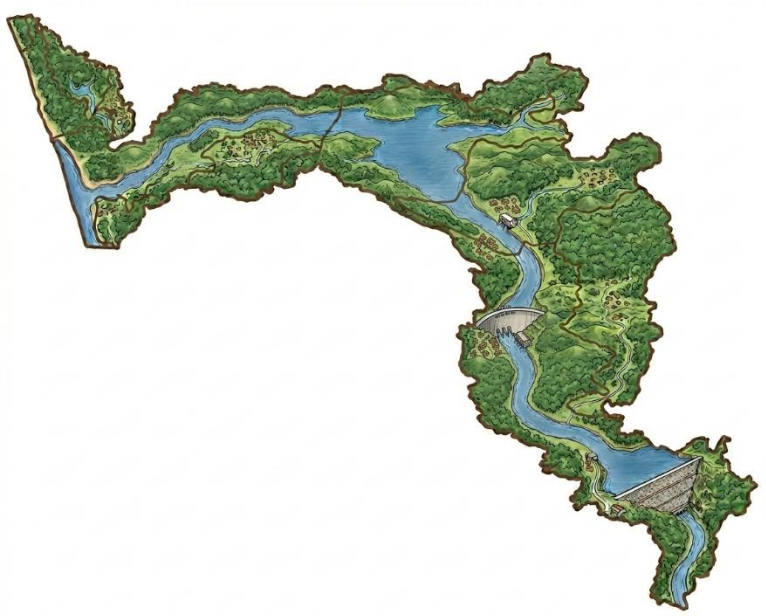
National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Waterbody Atlas

Periyar



September 2025

Waterbody Atlas

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National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

www.nrcd.nic.in

Centres for Periyar River Basin Management Studies (cPeriyar)

The Centers for Periyar River Basin Management Studies (cPeriyar) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by IIT Palakkad and NIT Calicut, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cPeriyar is committed to restoring and conserving the Periyar River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.cPeriyar.org

Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

www.cganga.org

Acknowledgment

This report is a comprehensive outcome of the project jointly executed by IIT Palakkad (Lead Institute) and NIT Calicut (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2025. We gratefully acknowledge the individuals who provided information and photographs for this report.

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Preface

Water is the most vital resource that acts as lifeline for all lifeforms and supports socioeconomic growth. The Periyar River Basin which provides for ecology, biodiversity and human life in the heart of Kerala, with a diverse system of waterbodies and river system.

The Waterbodies Atlas for Periyar River Basin acts as digital inventory for different waterbodies like ponds, lakes, check dams, wetlands tanks, large scale reservoirs and barrages in the basin. Through GIS and satellite imagery the waterbodies have been traced, and their water spread has been calculated.

With the increasing effects of urbanization, climate variability and increase in competing demands for the water as a resource it becomes essential that a database of waterbodies is required to make decisions and develop practices for better management of water as a resource. The Waterbody Atlas for Periyar River Basin is an effort that is bridging the gap of lack of data, especially spatial data that will provide to be a catalyst in developing a sustainable water resources management action plan at the local body levels.

The statistics and the detailed spatial data in this report are key to various stakeholders who play key role in decision policy framing and scientific research. As the statistics are focused on local body level, it helps the local body to include the waterbodies into development plans and also provides them with great insights for targeted planning and management of resources, while for the scientific community the insights and data in the report can act as the baseline on which further studies and changes in the region can be further be studied. The areal spread of the waterbodies, especially for the reservoirs that have vast spread area can be utilized for storage capacity assessments and flood management plans and initiatives.

This report is first step towards the continuous effort towards preparation of a digital inventory of waterbodies in the region, which can be revised with update on changes in polices. We hope that this helps in understanding waterbodies and the knowledge can be then be integrated into action plan to build better practices, legislation and development plans.

Centre for Periyar River Basin Management and Studies (cPeriyar)

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1. Introduction

Water is a fundamental component of terrestrial ecosystems and human societies, governing ecological processes, hydrological balance and socio-economic development; however, although it is a renewable resource, its availability is limited and the gap between supply and demand has been widening over time due to increasing population, urbanization and land-use change. In the context of increasing climate variability and rapid urban expansion, systematic documentation and management of surface water resources at the river basin scale have become essential for sustainable water resource planning. Kerala ranks 12th in terms of the total number of water bodies in India and 3rd in the number of water bodies located in urban areas in India according to the Waterbodies Census Report. Declining freshwater availability coupled with rising demand underscores the urgent need to conserve and efficiently manage this life-sustaining resource through watershed development, rainwater harvesting, water recycling and reuse, and the conjunctive use of surface and groundwater.

Periyar River Basin (PRB) is predominantly controlled by the South West and North East monsoons, with annual rainfall varying from less than 1000 mm to more than 5000 mm and an average of approximately 3000 mm, of which nearly 60% is contributed by the South West Monsoon (June–August) and about 25% by the North East Monsoon (September–November) (Periyar River at a Glance, cPeriyar, 2025). This monsoon-dominated hydrological regime, combined with basin physiography, necessitates the protection of existing water bodies and the creation of new water-retaining structures to ensure water availability during lean seasons, as the water resources in the state are heavily dependent on monsoonal precipitation. River basins function as integrated hydrological systems composed of interconnected water bodies such as ponds, lakes, reservoirs, wetlands and riverine hydraulic structures, which regulate runoff, enhance groundwater recharge, mitigate floods, support aquatic biodiversity and sustain agricultural and domestic water demands; however, small and medium water bodies remain inadequately represented in conventional databases despite their critical role in basin hydrology, particularly in monsoon-dominated regions, emphasizing the need for comprehensive and spatially explicit water body inventories for sustainable river basin management.

The Water body Atlas provides a comprehensive geospatial inventory of surface water bodies within the Periyar River Basin, using Google Earth satellite imagery and Geographic Information

System (GIS) techniques. Through systematic digitization and classification, the atlas identifies both natural and anthropogenic water bodies, including ponds, lakes, reservoirs, wetlands and check dams. This spatial dataset establishes a baseline for hydrological assessment, groundwater studies, flood and drought analysis and long-term monitoring of landscape changes such as encroachment and siltation. The atlas is intended to support integrated river basin management by offering a scientifically consistent and spatially explicit representation of surface water resources for planners, researchers, and policymakers.

