

PRE- PROJECT STUDY ON
CONSERVATION OF RIPARIAN AND
RIVER BIODIVERSITY OF
CHALAKUDY RIVER



APOLLO TYRE FOUNDATION



TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES

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Report of Pre-project study on Conservation of Riparian and river biodiversity of Chalakudy River

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Cover Photo: Chalakudypuzha at

Preface

India is facing acute water shortage due to a variety reasons including climate change, drought, ground water depletion and over exploitation and pollution resulted due to the rising population. At this point, conserving water bodies is most important owing to increase in water demand. Rivers, lakes, ponds, streams and wells are the conventional sources of surface water. Among them, river-ecosystem is distinct as they support wide varieties of flora and fauna including rare and even threatened species and also meet rising demand of water for local community. They are playing important role in supporting and maintaining ground water table. Human activities in the form of agriculture and industries are intensely carried out in the river basins mainly due to the availability of water, fertile soil and other natural resources. However, many of the rivers in our surrounding are being polluted leading to water shortage and biodiversity loss in the region. Rivers are becoming dumping points for wastes. Therefore, it is utmost important to protect rivers to safeguard our environment as well as human wellbeing.

Apollo Tyre Plant is located at Perambra, Thrissur. Chalakudy river is the fifth longest river of 44 rivers of Kerala, flowing through Palakkad, Thrissur and Ernakulam districts. As the major industry in Thrissur, Apollo Tyre Ltd. has keen interest in the well being of the local community as well as the environment. Apollo Tyre Foundation (ATF), fully understands the significance of water and biodiversity conservation in their operating area too. In this context, ATF approached Tropical Institute of Ecological Sciences (TIES), Kottayam, a leading eco-research organization and technical partner for ATF in many environment based projects, to perform a conservation project on Chalakudy river and to propose specific river management activities, that will ensure sustainable conservation of them, as an initial step. This report contains detailed information on history, geography, biodiversity and environmental issues of Chalakudy river. The present report includes the findings of the study along with valid recommendations and also specific proposals for the conservation of the river.

Acknowledgement

This short term study would not have been possible without the kind support and help of many individuals and organizations. We would like to express our deepest gratitude to Corporate Social Responsibility (CSR) team of Apollo Tyres Limited, for entrusting Tropical Institute of Ecological Sciences (TIES) with the responsibility of conducting the study of Chalakudy river. Special gratitude goes to CSR Group Manager, Mr. Viswabandhu Bhattacharya; CSR Specialist, Mrs. Smitha R., and Unit Head, Mr. George Ommen for regular support and constant involvement in the programme. Additionally, we convey our sincere gratitude to Pariyaram Panchayat Members, Sri. Babu Attakudam and Sri. Shyam and to Sri. Molly Kutty (Panchayat Member, Kadakutti). We convey our gratitude to Sri. Babu (Pump house operator, Ezhathumugham) and Sri. Chathukutty (Fisherman) for their kind cooperation. Also, we would like to make a special mention to the community members of Arangalikaladavu for their immense cooperation and participation. Further, we greatly appreciate the cooperation shown by Sri. Harinarayanan (Counselor, Chalakudy) and other officials. They have given all support to spread the message of our activities to others. We are thankful to everyone who were a part of the study and offered complete support. The Project team gratefully acknowledges the generous support of the people residing near the river. They were very cooperative throughout the study and shared the most important details about the river with us in spite of their busy schedules. PRA meetings were also very successful since the stake holders shared their information about the river and valuable time. And most importantly, we are highly indebted to TIES team for their guidance and constant supervision as well as for providing technical and office support throughout the tenure of the project.

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Chapter 1

Introduction & Review of Literature

1.1. Introduction

Chalakydy River (10° 10' 0" to 10° 33' 30" N; 76° 17' 0" to 77° 4' 0") is the fifth longest river of 44 rivers of Kerala. The river originates in Western Ghats, the Anamalai region of Tamil Nadu, and it is actually a collection of some major tributaries originated from Parambikulam, Kuriyarkutti, Sholayar, Karapara and Anakayam in Kerala. Also, it flows through some of the dense evergreen forests of the regions before emptying into the Arabian sea. In Kerala, it flows through Palakkad district, Thrissur District and Ernakulam District. The total drainage area of the river is 1704 km². out of this 1404 km² lies in Kerala and the rest 300 km² in Tamil Nadu. The length of the river is 145 km.

The Chalakydy river basin contains about 57 sub watersheds and 140 micro watersheds. These sub watersheds are mainly in the catchments and hence the basin becomes narrower towards the west. The river is formed by the confluence of four major tributaries, Sholayar, ParambikulamAr, KuriarkuttyAr and Karappara River.

The river is home to a large number of fish varieties and studies have identified 104 fish species from it. Considering the fish diversity supported by the river, the National Bureau of Fish Genetics Resources, Lucknow, has recommended that the upstream areas of the river should be declared as a fish sanctuary.

It is estimated that over 10 lakh people directly depend on the river for various needs. Lift irrigation, drinking water schemes and dams have been constructed in the river system.

1.2 Background of the study

Chalakydy river is under severe threats and yearning for a lifeline. Chalakydy riverine ecosystem is undergoing anthropogenic stress from large increases in population and urbanization. In many regions, changes in freshwater and material inputs to the rivers are altering the biogeochemical capacities of ecosystems. The river is faced with a series of risks including sand-mining, release of untreated effluents from an industrial unit and improper disposal of solid waste. Heavy sand-mining, over extraction of water for drinking purposes and irrigation and even for other river basins and saline ingress are taking their toll on the river.

According to Kerala State Pollution Control Board study, dissolved oxygen, abnormal colour and offensive odour were reported in the Kanjirapally area of the river basin and

this has been attributed to the discharge of effluents from an industrial unit. Clay mining, transportation of mined clay and its processing near Chalakudy Bridge, presence of pesticide from Koodapuzha and Kanjirapally were some of the signs of slow death awaiting the river.

Another cause of worry for the river was the presence of heavy metals in sediment samples collected from the river. Traces of Manganese, Lead, Nickel, Zinc, Copper and Cadmium were identified in the scientific analysis, it was reported.

The construction of dams and inter basin water transfers have added to the degradation of the river. The loss of rich riparian biodiversity once flourished especially in upstream areas is of great significance in the sustainability of the river.

Though scattered studies have been reporting on various aspects of the river, no comprehensive studies have done so far. Besides a practical, community based conservation plan is also not yet formulated for the river. In this background, a comprehensive study on a selected part of the river and based on the outcome development of an action plan for conservation of the river, is the need of the hour.

1.3 Significance on Conservation of Rivers

River conservation encompasses the policies, strategies and activities made to manage Rivers a sustainable resource, to protect the water environment, and to meet current and future human demand of water. This ensuring availability of water for future generations. Minimizing human water use helps to preserve freshwater habitats for local wildlife and migrating waterfowl, as well as reduces the need to build new dams and other water diversion infrastructures.

Chalakudy river basin, is like most river basins in developing countries perturbed by human activities. According to Dr. Sudhirendar Sharma, a water expert and Director of the Delhi-based Ecological Foundation, Chalakudy river has been the biggest victim with 37 per cent reduction in its natural flow and storage, and diversion of waters for irrigation has caused ecological damage as reflected in the salinity intrusions along the coast.

1.4. Review of Literature

The word “Riparian” itself means along the river margin. Plant communities seen along the river margins are commonly referred to as the riparian vegetation. From the beginning to the end of a river, the riparian zone is highly influenced by the quantum and flow of water in the river channel. Usually altitude, total rainfall, duration of rainy season, wind, and temperature along with soil characteristics influenced by climatic factors determine the nature of plant communities (Nair, 1994). In all the cases water availability, humidity becomes a critical factor. Because of this reason the riparian zone is a unique system. Being a transitional zone between the aquatic and terrestrial habitats they have their own unique characteristics like hydric soil, floral and faunal composition, community structure, relationships. The riparian wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstance do support a prevalence of vegetation typically adapted for life in saturated soil conditions (James *et al.*, 1992). Variations in the environmental conditions provide a diversity of inhabitants, for both aquatic and terrestrial animal community (Pratt 1995).

Due to this availability of watered condition, humidity, and open areas provided by the river, vegetation present in this area will have some unique characteristics. The availability of water, seasonal flooding and sedimentation influences the vegetation and also its development. The plant communities provide shade, which will cool the water, slow the flow, control flooding, and provide microhabitats for a lot of aquatic organisms. This dynamic but stable environment also provides a unique ecosystem essential for the normal health of the river system.

The unit characteristics of riparian system result from the spatial allocation and configuration. The plant communities in these systems are likely to be affected by both longitudinal (*i.e* upstream-downstream) (Vannote *et al* 1980) and transversal (*i.e* stream-floodplain or flood plain basin) (Newbold *et al* 1981) linkages for species recruitment and species diversity (Tabacchi 1996).

Riparian zones have been reported as some of the most species rich and most productive systems and they are also some of the most sensitive to human influence and potentially threatened ecosystems (Malanson 1993). Plant communities in a riparian zone may include some common elements or may be true riparian plant which can only be seen within this environment, many processes of their lifecycle are supported by this riparian environment for example they need more water, for their growth and seed dispersal, etc. or may need a seasonal availability of water. These plants, their establishment and development depend on the riparian environment. The riparian canopy regulates stream temperature through shadowing and provides organic matter *via* litter fall, while their root systems stabilize the bank and filter lateral sediment and nutrient inputs, thereby

controlling stream sediment and nutrient dynamics: (Naiman and Decamps 1997, Melfield and Naiman 2001).

The surfaces of submerged leaves are sites of primary and secondary production by micro algae and bacteria, which can rival that of phytoplankton and bacteriophiles in water column. The community serve as food for grazing invertebrates and protozoa, it contributes to bio-purification of organically polluted watercourses, and can be a substantial source of planktonic microorganism (Goulber and Baker 1991). In the lower reaches the riparian forests act as a buffer between the upland and the river. Rainfall on the watershed is efficiently absorbed by the litter covered forest floor. Evaporation rates are high so that runoff through the forest is generally kept at minimum. Runoff from adjacent uplands flowing across the riparian forest is purified by removal of inorganic nutrients, eroded sediments, and other materials such as agricultural pesticides (James et al 1991).

Usually rivers and streams have a one-way downhill flow, and in these lotic environments flow rate is of prime importance in determining the nature of plant and animal community (Osborne 2000). Tropical rivers have a significant interaction with the lining or the riparian zone of the main river channel. Hence the biological species and their diversity will be very unique in these fluctuating environments especially in the floodplains. The floodplains have a significant functional role in the nutrient balance and energy flow within the river system and the relationship between the floodplain and terrestrial system that lines it is both intimate and complex.

Rivers differ from other systems mainly in its longitudinal diversity. From the beginning of a river in the mountains up to the river mouth a continuous change can be observed in the floral and faunal composition with the changing environmental parameters like altitude, humidity, soil conditions and also in the conditions of water like quantum and flow, temperature, pH, salinity. In a tropical country like ours the riparian vegetation in a first order stream in the mountains may be ferns and other associated herbaceous plants in the rock crevices. When coming down, the quantum and the lateral influence of the water increases. So we can observe evergreen forest samples in the riparian zone. Further going down the bed conditions of the river changes from rocky to sandy especially in the floodplains. Here the soil becomes looser, sedimentation rate will be high, and a good amount of alluvium can be found. In these areas the water influence on the vegetation may be more. Herbaceous, grass and hydrophytic plant communities will be abundant in these zones. Coming to the river mouth, the situation changes and the increase in the salinity can be observed by the presence of some halophytic plants in the river margins. The riparian zone is an ecotone, a junction of the aquatic and terrestrial habitat and longitudinal continuity also exist. Hence the riparian zone is a habitat of number of organisms including human populations.

In the context of Kerala ($8^{\circ} 18'$ to $12^{\circ} 48'$ North latitude and $74^{\circ} 52'$ to $77^{\circ} 22'$ East longitude) having 44 rivers (41 West flowing and 3 East flowing with an average length of 100 km) the riparian zone is a very important habitat. Due to massive destruction of

catchments all rivers are striving for their healthy survival. Encroachment and destruction of the riparian habitat is very severe. These river courses are the basis of water resource of the State. All people directly or indirectly depend on these rivers for their basic needs.

Besides these the riparian habitat provides shelter for all wild animals including Elephant, Gaur, Deer, Monkeys in the forest areas and this abundance also attracts predator populations like Leopard and Tiger *etc.* the availability of reeds and bamboos and other varying micro and macro habitats characterised by different vegetation types support these organisms. Otters and Civets are inhabitants of the riparian forests up to the lower areas. The open spaces above the streams and the riparian vegetation attract a diverse butterfly and bird population because this provides a longitudinal continuity of the water and the vegetation.

Besides these, the riparian forest keeps the continuity of the fragmented forestlands; this acts as a corridor for the migration and movement of animal populations especially for the arboreal species and larger mammals like Elephants. Because of the longitudinal continuity of the streams and the riparian zone the animal and plant population are distributed up and down streams. The river is a continuous entity, which makes many small falls and rapids, and influences the land and biota. These variations in an altitudinal gradient provide different kinds of terrestrial and aquatic microhabitats. So the rivers support a great amount of fish and other aquatic life.

Not only the tribals and the wildlife but also every human being all around the world depend rivers for their survival. In the case of Kerala every water requirement of the people including drinking, domestic, agriculture, industrial are dependent on these rivers. The rivers and the forests maintain the ground water level. Most of the agricultural practices were in the flood plains and riparian zones. Lakhs of people were depending on these forests and rivers for their livelihood, which includes a small tribal community, fishermen communities, the village people and also the people in the cities.

Riparian zones have been reported as some of the most species rich and most productive systems and they are also some of the most sensitive to human influence and potentially threatened ecosystems (Malanson 1993). Penczak, *et al* (1994, 1995) in his study on the fish community dynamics related human influence and depletion of riparian vegetation. He has recorded depletion of fish species (17 to 11 in an year) by the removal of 450 m section of riparian vegetation from both sides of the river Warta in Poland. It also explains the increase of fish standing crop with the growth of the riparian trees. Samways and Steytler (1994) explains the importance and need of riparian vegetation (at least 30-20 meters) along the rivers at least for protection of dragonflies, which is a good indicator (*Chlorotestes tessalatus*) of 30 m width of riparian forest in South African rivers.

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1.4.1 Geography & Physical features of Chalakudy River

The Chalakudy River is a comparatively smaller perennial river in Kerala. Though Chalakudy river in strict geological sense is a tributary of Periyar river for all practical purpose it is treated as a separate river by Government and other agencies. The river joins the Periyar river near its mouth. It originates from the Anamalai hills of the Western Ghat mountain ranges and flows through the northern part of Periyar river. After draining through varied physiographic and geologic terrains of Tamil Nadu (minor portion) and Kerala (major portion) States, the river merges with the Periyar river at Elanthikkara located about 10 km upstream of the Periyar river confluence at Munambam. The Chalakudy river has a length of about 130 km and a catchment area of about 1704 Km² • Out of the total catchment area, about 300 Km² lies in Tamil Nadu and the remaining in Kerala. The river is formed by the confluence of 5 major tributaries: Parambikulam, Sholayar, Kuriyarkutti, Karappara and Anakkayam. Out of these, the first two tributaries originate from the Tamil Nadu State and the remaining from the Kerala State. The Chalakudy river hosts several waterfalls, of which Peringalkuthu and Athirappalli are the major ones. The reservoirs constructed in the river basin are Peruvareppallam, Tunakadavu, Parambikulam, Sholayar and Peringalkuttu.

1.4.2. River discharge

Analysis of 8 years of water and sediment discharge data (1987/88 - 1994/95) collected from the offices of the Central Water Commission (CWC) located at Malayattoor-Neeleeswaram Ernakulam district) in Periyar river and Arangali (Thrissur district) in Chalakudy river reveals that, on an average, 6613 million m³ of water and 346089 tonnes of sediment (sand = 83603 tonnes; mud = 262486 tonnes) are discharged through Periyar river every year.

1.4.3 Physiographic features of Chalakudy River

Physiographically, the study area can be broadly divided into 3 major zones lowland (< 8m amsl), midland (8 - 75m amsl) and highland (>75m amsl); The lowland has a width ranging from 10 to 15 km. The area close to the coast is dominated by a network of backwater channels. The midland region is characterized by an almost rugged topography comprising small flat-topped low mounts and broad valleys. The midlands are intensely cultivated. The highland is characterized by scarp, valleys, plateau and mountains. The highland host many reservoirs.

1.4.4 Riparian vegetation of Chalakudy River

Chalakudy River is the one of very few rivers of Kerala with relics of riparian vegetation in substantial level. The annual report of the National Bureau of Fish Genetic Resources Lucknow, mentioned that the Chalakudy River is the richest river in fish diversity perhaps in India. The riparian forests of the Chalakudy River have revealed the existence of a thick riparian vegetation of more than 10 metres width for a distance of 10.5 km downstream from Peringalkuth, covering an area of 58.5 hectares. Out of this, 26.4 hectares lie within the Vazachal area, including three large islands densely covered by riparian forests. The riparian forests of the area have been found to be characterised by the presence of typical riparian species of plants, in addition to evergreen and semi-evergreen species. Out of the 319 species of flowering plants reported from the river bed, 24 are endemic species of the Western Ghats and 10 are rare and endangered.

1.4.5 Faunal Diversity in Chalakudy river

The Chalakudy River is known for its diversity, as it contains 98 species of fresh water fishes out of the 152 species known from Kerala (Ajithkumar, *et al.*, 1999). Among these, 35 are endemic species of the Western Ghats and 31 are either vulnerable (11 species), endangered (16 species) or critically endangered (4 species) from indiscriminate collection for the aquarium fish trade, overfishing, pollution, dams and introduced species (Raghavan, *et al.*, 2008). According to a report of the National Bureau of Fish Genetic Resources in Lucknow, Chalakudy could well be the richest river in fish diversity in India, with thick

vegetation on both sides. Among the fish species in the river, the most species rich family are the Cyprinids, followed by Bagrid catfishes and hillstream loaches. *Sahyadria chalakudiensis* is a species of cyprinid fish endemic to the Chalakudy.

1.4.6 Biodiversity Potential and Ecological importance

About one third length of the river is flowing through natural forestlands and this feature is very important. The Chalakudy river basin occupies a major portion of the vegetation cover of important wildlife habitats of the southern Western Ghats. The Peechi- Vazhani Wildlife Sanctuary in the north and the Indira Gandhi Wildlife Sanctuary of Tamil Nadu in the east are connected with the forests in the basin. The Parambikulam Wildlife Sanctuary which lies within the basin is the second Tiger Reserve in the State. The Sholayar ranges have some of the remaining evergreen forests of Kerala.

The northern region of the basin occupies the famous Nelliampathy hills. This continuity of the forests is maintained towards westward by the Vazhachal and Chalakudy forests. This tract is having good amount of riparian forests and is ecologically very important. These areas contain sizeable stretch of Evergreen and Semi- Evergreen forests, the bamboo and reed brakes, deciduous forests predominated by teak, the riparian forests and the plantations. Hence this area supports a major portion of the wildlife and act as a corridor for many animals especially for elephants through maintaining continuity of our fragmented forest habitats.

Forest divisions of the Chalakudy basin are Parambikulam Wildlife Division, Vazhachal Division, Chalakudy Division and Nemmara Division. These areas protect many of the endangered and related wildlife like Lion Tailed Macaque, Nilgiri Langur, The Asiatic Elephant, Gaur, Tiger, Leopard and Great Indian Hornbill. And this vegetation cover accounts for the fish diversity in the river. The Chalakudy River is considered as richest in fish diversity in India (NBFGR, 2000).

1.5 Aim

To study the status of riparian and river biodiversity of Chalakudy River and to propose a model Conservation programme with community participation

1.6 Objectives

- To assess the status of riparian biodiversity of 20kms of Chalakudy river nearest to Apollo Tyres, Perampura.
- To assess the river biodiversity of the Chalakudy river with respect to the selected sample study area
- To assess the water quality of the study area of the river

- To study the traditional knowledge of riverine community with their specific knowledge
- To compile a review report of available studies on Chalakudy river
- To propose an action plan for improving riparian diversity and river conservation

Photo: Top: TIES Project officers with the local community representatives at a Check dam across Chalakudy river; Bottom:



Chapter II Methodology

2.1 Study area

The study area was identified by locating a parallel point in the river to the Apollo Tyres Pearmbra Plant, at an aerial distance of 5 Km and 300 m and the location named as Koodapuzha. The 20 Km. stretch of the river was identified as study area by taking 10 Kms. towards upstream from the Koodapuzha to a location named Virippara (Chakrapaani) near Konnakuzhi and 10 Km. towards downstream to a location named Kadikutty bridge. Virippara is coming under Pariyaram Panchayath and Kadikutty bridge is coming under Kadikutty Grama Panchayath.

