5) Severe water scarcity in the river basin.
- 6) Environmental pollution.
- 7) Declined water quality of rivers.
- 8) Morphological alterations of the rivers and extinction of the river channels.
- 9) Unpredictable local climate.
- 10) River fragmentation and flow regulation in rivers.
- 11) Over exploitation of the natural resources.
- 12) Changes in ecosystem processes and stability.
- 13) Frequent natural disasters like floods and droughts.
- 14) Habitat and community modifications.
- 15) Biotic homogenization and biodiversity loss in a river basin ecosystem.
- 16) Loss of aesthetic value or recreation.

3 FINDINGS

3.1 Tirunelveli

Thamirabarani, a perennial river strength of the water sources and sustaining city's growth. Potential to emerge as a key 'heritage hub' in the south, it can attract many tourists because of its rich heritage, culture and picturesque and congenial natural setting. With good regional and location advantage, city has the capacity to attract many potential developers in economic and tourism sectors.

The selected area of study is in Tirunelveli city, which is facing urban agglomeration currently that leads to the damage of Thamirabarani River stretch. The selected study area from Thamirabarani River is the stretch that runs between the Tirunelveli Town and Palayamkottai. Thamirabarani travels through Tirunelveli and Thoothukudi district. The only urban area it passes through is Tirunelveli, which is selected as the study area.

This selected area is believed to be the origin of the settlement. This covers distance of about 3km approximately.



Fig. 1 River dividing the city into two part

Tirunelveli is the sixth-largest city in the state of Tamil Nadu, India and the headquarters of the Tirunelveli District. Tirunelveli is also called Nellai. The translation in Tamil for paddy (rice fields) is "Nell". Both the names, Tirunelveli and Nellai, Even on satellite imagery, it can be seen that the city is surrounded by fertile paddy fields, enriched by perennial river "Thamirabarani". The river has a wide network of canals and waterways which irrigate numerous rice fields and support the villages around the district which primarily thrive

on cultivating rice. The region is also heavily dependent on the monsoon rains.

Tirunelveli is an ancient city with rich cultural heritage, including the largest Shiva Temple in Tamil Nadu. The city is considered to be one of the oldest in the Indian subcontinent, with a history that dates back to 1000 BC.

3.2 Impact of urbanization on Thamirabarani River at Tirunelveli

- Due to increasing population the encroachments towards the river corridors has been affected.
- The shape of the river has been changed.
- Settlement pattern have increased a long way.
- Many residential settlement started along the river and damaging the river with their sewage disposal.
- Many industries are placed along the river, which takes the river water and dispose their waste water in to the river, which affects the water quality.
- During summer, the river gets drained at few spaces where people occupy and do washing clothes, where the waste water gets into the river.
- Encroachments along the river affected the flood storage capacity of the river. During early monsoon period, the river faces flood every year.
- Due to urbanization, the vegetation corridor of the river has been badly affected. The vegetation of Tirunelveli was reduced and the microclimate of the zone is also changed.

3.2.1 Vegetation analysis



Fig. 2 Vegetation degradation on the riparian buffer of the river stretch at Tirunelveli, due to urbanisation.

The above maps shows the changes in vegetation pattern for over years. The vegetation has been degrading due to the impact of urbanization. It is facing a drastic change over years. Due to loss of vegetation, the flood plain and the river edge started to face problems like soil erosion, siltation, etc... At present the river doesn't have any measures to help during the seasonal floods. Tirunelveli faced drastic floods in the year 2020.



Fig. 3a Eroded riparian edges

Fig. 3b Present condition of the riparian edges.

This NDVI Map 2022 shows the health condition of vegetation in Tirunelveli at present.

The red indicates the poor health of the vegetation. This is due

to urban agglomeration.

- The green indicates good health and blue indicates better health of the vegetation.