1.1 Importance of Waterbodies

Water bodies are critical components of river basin systems and play a fundamental role in regulating hydrological, ecological and socio-economic processes. Surface water bodies such as ponds, lakes, reservoirs, wetlands and check dams contribute to groundwater recharge, regulating surface runoff, moderate floods, and sustaining base flow during dry periods. They provide essential habitats for aquatic and riparian ecosystems, supporting biodiversity and ecological connectivity. In addition, water bodies serve as vital resources for irrigation, domestic water supply, fisheries, livestock and other livelihood activities. In monsoon-dominated regions, the presence and condition of water bodies significantly influence water availability and resilience to hydrological extremes such as floods and droughts.

1.2 Concept of Waterbodies Atlas

A Water Bodies Atlas provides detailed, geospatially referenced information on the various surface water bodies within a river basin, including ponds, lakes, reservoirs and wetlands. It offers a comprehensive spatial representation of the distribution, extent, and characteristics of these water bodies, enabling a clear understanding of basin-level water resources. By integrating spatial and attribute information, the atlas serves as a valuable tool for guiding the planning, management and allocation of water resources. It supports informed decision-making by facilitating the balanced utilization of water among competing sectors such as agriculture, industry and domestic consumption, while also promoting sustainable and efficient water resource management.

1.3 Objectives of the Study

The primary objective of this study is to prepare a comprehensive Water Bodies Atlas for the study area using satellite imagery and GIS techniques.

The specific objectives of the study are:

- Identification and mapping of all surface water bodies within the Periyar River Basin, including ponds, lakes, reservoirs, wetlands and check dams.

- To generate a spatial database that can support hydrological analysis and water resource planning.
- To establish a baseline for future monitoring of changes in water bodies distribution and extent due to land-use change, encroachment, siltation or climatic variability.

1.4 Scope of the Atlas

The scope of the Water Bodies Atlas includes basin-wide mapping and spatial analysis of surface water bodies within the study area. The atlas focuses on the identification, delineation and classification of both natural and man-made water bodies using remote sensing and GIS tools. It provides information on the spatial distribution and density of water bodies across different parts of the basin, serving as a decision-support tool for water resource management, watershed development, flood mitigation and environmental conservation. The atlas is intended for use by researchers, planners, engineers and policymakers involved in integrated water resources management.

1.5 Definition of Waterbodies

In the present study, water bodies are defined as any natural or artificial surface feature that stores or conveys water for a significant duration of the year. This includes ponds, lakes, reservoirs, and wetlands, as well as engineered structures like check dams constructed across rivers. Features that are completely obscured by vegetation or cannot be reliably distinguished are excluded from the mapping process.

1.6 Classification of Waterbodies

The following types of water bodies identified within the basin:

- **Pond**: A pond is a small, shallow body of water, usually earthen in nature, although ponds with masonry dykes are also included. These water bodies are generally formed through excavation and represent a restricted hydrological environment. Ponds typically describe small water bodies that do not require the use of a boat for crossing.
- **Lake**: A lake is a relatively large waterbody surrounded by land and is not part of the ocean. Lakes are distinct from lagoons and are generally larger (>5 ha) and deeper (>5 m) than ponds, occupying natural depression in the landscape and serving as important freshwater storage systems.
- **Tank:** A tank is a shallow water body, usually larger than a pond, created by constructing earthen or masonry embankments. Tanks receive water primarily from rainfall, surface runoff,

or tube wells and are commonly used for irrigation and local water supply.

- **Reservoir**: A reservoir is a large man-made water impoundment of varying magnitude, created by constructing dams, bunds, barrages, or other hydraulic structures across rivers or streams. Reservoirs serve multiple purposes such as irrigation, hydropower generation, flood control and other water resource development activities.

- **Wetland**: A wetland is a low-lying area that is permanently or seasonally inundated with water, either fresh, brackish, or saline, and is characterized by hydric soils and vegetation adapted to saturated conditions. Wetlands include marshes, swamps, floodplains, estuaries, and coastal wetlands, and function as important transition zones between terrestrial and aquatic ecosystems. They play a critical role in flood attenuation, groundwater recharge, water purification, shoreline stabilization, and the maintenance of biodiversity by providing habitat for a wide range of plant and animal species.

- **Water Conservation Schemes**: Water conservation schemes are structures designed to improve the soil moisture regime of adjoining downstream agricultural fields for raising post-monsoon crops, often without direct irrigation. These include percolation tanks and check dams, which enhance groundwater recharge by increasing subsurface percolation, thereby contributing to improved groundwater availability.

1.7 Need for Waterbody Mapping in the Study Area

Mapping water bodies in the basin is essential due to increasing pressure on surface water resources arising from population growth, urbanization, land-use change and climate variability. In monsoon-dependent regions, surface water bodies play a crucial role in storing monsoonal runoffs and sustaining water availability during dry seasons. However, many small and medium water bodies are undergoing degradation due to encroachment, siltation and inadequate maintenance and are often missing from existing databases. A comprehensive and spatially explicit water bodies inventory is therefore necessary to assess the status of water resources, identify vulnerable and threatened water bodies and support effective planning for conservation, restoration and sustainable water resource management.

2. Data used and Methodology

The water bodies were delineated using existing point-based inventory data and high-resolution satellite imagery within a Geographic Information System (GIS) environment. Point shapefiles of waterbodies locations, including ponds, lakes, reservoirs and check dams, obtained from the

Irrigation Design & Research Board (IDRB) and Central Water Commission (CWC), were used as reference inputs to identify the spatial distribution of water bodies within the basin. The wetlands were digitised from the datasets obtained from the State Wetland Authority Kerala (SWAK). The dataset provides authoritative spatial information on the extent and distribution of wetlands. The details of the data used are shown in Table 1.

Table 1. Details of datasets used

Sl. No.	Data	Source
1	Point shapefiles of the locations of ponds, lakes, reservoirs	Irrigation Design and Research Board (IDRB) & Central Water Commission (CWC)
2	Wetland maps	State Wetland Authority of Kerala (SWAK)
3	Satellite imageries	Google Earth

The point features were overlaid on high-resolution (typically ranging from 15 cm to 15 m) satellite imagery available in Google Earth, and on-screen visual interpretation was employed to manually digitize the areal extent of water bodies by tracing their visible boundaries. The water bodies that were distinctly visible on the imagery were digitized, while those that were completely obscured by dense vegetation or tree canopy and could not be reliably distinguished in Google Earth imagery were excluded from the analysis. This approach ensured that the resulting polygon features represent visually verifiable surface water bodies while acknowledging limitations related to vegetation cover, image resolution and interpretation uncertainty.

