



Conservation and Management of Wetlands of Vellayani, Kalliyoor Grama Panchayat, Thiruvananthapuram District, Kerala

Shilpa S. Anil

MSc Geography

ABSTRACT

This research paper examines the conservation and management of wetlands, their socio-economic impact on Vellayani and adjoining areas of Kalliyoor Grama Panchayat of Thiruvananthapuram district. Wetlands act as a dominant eco system with different characteristics by soil saturation and flooding, which helps the growth of wide variety of microorganisms, flora and fauna and strongly influence our climate. Important objectives of this research include-Identify and map the wetlands of Vellayani and adjacent areas, identify and listen the environmental and socio-economic problem of the study area, to analyse the land use change and human intervention which causes the changes .and finally, to suggest various management measures for preserving and maintain the wetlands and its resources. This study investigates the causes and consequences of wet land degradation and its solution through complete analysing and interpretation by field surveys and using GIS techniques for relevant map preparation like land use change detection within 10 years etc. This study found out the role of human intervention especially construction activities and waste disposal which leads to the wetland degradation and promotion of awareness and capacity programmes on the importance, function and management of wetlands and their resources. And the development of agro-tourism without harming wetland ecosystem.

INTRODUCTION

Wetlands are the clear-cut ecosystem which is flooded by water seasonally or permanently. They are considered as a natural solution to climate change. World wetland day is celebrated on 2nd February every year. Wetlands are important biomes which consist of marshes, swamps and bogs. Many of the wetland act as a reservoir for a large amount of rainwater to prevent flooding. In this world, except Antarctica, wetlands are appeared on every continent. Kerala is a state which is well known for its biodiversity. It is famous for its rich wetlands.20% of Kerala's land area consists of wetlands (that is one fifth of the land area of the state). There are about 217 wetland areas in Kerala. It consists of a vast polder-paddy cultivation area, associated with backwater, waterlogged lands, marshy lands and swamps of Western Ghats region. Kalliyoor is a village in Thiruvananthapuram district in the state of Kerala which comprises of Vellayani Lake, the largest freshwater lake in Thiruvananthapuram and Punchakkari Wetlands. And famous for its agricultural practices in wetlands. Vellayani Lake is an important freshwater lake in the humid tropics of South Asia. This pristine lake is a source of drinking water, livelihood generation and other life supporting activities. The wetlands of Vellayani attract the tourist because of its natural beauty. These wetlands are famous for the arrival of migratory birds during the months of November to march. One of the oldest agricultural colleges in Kerala – college of agriculture, Vellayani under Kerala University is situated under Kalliyoor Grama Panchayat. Freshwater ecosystems are the most important functional unit that sustains human life on earth. But the deterioration and degradation of these ecosystems is a Universal phenomenon. The main reason for this is the lack of awareness among the people about the value of the ecosystem services provided by these ecosystems. Nowadays the wetland areas of our ecosystem are diminishing, wastelands are to be drained, filled and converted for other purposes. The main causes of wetlands loss consist of increase in agriculture, land use changes, grazing, air and water pollution, excess nutrients, urban infrastructure development etc .

1.1 TITLE OF STUDY

The present study is entitled as “Conservation and Management of Wetlands with Special Reference to Its Socio-Economic Impact –A case Study of Vellayani and adjoining areas of Kalliyoor Grama Panchayat, Thiruvananthapuram district, Kerala.”

1.2 SIGNIFICANCE

Kalliyoor Grama Panchayat in Thiruvananthapuram district is famous for its wetlands and agricultural activities. Wetlands are one of the most important biomes which balance our environment or ecosystem. Decreasing the number of wetlands in the world will lead to the destruction of nature and living species and become a reason behind so many natural disasters. Hence the present study seeks to understand the conservation and management of wetlands and its socio-economic impact of Vellayani and its adjoining area of Kalliyoor Grama Panchayat.

2. OBJECTIVES AND LITERATURE REVIEW

2.1 OBJECTIVE OF THE STUDY

1. To identify and map the wetlands of Vellayani and adjacent areas.
2. To identify and listen to the environmental and socio-economic problems of the study area.
3. To analyse the land use change and human intervention which caused the changes.
4. To suggest various management measures for preserving and maintaining the wetland and its resources.

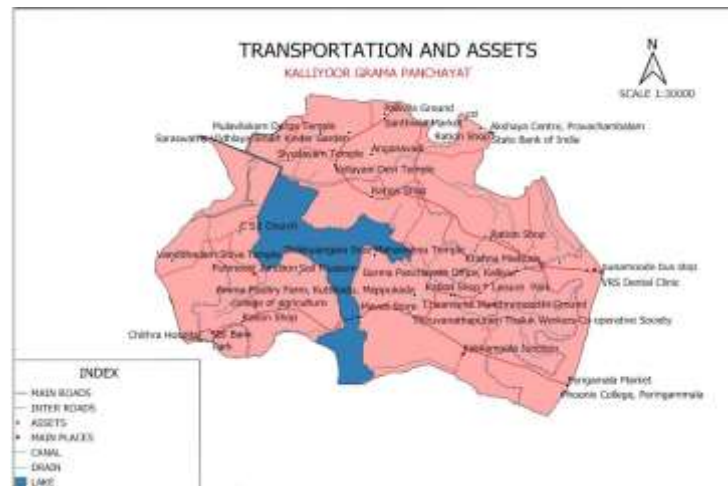
2.1 LITERATURE REVIEW

- **Douylas R. Porter and David A Salvesen:** *Collaborative Planning for Wetlands and Wildlife (Issues and Examples)*-Island press (1995). This book explains various case studies that discuss how different communities have creatively reunited problems between environmentalists and developers.
- **Gay M. Gomez:** *A Wetland Biography (Seasons on Louisiana's Chenier Plain)*, University of Texas PRESS 1990: Louisianas Chenier Plain is a marshes region of 2,200 square mile, which stretches along the Gulf of Mexico from Sabine Lake to Vermilion Bay. There are about 6000 inhabitants, they belong to Cajun and other ancestry, who follow strong cultural and economic ties to land and teeming wildlife. Gay Gomex after the deep study of Chenier plain says the relation between land, people, wildlife and uniqueness of the region and challenges it faces. He also reveals how wildlife use and appreciation can give a guidance which balances economic, cultural and biological concerns in species and protection of habitats.
- **Statewide Wetlands Strategies:** *(A Guide to Protecting and managing the resources)*-World WILDLIFE Fund-Island press 1992: This book says the comprehensive strategies of levels of public and private sectors, which coordinates and focus efforts to work towards the aim of no-net-loss of wetlands.
- **Aswathy Vijayan, Dr. Elsamma Job:** *Recreational value of Vellayani Lake in South India: A Travel Cost Approach* 2015. Published by International Journal for Scientific Research (IJSR): This journal provides the travel cost method (TCM), which acts as a consumer-oriented method used to estimate recreational values of natural resources in Vellayani Lake area.