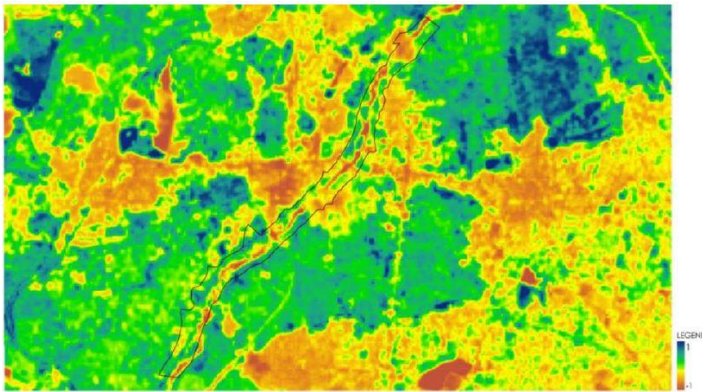
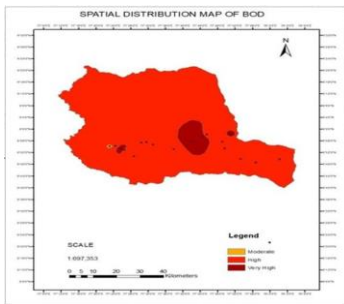


Fig. 4 NDVI Map 2022 of the study area.

3.2.2 Water quality analysis

For water that's fit for drinking, the BOD concentration mustn't exceed 0 mg/l. The map shows that the variation of nitrate and BOD in the river basin is uniform. Thus, it can be observed that the basin has a very poor BOD concentration, which is liable to elicit serious health disorders if not attended to immediately.



S.No	Station Name	Longitude	Latitude	BOD (mg/L)
1	Agasthiar	77.113	8.655	2.21
2	Vickramasingapuram	77.284	8.666	2.25
3	Vickramasingapuram D/S	77.292	8.661	2.23
4	Kannadai Anicut	77.370	8.623	4.20
5	Ambasamudram	77.403	8.633	2.48
6	Chidambaram	77.466	8.655	2.56
7	Aryankuppam Anicut	77.504	8.701	2.47
8	Chinnambalur	77.524	8.669	2.65
9	D/S of Sona paper mill	77.537	8.668	2.59
10	Tharuvai	77.516	8.648	1.99
11	Korakkurukulam	77.746	8.681	4.11
12	Tirunelveli	77.762	8.699	3.38
13	Vellakudi	77.776	8.689	2.63
14	Pottai	77.855	8.750	3.05
15	Manappadiyodu	77.897	8.730	2.66
16	Sivakapuri	77.915	8.768	2.50
17	Marudor Anicut	77.929	8.745	2.19
18	Karupandham	78.039	8.586	2.91
19	Sivakandam	78.051	8.579	2.56
20	Erud	78.330	8.539	2.53
21	Anthur	78.342	8.539	2.34

Fig. 5a water quality map of the study area, Fig. 5b BOD value of study area.

The river faces some major pollution like sewage disposal and waste disposal directly from the residence, which changes the water quality of the river. In the study area there are six points where sewage from the residence mix into the river directly and indirectly.



Fig. 6a Manimoortheeswaram sewage disposal point.
Fig 6b Sindhuipoondhurai sewage mixing point
Fig 6c Meenakshipuram sewage mixing point
Fig 6d Karupandhurai sewage mixge points
Fig 6e Kurukkuthurai mixing points
Fig 6f CN village sewage mixing points.

3.2.3 General issues

Since the edges of the river is not maintained properly, at some points the place looks like abondoned one and it is used by unwanted illegal activities like drinking, etc... And also there is an main issue like sand mining, though government banned but they area practising illegally.



Fig. 7 Seasonal floodings that happens due to encroachments.



Fig. 8 Seasonal flooding in Tirunelveli.

4 SOLUTIONS

4.1 Enhance flood storage

"The flood is not always a disaster, but part of its destructive effects is the result of human activities that causes rain and floods to be destructive," adding, deforestation and lost vegetation are the major reasons behind severe floods in different regions. Planting trees around rivers could reduce the height of flooding in towns by up to 20%, new research suggests.

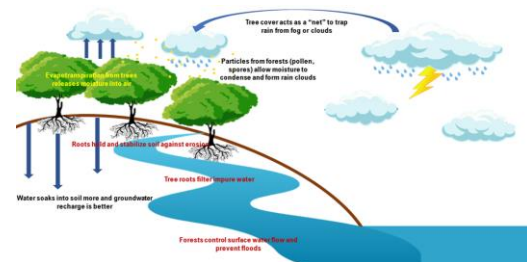


Fig. 9 Representing flood storage

4.2 Flood plain enhancement

Floodplains are hydrologically important, environmentally sensitive, and ecologically productive areas that perform many natural functions. ... In addition, floodplains are im-

portant because of storage and conveyance, protection of water quality, and recharge of groundwater.