3. Overview of Waterbodies in the Periyar River Basin

The Periyar River has a diverse range of waterbodies from large reservoirs to small tanks that makes the flow regulated and the efforts to ensure water availability to local community for their respective requirements. When the Idukki region is studied the total number of 2012 waterbodies where identified, in Table 2 detailed distribution of all the waterbodies in Idukki district of the Periyar River Basin in terms of the total spread area of each class of water body with respect to the spread area of the water body in terms of the percentage is given.

Table 2. Distribution of water bodies in Idukki district of Periyar River Basin

Sl. No	Type	Count	Area (sq. km.)	Percentage
1	Pond	1855	0.24	0.28
2	Check dam	128	0.17	0.2

3	Reservoir	11	84.2	99.45
4	Lakes	2	0.05	0.06

A close look at the table shows that the reservoirs in Idukki have the biggest effect on the area's hydrology. Other bodies of water, on the other hand, only play a small role in the area's hydrology. These bodies of water act as localized storage centers, which helps meet local water needs for things like agriculture, drinking water, and groundwater recharge. There are also roughly 140 tanks in the Idukki section of the Periyar River Basin. These tanks can hold about 8212 m3 of water, which is important for meeting localized water needs in the area. The Fig 1 a Shows the distribution of waterbody area in percentage which dominated by reservoirs while other waterbodies accoungt for less than 1% of total water spread area. The Fig 1 b shows the representation of rest of 1% of waterbodies which is dominated by ponds then check dams and lakes.

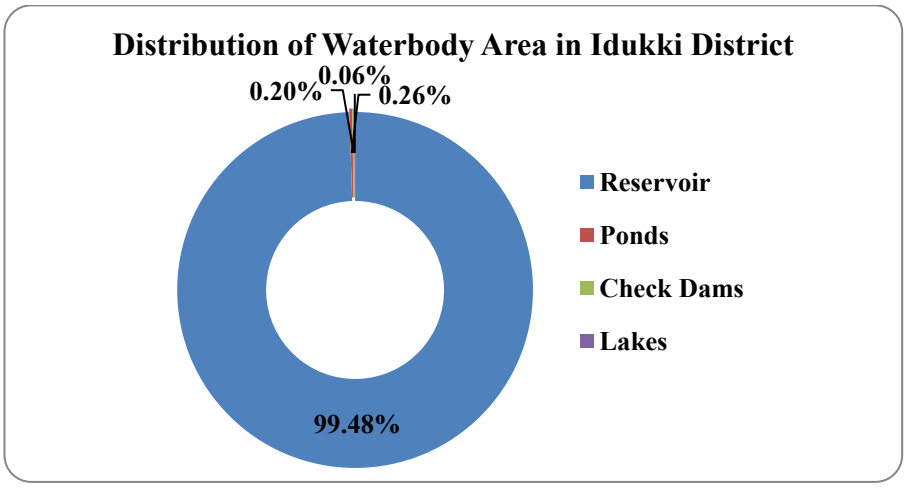

Fig 1 a: Distribution of Waterbody Area in Idukki District Periyar River Basin

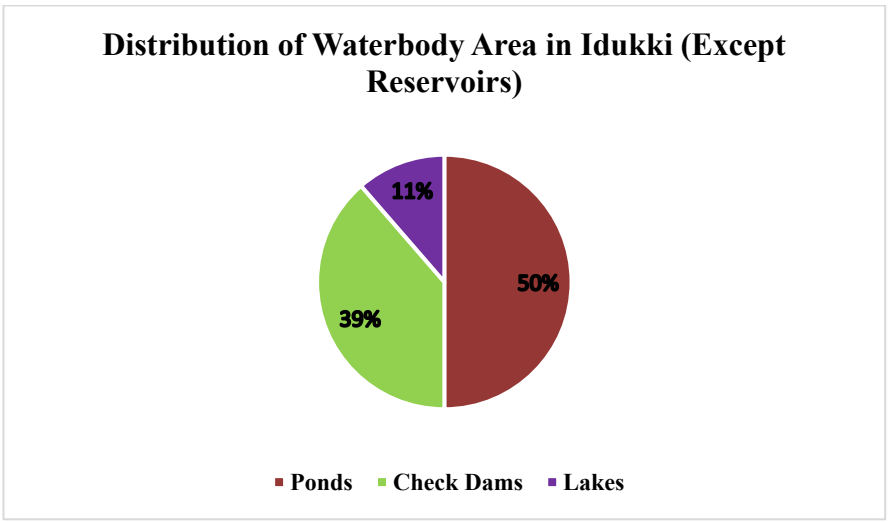

Fig 1 b: Distribution of Waterbody Area in Idukki District (Except Reservoirs) Periyar River Basin

A total of 2,198 water bodies were identified within the Ernakulam and Thrissur Districts of the Periyar River Basin using satellite imagery-based mapping. A larger share of these water bodies falls within the Ernakulam District portion of the basin. Of the total mapped water bodies, about 68% are located in the Ernakulam District area of the basin, while the remaining 32% occur within the Thrissur District area of the Periyar Basin.District.