3.1 BASIC DETAILS OF KALLIYOOR GRAMA PANCHAYAT



Number of Narrow paths	260
Number of Bridges	34
Educational Institutions (Schools and Colleges)	15
Health care centres/ Hospitals	5



4. METHODOLOGY

For a fruitful study of this kind, a large amount of data needs to be generated. Methodology is developed where both secondary and primary data are collected. This involves collection of data, collection of base maps, digitization of map and preparation of location map, drainage map, soil texture, geomorphology etc. Preparation of database for this study involves several steps.

DATA COLLECTION

Primary Data: Collected datas from the natives of panchayat area, especially farmers.

Secondary Data: Article from scientific journals, government reports, previous research and, newspaper clippings are taken.

METHODOLOGY: 1:25000 toposheet is used for preparing the base map. 1:10000 cadastral map is prepared for the field study. Using toposheet and with the intervention of GIS different types of thematic maps of the area are prepared. Relevant Maps are landuse, drainage, soil texture, slope, geomorphology, location map, boundary map etc are developed using arc QGIS software. Details of paddy fields, land use, vegetation, streams etc are collected through field survey. Problems and prospects with respect to the land, water and other resources are identified. **SATELLITE DATA:** The satellite data used in the study is acquired from the various satellites and sensors and was used in the form of geo-coded false color composite (FCC). The Survey of India (SOI) toposheets 55 L/1, 55 H/ 13 and 55 K/4 of 1:25,000 (KSLUB, Tvm) scale to study land use and land cover and also for field check and ground truth verification. Land Use/Land Cover mapping is carried out with the help of IRS-1P6 LISS IV satellite images.

CADASTRAL MAP: The cadastral map has four main purposes: Provides a cartographic record of official and sometimes private land surveys and subdivisions. Facilitates the administration and transfer of land ownership. Records land ownership. Assists in the valuation and taxation of land.

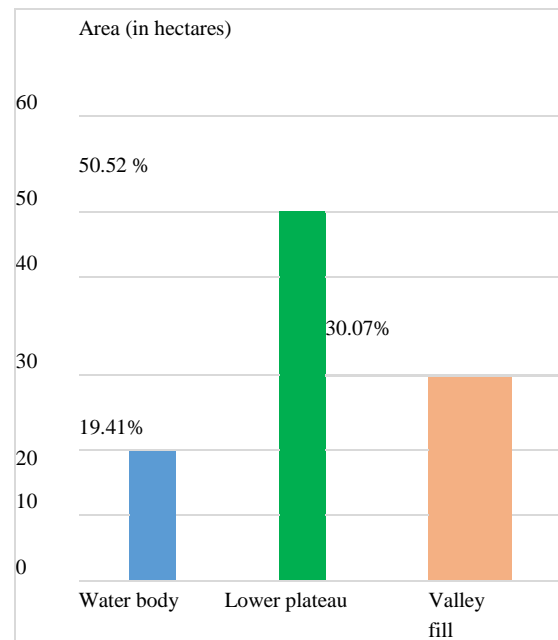
TOPOSHEET: Toposheet are detailed, accurate graphic representation of features that appear on the Earth's surface. 1:25000 Toposheet are used; The survey of India Toposheets essentially contains information about an area like roads, railways, settlements, canals, rivers, electric poles, post offices etc. they are available at different scales (eg; 1:25,000, 1:50,000 etc. Where is the former is a large scale as compared to the latter).

GEOREFERENCING: Georeferencing means that the internal coordinate system of a map or aerial photo image can be related to a ground system of geographic coordinates. The relevant coordinate transforms are typically stored within the image file (GeoPDF and GeoTIFF are examples), though there are many possible mechanisms for implementing geo referencing. The most visible effect of geo referencing is that display software can show ground coordinates (such as latitude/longitude or UTM coordinates) and measure ground distances and areas. In other words, Georeferencing means to associate something with locations in physical space. The term is commonly used in the geographic information systems field to describe the process of associating a physical map or raster image of a map with spatial locations. **QGIS:** QGIS (until 2013 known as Quantum GIS) is a free and open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data. QGIS functions as geographic information system (GIS) software, allowing users to analyze and edit spatial information, in addition to composing and exporting graphical maps QGIS supports both raster and vector layers, vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can georeference images. **REMOTE SENSING:** Remote sensing is an essential tool of land change science because it facilitates observations across larger extents of Earth's surface than is possible by ground-based observations. This is accomplished by use of cameras, multispectral scanners, RADAR and LiDAR sensors mounted on air and space borne platforms, yielding aerial photographs, satellite imagery, RADAR and LiDAR datasets. Data available from remote sensing varies from the very high resolution

5. DATA ANALYSIS AND INTERPRETATION:

In the present study, data was collected with help of kerala state land use board and randomly selected 60 inhabitants of kalliyo or grama panchayat in Thiruvananthapuram district. Data are tabulated for easy understanding and good presentation. this chapter gives the detailed information about the conservation and management of wetlands with special reference to its socio – economic impact in vellayani and adjoining area (kalliyoor grama panchayat) Following data was collected and analyzed: Physical characteristics of the region Average monthly temperature and rainfall Reasons of wetland degradation and socio-economic impact Species Diversity and extinction and use changes Problems due to wetland degradation

PHYSICAL CHARACTERISTICS OF THE REGION: GEOMORPHOLOGY: Physiographically, Kerala State has three natural regions namely, lowlands, midland, highlands. A physiographic classification, identified mainly in terms of broad geomorphic surfaces and altitudinal characteristics, is also used in the parlance of geographers (CESS, 1984). It has five physiographic zones, namely, high ranges with elevation above 600 m, foothill zone between 300 to 600 m, upland regions between 100 - 300 m, midland between 20 - 100 m and coastal areas and low land below an altitude of 20 m. (Kerala State Council for Science, Technology and Environment – 2019).