In this area the Chalakkudy River is flowing as a single channel and do not have any major tributaries and obstructions. This study area has some streams like '*Kappathodu*' can be considered as perennial and it becomes almost stagnant in summer. All other streams such as '*Parayanthodu*' and '*Meloorthodu*' on either sides are either dead or seasonal. From the upstream Virippara to Koodapuzha the riverbed is rocky and the remaining downstream part is sandy. Sand mining and allied activities are severe in this area.

Two mini hydel projects are within the study area named as Kompanpaara check dam and Koodapuzha check dam under river diversion scheme. The Kompanpaara is in the upstream and Koodapuzha in mid stream part. Major bridges across the river in the study area are bridge for the railway and national highway at Chalakudy, bridges at Njaralakadavu and new bridge at Vettukadavu (Meloor).

The industries and small scale units are also in the river bank of the study area and includes Sakthi Paper Mills at Athirapalli (now closed), a catering unit at Pariyaram, Beer bottling plant at Kompanpaara, Foreign Liquor Bottling Plant at Chalakudy. Divine retreat centre, Chalakudy, is a place where hundreds of devotees are assembling every day and heavy flow of sewage and waste water to the river is reported. The chalakudy town is on the bank of the river and coming under the study area, and receives sewage of the town area.

The river area under study has 17 schools which are located within 2 Km from the river. The area was rich in riparian diversity till the construction of the Anamala road (started in 1942) from Chalakudy to Valparai has opened.

2.2 Study Period

The study was conducted for a period of three months from 1st January 2016 to 31st March 2016.

Study area of Chalakudy River

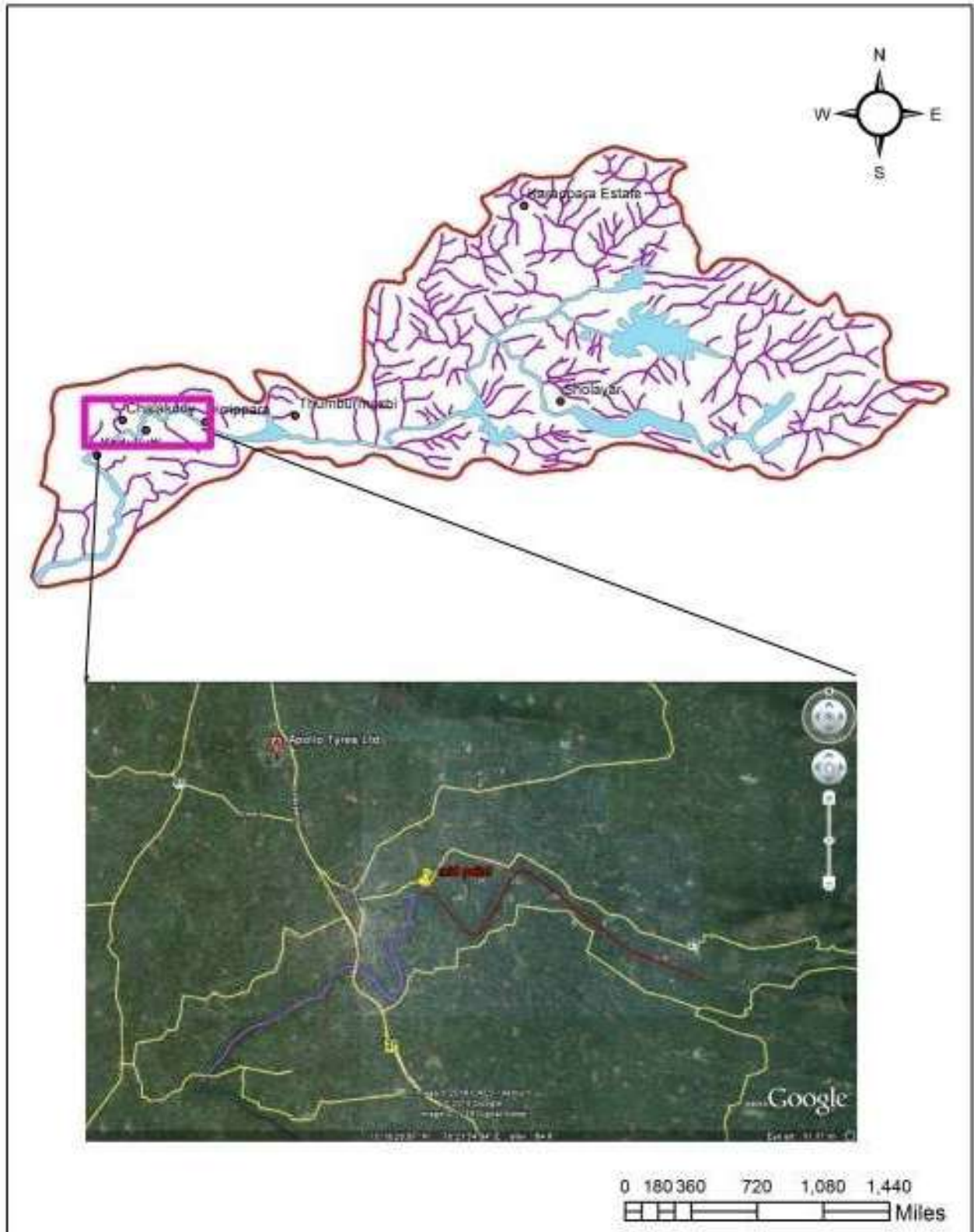
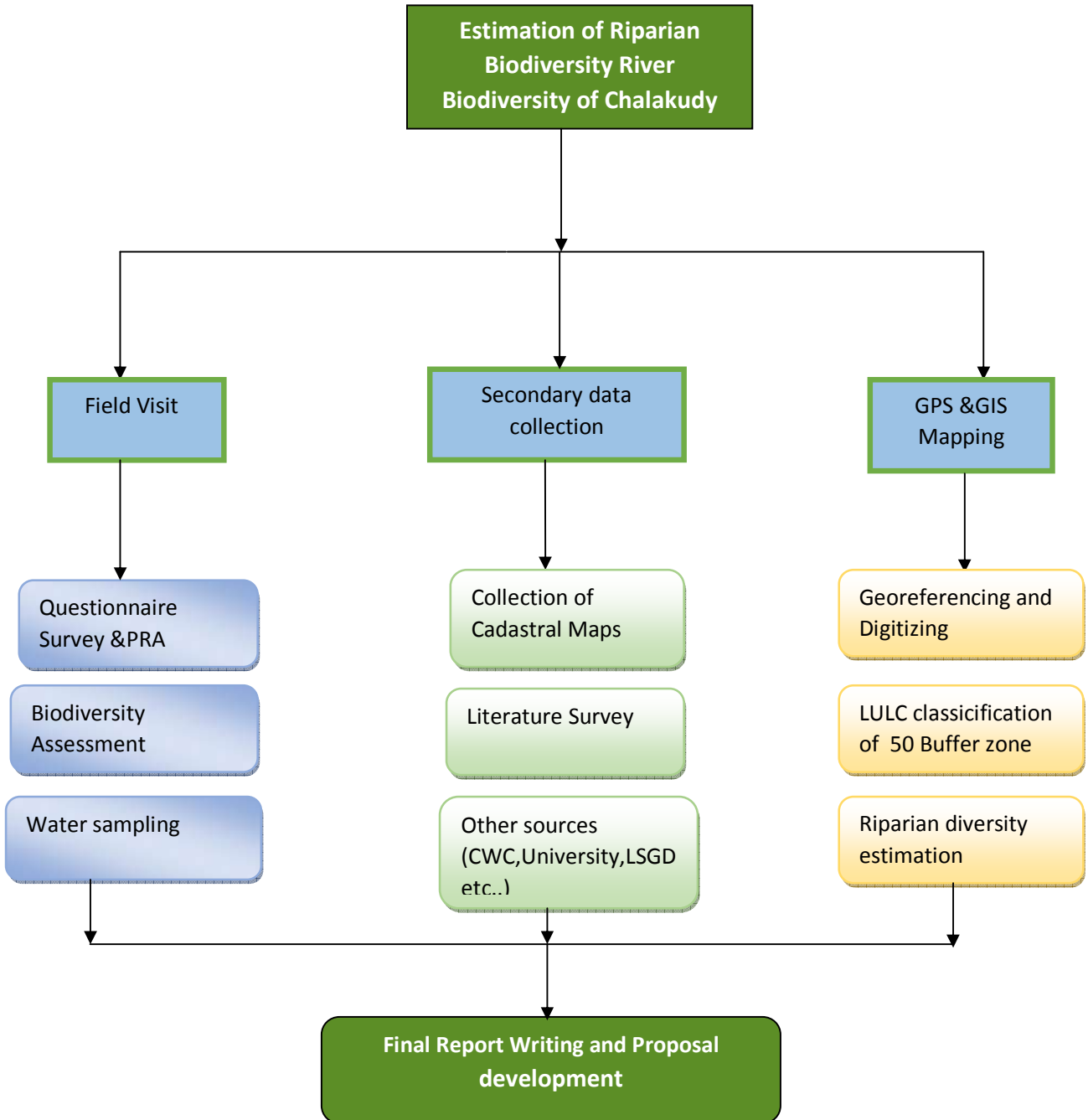


Fig. 2.1. Locations at Chalakudy river where the study conducted

2.3 Materials and Methods



2.4 Community survey

In order to explore the timeline history, biodiversity of the river and riparian zone, related traditional knowledge a survey was conducted among the river bank community with a sample population of 50 residents, spreading all through the length of the selected area of the river. Personally met each and every person and interviewed with a structured questionnaire.

2.5 PRA meetings

Participatory Rural Appraisal (PRA) exercise was conducted for the river bank community in order to cross check the information collected through interviews. The farmers, fisherman community, and the general fringe area people are participated in the PRA exercise conducted at their own locations. Three PRA meetings were conducted at different places such as Virippara, Kompanpaara and Arangali kadavu. About 100 people altogether attended in this exercise and valid informations have been obtained including the timeline history of the river and related biodiversity.

2.6 Collection and identification of plant diversity

Plant diversity was identified during the field visit. Photographic documentation was also done. For the fieldwork we have got the assistance from the local people and experts from different backgrounds were also consulted.

2.7 Fish survey

Experimental fishing was carried out by members of project by using expertise of local fishing folks. Different types of nets and gears were used at the time of fish survey.

2.8 GIS

A base map of the area was prepared in 1:5000 scale by using toposheets and Google earth. A preliminary transect walk was conducted in the beginning of the study throughout the study area and the presence, absence and main physical features and extant of existing riparian vegetation was marked on the GPS and rough cadastral map. The data as obtained by direct field observations. Identified riparian zones were studied frequently and Phytosociological characters were measured in the required sites. All these along with landuse of the adjacent areas, major human interventions in the river margins and characteristics of the vegetation in each area were marked in the map with GIS softwares (QGIS 2.1.4 and ARC GIS 10.1).

For the analysis of the riparian vegetation some analytical quantitative characters have been analysed from the plotted quadrats. From each quadrats these characters, Frequency, Density, Abundance, Relative frequency. Based on this aspect and for more convenience, the area has been divided into 6 stretches of 1km. Finally prepared maps of vegetation, manmade, physical. This will help to get more detailed picture of the riparian vegetation.

2.9 Biodiversity Estimation

For the riparian biodiversity estimation, transect method was employed. Transects were laid on the riparian areas through the river bank (within 50m from the centre of the river). The Phytosociological characters like Frequency, Density, Abundance, and Dominance were also analysed.

2.10 Water Quality

The analysis of water quality of the river was done for parameters suggested in IS 2296. The complete analysis (physico-chemical and biological characteristics) of the river water was conducted at TIES' Water quality Analysis Laboratory, at Velloor, Kottayam. The following parameters were tested for thirty samples collected from the river: Chemical: pH, alkalinity, Total Dissolved Solids (TDS) salinity, chlorinity, iron, conductivity; Physical: colour, odour, turbidity; Microbiological: MPN (Most probable number of Coliforms); FC (faecal coliforms); TC (Total coliforms) *etc..*



A PRA meeting at the river bank (Virippara)

Chapter III Results & Discussion

3.1. Current Status of Riparian Biodiversity of Chalakudy River

The field survey revealed that about 27.47% of the riparian vegetation comes under the study area (*i.e.* from virippara to kadikutti bridge). The data mainly collected from 6 sample stretches of 1Km each of the river and riparian zone.

The riverbed is rocky in up stream area (*i.e.* from virippara to vettu kadavu bridge) and it becomes sandy in the down stream area (*i.e.* from vettu kadavu bridge to kadikutti bridge). Large deposits of sand were noticed in down stream. But indiscriminate sand mining has reduced the sand deposits, which in turn has deepened the riverbed. Legal and illegal sand mining has affected the riverine habitat. The water level has lowered considerably during these years. Sand mining has wiped out large beautiful sand beds and the few remaining ones are under severe threat. The Arangali sand bed (5 Acre during summer season) only the sand bed remaining in the study area.

Using GIS software maps of vegetation, physical and manmade structures were prepared covering existing riparian vegetation, and the main features of the study area. The riparian vegetation is mainly evergreen type and based on the status it is classified as riparian wild vegetation, Areca nut- Coconut-Nutmeg mixed crop lands, open areas, rubber plantations, vegetable areas and Built up lands.

Both Riparian biodiversity survey and GIS mapping shows that 27.47% of riparian vegetation is existing in the study area. Most of the riparian area converted to mixed plantation (60%), vegetable areas (2.31%) and built up areas (2.78%). Most of the study area thickness of riparian vegetation is <10m width. In Chalakudy town region area possess comparatively undisturbed vegetation. For the analysis of 50m riparian vegetation analysed by quadrat methods.

Land use Land cover	Area in ha	percentage
Riparian vegetation	9.224	27.47
Arecanut Coconut Nutmeg Mixed	20.42	60.97
Open areas	1.82	5.44
Rubber	0.3391	1.01
Vegetable area	0.9335	2.31
Built_up	0.933	2.78

Table 3.1. Biodiversity and land use pattern of riparian area of Chalakudy river

3.2 Sample study Stretch -1 (1 Km. from Virippara to Chakaravani kadavu)

Virippara lies in 10°17'39.59"N-76°26'06.20"E .This is the upper most part of the study area. Hence disturbance in this riparian zone is comparatively high. The main disturbance is from tourism activities and agriculture related encroachment through the river side. According to our biodiversity survey only 21.27% of riparian vegetation is remaining and 60% of area is converted to mixed crops (such as nut mug, areca nut and coconut).people of this area is depends highly on agriculture activities. The disturbance of riparian vegetation is also high. The river in this area possess mainly rocky substratum. There is no sand deposition in this stretch and on an average 150 meters long area eroded in both banks.

Land use/Land cover in virippara	Area in ha	Percentage
Riparian vegetation	0.35	21.27
Arecanut Coconut Nutmeg Mixed	1.0076	60.14
Open areas	0.1175	7.56
Rubber	0.1	6.06
Vegetable area	0.441	2.63
Built up	0.0386	2.34

Table 3.2. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Virippara-1 Km. stretch)

Photo: Chalakudypuzha at Virippara



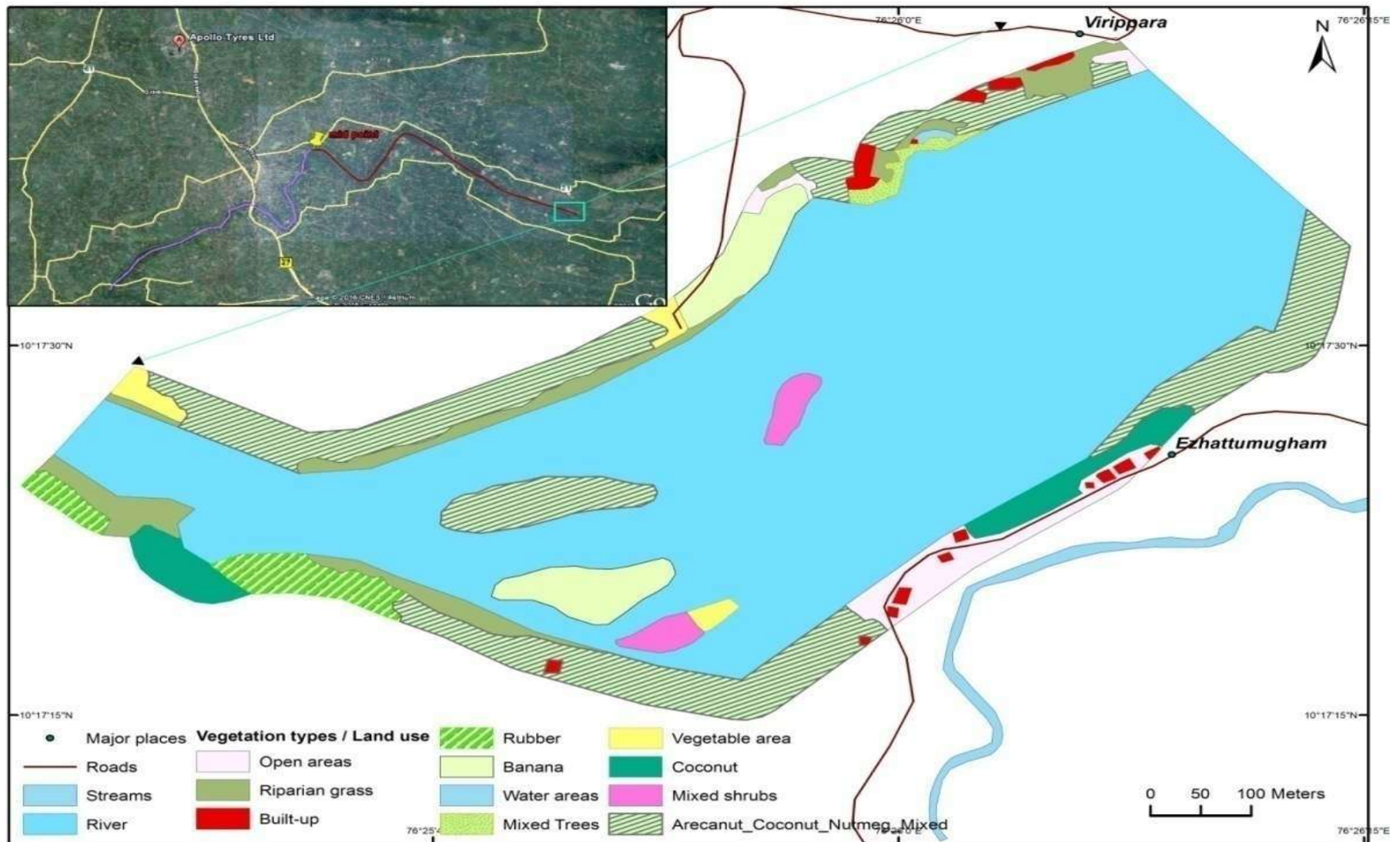


Fig. 3.1. Map showing the riparian vegetation of Virippara area (Sample stretch 1)