Table 3. Type-wise distribution of water bodies Ernakulam and Thrissur

Sl. No	Type	Count	Area (sq. km.)	Percentage
1	Pond	2190	3.372	2
2	Lake	3	99.396	53
3	Check dam	2	0.003	0
4	Reservoir	1	30.965	17
5	Barrage	1	6.909	4
6	Wetland	1	45.480	24

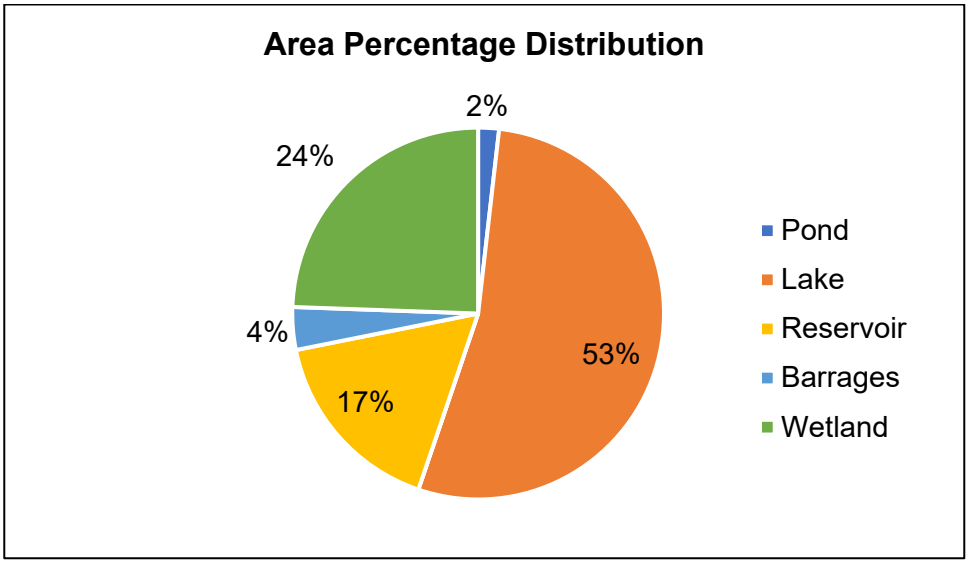

Fig 2. Area Percentage distribution Ernakulam and Thrissur

Analysis of waterbody types reveals that number of ponds dominate the inventory, accounting for 2,190, making them the most common surface water feature in the basin (Table 3). This is followed by lakes (3), while check dams (2) constitute a negligible proportion in terms areal extent. Other categories such as reservoirs, barrages and wetlands occur in relatively fewer numbers; however, despite their limited count, these water bodies contribute significantly to the total water spread area due to their larger spatial extent. Fig 2 shows that, in terms of area, lakes contribute approximately 53 % of the total waterbody area, followed by reservoir with about 17%, whereas check dams occupy the smallest share.

With respect to spatial setting, the distribution of water bodies is predominantly rural, with 90.76% (1,995) of the identified water bodies are in rural areas, while only 9.24% (203) occur within the urban areas. This pattern reflects the strong association between surface water resources and agricultural landscapes within the basin. The mapped water bodies primarily support irrigation, followed by domestic and drinking water supply and groundwater recharge. These functions highlight the critical role of surface water bodies in sustaining agricultural productivity, ensuring water security and maintaining hydrological balance within the Periyar River Basin.

4. Detailed Study of the Waterbodies in the Periyar River Basin

4.1 Dams and Reservoirs

Dams are structures that act as obstacles built across a stream to stop or control its flow, resulting in the formation of an artificial lake, which is then used to provide services such as irrigation, hydropower, industrial and domestic water supply, flood control, navigation, recreation, etc., making them an essential component of infrastructure. Despite their impact on society and the environment, the world has realized that more dams are needed to promote development and meet basic human needs. Overall, global trends concerning food, energy (including trade), water, and climate issues have emphasized the critical role of dams, thus making substantial investments in the construction and modernization of numerous projects worldwide (Kurli, 2014). The following sections will address the various aspects and characteristics of dams and other major reservoirs in Idukki and Ernakulam Districts. Fig 3 illustrates the distribution of dams and regulators within the Periyar Basin.

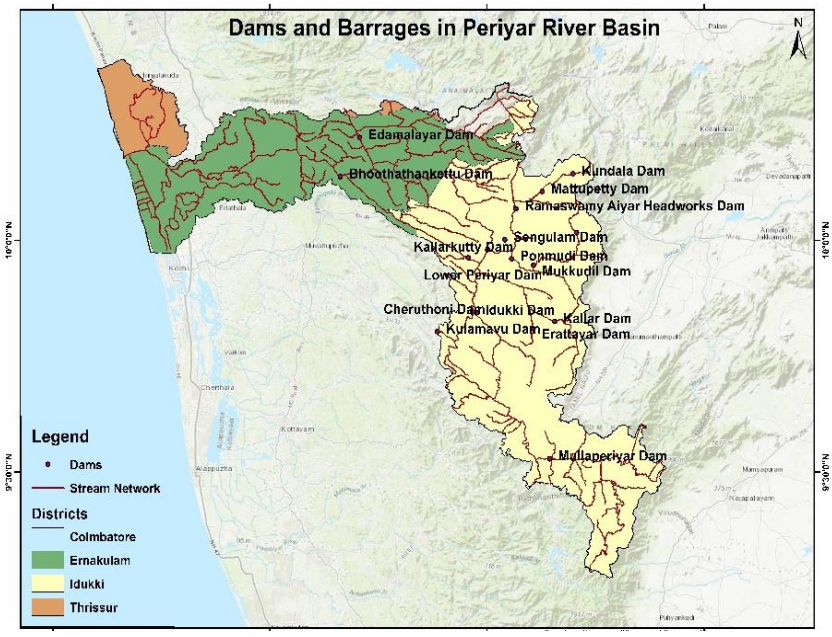

Fig 3: Major Dams and Regulators in the Periyar River Basin

4.1.1. Dams and Reservoirs in Idukki

The major dams and large reservoirs in the Periyar River Basin are concentrated in the Idukki District, where rainfall and physiography encourage large-scale storage development for various uses, including irrigation, streamflow regulation, and the production of hydroelectric power. Thus, the dams in Idukki play an important role in the hydrologic characteristics of the Periyar River by collecting excess runoff during the monsoons and regulating the release of water to ensure flow downstream across district and basin boundaries. Studying the reservoirs associated with these dams is crucial, as they represent the largest surface water bodies in the basin. Fig 4 depicts the reservoirs in Idukki, highlighting their areal extent.

In the basin according to the National Register of Large Dams the dams in Periyar River Basin in Idukki District are given in the table 4, wherein they are classified based on their respective heights.