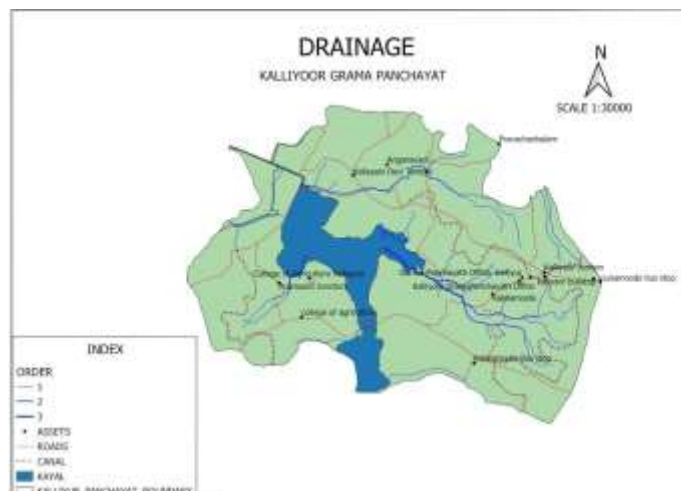
Geomorphology	Area (in hectares)	Percentage (%)
Lower Plateau (Lacteritic)	4.406	19.41
Valley fill	11.466	50.52
Waterbody	6.824	30.07

From Vandithadam to Pappanchani region of Kalliyoor Grama Panchayat consists of 'paaru' soil and about 200 feet deep sloped area. This region is under soil erosion. About 30-acre land near Vellayani Lake in Pappanchani area is marshland. The area, east side of Palapur area upto the lake is plain land. The land area from Poonkulam –Vandithadam road to the end of Vellayani kayal, the border of agricultural college is sloping towards east. This region consists of red soil which is suitable for agriculture. The land area from southeast bank of Vellayani Lake to the origin of Nedinjal thodu and south part of Peringamala road is generally red soil cover, suitable for agriculture and water drained sloped region. The area from Nedinjal thodu to lake is plain region with black soil. The area, on the east side of lake from Thrikulangara Mahavishnu temple to the north of Kakkamoola –Peringamala road contains red soiled sloped region. The area from Kakkamoola junction to NSS Karayoga building sloped towards north and ends Nearthe Lake. The half part of this hard 'paaru' sanded area slopes toward north and other part plain region. Region from the beginning and end of Kariyarathala narrow path up to Kalliyoor paddy field contain red clayee hard soil. This is a highly populated area. The western side of road from Punnamoodu junction to Kalliyoor consist of red soil plain. The land near Vellayani lake from Vellayani temple to Vellamcode, Muthukuzhi, Alarathala generally contains marsh land.

5.1.1 DRAINAGE

Order of stream	No. of stream
1st order	53
2nd order	17
3rd order	9

Order of stream	Length of stream
1 st order	536.188
2 nd order	1220.064
3 rd order	1526.434



Pallichal channel (which is the part of Neyyattinkara irrigation project) fills most of the water tanks in Kalliyoor Grama Panchayat. Apart from these springs in Kamukinkuzhi, Anakuzhi, Nedinjal Elayi has a vital role in supply of water. The backwater has two subsidiary streams that flourish the water level. Both streams originate from Peringamala, Thengupallikonam in a divergent direction of North and south. Ponds are another source Kulakottukonam, Kunnumpuram, Elatharakulam are some of them. Minnam, Kottukonam pond gives birth to a stream which ends up in backwater. The only fresh watered Backwater in Trivandrum is Vellayani, and Major portions are in Kalliyoor Gramapanchayat. Vellayani backwater which is the major supplier of fresh water to Vizhinjam harbour, Kovalam, Vengannur Trivandrum City Co-orporation. The government is about to take an effective action to reduce the risk regarding flood by deepening the backwater and convert it into a freshwater storage in future. Vellayani is a mind-blowing spot, it is one of the best tourism spots in Trivandrum, Water plants such as Lotus and many mosses are cultivated in Vellayani along with fish cultivation.

LIST OF IMPORTANT STREAMS, CHANNEL AND PONDS IN KALLIYOOR GRAMA PANCHAYAT

STREAMS

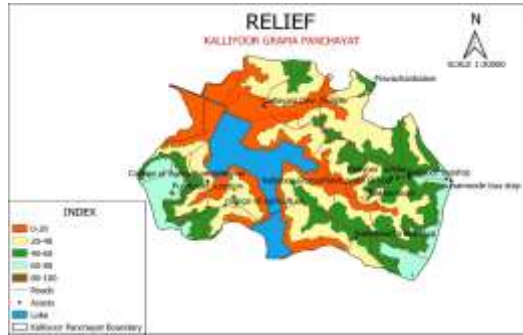
● Midstream of Pandarakkari agricultural land	● Thottuvarambil stream	● Mannam Stream
● Pallichal stream	● Panayil stream	● Vallamcod Elakkara stream
● Largestream flowing from Arattukadavu to Vellayani lake	● Nilama stream	● Minnamcode stream
● Panangottu Vilakam Stream	● Chalarathara stream	● Nedinjal stream
● Kamukinkuzhi Stream	● Pumb House stream	● Karottukonam– Kamukinkuzhi stream
● Thegumpallikonam stream	● Kalliyil Stream	● Anakuzhi-Kmukinkuzhi stream

PONDS

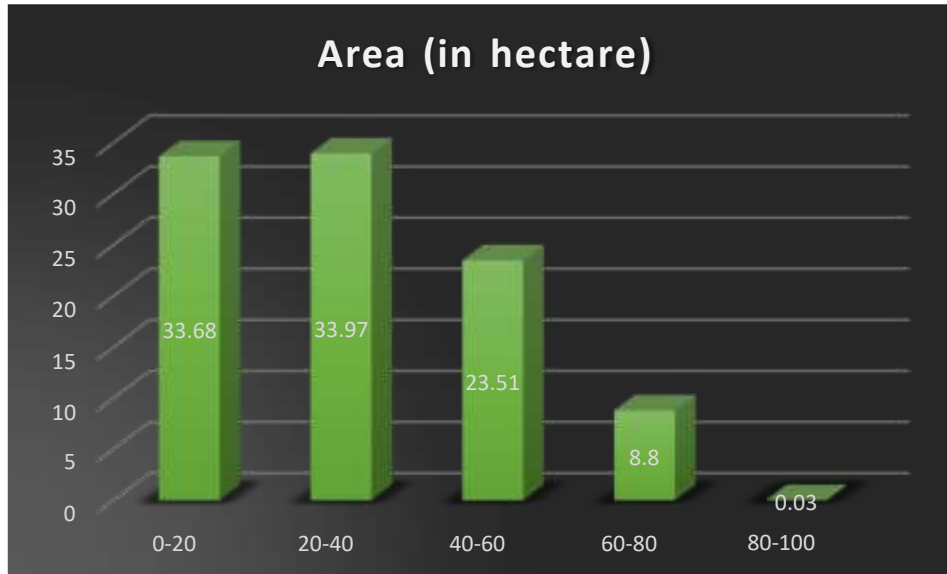
● Thennur pond	● Nilama Muthuvacodu pond	● Meppayoorkonam pond
● Paraykodu big pond	● Chemcodu pond	● Pakaloor pond
● Eraparaikodu small pond	● Ellucodu pond	● Elambilamcodu pond
● Pumripuram pond	● Veyiloorakonam pond	● Kulakottukonam pond
● Vellakam pond	● Mathoorkonam pond	● Puliya pond
● Kottukonam pond	● Vallamcodu pond	● Thengumpallikonam pond
● Kodurkulam pond	● Pakaloor Konnaycodu pond	● Mangalathukonam
● Plakuzhi pond	● Konnaikottukulam	● Vellakam pond