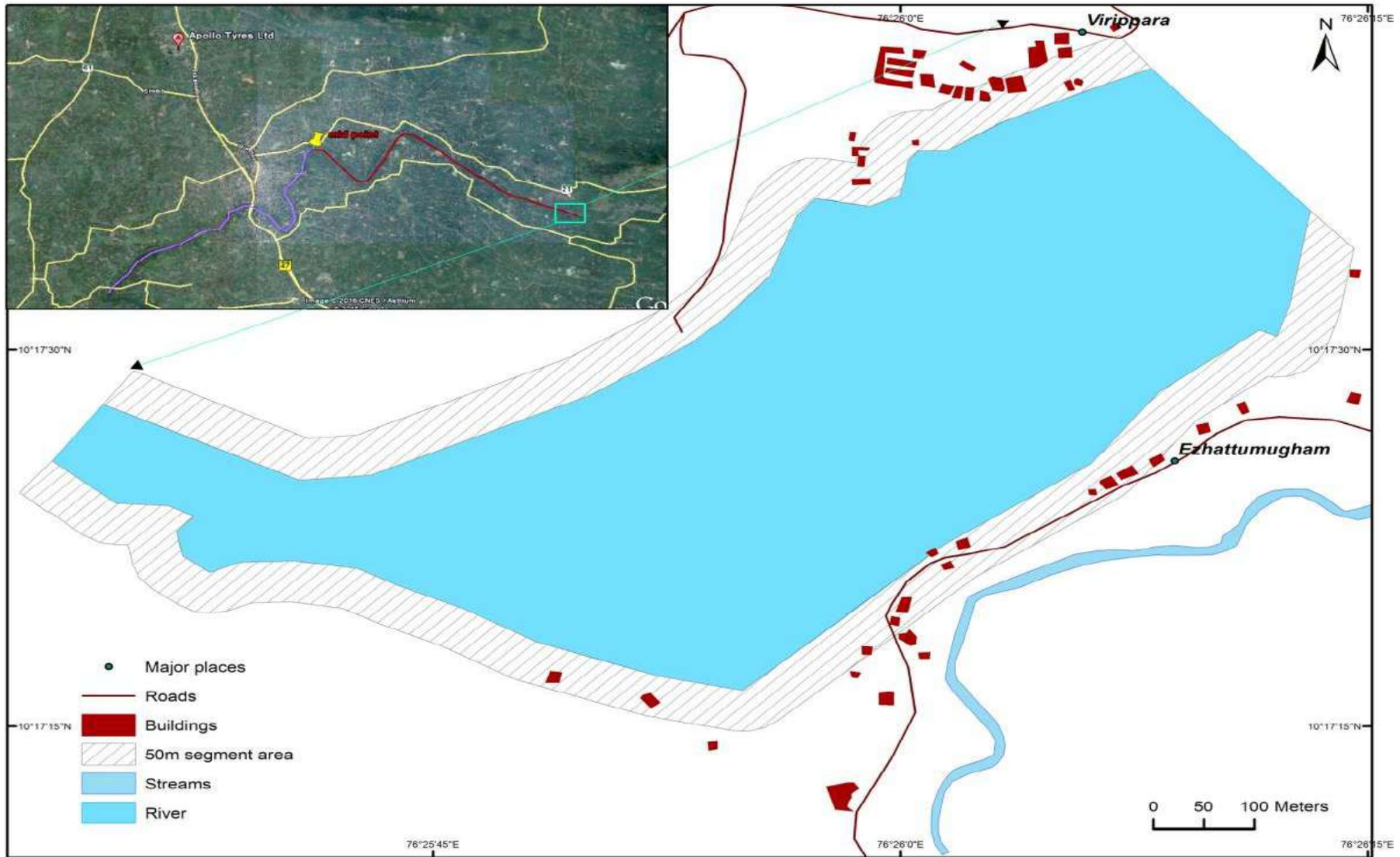


Fig. 3.2. Map showing the man-made structures of Virippara area (Sample stretch 1)

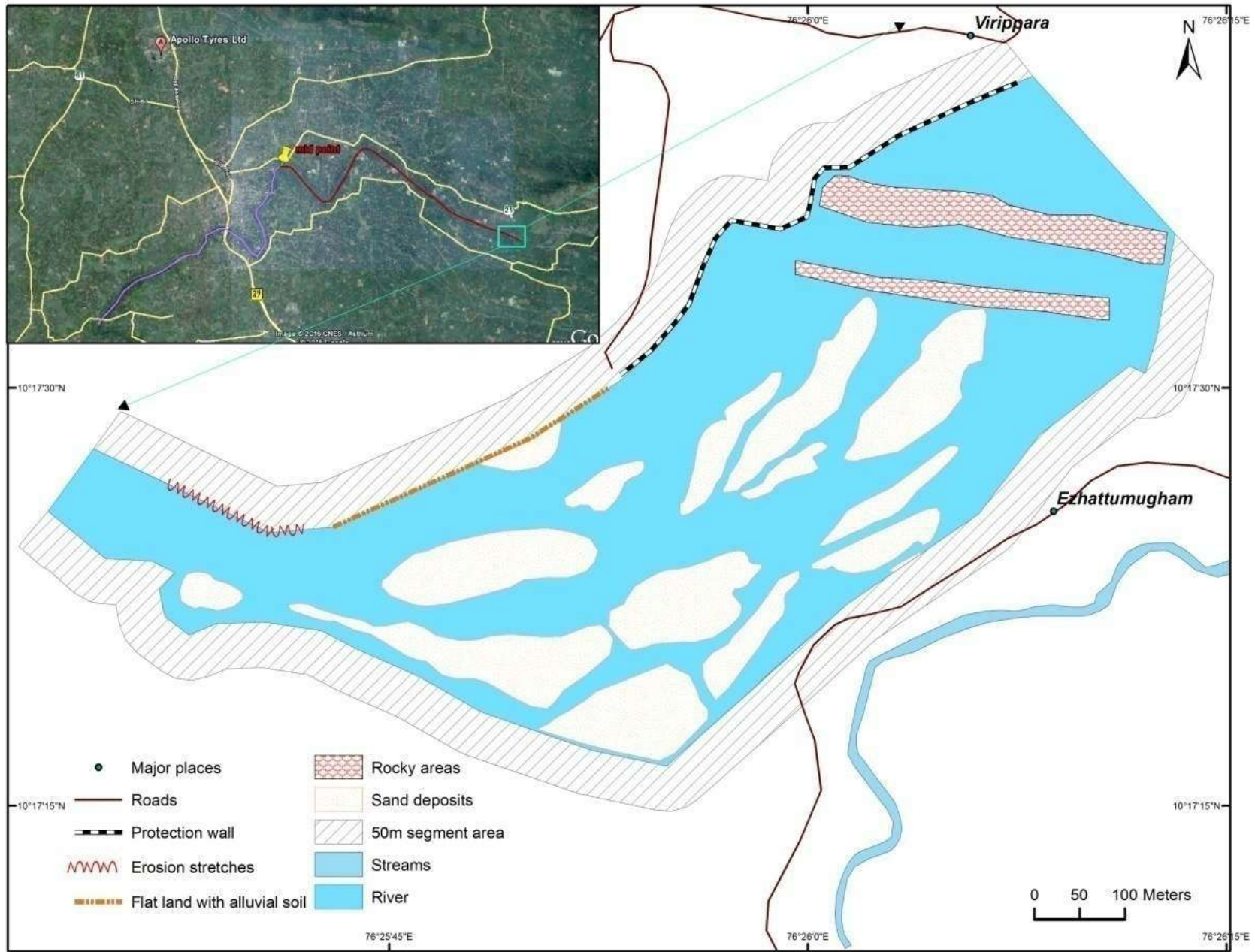


Fig.3.3. Map showing physical features of riparian area of Chalakudy river in Virippara area (Sample stretch 1)

3.3 Sample study Stretch -2 (1 Km. from Kompanpara to Edathra kavu kadavu)

Kompanpara lies in 10°19'03.05"N-76°22'31.54"E .This is the second stretch in up stream part. Hence disturbance in this riparian zone is comparatively high. The main disturbance is agriculture related encroachment through the river side. According to our biodiversity survey only 17.67% of riparian vegetation is remaining and 67.8% of area is converted to mixed crops (such as nut mug, areca nut and coconut). In Kompanpara area there is one Beer manufacturing company, a big catering unit and a bar from which liquid and solid wastes releasing directly to the river according to the local community. The liquid wastes are releasing during late midnight hours and by early morning it goes to downstream leaving foul smell and slight colour change for water. The river in this area posses many shallow as well as deep, rocky regions. There is no sand deposition in the Kompanpara stretch and on an average 100 meters eroded in both banks. One stream named Kappathodu joins to the river I this stretch.

Land use /Land cover in Kompanpara	Area in ha	percentage
Riparian vegetation	0.176	17.67
Arecanut Coconut Nutmeg Mixed	1.13	67.8
Open areas	0.091	5.45
Vegetable area	0.1169	7
Built up	0.0347	2.08

Table 3.3. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Kompanpara-1 Km. stretch)

Photo: Chalakudypuzha at Kompanpara region



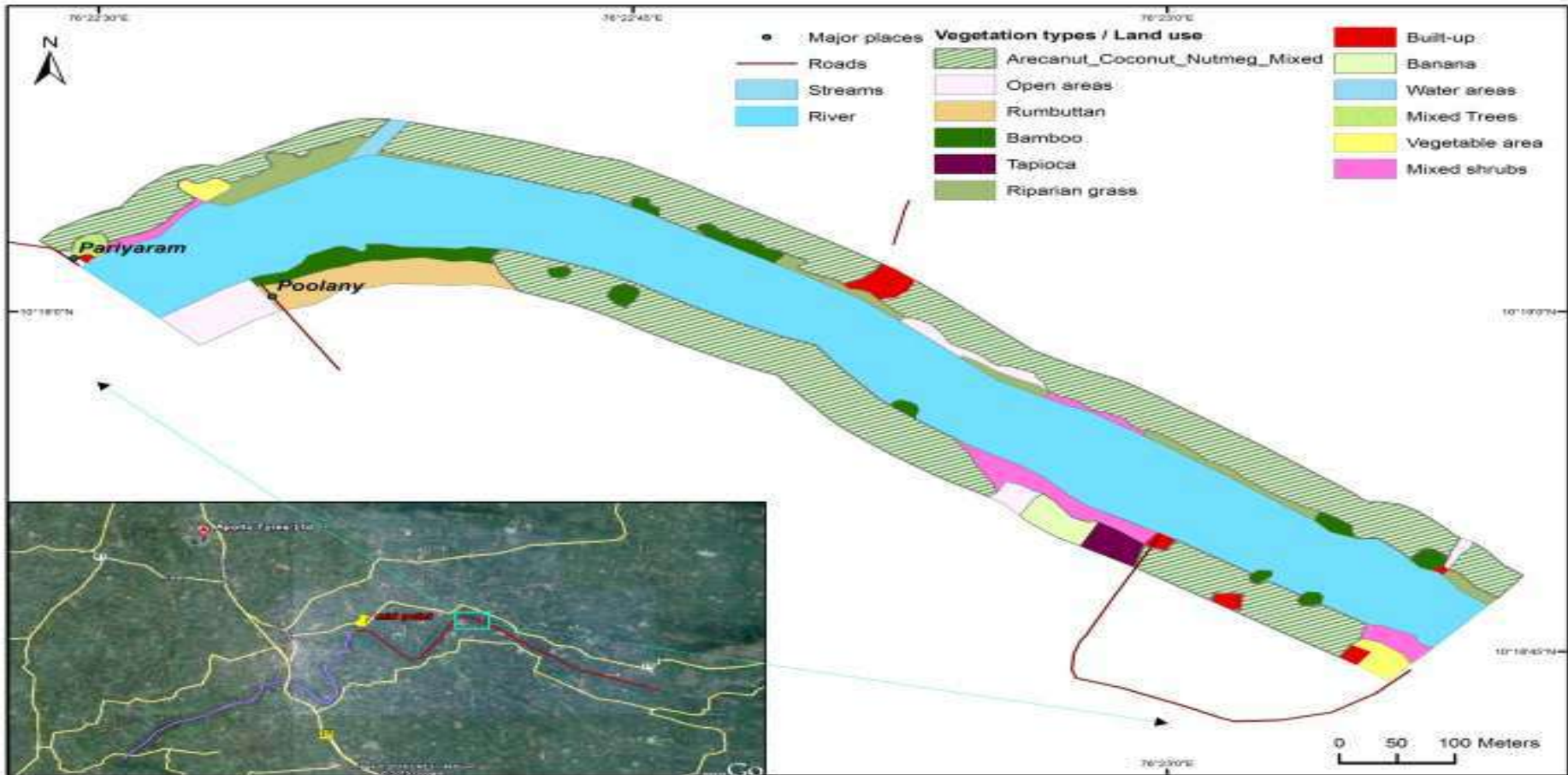


Fig.3.4. Map showing major vegetation type and land use pattern of Kombanpara area of Chalakudy river (Sample stretch 2)

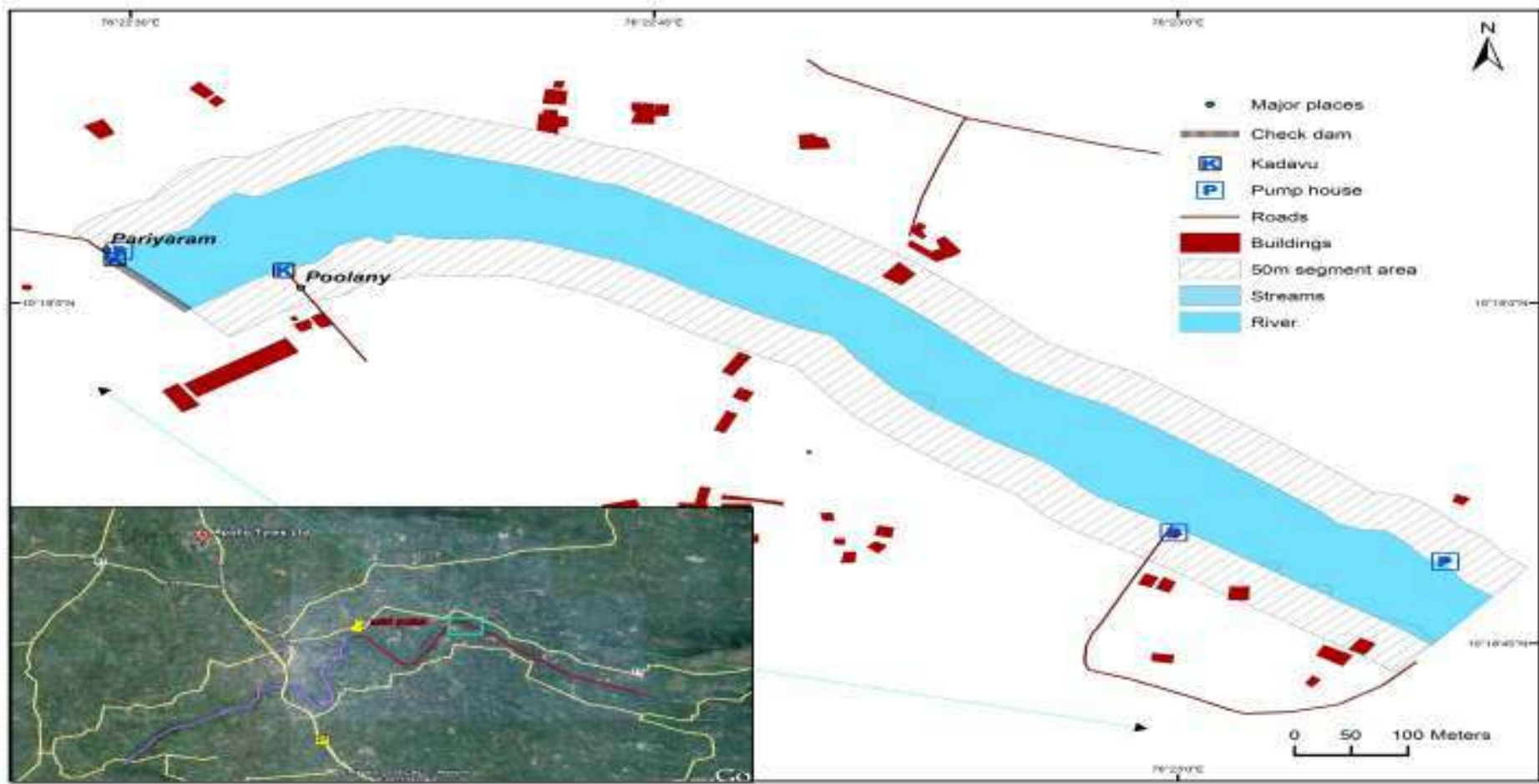


Fig.3.5. Map showing man-made structures of riparian zone at Kombanpara area of Chalakudy river (Sample stretch 2)

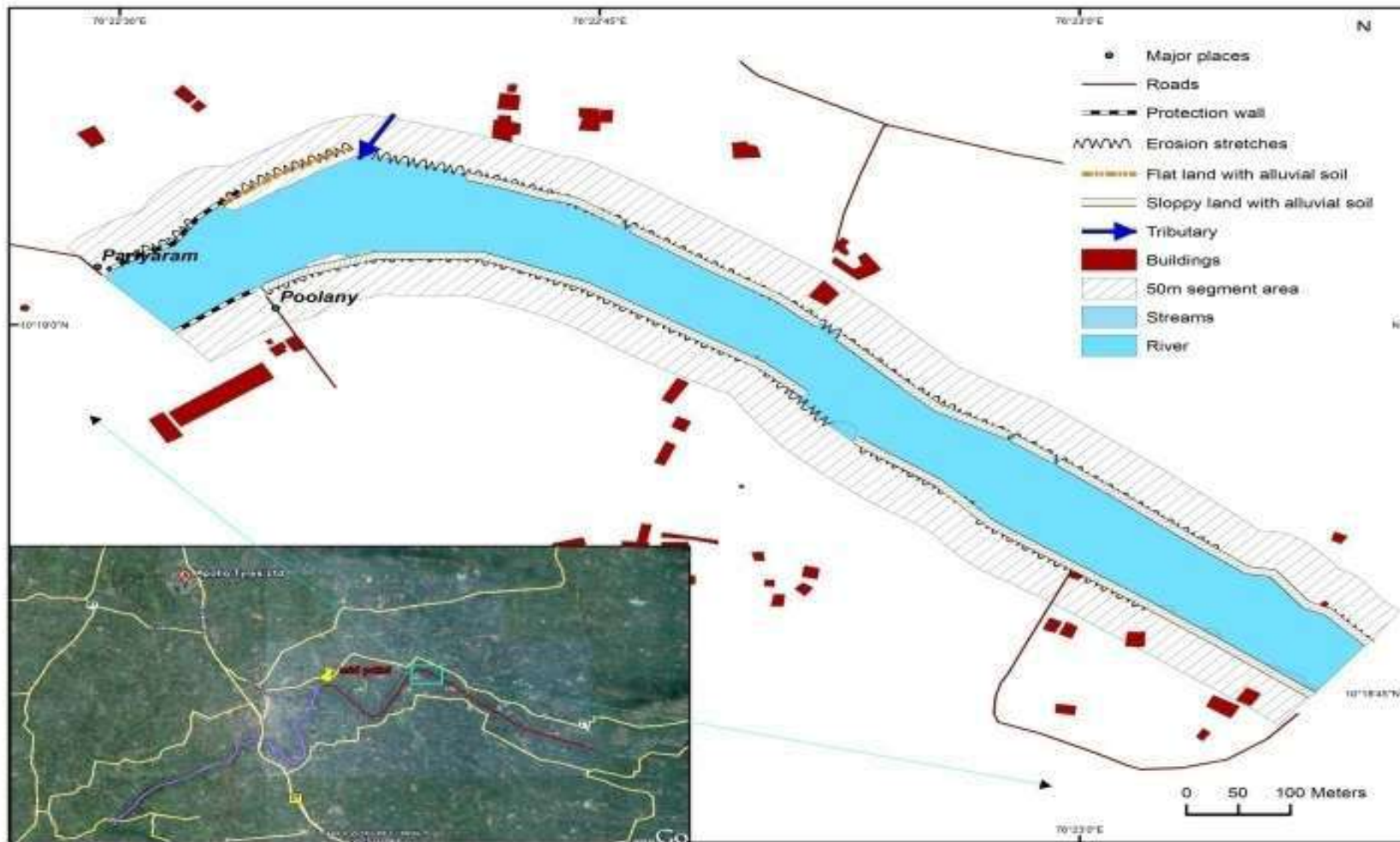


Fig.3.6. Map showing physical features of riparian zone at Kombanpara area of Chalakudy river (Sample stretch 2)

3.4 Sample study Stretch -3 (1 Km. from Koodapuzha to pariyaram)

Koodapuzha lies in 10°18'39.52"N - 76°21'01.41"E .This is the third stretch in study area it is in up stream part. Hence disturbance in this riparian zone is comparatively high. The main disturbance is agriculture related encroachment through the river side. According to our biodiversity survey only 26.92% of riparian vegetation is remaining and 65.88% of area is covered to mixed crops (such as nut mug, areca nut and coconut).There is no sand deposition in this koodapuzha stretch and 414 meters eroded in both banks. In koodapuzha area lot of land conversion and urbanization is happening . The starting point of the study area is coming under chalakudy municipality limit .The area covers under koodapuzha check dam these check dam reduces the ground water scarcity on surrounding area.