Table 4: Dam Classification as per NRLD

Sl.No	Type of Dam	Classification Criteria (based on height)	Number of Dams	Name of Dams
1	Very High Height Dam	Greater than 100 m	1	Cheruthoni Arch Dam
2	High Height Dam	30 m > Height >100 m	6	Mattupetty, Kallarkuty, Mullaperiyar, Ponmudi, Annayarinkal, Lower Periyar
3	Medium Height Dam	15 m > Height >30 m	1	Erattayar, Kundala, Chengulam
4	Small Height Dam	Less than 15 m	3	Kallar

The Idukki Reservoir, which is the largest in the basin, has its water level controlled by three dams: Kulamavu, Cheruthoni, and Idukki Arch Dam (Sudher et al., 2019). These dams produce hydroelectric power and are part of the Idukki Hydroelectric Power Project (KSEB, 2023). Other major projects in the basin are the Pallivasal Hydroelectric Project (HEP), the Panniyar HEP, the

Sengulam HEP, and the Lower Periyar HEP. Apart from hydropower generation, the reservoir also acts as a place of recreation and tourist attraction; the reservoir of Mullaperiyar Dam forms the Periyar Lake, also called Thekkady Lake, which is a tourist attraction and acts as a vital source of water for the protected Periyar Tiger Reserve, supporting its rich biodiversity. Table 5 provides details about the dams in the Idukki region of the Periyar River Basin. While studying the water spread area, Idukki ranks the highest, followed by Mullaperiyar Dam, indicating they act as the primary storage and regulation structure, while smaller reservoirs act for the specific projects and purposes they are involved in. The detailed water spread area distribution is given in Fig 5.

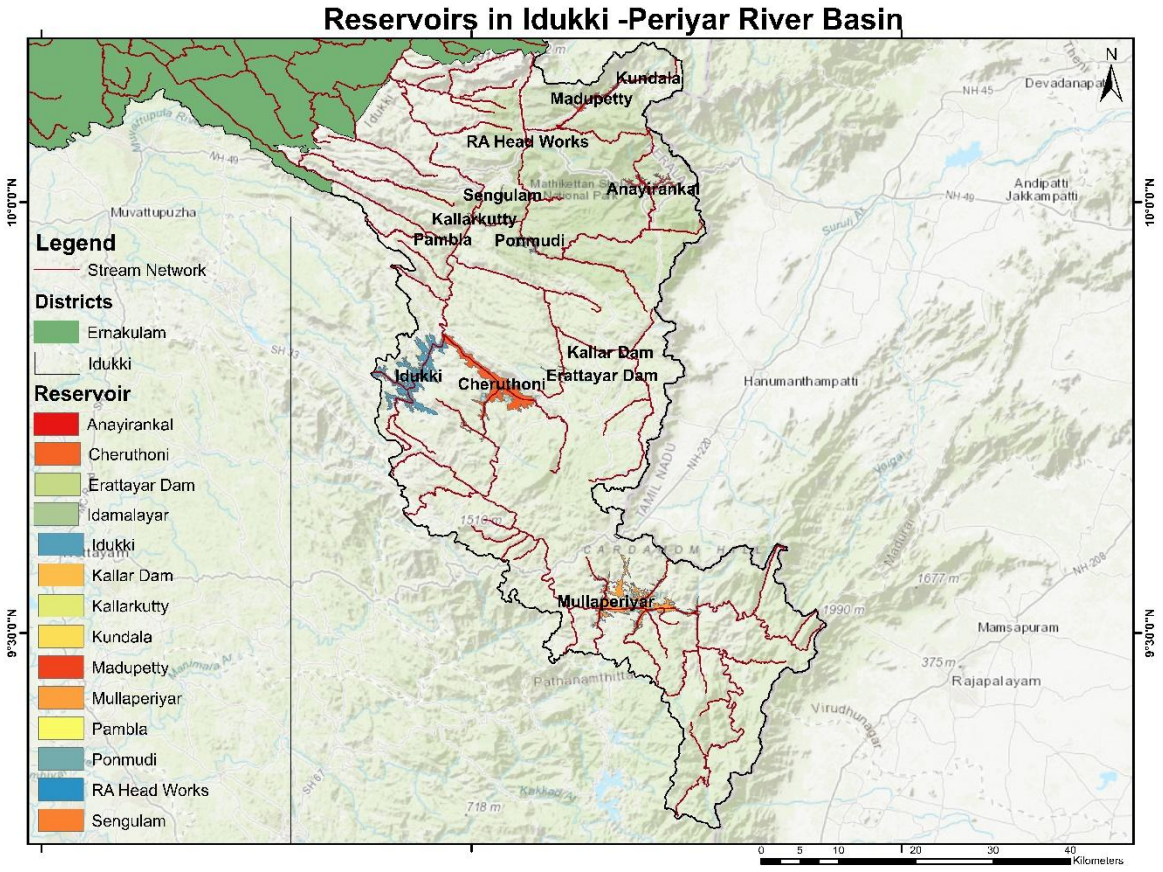

Fig 4: Reservoirs in the Idukki -Periyar River Basin

Table 5: Water Spread area of Dams in Idukki District, Periyar River Basin (Source: Open Government Portal)

Sl. No.	Dams	Block	Water Spread Area (in ha)	Max Depth (m)
1	Anayirankal Dam	Devikulam	485.60	34

2	Lower Periyar	Idukki	44.50	39
3	Kallar Dam	Nedumkandam	25.49	12
4	Erattayar Dam	Kattapana	96.00	24
5	Ponmudi Dam	Nedumkandam	278.00	58
6	Mullaperiyar Dam	Azhutha	1025.00	43
7	Idukki Reservoir	Idukki	5983.00	100
8	Kundala Reservoir	Devikulam	64.75	26
9	Kallar Kutty Dam	Adimali	65.00	43
10	Chengulam Dam	Adimali	29.10	27
11	Mattupetty Dam	Devikulam	323.70	84

When analysed in detail the Idukki dam and Mullaperiyar dam contributes to about 83% of total water spread area of the reservoir in the region. This combined effect signifies the role that these reservoirs play in the hydrological character of the basin in the highly regulated upstream region. The rest of the dams contribute to smaller amounts indicating that they play a role in local requirements and sub basin level management and regulation of flow. Also, it was observed that there is a non-liner relationship between the depth and water spread area between the max depth and water spread area indicating that the storage capacity is majorly governed by the basin morphology.

When the water holding capacity was studied in the dams it has been found out that there has been a huge hit on the total holding capacity of the dams. Table 6 gives the detailed information on the

sharp decline in the total capacities in the dams in Idukki region of Periyar River Basin.