RELIEF

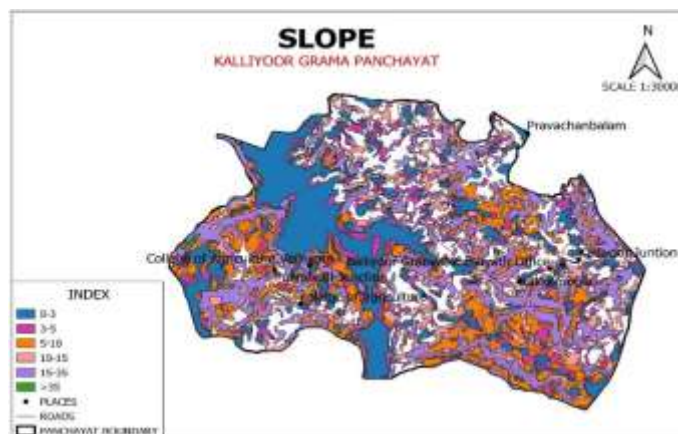
Relief is a term that represents the difference between the highest and the lowest elevation of an area. Mountains and ridges are typically the highest elevation points, while valleys and other low-lying areas are the lowest.



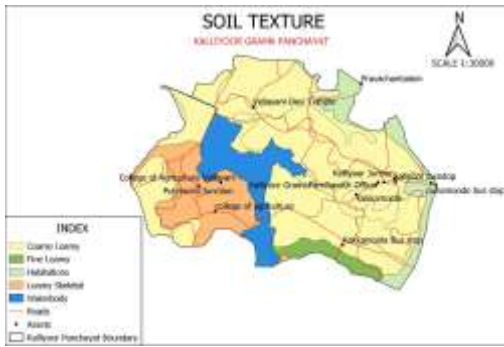
No:	Elevation	Area (in hectares)	Percentage (%)
1.	0-20	582.19	33.68
2.	20-40	587.156	33.97
3.	40-60	406.447	23.51
4.	60-80	152.128	8.80
5.	80-100	0.52	0.03



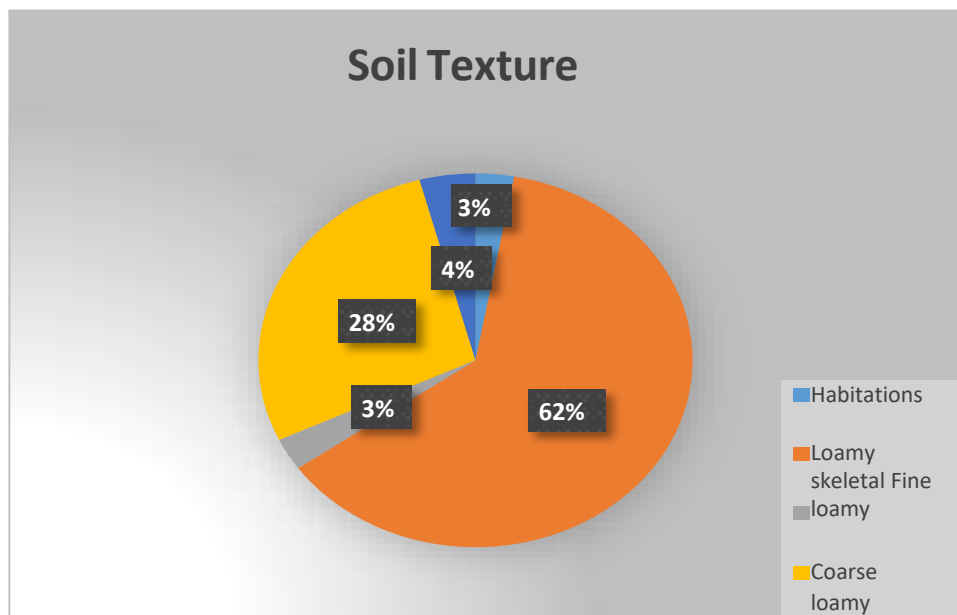
SLOPE: Slope is an important factor which directly influences the land use pattern of the region. The slope degree refers to the rate of change in elevation with respect to the horizontal over distance with lower the slope value representing flatter terrain and higher values representing steeper terrain. The nature of slope determines its susceptibility to erosion hazard. The slope and its evolution in time are governed by several environmental factors such as lithology, climate, and vegetation and the nature and intensity of various weathering processes operating along the slopes. For the present study, slope map is derived from the QGIS. The slope class was categorized as 0-3 as very gentle slope, 5°-10° as gentle slope, 10°-17° as gentle slope, 17°- 27° as moderate slope, 27°- 35° as high slope and >35° as very high slope .



SOIL TEXTURE



Soil Texture	Area(hectare)	Percentage
Coarse Loamy	134.48	27.87
Fine Loamy	2939.15	2.78
Habitations	130.81	2.85
Loamy Skeletal	1313.33	63.28
Water Body	193.95	4.15



Soils differ widely in their properties because of geologic and climatic variation over distance and time. Even a simple property such as the soil thickness, can range from few centimeters to many meters depending on the intensity and duration of weathering, episodes of soil deposition and erosion, and the patterns of landscape evolution. Soil texture, organic matter content, structure and permeability are other important factors among them. Soil texture refers to the relative proportion of clay, silt and sand. The risk of runoff is affected by small differences in texture. This is because texture influences the degree of percolation of water through the soil and the stability of soil. Soil structure refers to the arrangement of soil particles in the soil. Clay content, organic matter (and in some soils calcium and iron compounds) help to bind the soil together into structural units, aggregates or beds. Organic matter causes soil to clump and form aggregates, which improves soil structure.

The present study about the soil texture and its amount in a hectares of area of the kalliyoor grama panchayat is found that, a great part of this region consist of loamy skeletal soil, which is about 62%, followed by coarse loamy which is about 28%, 3% of habitations and 3% fine loamy.