Land use/Land cover in Koodapuzha	Area in ha	percentage
Riparian vegetation	0.449	26.92
Arecanut Coconut Nutmeg Mixed	1.1	65.88
Open areas	0.0743	4.45
Vegetable area	0.028	1.75
Built up	0.0167	1

Table 3.4. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Koodapuzha-1 Km. stretch)

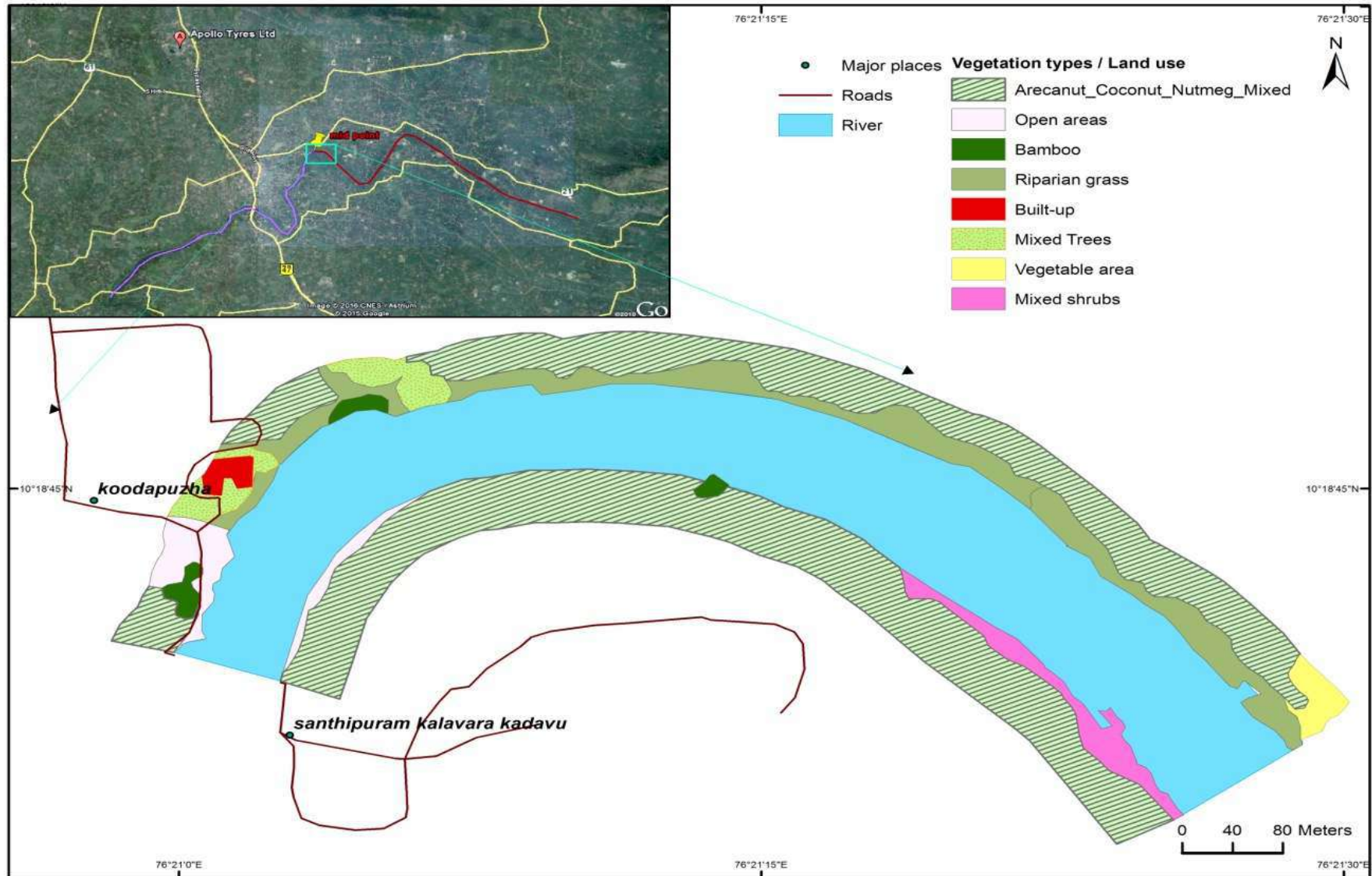


Fig.3.7. Map showing vegetation and land use pattern at riparian zone of Koodapuzha region of Chalakudypuzha (Sample stretch 3)

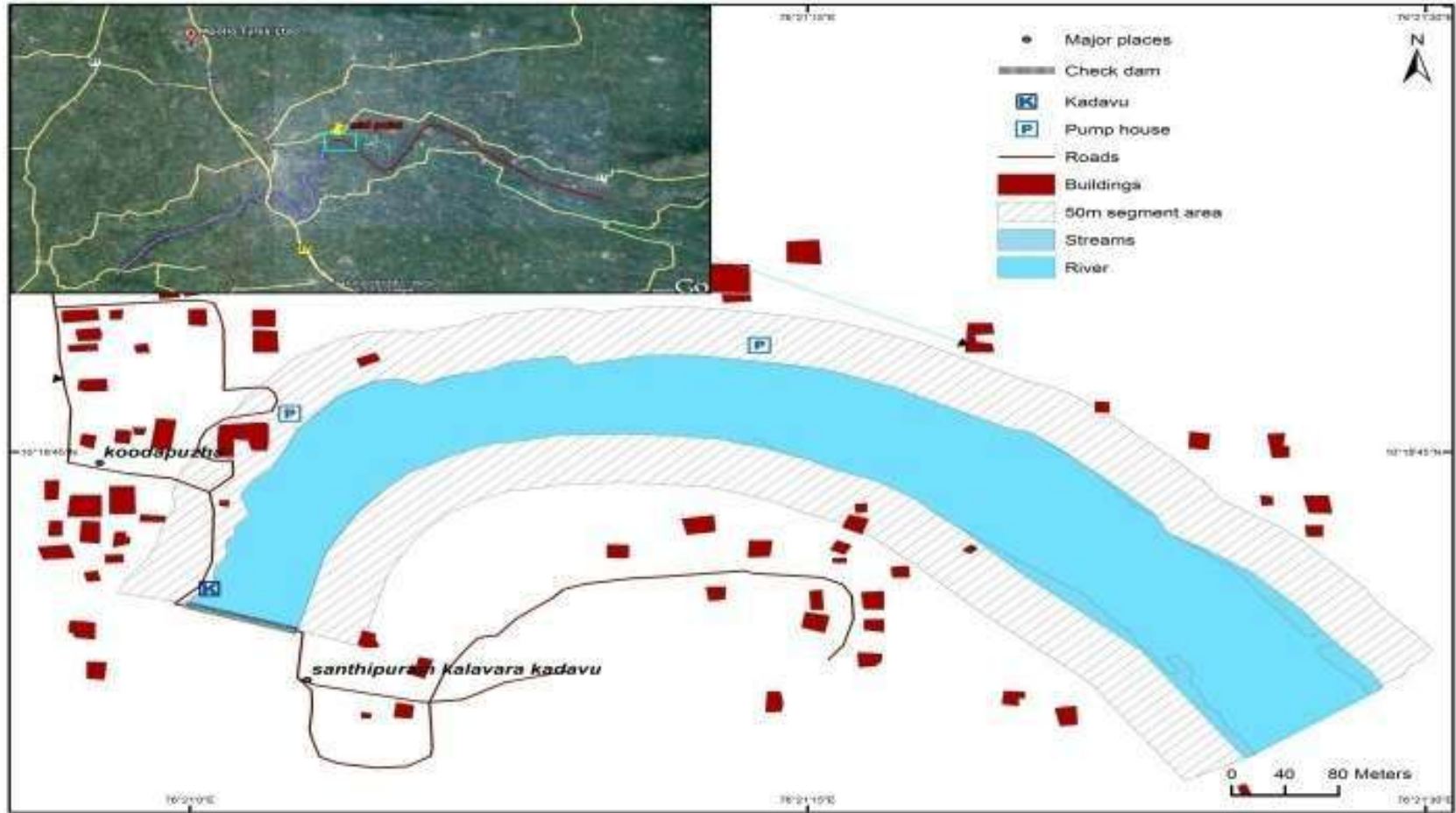


Fig. 3.8. Map showing man-made structures in the riparian zone of Chalakudy river at Koodapuzha region (Sample stretch 3)

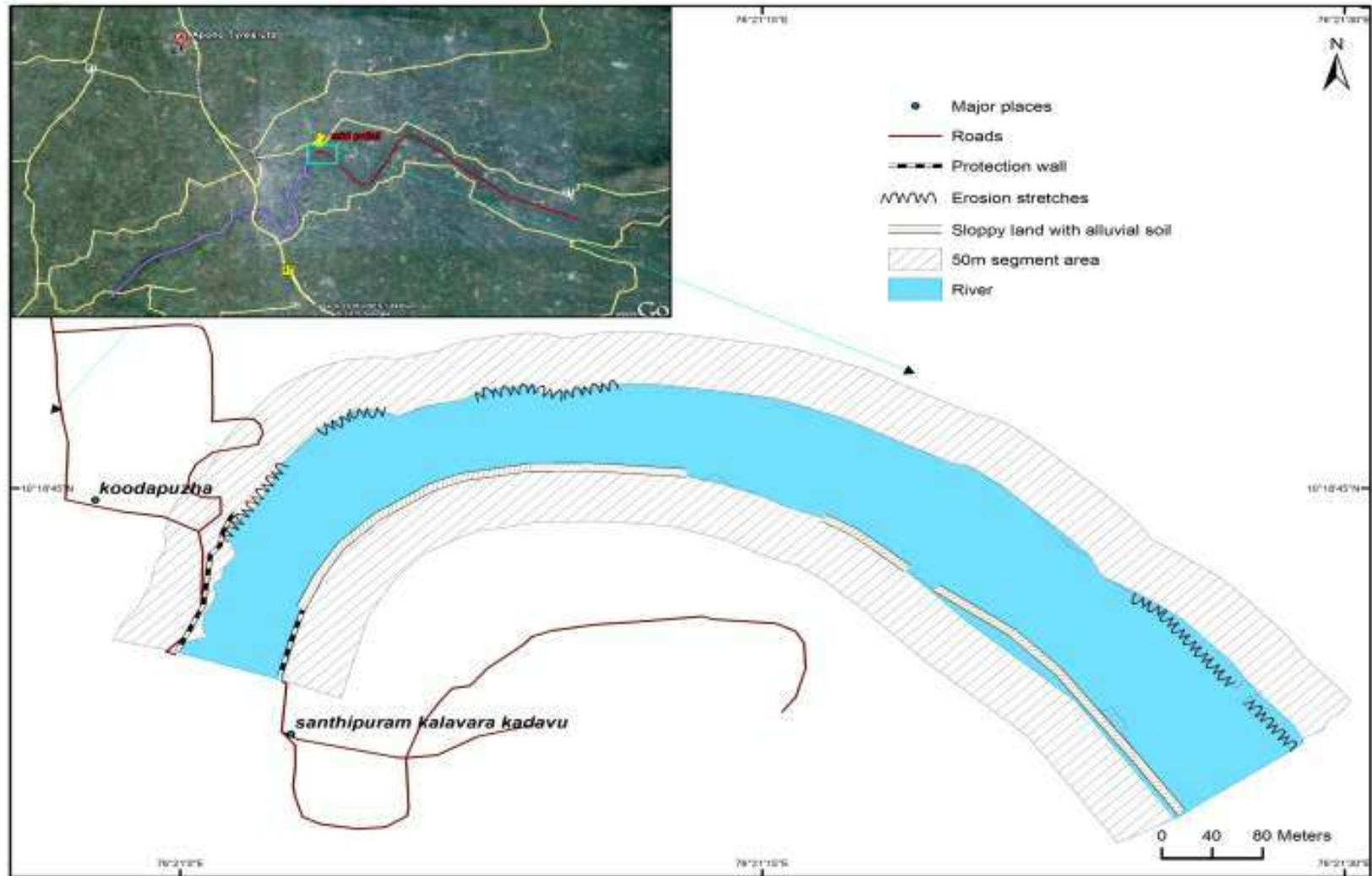


Fig. 3.9. Map showing physical features in the riparian zone of Chalakudy river at Koodapuzha region (Sample stretch 3)

3.5 Sample study Stretch -4 (1 Km. from Kadathukadavu to Malakaran kadavu)

Kadathu kadavu (near chalakudy town) lies in 10°17'44.50"N – 76°20'44.78"E .This is the fourth stretch in study area it is in down stream part. Hence disturbance in this riparian zone is comparatively high. The main disturbance is agriculture related and built up encroachment through the river side. As the township is nearby severe human interference is continuous and pollution from various sources also high. According to our biodiversity survey only 27% of riparian vegetation is remaining and 55% of area is covered by mixed crops (such as nut mug, areca nut and coconut). 8% of open areas are found in this study shows that the riparian areas have been changed to urbanized plots. 200 meters of sand deposition in Kadathu kadavu stretch is still exists and on an average 500 meters of river bank eroded in both banks.

Land use/Land cover in Kadathu kadavu	Area in ha	Percentage
Riparian vegetation	0.4509	27
Arecanut Coconut Nutmeg Mixed	0.9185	55
Open areas	0.1336	8
Vegetable area	0.0167	1
Built up	0.1503	9

Table 3.5. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Kadathukadavu-1 Km. stretch)

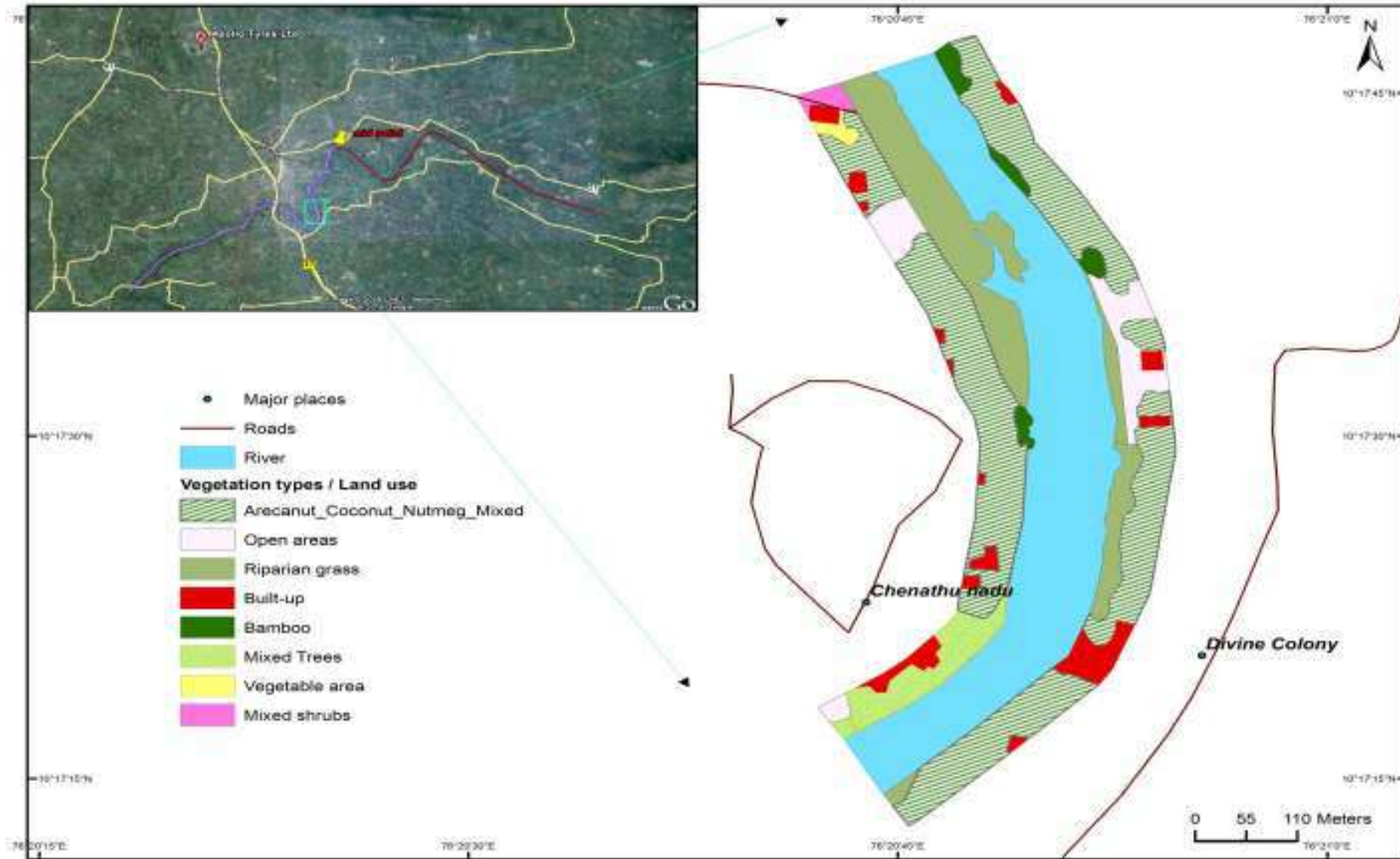


Fig. 3.10. Map showing vegetation type and land use pattern of riparian zone at Kadathukadavu area of Chalakudy river (Sample stretch -4)

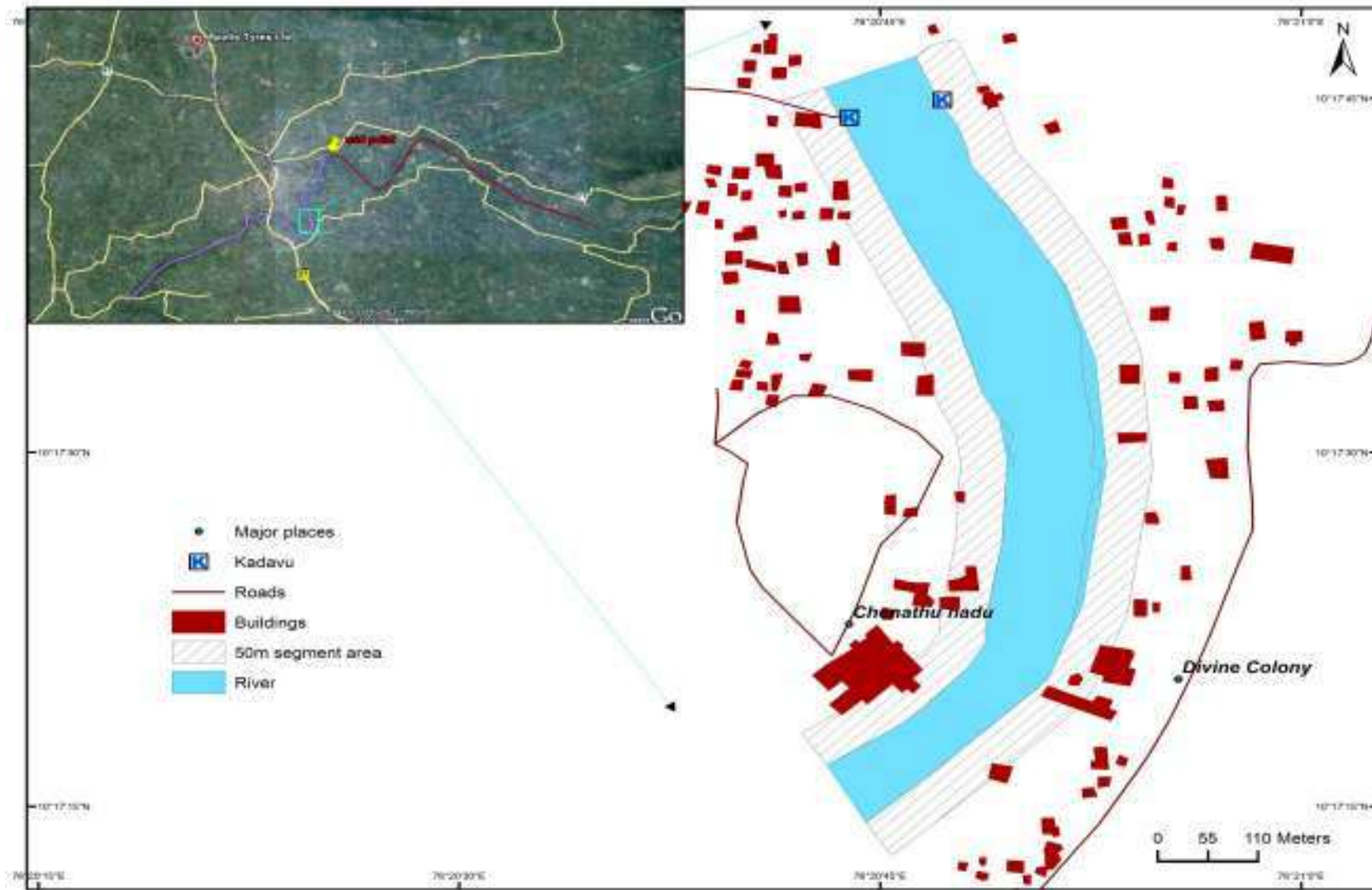


Fig. 3.11. Map showing man-made features of Kadathukadavu area of Chalakudy river (Sample stretch -4)