Some of the benefits of floodplains to a functioning natural system include:

Fish and wildlife habitat protection.

Natural flood and erosion control.

Surface water quality maintenance.

Groundwater recharge.

Biological productivity.

Higher quality recreational opportunities (fishing, bird watching, boating, etc.)

4.3 Control of encroachments along the river

Control of encroachments is one such important recommendation to enhance the river flood storing capacity. Due to over population of the city, people tends to encroach along the river side, destroying its vegetation and flood plains. People's encroachments along the river should be controlled by the government. They should allocate separate area for people who are encroaching the river (mainly slums). Avoiding encroachments will be helpful in enlarging the flood plain which will reduce the flood damage into the city.

4.4 Improving water quality

4.4.1 Waste water treatment

Sewage treatment plant, will prevent the flow of polluted water into the river. Thamirabarani River, which has industries near to them, which allow their polluted water into the river really need this treatment plant in their area.

4.4.2 Green bridge technology

The green bridge system is a filter which is the combination of coconut coir mats, sand, gravel and boulders. It is a v shaped structure (inverted v). Covered with cloth made of coconut coir. Mix of microbes and biochemical solution is then poured into it again covered with coconut husk. Metal screens installed at the upstream of the bridge to prevent solid waste entering. Floatable and suspended solids are trapped.

4.4.3 Separate space for dhobi ghat

The government should allocate separate place for washermen who are using the river water and polluting the river with waste water.

4.4.4 Creating stormwater parks and constructed wetland along the flood plain

Floating treatment wetlands (FTWs) or islands are small artificial platforms that allow these aquatic emergent plants to grow in water that is typically too deep for them. Their roots spread through the floating islands and down into the water creating dense columns of roots with lots of surface area.

Based on the soil-less hydroponics technique, the FTW comprises four layers. Floatable bamboo forms its base, over which Styrofoam cubicles are placed. The third layer consists of gunny bags. The final layer is of gravel. "Hydroponics permits plants to grow only on sunlight and water. There is no need of soil. There are small holes at the bottom which facili-

tate the flow of nutrients from the water to the plants (biological uptake process), which are held upright by the gravel layer. Cleaning agents planted on the FTW include vetivers, canna, cattalis, bulrush, citronella, hibiscus, fountain grass, flowering herbs, tulsi and ashvagandha.

Wetlands can improve water quality by removing pollutants from surface waters. Three pollutant removal processes provided by wetlands are particularly important: sediment trapping, nutrient removal and chemical detoxification.

4.4.5 Riparian buffer

Using a diversity of trees, shrubs, grasses, and forbs will provide shade, organic matter, and eventually woody debris to the water body. The type of vegetation, configuration, and maintenance regime you use will vary depending on site conditions, your objectives and economic concerns. Temporary exclusion of livestock and wildlife may be required until the desired vegetation is established. Grazing management is essential to maintain healthy riparian buffers. Riparian buffers are the grasses, grass-like, forbs, shrubs, trees or other vegetation growing along streams. These plants control erosion and help filter and keep water clean. Cropland fields shouldn't be planted right up to a stream's edge where the soil is generally more fragile and subject to erosion. Maintenance needs will vary by design. Timing of thinning, pruning, burning, and grazing is particularly critical during migration periods, calving, nesting or spawning.

4.5 Enhance safe public access

Riverfront development is used as an additional buffer, creating a non-residential zone between the river and homes in the area around it. Planners create public spaces to let residents enjoy the riverfront and its surrounds. These include parks, walkways, and spaces to host festivals, firework displays, and concerts.

- Increased revenue from tourism due to job creation.
- Enhanced community culture and quality of life.
- Creation of green belts in the city.
- Reduction in crime along the riverfront.
- Creation of jobs for infrastructural development and maintenance.
- Environmental conservation.
- Increase in housing options beyond the riparian buffer.

5 CONCLUSION

Urbanization in the river corridor is unavoidable due to rapid population growth. The landscape related transformations have significantly changed the river system. Urbanization induced changes in the hydrogeomorphology of the streams as well as the water pollution are the most consistent and harmful effects of urbanization on river basins. Inadequate knowledge of the factors affecting river basins and their inter-relationships are the major research areas to be explored. Many landscape related sustainable techniques can save the river and bring back its lost values. This paper ends up provid-

ing recommendations to the negative impact of urbanization faced by the Thamirabarani River at Tirunelveli stretch.

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