AVERAGE MONTHLY TEMPERATURE AND RAINEALL: A swamp is defined as a wetland dominated by trees or dense shrub thickets, although in popular parlance it's commonly applied to many other soddenecosystems, including marshes, bogs, fens and mires. True swamps are found from the subarctic to the heart of the tropics, native to a significant range of climate zones. They may be permanent or seasonal in nature, and when left undisturbed, foster a wild, primal atmosphere. Swamps require adequate precipitation to feed seasonally flooded rivers and high-water tables and to collect in slow-draining depressions -- conditions met in places from tropical-wet to subarctic climate zones. However, such locations, varied as they are, must also have the correct temperature and precipitation patterns for tree or shrub growth, as the absence of a dense population of woody plants defines a waterlogged basin, rather than a swamp. Swamps that are only seasonally inundated are common in regions where hydrological patterns vary markedly across the year.

REASONS OF WETLAND DEGRADATION AND SOCIO- ECONOMIC IMPACT: Population growth: The rapid population growth, which is 1.35% per annum, is the most important factor for polluting wetlands. Intense boating activities can also increase turbidity and degradation of wetlands. Due to the rapid growth of population, the waste production from the household also increases. People throw waste around the sources of water. The waste thrown to the wetlands plays a vital role in the degradation of wetlands. **Extensive agriculture :** excessive number of fertilizers and animal waste reach in wetlands in runoff agricultural operations, including confined animal facilities can cause eutrophication.

5.1 SPECIES DIVERSITY AND EXTINCTION:

Wetlands are the most productive ecosystems in the world, comparable to rain forests and coral reefs. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals are parts of wetland ecosystem. Climate and landscape shape topology, geology and movement and abundance of water help to determine the plants and animals that inhabit each wetland. The complex, dynamic relationships among the organisms inhabiting the wetland environment are known as food web. They provide great volumes of food that attract many animal species. These animals use wetlands for part of or all of their life cycle. Dead plants' leaves and stems break down in the water to form small particles of organic material called detritus. This enriched material feeds many small aquatic insects and fishes. Species diversity in the wetlands of Vellayani and Punchakkari of Kalliyoor Panchayat is popular in the state of Kerala. Vellyani wetland regions consist of a wide variety of species and their habitats, which is largely dependent on Vellayani Lake and wetlands. There are about 60 species under 37 families of insect fauna present in Vellayani wetland regions. There about 42 fish species are seen in the Vellayani Lake. Fish breeds or species found in Vellayani Lake includes Mushi, Attu Vaala, zig-zag eel karimeen, varal etc. Punchakkari wetlands is one of the major wetlands in Thiruvananthapuram, the state capital of Kerala. This wetland is situated 6 km from the city centre. The adjacent Vellayani Lake and Punchakkari Wetlands are famous for its adobe butterflies. In all season common and uncommon species of organisms are observed here. There are about seventy species of butterflies are recorded in Punchakkari, Vellayani wetlands in 2022. From these 15 species of organisms belongs to Hesperidae family (Skippers), even species of organisms belongs to Papilionidae family (Swallowtails), ten species of organisms belongs to Pieridae family (white and yellows) ten species of organisms belongs to Lycaenidae family (Blues) and twentyfive species of organisms belongs to Nymphalidae family (Brush footed butterflies). Many rare bird species visit Vellayani during summertime. Around 160 local and migratory birds' species of 74 species including grey-headed lapwing (Russia, China), hoopoe (Israeli national bird) etc are found in these wetland regions. A large variety species of water plants like lotus, water lilly, water cabbage, african weeds etc are found here. Lotus cultivation is popular here.

EXTINCTION OF SPECIES IN WETLAND OF VELLAYANI Punaari-Vellayani wetland complex, the birding hub of the city is facing so many threats especial caused due to human activities. The fishes that record sharp decline in availability are mushi, Wallago attu and zig-zag eel, which are economically very important. One important and recent problem detected during survey was the overgrowth or dominance of the exotic African cichlid Tilapia, which affects the existed fish population there. Introduction of other species of plants and animals in wetland (alien) also leads to the destruction or extinction of native living organisms. Wide growth of water plants like African weed or water cabbages also act as a threat to aquatic ecosystem of Vellayani.

REASONS OF SPECIES EXTINCTION: Reclamation, Clearing of vegetation, Water pollution, Organic pollution, Other Chemical effluent, Sewage disposal, Garbage disposal, Regulation of water flow, irrigation, structures Mining (sand or soil), Construction of buildings, Climate change, Agricultural activities etc. **PREVENTIVE MEASURES:** Avoid pollution, which affects wetland ecosystem. Provide awareness for the need for protection of species in wetlands to the public. Ensure the development of fisheries. Avoid illegal constructional activities in wetlands. Strict legal action against sand mining in wetland region (lake). Avoid extensive use of land for agricultural purposes in wetlands and use of high chemical fertilizers and pesticide.

List of some bird species (Migratory and Local) seen in the wetlands of Kalliyoor

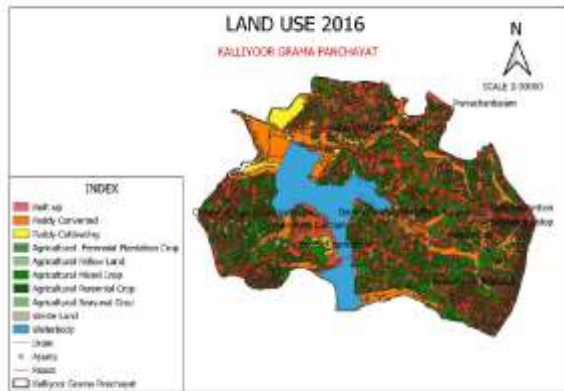
<ul style="list-style-type: none"> ● White-cheeked barbet ● Greater painted snipe ● Wood sandpiper ● Eurasian marsh harrier ● Rosy starling ● Glossy ibis ● Open-billed stork 	<ul style="list-style-type: none"> ● Black bittern ● Pale-billed flowerpecker ● Purple heron ● Great egret ● Intermediate egret ● Little egret ● Cattle egret 	<ul style="list-style-type: none"> ● Zitting cisticola ● Water cock ● Lesser whistling duck ● Cotton pygmy goose ● White-breasted waterhen
--	--	---