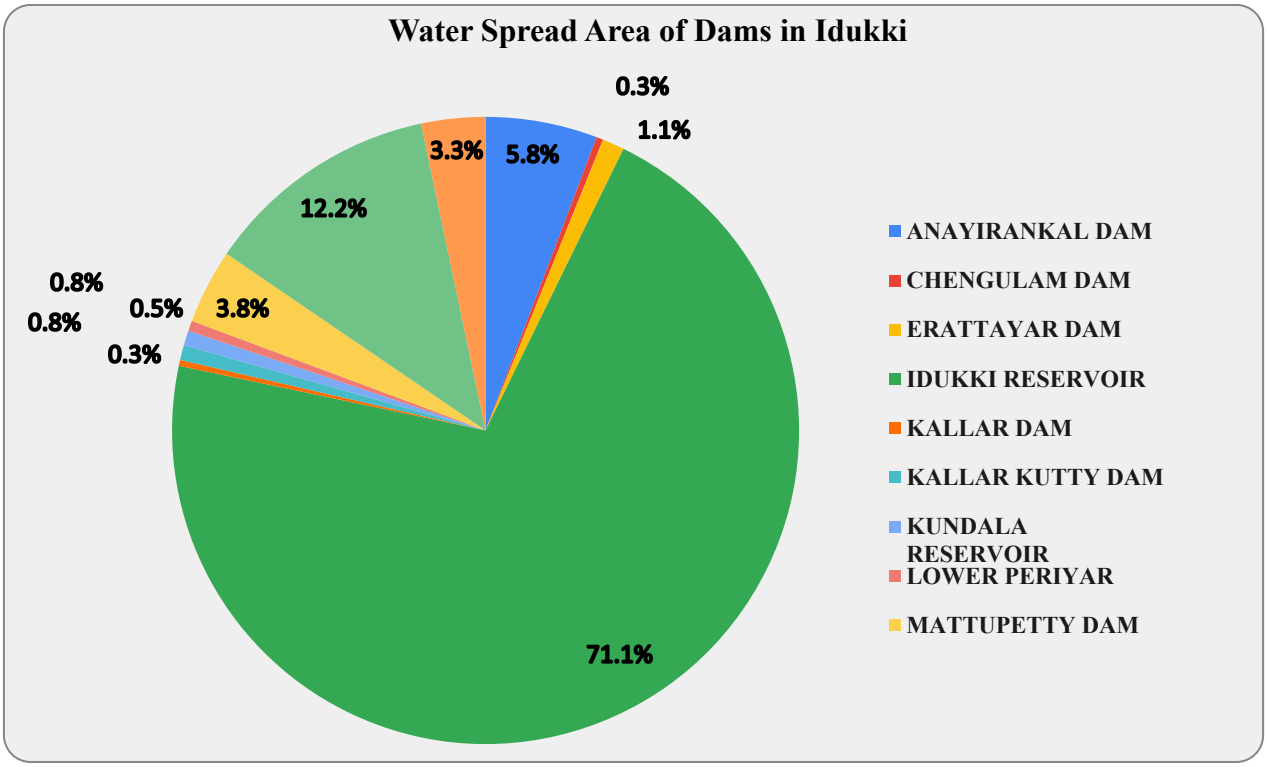

Fig 5: Percentage breakdown of water spread area of Dams in Idukki Periyar River basin

The data clearly indicates that there has been reduction in the capacities of the dam in the region. About 60% combined decline in the total capacity has been observed in the region. The sharpest decline was studied in the case of Idukki reservoir; the decline was about 78% other significant declines were observed in the case of Lower Periyar 54% and Kallar dam 60%, based on the data obtained from the Open Government Portal. These reduction in storage capacity has serious implications on flood mitigation and management, hydropower generation and drought resilience. This sharp decline in capacity can be attributed to heavy sediment inflow and long-term silt accumulation. Fig 6 illustrates the reduction in capacity of dams in Idukki region of the Periyar River Basin as a fraction of the percentage drop in the total capacity of the dam over the period.

Table 6: Comparison of Dam capacities of the Dams in Idukki District, Periyar River Basin (Source: Open Government Portal)

Sl. No.	Dams	Block	Original Capacity (MCM)	Storage Capacity at Present (MCM)
1	Anayirankal Dam	Devikulam	49.84	40.87

2	Lower Periyar	Idukki	4.55	2.1
3	Kallar Dam	Nedumkandam	0.76	0.3
4	Erattayar Dam	Kattapana	5.3	2.5
5	Ponmudi Dam	Nedumkandam	51.54	41.706
6	Mullaperiyar Dam	Azhutha	443.23	352.5
7	Idukki Reservoir	Idukki	1459.4	320
8	Kundala Reservoir	Devikulam	7.65	7.34
9	Kallar Kutty Dam	Adimali	6.75	3.75
10	Chengulam Dam	Adimali	2.04	1.3
11	Mattupetty Dam	Devikulam	55.23	54.07

Details of the Major Dams in Idukki are given in the table 7a to 7j respectively.

Table 7a: Details of Idukki-Cheruthoni Dam

Idukki-Cheruthoni Reseerviors	
Total Catchment Area	526.28 km^2
Full Reservoir Level	732.62 m
Maximum water level	734.3 m
Minimum draw down level	694.94 m
Dead storage (below MDDL)	536.79 Mm^3
Effective storage (above MDDL)	1017.8 Mm^3
Water spread area at FRL	59.83 km^2

Table 7b: Details of Kallar Dam

Kallar Dam	
Catchment Area at Dam Site	187 km^2
Full Reservoir Level	824.5 m
Maximum water level	824.5 m
Minimum draw down level	816.86 m
Live Storage Capacity	0.76 Mm^3
Gross Storage Capacity at FRL	0.79 Mm^3
Water spread area at FRL	0.25 km^2

Table 7c: Details of Erattyar Dam

Erattyar Dam	
Catchment Area at Dam Site	68.80
Full Reservoir Level	754.40 m
Maximum water level	754.40 m
Minimum draw down level	816.86 m
Gross Storage Capacity at FRL	5.35 Mm^3
Water spread area at FRL	0.96 km^2