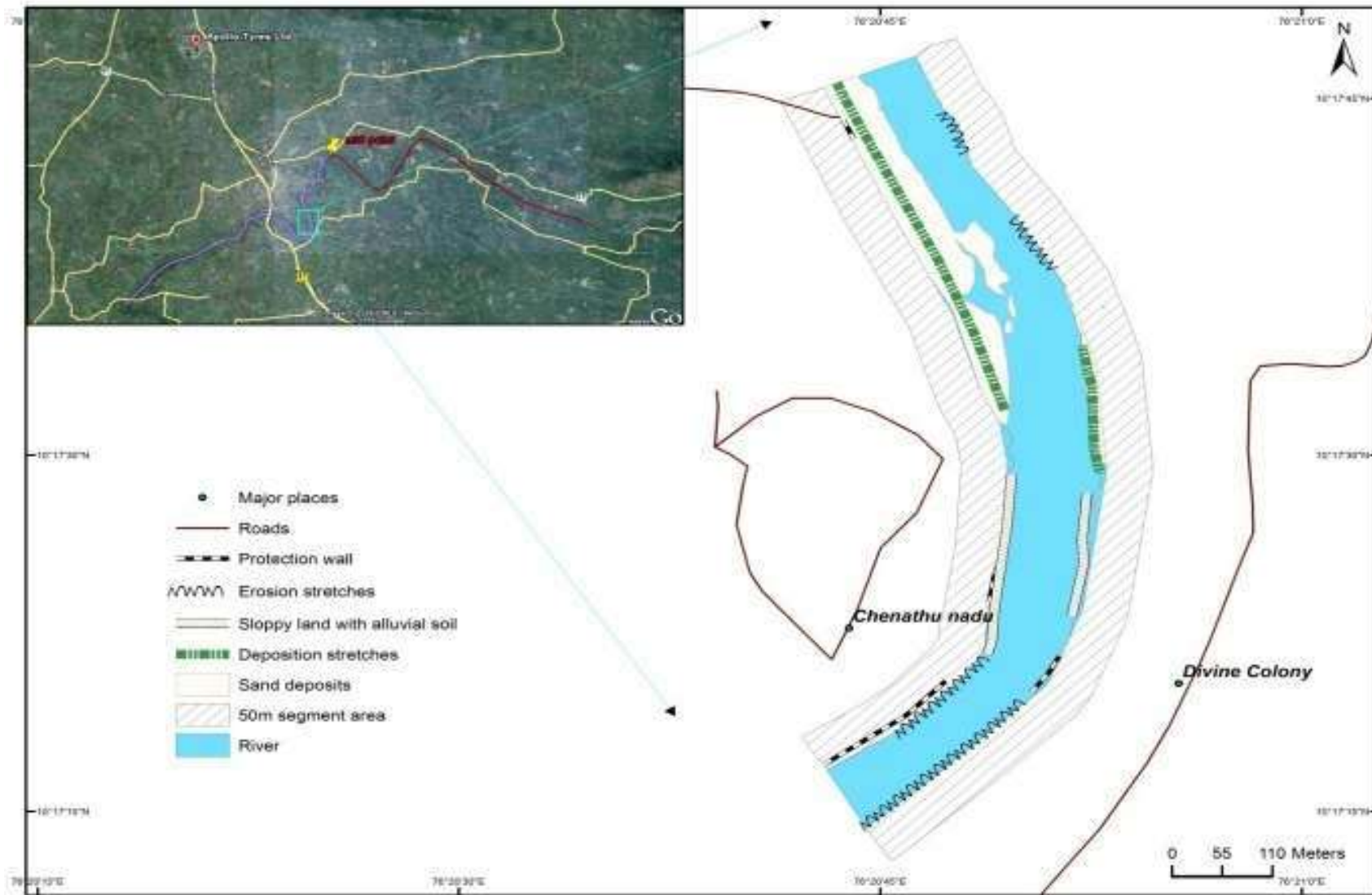


Fig. 3.12. Map showing physical features of Kadathukadavu region of Chalakudypuzha (Sample stretch 4)

3.6 Sample study Stretch -5 (1 Km.from Arangalikadavu to Arangalikadavu end)

Arangali kadavu lies in 10°17'04.53"N – 76°19'17.31"E. This is the fifth stretch in study area and it is in down stream part. Arangali kadavu is unique with a large sand bed of more than 5 Acre area. It is a splendid view and local community has several childhood memories with regard to this area. The sense of conservation among the local community is still exists, hence disturbance in this riparian zone is moderately low. Among the disturbed areas major reason is agriculture related and built up encroachment through the river side. According to our biodiversity survey only 37% of riparian vegetation is remaining and 57% of area is covered to mixed crops (such as nut mug, areca nut and coconut). 3.23 % of open areas are found in this study this sign shows that the riparian areas changed to urbanized plots. 800 meters of sand deposition in this Arangalikadavu stretch and on an average 900 meters of river bank eroded in both banks.

Land use/Land cover in Arangali kadavu	Area in ha	percentage
Riparian vegetation	0.6179	37
Arecanut Coconut Nutmeg Mixed	0.9519	57
Open areas	0.053941	3.23
Vegetable area	0.02521	1.51
Built up	0.02104	1.26

Table 3.6. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Arangalikadavu-1 Km. stretch)



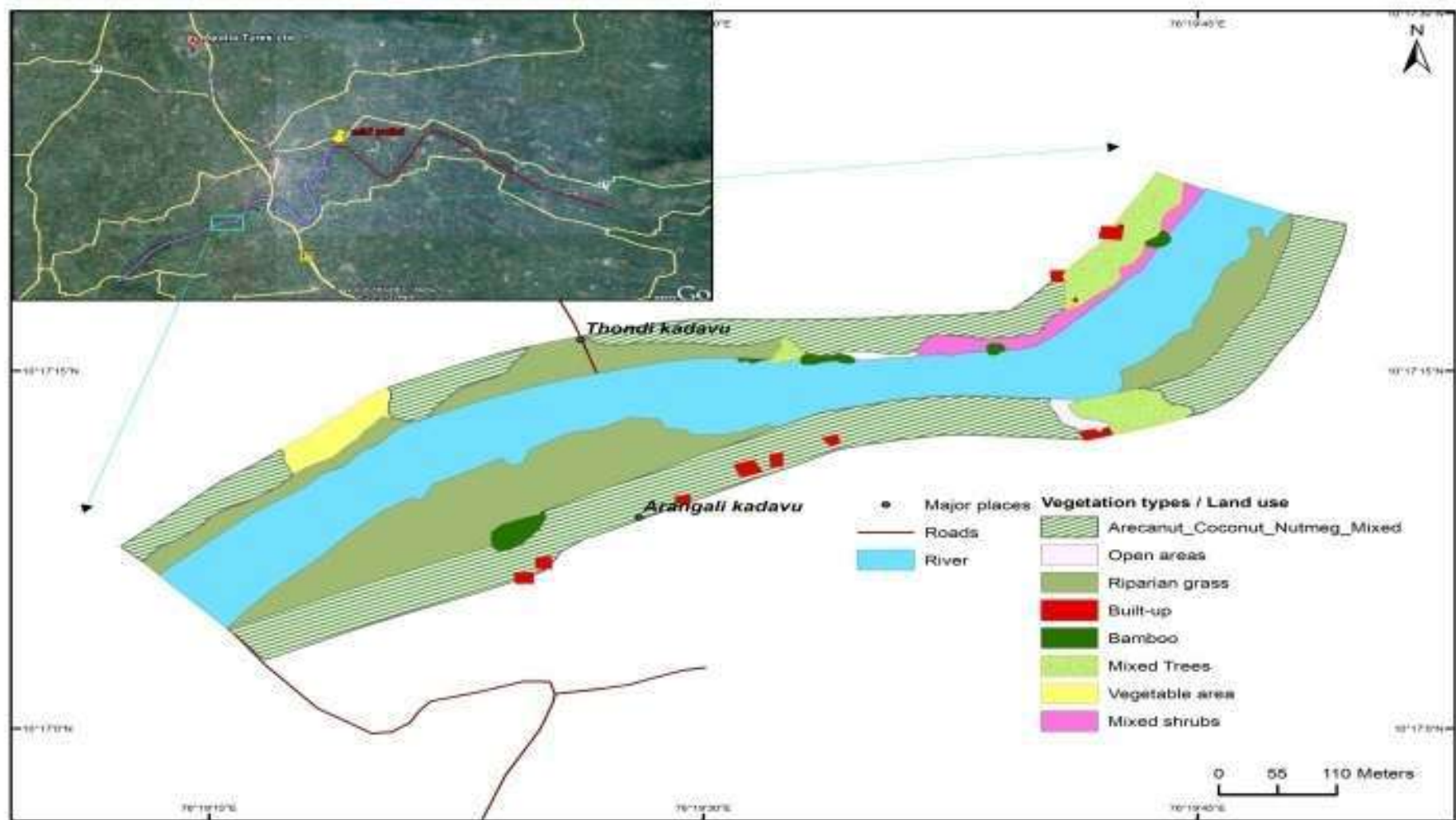


Fig. 3.13. Map showing the vegetation and land use pattern at Arangali kadavu region of Chalakudy river (Sample stretch 5)

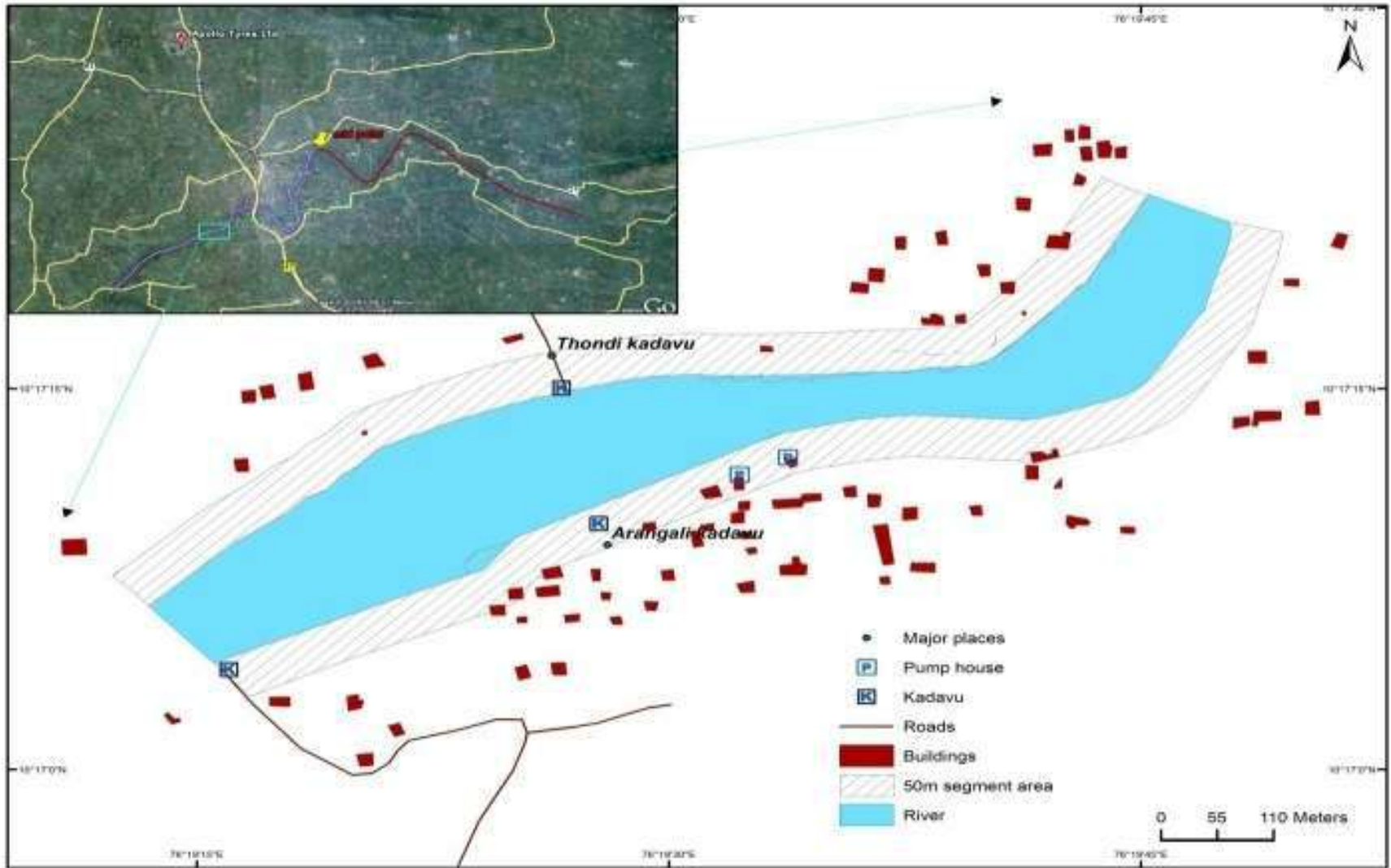


Fig.3.14. Map showing man made structures at Arangalikadavu area of Chalakudy river (Sample stretch -5)

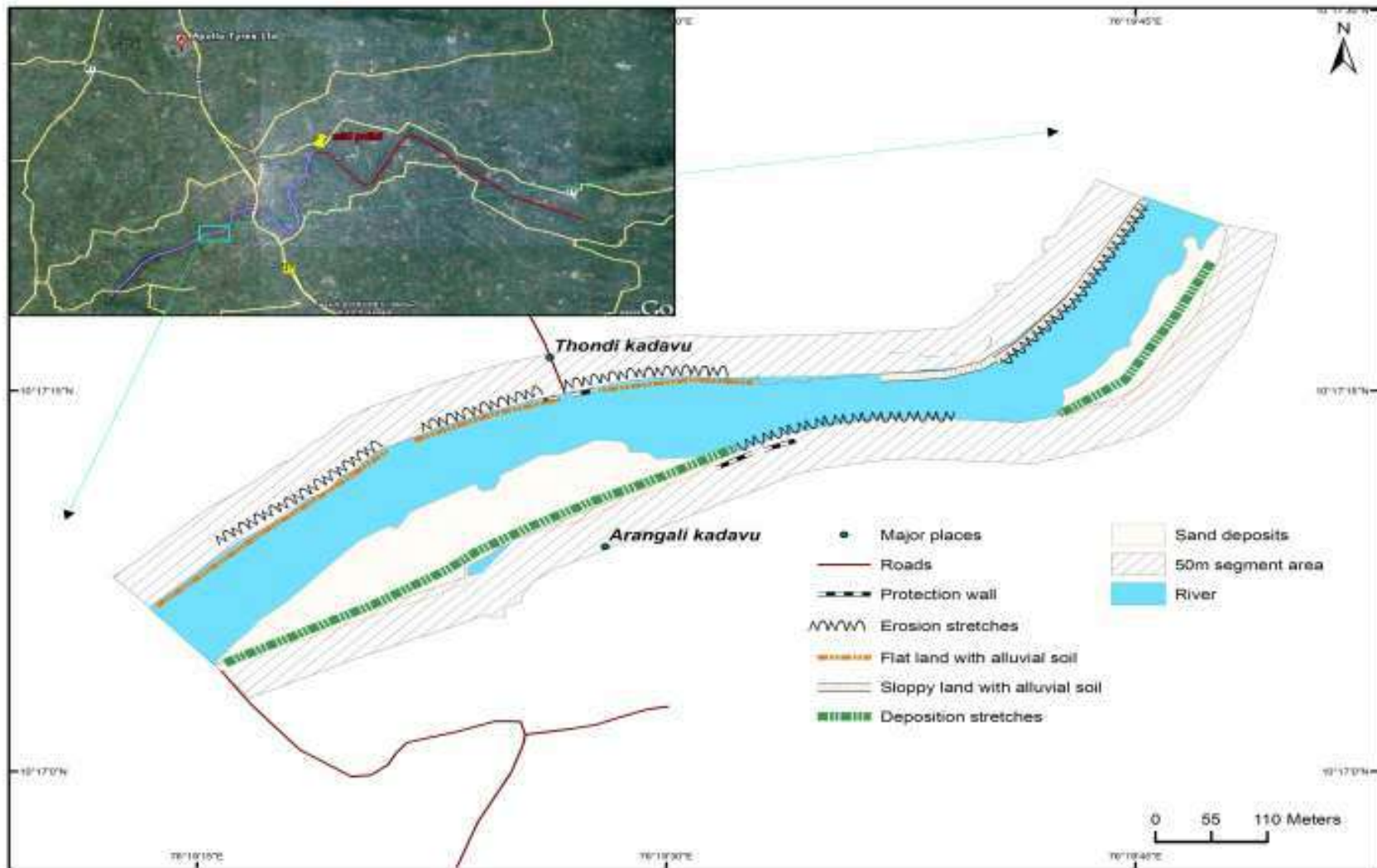


Fig. 3.15. Map showing physical features of Aranagalikadavu region of Chalakudy river

3.7 Sample study Stretch -6 (1 Km. from Kadukutti to Mozhikkakadavu)

Kadukutti bridge(Njrara kadavu) lies in 10°16'06.47"N – 76°17'58.64"E .This is the sixth stretch in study area it is the end part of down stream part. Hence disturbance in this riparian zone is moderality low.The main disturbance is agriculture related and built up encroachment through the river side. According to our biodiversity survey only 35% of riparian vegetation is remaining and 60% of area is covered to mixed crops (such as nut mug, areca nut and coconut).4% of open areas are found in this study this sign shows that the riparian areas changed to urbanized plots. 387 meters of sand deposition in this kadukutti stretch and 775 meters eroded in both banks. Due to excess of sand mining causes erosion in this stretch. In this stretch parayan thodu is merging with chalakudy river.

Land use/Land cover in Kadukuttii bridge	Area in ha	percentage
Riparian vegetation	0.5845	35
Arecanut Coconut Nutmeg Mixed	1.0074	60
Open areas	0.0668	4
Built up	0.0167	1

Table 3.7. Biodiversity and land use pattern of riparian area of Chalakudy river (Sampling area at Kadukutti-1 Km. stretch)

Photo: PRA session at Arangalikadavu-Kadukutti area



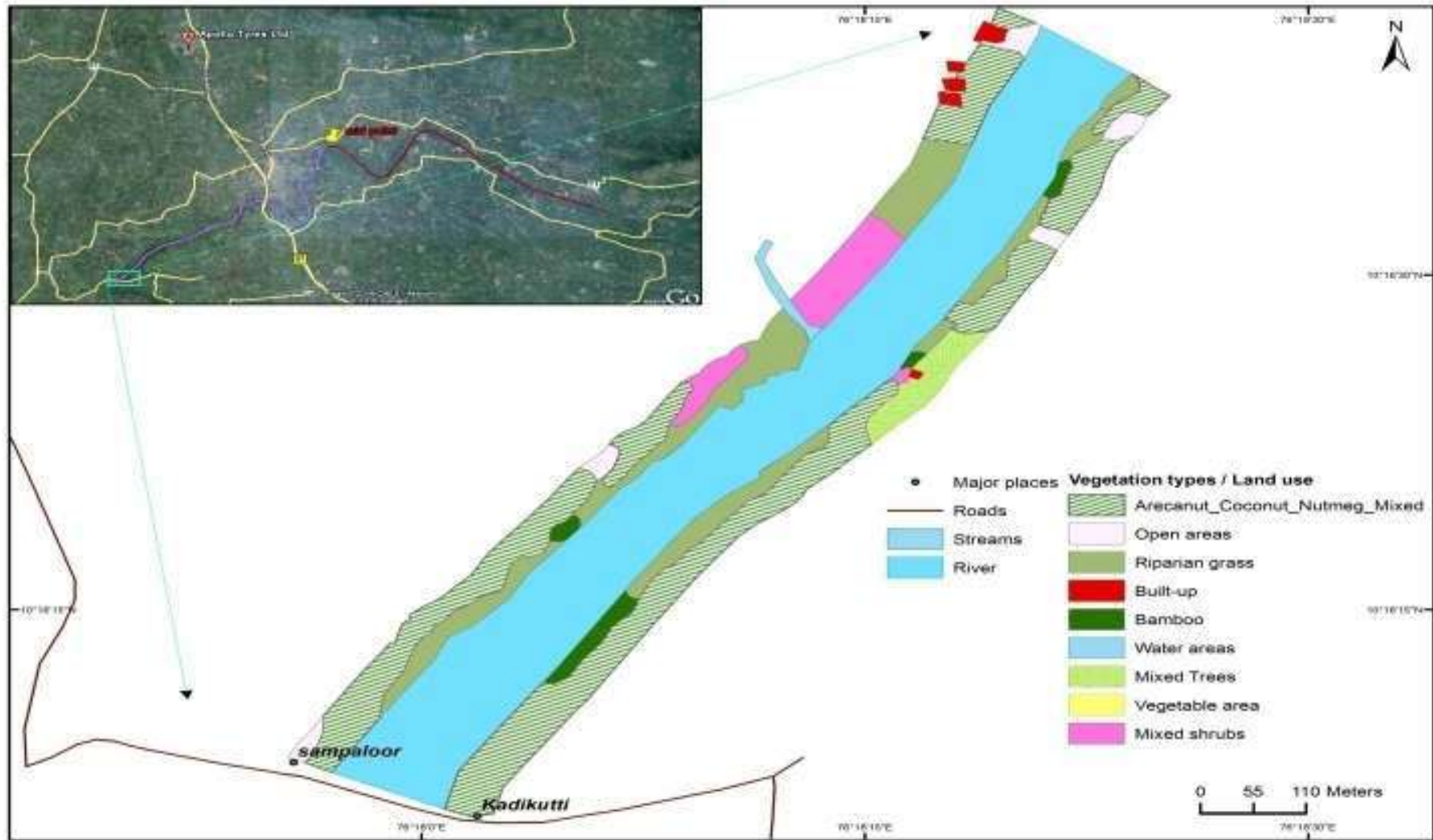


Fig. 3. 16. Map showing vegetation type and land use pattern at Kadikutty region of Chalakudy river (Sample stretch-6)