5.1.1 LAND USE CHANGES (WITHIN TEN YEARS):

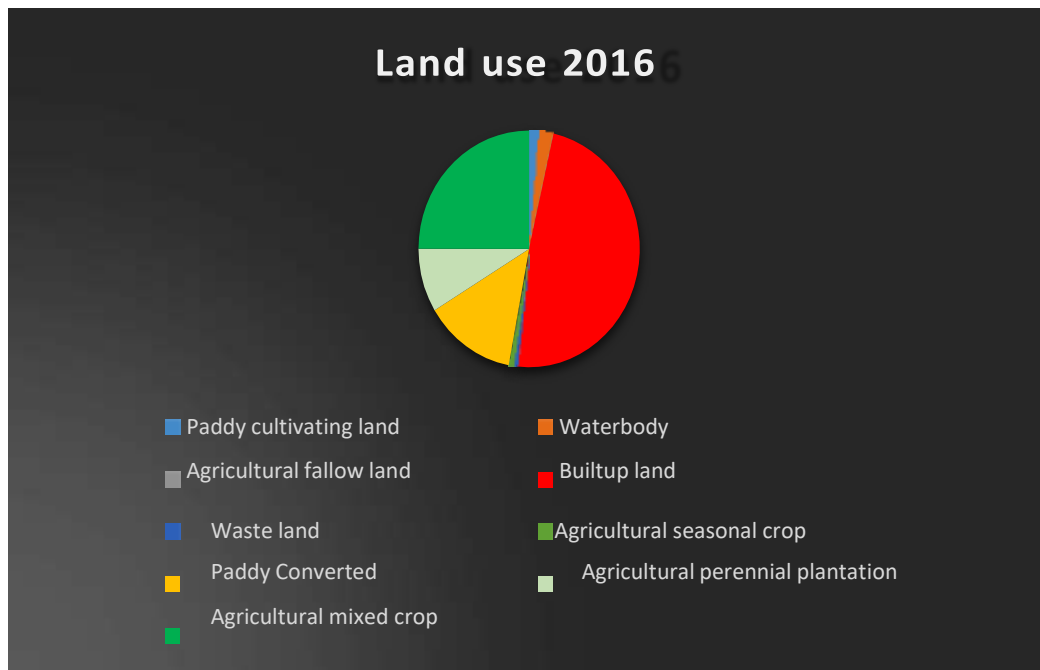
The land use of Kalliyoor Grama Panchayat is characterized by built-up areas, paddy converted land, paddy cultivating land, agricultural perennial plantation crops, agricultural fallow land, agricultural mixed crops, agricultural perennial crops, agricultural seasonal crop, waste lands and surrounded by the Vellayani Lake, which act as a key source of irrigation. The present study about the land use changes in Vellayani region in Kalliyoor within ten years is very helpful to understand great changes which happened in the land area, agriculture, farming system and development of the region very clearly.

5.1.2 LAND USE 2016:

We can easily determine from the map about the thick vegetation cover in the land area of Kalliyoor, especially regions surrounding the Vellayani Lake and a huge distribution of built-up and road networks are also present in this. Paddy cultivated land is less when is compared to passy cultivated. Agricultural mixed crops are seen more.



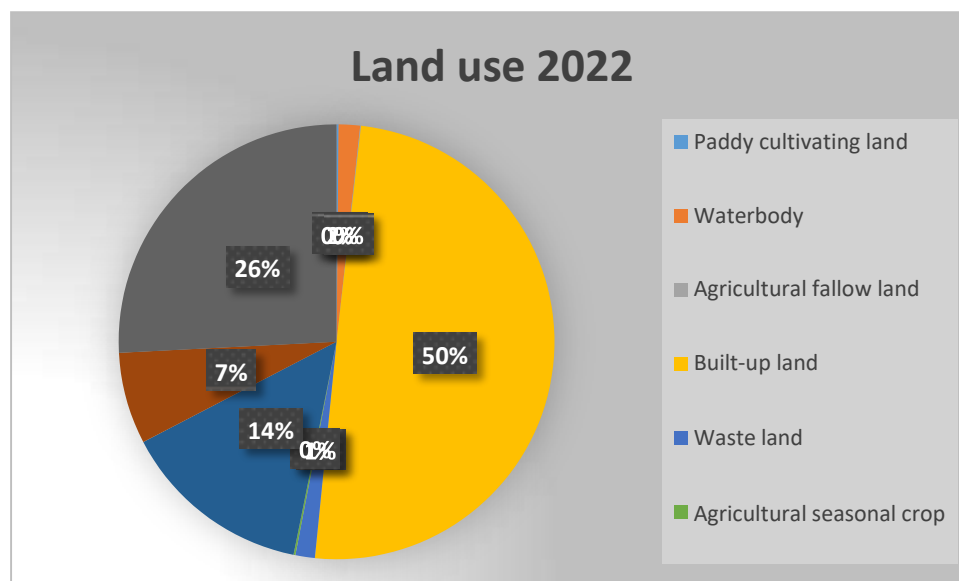
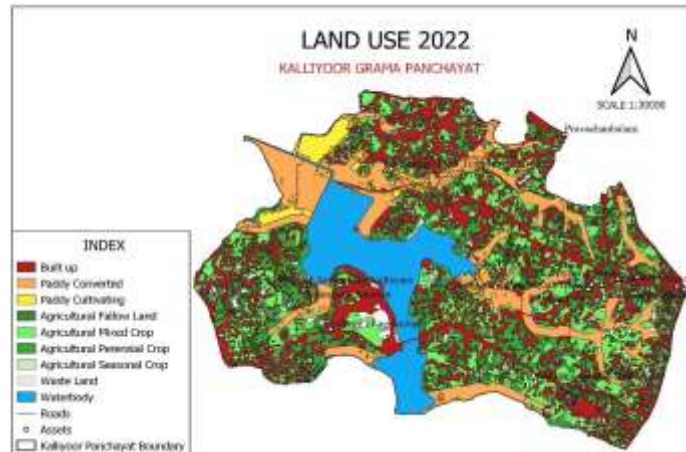
Land use	Area (in hectare)	Percentage (%)
Built up	95.03	48.19
Paddy converted	26.32	13.35
Paddy cultivating	2.76	1.39
Water body	4.24	2.16
Agricultural fallow land	49.27	0.015
Agricultural mixed crop	49.27	24.98
Agricultural perennial crop	17.16	8.70
Agricultural seasonal crop	13.31	0.67
Waste land	1.08	0.55



In 2016 it is about 95.3 hectares of land area in Kalliyoor is used for construction or built-up areas. A greater percentage of the land used for built up than other land use activities, which is about 48.19%. An area of 49.27 hectares are used for mixed crop cultivation, which is about 24.98%. Followed by paddy converted land of area 26.32 hectares that is 13.35%. 49.27 hectares of lands are agricultural fallow lands. 17.16 hectares of land is used for the cultivation of perennial crops, which is about 8.70%. Seasonal crops are cultivated in 13.31 hectares of land, and it is 0.67%. A few land areas are used for the paddy cultivation (2.76 hectares), which is about 1.39% and water body consist of 4.24 hectares, that is 2.16 percent.

LAND USE 2022: In 2022, land area of the Kalliyoor is mainly characterized with the increase in the paddy converted lands and expansion of agricultural, fallow land and mixed crops became in high level and also, we can observe the thick concentration of builtup around.