Table 7d: Details of Kallarkutty Dam

Kallarkutty Dam	
Catchment Area at Dam Site	758.87 km^2
Full Reservoir Level	456.60 m
Maximum water level	456.60 m
Minimum draw down level	438.90 m
Live Storage Capacity	6.52 Mm^3
Gross Storage Capacity	6.8 Mm^3
Water spread area at FRL	0.65 km^2

Table 7e: Details of Madupetty Dam

Madupetty Dam	
Catchment Area at Dam Site	60.50 km^2
Full Reservoir Level	1599.99 m
Maximum water level	1599.99 m
Minimum draw down level	1568 m
Live Storage Capacity	54.77 Mm^3
Gross Storage Capacity at FRL	55.23 Mm^3
Water spread area at FRL	3.24 km^2

Table 7f: Details of Sengulam Dam

Sengulam Dam	
Catchment Area at Dam Site	5.18 km^2
Full Reservoir Level	847.65 m
Maximum water level	849.49 m
Live Storage Capacity	0.76 Mm^3
Gross Storage Capacity at FRL	0.79 Mm^3
Water spread area at FRL	0.29 km^2

Table 7g: Details of Kundala Dam

Kundala Dam	
Catchment Area at Dam Site	36.24 km^2
Full Reservoir Level	1758.69 m
Maximum water level	1759.30 m
Minimum draw down level	1735.84 m
Live Storage Capacity	7.65 Mm^3
Gross Storage Capacity	7.78 Mm^3
Water spread area at FRL	0.65 km^2

Table 7h: Details of Lower Periyar Dam

Lower Periyar Dam	
Catchment Area at Dam Site	584.00 km^2
Full Reservoir Level	253.00 m
Maximum water level	256.00 m
Minimum draw down level	237.44 m
Live Storage Capacity	4.55 Mm^3
Gross Storage Capacity	5.35 Mm^3
Water spread area at FRL	.445 km^2

Table 7i: Details of Anayirankal Dam

Anayirankal Dam	
Catchment Area at Dam Site	64.92 km^2
Full Reservoir Level	1210.01 m
Maximum water level	1210.07 m
Minimum draw down level	1188.10 m
Gross Storage Capacity	50.97 Mm^3

Table 7j: Details of Ponmudi Dam

Ponmudi Dam	
Catchment Area at Dam Site	221.75 km^2
Full Reservoir Level	708.66 m
Maximum water level	707.75 m
Minimum draw down level	676.65 m
Gross Storage Capacity	51.536 Mm^3

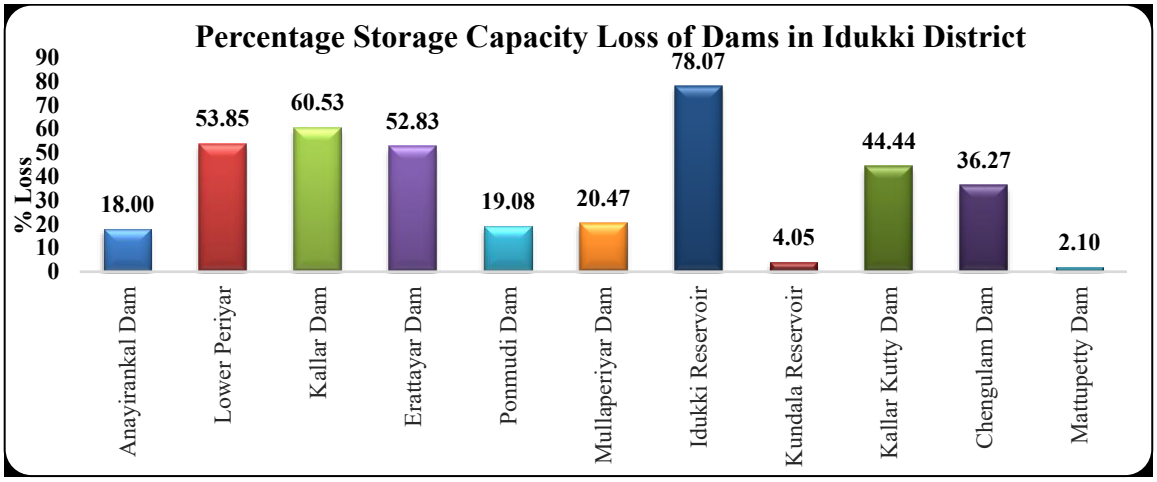

Fig 6: Percentage breakdown of Loss in Storage Capacity of Dams in Idukki Periyar River basin

4.1.2. Dams Reservoirs and Barrages in Ernakulam

The Idamalayar Project is a hydroelectric scheme located in Ernakulam District, Kerala. The Idamalayar Dam is a multipurpose concrete gravity dam constructed across the Idamalayar River at Ennakkal and is operated by the Kerala State Electricity Board (KSEB) to augment peak power generation requirements. The Idamalayar Reservoir (Fig 7) is an artificial freshwater reservoir formed by this dam across the Idamalayar River, a major tributary of the Periyar River (CWC, 2020).

The Idamalayar dam is classified as a very high dam, with a total height of 102.4 m and a crest length of 373 m. The reservoir has a gross storage capacity of 1,089.8 million cubic metres (Mm^3) and a water spread area of approximately 30.96 km^2 at Full Reservoir Level (FRL), making it the second-largest reservoir in Kerala (Table 8). The large reservoir created by the Idamalayar Dam supports the Idamalayar Irrigation Development Project by diverting water released from the tailrace channel of the Idamalayar power station. The project envisages the utilization of water from 381 km^2 of the Idamalayar catchment, in addition to releases from the Nirar weir/dam, proposed in the upper Idamalayar catchment under the Parambikulam–Aliyar Project (Room for River, Periyar, n.d.).

The Idamalayar Hydroelectric Project was commissioned in 1987 and consists of two Francis-type vertical turbines, each with a capacity of 37.5 MW. The project has an annual energy generation potential of about 380 million units (MU), with an average generation of 0.25 MU per million cubic metres (MCM) of water (Kerala State Electricity Board Limited [KSEB], https://kseb.in.). After power generation, tail race water from the powerhouse is collected in the barrage at Bhoothathankettu, constructed across river Periyar. Because of its reservoir capacity, Idamalayar

generation is kept minimum during monsoon period. The main source of water inflow into dam is natural inflow in the catchment area (Idamalayar 380.79 m^2 & Nirar 101m^2) and the water available through the Vachumaram discharge from Poringal during monsoon. After power generation, tail race water from the powerhouse is collected in the barrage at Bhoothathankettu, constructed across the Periyar River. Its large storage capacity plays a crucial role in hydropower generation, seasonal flow regulation, and water storage within the Periyar River Basin. By enabling effective monsoon water retention and controlled downstream releases, it contributes significantly to energy security and sustainable water resource management in central Kerala.