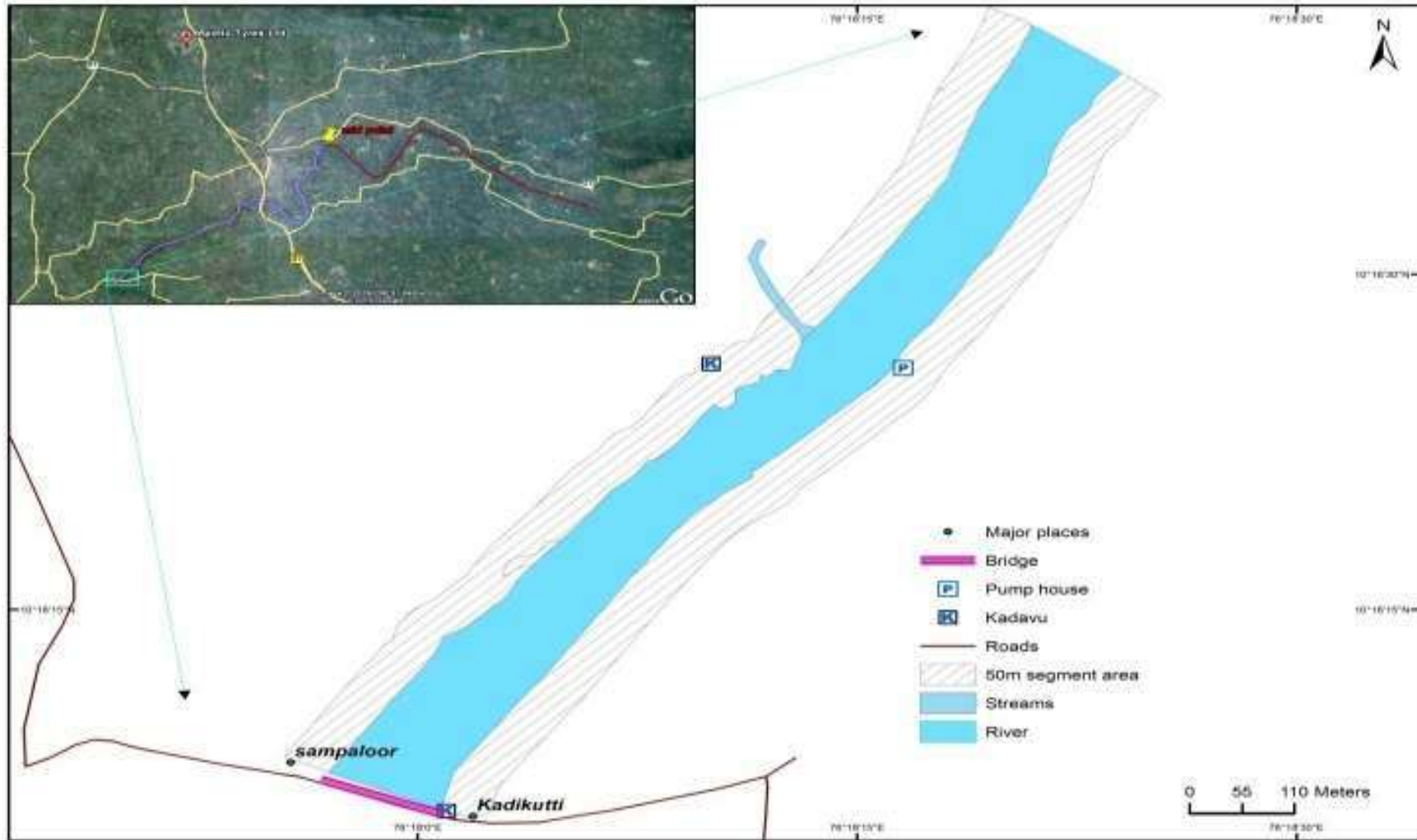


Fig. 3.17. Map showing man made structures in the riparian zone at Kadikutti region of Chalakudy river (sample stretch 6)

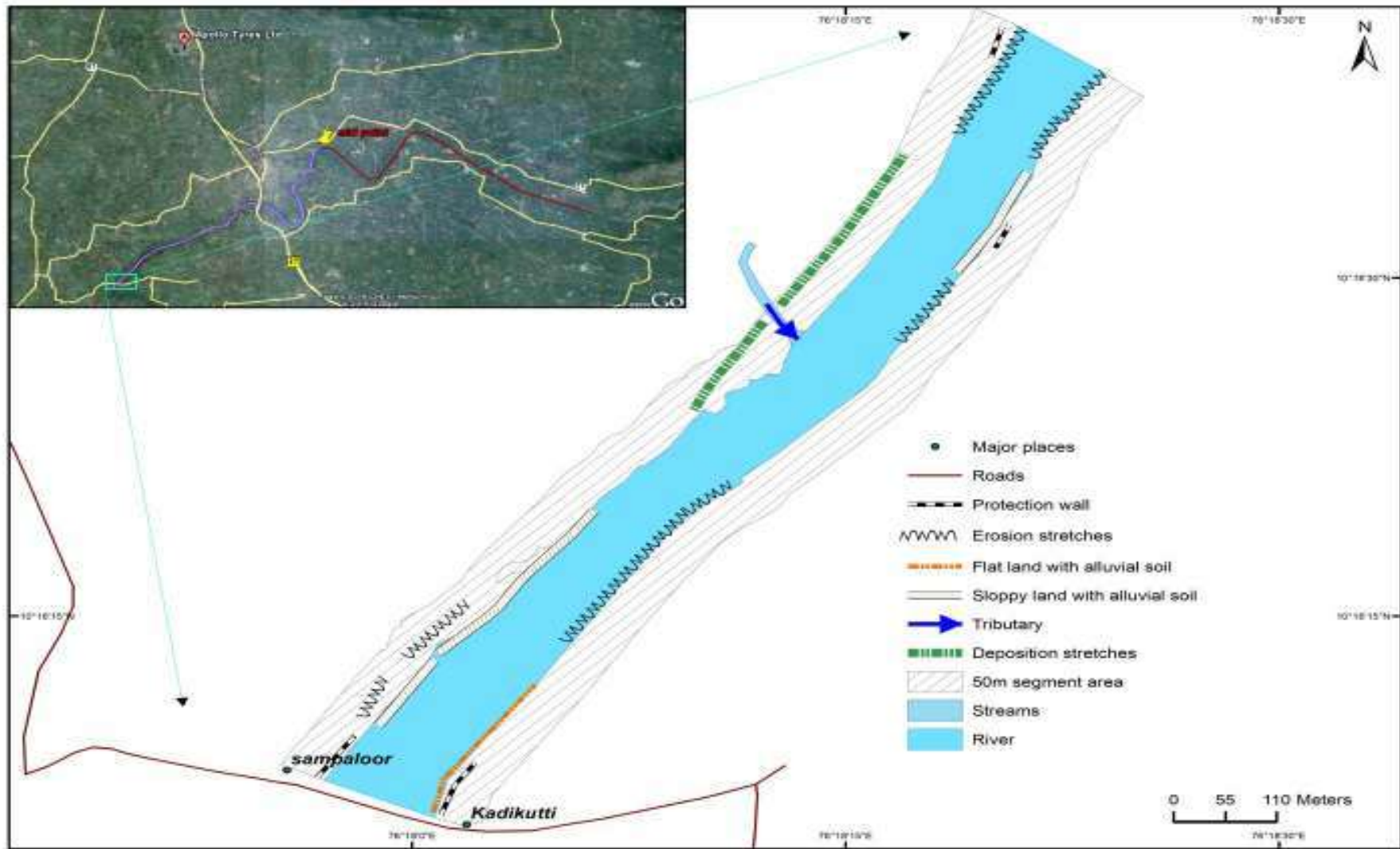


Fig. 3.18. Map of physical features of river bank at Kadukutti of Chalakudy river (Sampling stretch 6)

3.8 Change in the status of Riparian Biodiversity

According to the data of biodiversity survey the riparian vegetation is dominated by species like *Syzygium occidentale*, *Barringtonia acutangula*, *Madhuca neriifolia*, *Humboldtia vahliana*, *Mallotus aureo-punctatus*, *Homonoia riparia*, *Hopea sp.*, *Ochlandra sp.*, *Bamboosa sp.*, *Vateria sp.*, *Ficus sp.*. River bank area in and around Chalakudy town has lost riparian vegetation almost completely and damage to riparian zone is severe. Now the only major plant species available here and there is Bamboo clumps.

Currently the riparian zone has only 13 major species of trees (Table 3.8)

Sl No	Botanical name	Family	Common name	Vernacular name (Malayalam)	Status
1	<i>Syzygium occidentale</i> (Bourd.) D.N.Gandhi	Myrtaceae		Attuchamba/Karinjara	Vulnerable and Endemic to Southern western Ghata
2	<i>Barringtonia acutangula</i> (L.) Gaertn.	Lecythidaceae	Indian oak	Attupezhu/Neerpezhu	
3	<i>Madhucaneriifolia</i> (Moon) H.J.Lam	Sapotaceae		Attu-ilippa	
4	<i>Humboldtia vahliana</i> Wight	Leguminosae		Aattuvanchi / Karappongu	Endangered and Endemic to Southern western Ghata
5	<i>Mallotus aureo-punctatus</i> (Dalzell) Müll.Arg.	Euphorbiaceae			Endemic to western Ghata
6	<i>Homonoia riparia</i> Lour.	Euphorbiaceae		Neervanchi/Kadallari	
7	<i>Hopea parviflora</i> Bedd.	Dipterocarpaceae	Iron wood of Malabar	Kambagam	Vulnerable and Endemic to Southern western Ghata
8	<i>Vateria indica</i> L.	Dipterocarpaceae	Indian copal tree	Vellappayin	Endemic to western Ghata
9	<i>Xanthophyllum marnottianum</i> Wight	Polygalaceae		Madukka/Mottal	Endemic to western Ghata
10	<i>Aporosacardiosperma</i> (Gaertn.) Merr.	Phyllanthaceae		Ponvetti/Vetti	
11	<i>Xylocarpus</i> (Roxb.) Taub.	Leguminosae		Irul	
12	<i>Hydnocarpus alpina</i> Wight	Flacourtiaceae		Malamarotti	
13	<i>Baccaurea courtallensis</i> (Wight) Müll.Arg	Phyllanthaceae		Mootippuli	Endemic to Peninsular India

Table 3.8 riparian plants of chalakudy river

3.9 Fish diversity in the Chalakudy river

23 species of fishes are only found in the current study during the sample capture process. According to the riverine community about 40 species are still common in this part of the river. The study recorded the common name, Malayalam name and scientific name. The list are given in Table 3.9

Sl. No.	Malayalam Name (Common Name)	Common Name	Scientific Name
1	Aacharya paral	Exclamation barb	<i>Puntius exclamation</i>
2	Aaron	Malabar Spinyeel	<i>Macrogathus guentheri</i>
3	Arakan	Tire-track spinyeel	<i>Mastacembelus armatus</i>
4	Catla	Katla	<i>Catla catla</i>
5	Chemballi	Red Snapper	<i>Lutjanus argentimaculatus</i>
6	Cherumathi Paral		
7	Cherumeen	Cobra snakehead/Great snakehead	<i>Channa marulius</i>
8	Cheru varal		
9	Chillaan	<i>Mystus vittatus</i>	
10	Ilam Manja		
11	Kaari	Stinging catfish	<i>Heteropneustes fossilis</i>
12	Kallada/Antikalli	Climbing perch	<i>Anabus tesudineus</i>
13	Kallada mutti		<i>Anabus Testudineus</i>
14	Kallelmutti		<i>Anabus Testudineus</i>
15	Kanambu/Thirutha kanambu	Mullet	<i>Mugil cephalus</i>
16	Karimeen	Green chromide/Pearl spot	<i>Etroplus suratensis</i>
17	Katla	Catla	<i>Catla Catla</i>
18	Kodiyam Paral	Mascara barb	<i>Puntius assimilis</i>
19	Kola	Freshwater garfish	<i>Xenentodon cancila</i>
20	Kullan Kallotti	Mullya garra	<i>Garra mullya</i>
21	Kuruva Paral	Peninsular olive barb	<i>Puntius sarana</i>
22	Kuruva	Oliver barb	<i>Systemus sarana</i>
23	Mananjil/malanjil	Indian mottled eel	<i>Anguilla bengalensis</i>
24	Manalaaron	Malabar Loach	<i>Lepidocephalichthys thermalis</i>
25	Manjakoore	Yellow catfish	<i>Horabagrus brachysoma</i>
26	Mushi	Walking catfish	<i>Clarias batrachus</i>
27	Pallathi	Orange chromide	<i>Etroplus maculates</i>
28	Panna Karimeen	Malabar leaf fish/common	<i>Pristolepis marginata</i>

		catopra	
29	Paral	Giant danio	<i>Danio malabaricus</i>
30	Parapparal	Scarlet banded barb	<i>Puntius parrah</i>
31	Poovali Paral	Black spot barb	<i>Puntius filamentosus</i>
32	Pullan	Pamba labeo	<i>Labeo dussumieri</i>
33	Rohu	Reba	<i>Labeo Rohita</i>
34	Thirutha	Flathead mullet	<i>Mugil cephalus</i>
35	Tilopia	Tilapia	<i>Oerochromis mossabicus</i>
36	Gourami	Gourami	<i>Osphronemus goramy</i>
37	Valah	Ribbon Fish	<i>Lepturacanthus saval</i>
38	Varaal	Banded snakehead	<i>Channa striatus</i>
39	Vayambu	Silver carplet	<i>Amblypharyngdon melettinus</i>
40	Vellakoori	Long whiskered catfish	<i>Mystus gulio</i>

Fig.3.9 Fishes of Chalakudy river

Photo: Clockwise-

A catch from Chalakudypuzha routinely collected by a local fisherman.

Fisherman at a boat-putting the net.

TIES Project officer with the fishers



3.10 Birds of Chalakudy river

61 species of birds are only found in the current study. The study Local name and scientific name. The list are given in Table 3.10.

Sl.No	Local Name	Scientific Name
1	Aanaranchi	<i>Cinergula</i>
2	Aankuyil	<i>Eudynamys scolopacea</i>
3	Aattakkaruppan	<i>Lonchura striata</i>
4	Aattakkuruvi	<i>Ploceus philippinus</i>
5	Adakka kuruvi (Purplerumped Sunbird)	<i>Nectarinia zeylonica fluviventris</i>
6	Angaadikkuruvi (House Sparrow)	<i>Passer domesticus indicus</i>
7	Arippravu	<i>streptopelia chinensis</i>
8	Attakkuruppan	<i>Lonchura striata</i>
9	Ayora	<i>Aegithina tiphia</i>
10	Balikakka (Large-billed Crow)	<i>Corvus macrorhynchos culminatu</i>
11	Chakkiparunthu	<i>Milvus migrans</i>
12	Charamundi(Grey Heron)	<i>Ardea cinerea rectirostris</i>
13	Charapoondan	<i>Coracina novachollandiaemacei</i>
14	Chayamundi	<i>Ardea cinerea</i>
15	Chempothu	<i>Centropus sinensis</i>
16	Chempukotti	<i>Megalaima haemacephala</i>
17	Cherumundi (Intermediate Egret)	<i>Mesophoyx intermedia</i>
18	Chinna mundi (Little Egret)	<i>Egretta garzetta garzetta</i>
19	Chinnakkokku	<i>Ardeola striatus</i>
20	Eranda	<i>Dendrocygna bicolor</i>
21	Erattavalan pakshi (Greater Racket-tailed Drongo)	<i>Dicrurus paradiseus</i>
22	Garudan (Krishnaparunthu)	<i>Haliastur indus indus</i>
23	Kaalimundi (Cattle Egret)	<i>Bubulcus ibis coromandus</i>
24	Kakka (Crow)	<i>Corvus brachyrhynchos</i>
25	Kakka meenkothi (Storkbilled Kingfisher)	<i>Pelargopsis capensis</i>
26	Kakkakuyil	<i>eudynamya scolopacea</i>
27	Kakkathampuratti (Greater Racket-tailed Drongo)	<i>Dicrurus paradiseus</i>
28	Kalmanathi	<i>Sanicoloidus fulicata</i>
29	Kandatil mundi	<i>Ardeola grayii</i>

30	Kariyila kili/ Kariyilapeda (Jungle Babbler)	<i>Turdoides striatus malabaricus</i>
31	Karuppan thenkili	<i>Nectarinia asiatica/ nectarinia lotenia</i>
32	Kathirvalan kuruvi	<i>Prinia socialis</i>
33	Kavalam Kali	<i>Acridotheres tristis</i>
34	Kavathi kakka (House crow)	<i>Corvus splendens protegatus</i>
35	Kazhukan (White-rumped Vulture)	<i>Gyps bengalensis</i>
36	Koel (Cuckoo)	<i>Cuculidae Cuculiformes</i>
37	Kokku (Little Egret)	<i>Egretta garzetta garzetta</i>
38	Kula kokku (Indian Pond Heron)	<i>Ardeola grayii grayii</i>
39	Kula kozhi (Whitebreasted Waterhen)	<i>Amaurornis phoenicurus</i>
40	Kuruvi	<i>Passer diomesticas</i>
41	Kuyil (Asian Koel)	<i>Eudynamys scolopacea</i>
42	Madapravu (Rock Pigeon)	<i>Coumba livia</i>
43	Manja kili (golden oriole)	<i>Oriolus oriolus kundoo</i>
44	Manjakili (Eurasian Golden Oriole)	<i>Oriolus oriolus kundoo</i>
45	Maramkothi (Woodpecker)	<i>Melanerpes formicivorus</i>
46	Mazhakkocha	<i>Ixobrychus cinnamomeus</i>
47	Mungam kozhi (Little Grebe)	<i>Ruficollis capensis</i>
48	Myna (Common Myna)	<i>Acridotheres tristis</i>
49	Neelakozhi (Purple Moorhen)	<i>porhyrio porphyrio</i>
50	Neer kakka (Little Cormorant)	<i>Phalacrocorax niger</i>
51	Olenjali (Rufous Tree Pie)	<i>Dendrocitta vagabunda parvula</i>
52	Pachakkali (Nordmann's Greenshank)	<i>Tringa nebularia</i>
53	Pachilakkudukka (White-Cheeked Barbet)	<i>Megalaima viridis</i>
54	Parunth (Eagle)	<i>Haliaeetus albicilla</i>
55	Pathira kokku (Black crowned Night Heron)	<i>Nycticorax nycticorax nycticorax</i>
56	Ponman (Kingfisher)	<i>Alcedo attis</i>
57	Ponman (White-throated Kingfisher)	<i>Halcyon smyrnensis fusca</i>
58	Pullimeenkothi (Pied Kingfisher)	<i>Ceryle rudis travancoreensis</i>
59	Tharavu (duck)	<i>Anas platyrhynchos</i>
60	Thira mundi (Western Reef Heron)	<i>Egretta gularis schistacea</i>
61	Uppan (Greater Coucal)	<i>Centropus sinensis parroti</i>

Table 3.10. Bird fauna observed in Chalakudy river area

3.11 Odonates of Chalakudy River

The survey conducted on the banks of chalakudy River identified 27 species of dragonflies. The study recorded the local name, scientific name. The list of dragonflies identified is given in Table 3.11.