Land use	Area (hectares)	Percentage (%)
Built up	101.123	49.78
Paddy converted	28.836	0.14
Paddy cultivating	0.285	14.19
Agricultural fallow land	0.142	0.07
Agricultural mixed crops	52.443	25.81
Agricultural perennial crop	13.865	6.82
Agricultural seasonal crop	0.293	0.14
Waste land	2.929	1.44
Water body	3.241	1.59



In 2022, that is after 10 years, we can find a great change in the land use of Kalliyoor. About 101.123 hectares of land area in Kalliyoor is used for construction or built-up areas. A greater percentage of the land used for built up than other land use activities, which is near to 50%. An area of 52.443 hectares are used for mixed crocultivation, which is about 225.81%. Followed by paddy converted land of area 28.836 hectares that is 0.14%. 0.14 hectares of lands are agricultural fallow lands. 13.865 hectares of land are used for the cultivation of perennial crops, which is about 6.82%. Seasonal crops are cultivated in 0.293 hectares of land, and it is 0.14%. A few land areas are used for the paddy cultivation (0.285 hectares), which is about 114.19% and water body consists of 3.241 hectares, that is 1.59 percent. From these two maps we can easily find out the great reclamation of paddy cultivating lands, Higher level expansion of built-up areas in these wetlands, increase in amount of mixed crop cultivation, reducing water bodies etc. The above maps, land use 2016 and land use 2022- display the changes in the Vellayani and its adjoining areas of Kalliyoor Grama Panchayat and from 2016, more than half percentage paddy field reclamation is indicated and agricultural mixed crops, agricultural fallow land and high concentration of human settlement or built-up areas is highly sensational on majority area. Paddy fields reclaimed to built-up lands and used for mixed crop cultivation, fallow land etc. From the comparison of two maps in 2022 paddy reclamation is more than that to 2016, built up land and settlements are also rapidly increase in 2022 than 2016. The Vellayani and adjoining area of the Kalliyoor Panchayat consist of 24 ponds, 19 streams and so many water channels and drains are present. Both perennial and seasonal streams are present, many ponds are reclaimed, many streams are covered with algal growth etc.

LAND USE AND LAND COVER:

Land use classification schemes typically address both land use and land cover. Land cover refers to the characteristics and surface cover of Earth's surface, as represented by natural elements like vegetation, water, bare earth, impervious surface and other physical features of the land. However, land use refers to the activity, economic purpose, intended use and management strategy placed on the land by humans. (Wischmeier and Smith, 1978). There are different classification schemes that are being adopted in the country today. The major land use classification system has multiple levels of classification and these categories within those levels are arranged in a nested hierarchy. The most general or aggregated classification (level I) includes broad land use categories such as built up, agricultural land, paddy, waste land and water bodies. Within each level 1 class are a few more detailed (level II) (Wischmeier and Smith, 1978). Land use and land cover classes. For instance, the agricultural land class includes crop land, fallow land and plantation

sub classes. Within each of the level II classes, even more detailed classes (level III) are defined and mapped. Together these three levels of classification comprise a hierarchical system for Describing and monitoring land use and land cover change. This unique, standard, multi-level classification system enables to enhance spatially explicit comparisons of land use inventories conducted over time. **BUILT UP LAND:** It is an area of human habitation developed due to non-agricultural use and that has a cover of buildings, transport and communication utilities in association with water, vegetation and vacant lands. This category accounts for 101.123 hectares, which contributes to 049.78% of the total geographic area of the watershed. About 52.443 hectares (25.81 %) of the area is mixed built up which occupies the maximum area under built up class. This is followed by more than 400 roads, and number of pathways, bridges of total built up land. **PADDY:** Paddy land occupies 0.285 hectares which is 14.19 % of the total water shed area and Paddy is cultivated about 14 % of total paddy land. Paddy land converted to seasonal and perennial crop constitutes 50 % of total paddy land.

- **AGRICULTURAL LAND:** These are lands primarily used for farming and for production of food, fiber and other commercial and horticulture crops. The major level II subclasses identified in the study area are crop land, plantation and fallow land. Crop lands are the areas with standing crops. Some areas are separable from cropland and appear as large farms, or areas of land where trees are planted for commercial purposes referred to as plantation. Fallow lands are the area that cultivated but un-cropped for one or more seasons, but not less than a year. In the study area, the agriculture land accounts for 66.746 hectares which contributes to 34.28% of the total geographical area. The major cultivation under this area is mixed crops which contributes to 25.81 % of the total land area. That is, the highest area under agriculture crop is occupied by mixed crop of 52.443 hectares. An area of 10.142 hectares comes under fallow land which contributes 2.07 % of the total geographical area of the total area, 13.862 hectares of perennial crops of 6.82 % and 0.293 hectares of agricultural seasonal crops of 0.14.
- **WASTE LAND:** These are described as degraded land which can be brought under vegetative cover with reasonable effort, and which is currently utilized which is deteriorating for lack of appropriate water and soil management or an account of natural causes. In this watershed area, the major category of wasteland is barren or rocky land and quarry. The barren rockylands are rock exposures of varying lithology often barren and devoid of soil and vegetation cover. About 2.929 of land is waste land which accounts to 1.44% of the total area of the water sheds.
- **WATER BODIES:** This category comprises of areas with surface water either impounded in the form of ponds, lakes and reservoirs or flowing as streams, rivers, canals etc. Water bodies occupy a total area of 3.241 hectares of total area followed by 24 ponds and 12 streams.
- **MAJOR CROPS CULTIVATED IN KALLIYOOR**

Major Crops	Area (in hectare)
Coconut	660
Paddy	40
Plantain	136
Vegetables	50
Tuber Crops	20
Mixed Crops	50

PROBLEMS DUE TO WETLAND DEGRADATION

Change in chemical and physical properties of wetlands (such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties and pH): Sediments and water quality data demonstrate that natural reference wetlands and natural wetlands adjacent to agriculture, typically have higher concentrations of macro nutrients such as nitrogen and phosphorus, more sediment organic matter. **Extinction and reduction of wildlife:** 40 percent of species live and breed in wetlands. Now more than 25 percent of all plants and animals are at risk of extinction. They are among the most bio-diverse ecosystems. Humans over exploiting activities in wetlands is the most important cause of wetland degradation. **Many species of flora and fauna of wetlands are threatened:** Increasing amount of pollution leads to the degradation of aquatic habitat. Increasing amount of temperature due to global warming also plays an important part in the degradation of wetlands in a large scale like drying up of water bodies, etc. **Extinction of many indigenous wild and domesticated rice varieties:** Now a day's most of the farmers prefer HYVs, for the better quality and quantity of food production mainly with the use of chemical fertilizers and fertilizers rather than indigenous wild and domesticated rice varieties. **Loss of many indigenous aquatic plants, herbs, shrubs and weeds:** Aquatic plants are considered as the lungs of a lake since they play a major role in regulating turbidity and maintaining the biological oxygen demand.

SUMMARY OF MAJOR FINDINGS:

The present study is aimed at bringing out the problems faced by wetlands of Vellayani and adjoining areas of Kalliyoor Grama Panchayat in Thiruvananthapuram and its conservation and management. From the survey it has been identified that the degradation of wetland ecosystem is increasing day by day mainly due to human activities. Wetlands are the most important ecosystem which act as a natural water storing tank and protecting from flood. A wide variety of species depend on wetlands. So, there is a necessity to establish the proper measures to reduce wetland degradation by their conservation. The wetlands of Kalliyoor Grama Panchayat are a transitional zone of land ecosystem and aquatic ecosystem. These wetlands provide shelter and food for various living species. The total panchayat area consists of 19 streams and 24 ponds. Wetlands act as an ecological zone of species diversity. The wetlands of Vellayani help to sustain various ecosystems. The quality of the wetlands had been degrading due to the lack of management of

forestry, urbanization, industrialization and awareness of the people in this region. Kalliyoor consists of 50.52% of dissected lower plateau, 30.07% valley fill and 19.41% of water body. Reclamation of paddy cultivating land is very high here. 95.3 hectares of built-up area of land in Kalliyoor in 2016 is changed to 101.123 hectares today (2022). Expansion of built-up areas within ten years is very high. Wetlands of Kalliyoor are crucial for food production such as rice, vegetable, fish etc. Wetlands help in conserving the bio-diversities different plant species of wetland provide habitat for varied animal species community. The highest rainfall receiving month of Kalliyoor region is June, in which the average rainfall is about 24.9 mm. While high temperature is experienced during the months of March, April and May. We can easily find the reclamation of water body with the help of land use maps of ten years difference. 4.24 hectares of water body in 2016 decreased to 3.2 hectares, a great change occurred in its area. The wetlands of Kalliyoor have a special socio-economic and cultural importance. A great change or decrease in the arrival of migratory birds and other local birds, decrease in number of insects, butterflies, fishes, water plants (native) etc which depends on wetlands are found in wetlands of Vellayani and its adjoining areas. The wetlands of Vellayani and Punchakkari provide educational opportunities for scientific research and nature studies. These wetlands act as home to many faunal and floral species, especially water plants, local and migratory birds, butterflies, algae, fishes etc.

CONTROLLING MEASURES OF WETLAND DEGRADATION:

Strict law against illegal constructions in wetlands and disposal of inorganic wastes and chemicals. Research on wetland resources to provide scientific data and information. Identification of critical wetland habitat and their protection, data base and directory on wetlands. Provide proper guidance to the residents near for conserving wetlands. Development of Agro-tourism without harming wetland ecosystem. Avoid human activities which lead to wetland degradation like pollution, extensive agricultural practices, land tilling, sand mining, disposal of waste, use of chemical fertilizers and pesticides etc.

CONCLUSION :

The present study was about the Conservation and management of wetlands with special reference to its socio-economic impact –A case study of Vellayani and its adjoining areas of Kalliyoor Grama Panchayat. The study area covers 17.28sq.km. In this study a comparison of land use changes from 2016 to 2022 is done and many land use changes such as paddy field replacement, and shortening and water scarcity of streams, high expansion of built-up areas are identified and identified the the factors which lead to the degradation of wetland ecosystems in Vellayani. Those are analyzed and put forwarding some possible preventive measures for the identified problems. Kalliyoor is basically an agricultural village in the district of Trivandrum in Kerala which is near to the Arabian Sea. The land area of Kalliyoor is famous for its beautiful wetland and agricultural practices which carried out through it. A wetland is a geographical area with characteristics of both dry land and bodies of water. Wetlands typically occur in low lying areas that receive fresh water at the edges of lakes, ponds, streams, and rivers or salt water from tidal in coastal areas protected from waves. In wetlands the surface of the water is usually above or just below the land surface. It promotes the development of soils characteristics of a wet environment. The physical characteristics of the region are mainly depicted through a map which is constructed with the help of GIS Technique. The dominant land use categories in the study area including the buildup areas, paddy converted land, paddy cultivating land, agricultural perennial plantation crops, agricultural fallow land, agricultural mixed crops, agricultural perennial crops, agricultural seasonal crop, waste lands. Land use has changed significantly over the last ten years. Both built-up and mixed crop cultivation grew remarkably in this watershed area and the percentage of agricultural crop land declined sharply over the last years. Paddy lands experienced one of the most critical land transformations during these periods and have many environmental impacts. The paddy land shows a negative change i.e, the area under paddy cultivation is decreasing. In the study area, paddy fields observed near Punchakkari area in a small percentage. It was found that the total paddy area was reclaimed into other land uses. These types of intensive land conversion may have serious effects on the environment. Paddy fields are an important component in the agricultural ecological system. There are number of advantages of continuous paddy cultivation, such as it increases the water percolation in the area, protects springs and helps to saturate the soil etc. It is necessary to restore more paddy fields for the achievement of ecological sustainability. Also, it is observed that many perennial rivers which were perennial once are now changed to seasonal rivers. Kerala's famed wetlands face multiple threats, including rapid development activities and unscientific land use. Large scale reclamation, pollution and deforestation are also causing the area covered by wetlands to shrink, says the "Biology Richness of Kerala-Kerala State Biodiversity Board". The indiscriminate activities will have a serious negative impact on the entire ecological system. In 2004, Kerala had around 328,402 hectares of wetlands. Currently this has fallen to 160,590 hectares, a dramatic 49% decrease.

REFERENCE:

- Dr. Ramendra Chandra Barman, Dr. Devashish Kar: Wetland Management and people Participation-A study from India.
- Kailash Chandra: *Faunal Diversity in Ramsar Wetlands of India*, Published by Zoological Survey of India in 2021.
- A. Krihnakumar (National Centre for Earth Science Studies), Revathy Das (Centre for Earth Science Studies), K.G. Prijilal Swapna Johny, Dalie Dominic A: *An Overview of Wetlands in Kerala* (July 18,2019)
- U.G. Abhijna, R. Ratheesh, A. Biju Kumar : *Distribution and diversity of aquatic insects of Vellayani lake in Kerala* (Journal of Environmental Biology-JEB) 2013.
- University of Massachusetts Press (2013): Tidal Wetlands Primer-An Introduction to Their Ecology, Natural History, conservation.