Sl. No.	Malayalam Name (Common Name)	Common Name	Scientific Name
1	Changathi thumbi	Ditch Jewel/Orange skimmer/Asian groundling	Brachythemis contaminata
2	Chenkali palthumbi	Blue bush dart	Copera vittata
3	Chenthavidan vyali	Red faced skimmer	Orthetrum chrysis
4	Cheriyathanal thumbi	Clear winged forest glory	Vestalis gracilis
5	Choravalan thumbi	Asiatic bloodtail	Lathrecista asiatica
6	Chuttinilathan	Black tipped ground skimmer	Diplacodes nebulosa
7	Kaarthumbi	Black Stream Glider	Trithemis festiva
8	Kaduva Thumbi		
9	Kanalvaalan Chathuppan	Orange Tailed Marsh Dart	Ceriagrion cerinorubellum
10	Manjakaali Paalthumbi	Yellow bush dart	Copera masginipes
11	Nattukaduva	Common clubtail	Lctinogomphus rapax
12	Nattunilathan	Ground skimmer	Diplacodes trivialis
13	Nattupoothaali	Blue sprite/Blue grass dart	Pseudagrion microcephalum
14	Naattupulchinnan	Pigmy Dartlet	Agriocnemis pygmaea
15	Onathumbi	Wandering Glider	Pantala flavescens
16	Paandan Parunthan	Amber-winged glider	Hydro basileus Croceus
17	Paandan Vayaltheyyan	Scarlet Basker	Urothemis signata
18	Pacha vyali	Green Marsh Hawk	Orthetrum Sabina
19	Pavizha vaalan vyaali	Crimson-tailed Marsh Hawk	Orthetrum prunosum
20	Peelithumbi	Stream Glory	Neuribasis chinensis
21	Pullivalan	Yellow tailed Ashy skimmer	Potamarcha congener
22	Shalabha thumbi	Common picture wing	Rhyothemis variegata
23	Sindhoora chirakan	Crimson marsh glider	Trithemis aurora
24	Soochivaalan Sandhyathumbi	Brown Dush Hawk	Zyxomma petiolatum
25	Swamy thumbi	Pied paddy skimmer	Neurothemis tullia
26	Theekkarimuthan	Scarlet marsh hawk	Aethriamanta brevipennis
27	Vella Pulchinnan	White dartlet	Agriocnemis pieris

Table 3.11. Odonates of Chalakudy river area

3.12. Change in the status of river biodiversity

As per the opinion of the local people (exposed through survey) width and depth of river has increased over the years. The average change of width is 13.16(m) and depth is 6.7(ft), as opined by stakeholders. The major reason for these changes is illegal sand mining and cutting of riparian vegetation. Water table has decreased due to the mining of river bed and distortion in rain pattern.

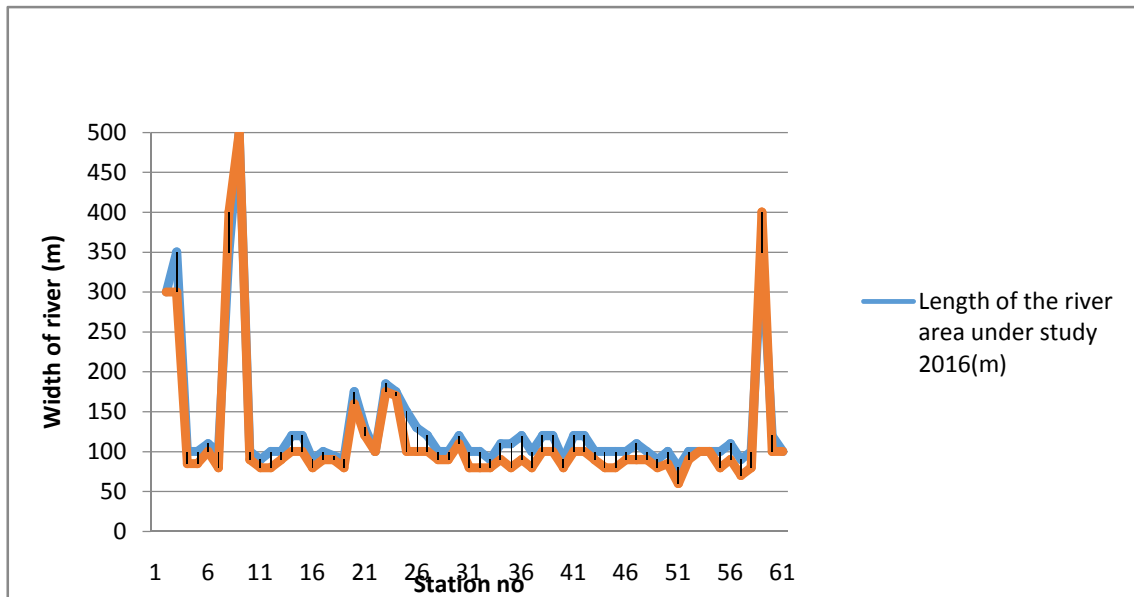


Fig. 3.19. Changes in width of chalakudy river (of the study area)

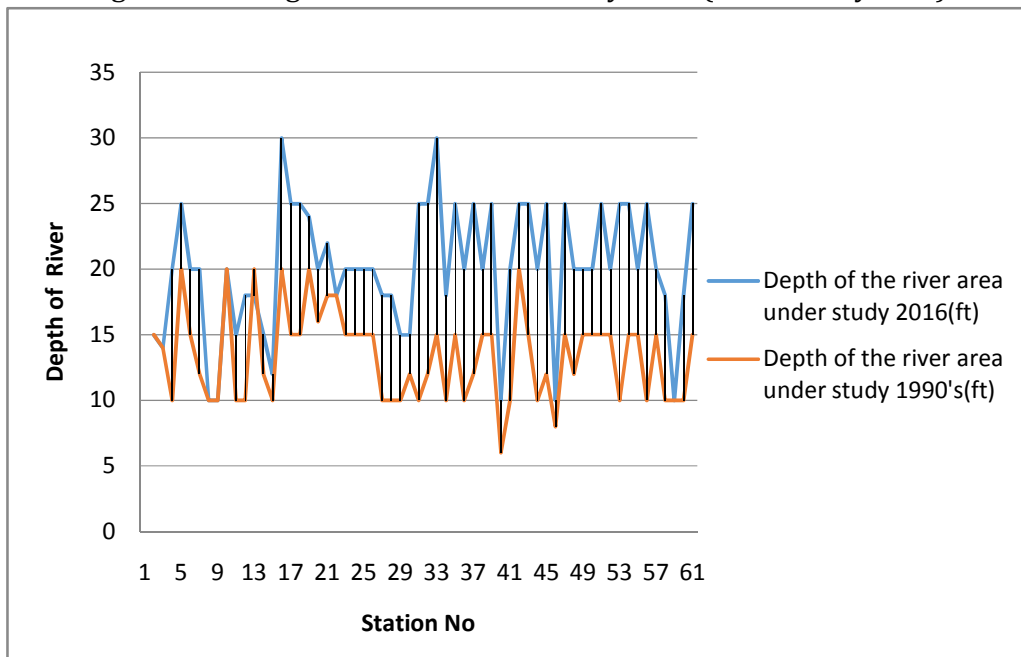


Fig. 3.20. Changes in the depth of Chalakudy river (of the study area)

3.13 Livelihood based on Chalakudy river

The major livelihood associated with Chalakudy river is based on agriculture, as similar for any other river in Kerala. Coconut, arecanut and nutmeg are the main crops. Some areas are occupied by banana cultivation. All sorts of water requirements of the people are met from the river and are mainly for drinking, agriculture and other domestic and industrial purposes. Some major drinking water supply schemes like all Panchayaths including the Chalakkudy Municipality. Some of the people depend on this river for their livelihood, like fishing or sand mining. This river is considered to be the richest in terms of fish diversity. Fishing from the river and flood plain was an important livelihood activity of the local people, but currently with the decreasing fish diversity and density, such livelihoods also vanishing. At present, there are very few people make their livelihood completely based on the river.

3.14 Main uses of the chalakudy river in past and present

The main uses of the river in the past were agriculture/farming, bathing, showering animals, fishing, etc.. Fig. 3.21 clearly shows that the use of the river has changed significantly. Currently the river is mainly used for agriculture activities alone. A large number of irrigation and drinking water projects are also existing based on the river.

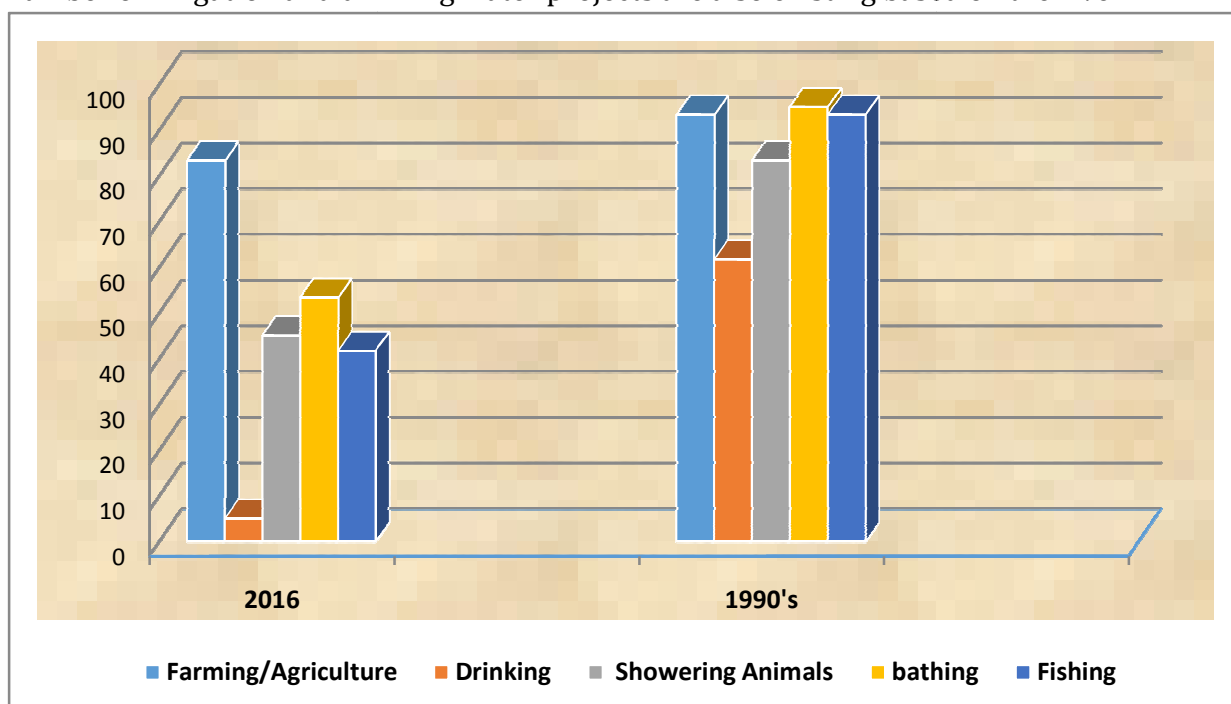


Fig. 3.21. Major Livelihoods related to Chalakudy river in the 1990's and 2016

3.15 Threats of Chalakudy River

3.15.1. Agricultural

Agricultural practices are found mainly in the Virippara up to Vettu kadavu and in down stream Chalakudy railway bridge to Kadikuttii bridge of study area. Local people were growing Tapioca, Banana in the riparian areas including many islets. In this area mainly ca, Banana and other seasonal crops are widely cultivated. Perennial crops like coconut, arecanut and nutmeg found mainly in Ezhattumugham, Pariyaram, Meloor, Arangali kadavu and Kadikuttii areas. The topographical features restrict paddy cultivation to the lower Kadikuttii areas. Banana cultivation is found in extensive areas in the riparian zones of Virippara, Kompan para, Koodapuzha and Kadikutti. These activities have caused serious impact on the remaining riparian vegetation. Clearing of the riparian vegetation has been noticed at Koodapuzha, Chalakudy town areas.

Motor pumps operating directly from the river both legally and illegally at more than hundreds of locations in the middle and lower regions of study area. Such pumps are mainly supply water for irrigation.

3.15.2. Sand mining

Sand mining is the most destructive anthropogenic activity on the riverine habitat. Chalakudy River is not an exception, here about 420800 m³ of sand was mined from 34 stations within 9 local bodies (according to records GPs). These sand mining locations (Kadavu) extend from Pariyaram to kadikutty bridge (our study area). Many other small sand mining locations were also noticed.

Actually these sand mining Kadavus (ghats) are locations for piling up and transport of collected sand. Sand mining takes place almost uniformly throughout the river, especially in mid and downstream areas. About 20 sand banks covering 160 ha of area have completely disappeared from this river during 1976-2005 (Amithab Bachen, 2005). Only one sand bed, Arangaly has been retaining due to strong vigilance of the local people and also due to their aesthetic and devotional value.

As per the study the riparian lands have disappeared. Older folks recollected presence of abundant riparian vegetation of bamboos, wild trees including *Hopea*, mangroves, and large trees of *Thespesia* in the lower zones. Sand quarrying in rivers and watersheds are killing the rivers. Such activities lead to bank erosion, lowering of water table and create several environmental problems. Ground water level in some of the watersheds has gone down by nearly one meter in the last two decades. Agricultural practices in the riverbanks (and also inside the dry riverbeds) during non-rainy months also add to bank erosion and sedimentation in rivers.

3.15.3 Quarrying and clay mining

Clay mining is also a severe problem mainly located at the wetland and paddy fields of Kadikutti region. This is mainly due to the availability of clay and they can easily access paddy fields because the people are not doing any farming now. Most of them sell clay from the paddy fields for making money. Granite quarrying near to hillrocks of the river bed also reported. Granite quarrying in 50 ha of 3 Panchayaths, laterite quarrying in three Panchayaths and clay mining in six Panchayath were reported earlier (George, 2001).

3.15.4 Encroachment

Encroachment and reclamation of riparian area and vegetation for various purposes are another important anthropogenic activity which has serious impacts on the riparian vegetation. This was noticed at many places in Virrippara, Koodapuzha and Chalakudy town. These are mainly for the agricultural and other private purposes including construction of private farms, resorts and parks or for tourism activities.

3.15.5. Agricultural related encroachment

This was noticed mainly in the residential areas *i.e.* which starts from the Virrippara and found up to the Njarala kadvu (Kadikutti). In the Virrippara, and Pariyaram areas many riparian habitats were found to be invaded by the local residents. Some islets such as Vrippara and Pariyaram are also found in regular use by the local people for agricultural purposes. After Ezhattumugham up to the lower areas the riparian land uses were represented by coconut and mixed crops such as nut mug, arecanut *etc.*, all in private ownership. In most of these areas mainly in Pariyaram vegetable cultivation has completely destroyed the riparian vegetation. The riverbanks in this vegetation less area is highly eroding as in Koodapuzha and Vettu kadavu bridge . Seasonal agricultural practices of Paddy, Banana, Legumes, Tapioca, are found at many sites throughout the area and in some places within the river in Chakaravani kadavu.

3.15.6. Tourism related encroachment

Tourism industry is booming all through the river banks, especially upstream area. Private individuals and groups are found to construct hotels, resorts, parks and farms in the river margin. Tourism related activities are mainly located in the Virrippara and Koodapuzha areas. It is reported that many resorts in Virrippara area have completely destroyed the natural vegetation in the river margin for the construction of the resort. Many similar cases were found in different other areas too. Encroachment and construction for making private farms were noticed in Pariyaram, Koodapuzha, Chalakudy town areas. For instance the Chalakudy municipal area has many private land holdings and farms including the 'divine

farm' and new tourism resorts just aside the national highway, are invade and have constructions in the river margin zone. In the same way some local people also encroached the area at many places. One significant thing is that a majority of the riparian lands were either encroached or has been destroyed or eroded. Most of the riparian lands were under private ownership too.

3.15.7. Check dams & bridges

There are two mini hydel projects are within the study area of the river, the Kompanparaa check dam and Koodapuzha check dam, constructed under river diversion scheme. The Kompanparaa area in the upstream and Koodapuzha in mid stream part. This has disrupted the river flow much and the water quality also diminished. After the construction, balance stones, concrete blocks and quarry wastes are still retained in the location, so local people have been denied of bathing in the river.

Four bridges are also coming in the study area of the river. Railway bridge, National Highway bridges at Chalakudy and Njaralakadavu, and new PWD bridge at Vettukadavu (Meloora) are the major bridges across the river in the study area.

The major problems related with these constructions are not only the reclamation of the to the unscientific construction and due to lack of maintenance also negatively affected the riverine system. Blockage of the river at many places has resulted in the alteration of flow of river and serious damage to the riverbanks. One incomplete barrier across the river at Vettukadavu of Chalakkudy municipality caused massive flow on one side of the river and has resulted in serious erosions of the banks on the opposite side. The same phenomena



Checkdam at Kompanpara

has noticed in left side of Njaralakkadvu Bridge where the continuity of the river has been blocked using clay and other materials and left a small area on the left side. They did not remove the clay after the construction and has deposited waste of construction material in that region. Consequent blockage of the river and increased flow on the left side has seriously damaged the left bank and destroyed the houses. And now local bodies are funding for the construction of walls for the protection of the riverbanks.

3.15.8 Cutting of the riparian forest

In some region in the Virippara and near to Pariyaram trees in the islets are found to cut down by the local community. Local people said that they cut and use these trees for various purposes including agricultural, fishing and as firewood. Bamboo and Ochlandra on the banks are also being cut occasionally by the local people. There are no system to monitor or inspect these type of activities, so such crimes are continuing.

In the lower areas almost all-riparian vegetation were found to be cut down by local people for different purposes. This ranges from localized collection of wood for fishing purposes, cutting for firewood, agricultural and other allied activities and up to clearing of the areas for economic needs. Large private firms and individuals are clearing the riparian vegetation for various purposes.

3.15.9 Illegal fishing



Fig. 3.22. A fish (Pearl spot) captured using dynamite from Kompanpara area

Illegal fishing is also observed in many areas. Many local people are found to fishing using large nets. For fishing many people use dynamites in this zone. In the Pariyaram, Koodapuzha, Vettukadavu and Arangali areas were reported as dynamites are regularly used for fishing. Dynamiting for fishing is found to be a common activity after the Pariyaram region too. Now tourists are also engaged in such illegal activities. Collection of small hill stream fishes was also noticed in these areas. Young people and children were engaged in this activity. This is more common in the lower areas. The activity of dynamiting and over fishing was severe in the downstream areas. Dynamiting is become a common practice and investigators also observed this at many occasions. Locals had indicated that many people were injured during this activity. Illegal large scale fishing by use of banned nets with small mesh sizes were also recorded from many places both in up and down stream region.

3.15.10 Tourism

The riparian zone in the study area has tourism activities. People are coming from even distant places to various river bank spots and using it as a hide out for drinking liquor or merry making, especially in Virippara and Koodapuzha areas. The broken bottles, tons of plastic litter and other wastes are thrown all around the river bank and river bed. Several spots like one in Kompanpara check dam area are good hide outs for drinking or waste dumping, escaping from Police patrol. As some of the local people are also involved, such activities are not usually reported.

3.15.11. Cattle grazing

Grazing is also noticed throughout the area. The riparian zones are always rich with herbs, grasses and seedlings. This attracts the local people to cattle rearing. In the up stream many cattle were freely allowed to graze in the riverbanks and sand beds. These activities were mainly located in the sand beds and are a part of livelihood activities of local people. Normally, grazing will not adversely affect the land, but over grazing leads to soil erosion. But in recent years, highly degraded condition of the riverbank vegetation and decrease in the sand beds for grazing has increased the stress on the remaining vegetations.

3.16 Water Quality Analysis

The analysis of water quality of the river as per IS 2296 showed that almost all water samples tested are fit for bathing or irrigation. However the presence of coliforms is extremely high in almost every part of the river. In this respect, water is highly polluted through out the study area (Kadathu kadavu, Vettu kadavu, Kalady kadavu, Edatharakavu kadavu). This is because of the sewage, household gray water and waste water from hotels, catering units, mass eateries *etc.* The major point source of biological waste in the study area is Chalakudy town.

Station no	pH	S a l i n i t y	Con duct ivity	Tu rbi dit y	Tot al Dis sol ved Sol ids	Tot al Har d nes s	C a + io n s	M g + io n s	Ac idi ty	Alk ali nit y	T ot al ir o n	Chl ori de	Flu ori de	Ni tr ate	Su lfa te	D O	B O D	C O D	Tot al bac teri al cou nt/ 1ml	Tot al colif orm s MP N/1 00 ml	Fae cal colif orm s MP N/1 00 ml	E. co li
Chalakkudy Town Bridge(CS-1)	5.9 7	0. 0 3	57.3	55	30.1	44	1 8	26	42	28	0. 9	40	0	2	0	3 9. 8	31 .2	46.8	6	460	23	Pr ese nt
Kadathukad avu(CS-2)	5.9 9	0. 0 3	51.6	6	27.1	38	8	30	30	20	0. 2	40	0	4	0	2 5. 7	17 .1 6	25.9 6	14	1100	43	Pr ese nt
Koodapuzha - near temple(CS- 3)	7.6 9	0. 0 5	78	14	41.1	94	1 6	78	32	82	0. 9	40	0	2	0	3 4. 3	28	42	2	75	9	Pr ese nt

Maloor(CS-4)	7.215	0.0	85.3	5	44.8	92	12	80	48	52	0.09	60	0	2	0	3	22	33.93	3	75	21	Present
Koodapuzha Pump house(CS-5)	6.463	0.0	48.6	4	25.7	38	10	28	50	24	0.07	40	0	0	0	5	18	27.0	4	210	9	Present
Kompanpara(CS-6)	7.123	0.0	47.1	7	24.7	36	63	30	62	22	0.09	40	0	8	0	3	17	25.74	2	75	23	Present
Poolani(CS-7)	7.463	0.0	57.1	2	29.9	58	12	46	32	34	0.02	60	0	12	0	3	16	24	6	210	45	Present
Viripara(CS-8)	5.943	0.0	43.5	4	22.8	48	14	34	28	30	0.03	40	0	0	0	2	4	6	21	2400+	210	Present
Viripara farm(CS-9)	6.452	0.0	40.1	0.3	21.7	26	10	16	54	22	0.03	60	0	0	0	4	29	44.46	3	150	45	Present
Ezhattumgham(CS-10)	6.443	0.0	41.4	1	21.8	48	12	36	26	26	0.04	40	0	5	0	6	53	79.56	4	150	45	Present
Kaiyanikada vu(CS-11)	6.514	0.0	73.8	2	38.9	58	12	46	34	52	0	20	0	0	0	3	27	40.95	9	1100	210	Present
Edatharakadavu(CS-12)	6.023	0.0	46.5	2	24.8	40	12	28	42	30	0.01	20	0	0	0	3	10	15	4	460	45	Present
Arangalikalavu(CS-13)	5.924	0.0	62.4	12	33.1	33.1	14	44	96	30	0	0	0	0	0	4	32	49.14	4	210	23	Present
Arangalikalavu(CS-13)	6.313	0.0	53.3	2	28.1	60	14	46	56	28	0.02	20	0	12	0	3	19	29.25	3	210	23	Present

avu(CS-14)																						
Kadikutti njaralakada vu(CS-15)	6.0 3	0. 0 4	60.9	10	32.2	60	1 6	44	48	38	0. 1	40	0	0	0	4 5. 2	28 .0 8	42.1 2	2	210	21	Pr ese nt
Kadikutii njralla kadavu(CS- 16)	6.2 1	0. 0 3	53.3	2	28	38	1 2	26	70	32	0. 1	40	0	11	0	3 3. 5	22 .6 2	33.9 3	6	210	23	Pr ese nt
Santhipura m kadathu kadavu(CS- 17)	6.2	0. 0 3	53	2	38	38	1 2	26	70	32	0. 1	20	0	11	0	4 3. 5	12 .6 2	18.9 3	6	110	23	Pr ese nt
Vattu kadavu(CS- 18)	6.5 2	0. 0 3	56.5	2	44.8	40	1 2	28	42	30	0. 1	20	0	0	0	3 2	8	12	4	460	15	Pr ese nt
Kalady kadavu(CS- 19)	6.8	0. 0 3	96.5	2	45	40	1 2	28	62	45	0. 1	20	0	0	0	3 3	8	12	6	460	23	Pr ese nt
Alakkappell i kadavu(CS- 20)	7.1	0. 2	36.5	2	54	40	1 4	26	72	54	0. 2	20	0	0	0	2 8	4	6	3	1100	75	Pr ese nt
Kodungapuz ha kadavu(CS- 21)	6	0. 3	67.3	55	70.1	44	2 0	24	42	28	0. 9	60	0	2	0	3 9. 8	11 .2	16.8	6	460	21	Pr ese nt
Poolanii kadavuu(CS- 22_)	5.9 9	0. 0 2	61.6	6	27.1	38	8	30	40	35	0. 2	40	0	6	0	3 5. 7	17 .1 6	25.7 4	14	1100	23	Pr ese nt

Moozhikka kadavu(CS-23)	7.6	0.05	68	4	41.1	94	26	68	32	82	0.09	40	0	4	0	34.3	18	27	2	75	9	Present
Kaiiyani kadavu(CS-24)	7.4	0.05	95.3	3	44.8	92	42	50	48	42	0.09	60	0	2	0	32.8	12	18.93	3	110	21	Present
Kannampuzha kadavu(CS-25)	6.46	0.01	48.6	4.2	25.7	38	14	24	52	24	0.07	40	0	0	0	53	18	27	6	210	9	Present
Vathakkattukulangara kadavu(CS-26)	6.02	0.03	46.5	2	24.8	40	18	22	42	30	0.01	20	0	0	0	32	7	10.5	4	460	43	Present
Choondani kadavu(CS-27)	6.12	0.04	62.4	11	33.1	58	14	44	96	30	0	0	0	0	0	40.6	12.7	19.14	7	210	21	Present
Alakkappelli kadavu(CS-28)	6.4	0.01	53.3	2	28.1	60	34	26	46	48	0.02	20	0	12	0	32.8	9.5	14.25	15	1100	23	Present
Moozhikka kadavu(CS-29)	6.52	0.04	60.9	10	32.2	60	26	34	48	28	0.01	40	0	2	0	45.2	18.08	27.12	2	210	23	Present
Pottath kadavu(CS-30)	6.21	0.03	53.3	2	28	38	22	16	60	32	0.01	40	0	11	0	33.5	2.62	3.93	5	210	15	Present

Table 3.12. Result of analysis of water quality of Chalakudy river

Parameter	Permissible limit for bathing and irrigation (IS2296 standard)
pH	6.5 – 8.5
Salinity	3 ppt
Conductivity	2250 μ S
Turbidity	300 NTU
Total Dissolved Solids	2100 mg/L
Total Hardness	1100 mg/l as CaCO ₃ *
Ca⁺ ions	500 mg/l as Ca ⁺ *
Mg⁺ ions	30 mg/l as Mg ⁺ *
Acidity	200 mg/l as CaCO ₃ *
Alkalinity	200 mg/l as CaCO ₃ *
Total iron	2.0 mg/l as Fe*
Chloride	600 mg/l as Cl
Fluoride	1.5 mg/l as F
Nitrate	30 mg/l as NO ₃ *
Sulfate	1000 mg/l as SO ₄
DO	50.0mg/l
BOD	30.0mg/l
COD	120mg/l
Total bacterial count/1ml	5
Total coliforms MPN/100ml	500
Faecal coliforms MPN/100ml	200
<i>E. coli</i>	0*

Standard values for various water quality parameters (IS 2296)

Proposal

My River, My Life

A School based River Conservation Project
for Chalakudy Puzha, Kerala, India

Introduction

Chalakudy River (10° 10' 0" to 10° 33' 30" N; 76° 17' 0" to 77° 4' 0") is the fifth longest river of 44 rivers of Kerala. The river originates in Western Ghats, the Anamalai region of Tamil Nadu, and it is actually a collection of some major tributaries originated from Parambikulam, Kuriyarkutti, Sholayar, Karapara and Anakayam in Kerala. Also, it flows through some of the dense evergreen forests of the region, before emptying into the Arabian sea. In Kerala, it flows through Palakkad, Thrissur and Ernakulam Districts. The total drainage area of the river is 1704 km². Out of this 1404 km² lies in Kerala and the rest 300 km² in Tamil Nadu. The length of the Chalakudy river is 145 km.

The Chalakudy river basin contains about 57 sub watersheds and 140 micro watersheds. These sub watersheds are mainly in the catchments and hence the basin becomes narrower towards the west. The river is formed by the confluence of four major tributaries, Sholayar, Parambikulam, Kuriarkutti and Karappara River. It is estimated that over 5 lakh people directly depend on the river for various needs. Lift irrigation, drinking water schemes and dams have been constructed in the river system.

Chalakudy River is one of the few remaining sites of riparian vegetation in substantial quantities, especially upstream areas. The riparian forests of the area have been found to be characterized by the presence of typical riparian species of plants, in addition to evergreen and semi-evergreen species. All these human activities along with the global environmental changes have either destroyed the structure and stability of Chalakudy river ecosystems.

Catchments and riparian areas of Chalakudy rivers have been destroyed and the perennial nature has been lost. This change in the hydrology of river has affected human life and all our activities. Drinking water scarcity, ground water depletion, land slides, soil erosion, erosion of river banks, and lack of basic life support resources have all become common problems in Chalakudy river. The riparian habitat is highly dynamic being at the meeting zone or ecotone of the flowing river and the riverside land subjected to anthropogenic influences. It can be considered as the stretch of common land which any human community could depend upon for a wide variety of uses including the protection of the riverbank from erosion.

The alteration of the physical structure of the habitat is one of the major factors that degrade aquatic resources and threaten the very existence of aquatic organisms especially the fishes. Habitat, as structured by in-stream and surrounding topographical features, is a major determinant of aquatic community potential. Both the quality and quantity of available habitat affect the structure and composition of resident biological communities.

Background

Chalakydy river is under severe threats and yearning for a lifeline. It is recorded that Chalakydy river has been the biggest victim with 37 per cent reduction in its natural flow and storage, and diversion of waters for irrigation has caused ecological damage as reflected in the salinity intrusions along the coast. Chalakydy riverine ecosystem is undergoing anthropogenic stress from the burgeoning population density and urbanization. River is heavily polluted due to sewage and industrial wastes, which significantly altered the biogeochemical capacities of the ecosystem. Besides, a series of risks including sand-mining, over-extraction of drinking water, encroachment, land filling, tourism activities and other anthropogenic pressures are aggravating the situation.

River conservation encompasses the policies, strategies and activities made to manage rivers as a sustainable resource, to protect the water environment, and to meet current and future human demand of water. Community participation is the key for success of river conservation in Kerala, being the principal part of the river is part of community life, both in urban and rural situations.

In this background Apollo Tyre Foundation entrusted Tropical Institute of Ecological Sciences (TIES) to study the conservation issues of Chalakydy river and to propose a community linked conservation strategy. TIES conducted a short-term study during Jan-March, 2016 and reached the following conclusions:

- The riparian and river biodiversity is a unique and rich natural ecosystem which has great influence on aquatic and terrestrial systems. In addition to stabilizing and safeguarding the river bank from erosion, the riparian ecosystem increases the biotic productivity and the biodiversity potential of the river.
- The emphasis of this study was on the status of the remaining riparian and river biodiversity of 20 kms of Chalakydy river (From Virippara [upstream] to Kadikutty Bridge [downstream]) nearest to Apollo Tyres, Perampura and the major human interventions on the riparian zone. The selected area of the river is coming under Pariyaram Panchayath, Karukutty Panchayath, Melur Panchayath, Chalakydy Municipality, and Kadikutty Panchayath.
- A survey was conducted among the river bank community in order to expose their knowledge on the river and to find out the changes that happened to the river system. PRA meetings also conducted to validate the survey data.
- Resources like cadastral maps of villages and secondary data on the river studies were collected and used for analysis. The status of riverine system in terms of riparian

biodiversity, physical features and man-made structures were plotted with GIS & RS. Water quality analysis was also conducted.

- The Chalakudy River is known for its diversity, as it contains 98 species of fresh water fishes out of the 152 species known from Kerala. However 23 species of fishes are only found in the current study during the sample capture process. According to the riverine community about 40 species are still common in this part of the river.
- As per the available data the riparian vegetation of the area was characterised by the presence of typical riparian species of plants, in addition to evergreen and semi-evergreen species, but present study observed that significant loss has been occurred.
- Chalakudy river traditionally support livelihood of local community in many ways such as cattle rearing, laundry, fishing, drinking, agriculture *etc.* However dependency on the river for various livelihood activities has been decreased over the years.
- The GIS & RS analysis of the riverine system in terms of physical, biological and man-made features showed that riparian vegetation has been lost significantly. The GIS data showed that currently 15-18% of the river bank area has only riparian cover with a dominant share at upstream region. The area of river bank within a 50 meter distance from the river center has been transformed into human settlements with mixed crops or with just grasses alone.
- Sandmining is the most destructive anthropogenic activity on the riverine habitat. Chalakudy River is not an exception, here about 420800 m³ of sand was mined from 34 stations within 5 local bodies (as per the records of GPs).
- Only one sand bed at Arangaly (5 acre in area during summer season) have been retained due to strong vigilance of the local people and also due to their aesthetic and devotional value.
- Due to the sand quarrying heavy rate of river bank erosion, lowering of water table and loss of biodiversity through damages on the river bed are reported. As per the community survey data ground water level in the downstream area (from Koodapuzha to Kadikutty) has gone down by nearly one meter in the last two decades.
- Clay mining is heavily reported in the wetland and paddy field areas of Kadikutty (downstream area). The abandoning of paddy cultivation led to explore other income sources like clay mining. Most of them sell clay from the paddy fields for making money.
- The analysis of water quality of the river as per IS 2296 showed that almost all water samples tested are fit for bathing or irrigation. However the presence of coliforms is extremely high in almost every part of the river. This result shows severe pollution of the river, especially of sewage, household gray water and waste water from hotels, catering units, mass eateries *etc.*
- Several polluting industries and small scale units are on the river bank throughout the area. Sakthi Paper Mills at Athirapalli (now closed), catering unit at Virippara, beer

bottling plant, Divine retreat centre, sewage from Chalakudy town *etc.* are among the major polluters. Currently no major industries are operating in the studied stretch of the river, hence no much industrial pollution was observed.

- Major human interventions in the riparian zone such as Tourism, Sand mining, Quarrying and clay mining, Agricultural related encroachment, Tourism related encroachment, Constructions activities, Cutting of the riparian forest, Illegal fishing, Cattle grazing *etc.*
- Encroachment riparian land and river bed is widespread in the study area especially at the upstream Athirappally area. These are mainly for the agricultural and other private purposes including construction of private farms, resorts and parks related with tourism activities.
- Private individuals and groups are found to construct hotels, resorts, parks and farms in the river margin. These people prohibit the entry of public into these areas. Tourism related activities are mainly located in the virippara and koodapuzha areas.
- Chalakudy municipal area has many private land holdings and farms including the 'divine farm' and new tourism resorts just aside the national highway, found to invade and have constructions in the river margin zone. In the same way some local people also invaded the area at many places.
- Two mini projects within the study area are Kompanparaa check dam and Koodapuzha check dam in river diversion scheme. The Kompanparaa area in the upstream and Koodapuzha in mid stream part.
- The major bridges across the river are bridge for the railway and national highway at Chalakudy, bridges at Njaralakkadavu and new bridge at vettukadavu(meloor).
- One incomplete barrier across the river at Vettukadavu of Chalakkudy municipality caused massive flow on one side of the river and has resulted in serious erosions of the banks on the opposite side. The same thing was noticed in left side of Njaralakkadavu Bridge where the continuity of the river has been blocked using clay and other materials and left a small area on the left side.
- In some region in the Virippara and near to pariyaram trees in the islets are found to cut down by the local community. Local people said that they cut and use these trees for various purposes including agricultural, fishing and other personal purposes. The local community also uses up species of Bamboo and *Ochlandra* (reed).
- Illegal fishing is also observed in many areas. Many local people are found to fishing using large nets. For fishing many people use dynamites in this zone. In the Pariyaram, Koodapuzha, Vettukadavu and Arangali areas dynamiting was observed at many occasions.
- Over grazing is also noticed throughout the area. The riparian zones are always rich with herbs, grasses and seedlings many cattle were freely allowed to graze in the riverbanks and sand beds.

- The river area under study has 17 schools which are located within 2 Km. from the river.
- A conservation programme for the river is an imminent need in order to prevent further degradation and to develop a model sustainable programme for similar situations.
- School community is the best group to implement a sustainable conservation programme. The proposed programme will be implemented through students under the leadership of the teachers. Students will conduct surveys among the aged people on the history and natural heritage of the river, conduct a 'river walk', as a public awareness and self-learning programme, clean the river bed and riparian zone by removing plastic litter, plant bamboos to improve the riparian vegetation and to prevent soil erosion. Hence the students will be aware of the real issues related to the river and the participatory nature of the activities they undertaken will help to sensitize the river bank community too.
- A series of awareness workshops will be conducted for school community which will enable them to approach issues scientifically and to provide sustainable solutions.

Based on these inputs the following proposal is mooted.

Aim

To conserve the Chalakudy river through a model participatory programme involving riverbed school community

Objectives

- To link the school to the river and to provide a sense of ownership, in order to promote conservation of the river, through awareness and sensitization programmes
- To assess the status of riparian and river biodiversity of Chalakudy river through students from schools in the riverbed
- To document the biodiversity of the river in the past and present, including related Traditional Knowledge (TK), and to make a River Biodiversity Register (for the respective part of the river)
- To make a school level action plan for improving riparian diversity and river conservation (cleaning programme; placing boards to avoid pollution; planting bamboos, introduction of native fish fingerlings *etc.*)

Target group

- Primarily students, teachers and staff of selected 7 schools in the riverbed

- Indirectly, their parents and community at large

Method

100 students and 2 teachers will be selected from each school (7 schools) and they will be trained in biodiversity assessment techniques. Specific areas will be allotted for each school (approximately 1.5 km). The biodiversity will be assessed through field survey, discussions or interviews with aged people (of past), and research from secondary literature. A river biodiversity register will be prepared by each school and all of them will be compiled to form a biodiversity register for the river. It will include the traditional knowledge related to river also. After the data collection, action plans will be created for improving the riparian flora of the area. Also, school level awareness programs will be conducted for the conservation of the river and its biodiversity.

Project Period

Eleven Months (2016 May to March, 2017)

Expected output

- 7 School level River biodiversity registers & one compiled register including data on river and riparian biodiversity and related traditional knowledge existing in the area
- Empowered school community having rich experience in doing community research programmes
- Improved community participation generated through the sense of ownership and feeling gained out of various participatory programmes
- Clean and neat river bed
- More biodiversity, both in riparian and river

Deliverables & Milestones

Mile stone no.	Period	Deliverables	Comments
I	2016 May 1 st to 2016 June 31 st	<ul style="list-style-type: none"> • 7 schools identified and agreed for participation in the project • First workshop (Installation) conducted • Field handbooks and guides published & distributed 	The list of teacher co-ordinators and student leaders will be collected
II	2016 July 1 st to September 30 th	<ul style="list-style-type: none"> • School level meetings conducted • Collection of past and present 	

		biodiversity and related traditional knowledge completed • River walk conducted by all the participants schools	
III	2016 October 1 st to December 31 st	• Cleaning day conducted in all the schools • Bamboos and other riparian plants planted • Fish fingerlings of native species introduced to the selected parts o the river	
IV	2017 January 1 st to March 31st	School level River biodiversity registers and activity report prepared Final workshop conducted and all the reports presented Final reports submitted	

Budget

1. River data collection campaign (500*7 schools)	3500.00	Stationary & field expenses
2. River walk (sensitization rally) (2000*7 schools)	14000.00	Banner, mike, cap
3. Cleaning Day (2000*7 schools)	14000.00	Glouses, cap, Refreshments
4. Bamboo & fish fingerlings (2500*7)	17500.00	Cost + transport
5. River Biodiversity Register (7+1 registers) (1000*8)	8000.00	Final report
6. Field Handbook 1200 Nos. (20*800 copy)	16000.00	Guidelines, data entry forms <i>etc.</i>
7. Identification guides for F.W. fauna and flora (Set of 8 for a school - 7 schools x 500.00)	3500.00	--
8. Documentation Expense (Including Videography) – 21 activity days (7 x 3); 7 additional days [1 day for each school]- Total 28 days	28000.00	
9. Communications <i>etc.</i>	2000.00	
10. Printing and Stationery	3000.00	Data entry forms, Consolidation sheets <i>etc.</i>

11. Training and workshop expenses (2 [one installation and one final]) Each will have 49 participants- 2 teachers and 5 students from each school	20000.00	one-day each
12. Salary – Project officer (20000.00 X 11)	2,20,000.00	One full time
13. T.A. for the Project officer (3500 x 11)	38500.00	--
14. T.A. for experts & resource team (4 times x 5000)	20000.00	Only for workshops & interim field evaluation
15. Final report (edited video and hard copy)	14000.00	
TOTAL	4, 22,000.00	
16. TIES Consultancy charges @ 12%	50640.00	
Grand Total	4, 72640.00	

Rupees Four Lakh Seventy Two Thousand six Hundred and Forty only

Conclusion

This will be one of the best project with maximum community participation, visibility and sustainable impact.

APPENDIX -1. LIST OF SCHOOLS IN THE CHALAKUDY RIVER BASIN (STUDIED PART)

Schools	Km from river
1. CKH NSS Senior secondary school	1km
2. Government model higher secondary school	2km
3. Sacred heart convent girls HSS chalakudy	2 km
4. Crescent Public School Chalakudy	2 km
5. St. joseph Hss meloor	1km
6. Meloor st.johns ups	1km
7. Potta SHB UPS	2km
8. Union HSS annandu	1km
9. St.JBLPS pariyaram	1km
10. Poolany VB UPS	1km

6 Conclusion

This short-term pre project study in 20km stretch of chalakudy river carried out to analyse the present status of the riparian vegetation and river biodiversity. In Pariyaram and chalakudy town ship brings out many significant features of the riparian vegetation. This enables the analysis of factors relevant to river protection, biodiversity conservation and other social, economic and ecological dependence. The remaining vegetation patches were identified, mapped and its status was analysed in detail. Ecological as well as social significance of the riparian vegetation and water sample was analysed through scientific sampling methods and by relating it with social aspects.





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