Fig 7. Aerial imagery of Idamalayar Reservoir

Table 8. Details of Idamalayar Reservoir

Idamalayar Reservoir	
Full Reservoir Level	169.0 m
Maximum water level	171.0 m
Minimum draw down level	115.0 m
Gross storage at MWL	1153.0 Mm^3
Gross storage at FRL	1089.8 Mm^3
Dead storage	72.0 Mm^3
Live storage at FRL	1017.8 Mm^3
Live storage up to top of the gates	1032.3 m^3
Water spread area at FRL	30.96 km^2

Bhoothathankettu Barrage is a diversion structure constructed across the Periyar River near Bhoothathankettu in Pindimana Grama Panchayat of Ernakulam District. The scheme has a total

catchment area of 3,048 km² and comprises the barrage along with an extensive canal network (Fig 8). It functions as an important downstream hydraulic structure associated with the Idamalayar Hydroelectric Project, regulating and utilizing the tailrace discharge from the Idamalayar powerhouse. Water released from the Idamalayar Hydroelectric Project is intercepted at the Bhoothathankettu Barrage and diverted through a right bank canal system as part of the Idamalayar Irrigation Project. The irrigation scheme provides benefits to both wet and dry agricultural lands, covering a total ayacut area of 14,394 hectares (35,570 acres), of which the cultivable command area is 13,209 hectares (32,640 acres), and the associated water spread extends over an area of approximately 6.91 km² (Table 9). The project has been under implementation since 1981.

In addition to irrigation and flow regulation, the Bhoothathankettu Barrage supports power generation through the Bhoothathankettu Small Hydroelectric Project, an ongoing initiative of the Kerala State Electricity Board Limited (KSEBL). The project has an installed capacity of 24 MW, consisting of three horizontal bulb turbines of 8 MW each, with an expected annual energy generation of 83.5 Million Units (MU). The proposed powerhouse is in proximity to the Periyar Valley Irrigation Project barrage and utilizes regulated releases from upstream hydropower stations along with inflows from its local catchment. The scheme is planned as a runoff the river scheme utilizing the storage of the existing reservoir of the Periyar Valley Irrigation Project less its irrigation releases (Kerala State Electricity Board Limited [KSEB], https://kseb.in).

Table 9. Details of Bhoothathankettu Barrage

Bhoothathankettu Barrage	
Full Reservoir Level	34.95 m
Gross Storage Capacity	60 TMC
Lowest Riverbed Level	23.1 m
Top Level of Barrage	45.89 m / 44.67 m
Length of Barrage	210.92 m
Spillway	5 Nos.
Sluice Gates	3 Nos.
Water spread area at FRL	6.91km^2

The barrage plays an important role in flow regulation, irrigation support and water supply in the lower reaches of the Periyar River Basin. By controlling the discharge from the hydropower project, it helps in maintaining environmental flows, especially during lean seasons and supports agricultural activities in the surrounding regions. In addition to its hydrological importance, the

barrage contributes to flood moderation during high inflow periods and ensures efficient utilization of water released after power generation.

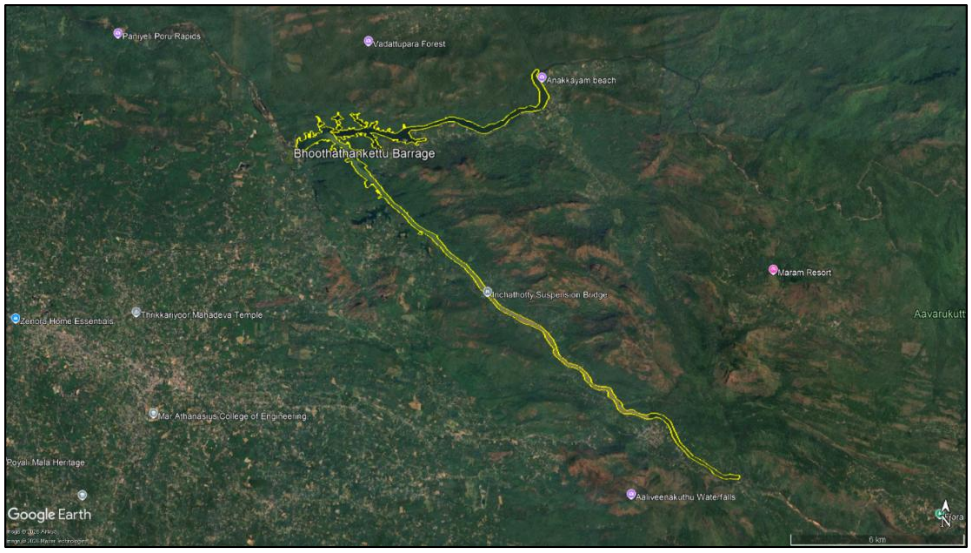

Fig 8. Aerial Imagery of Bhoothathankettu Barrage

4.2 Check dams

Check dams are classified as water harvest structures that are constructed across small streams, gullies, etc., to slow down the surface runoff and slow the sediment deposition. They are much smaller in scope in comparison to large reservoirs and thus can be implemented with far fewer resources or technical know-how (Tripura Forest Department). For Waterbody Atlas they come under the class of water conservation structure, signifying the role they play in conservation practices. Check dams act as in channel Managed Aquifer Recharge structure capturing monsoon runoffs. (Mozzi et al, 2021). Fig 9 is an image of a check dam in Idukki part of the Periyar River Basin.

Fig 9: A check dam in Idukki- Periyar River Basin (Source: Google Maps)

4.2.1 Check dams in Ernakulam

There are two check dams in this region, both located in the Kuttampuzha Grama Panchayath of

Ernakulam District (Fig 10). The check dams together make an area of 0.0027 km^2 which contributes a negligible area to the overall water bodies present in the Ernakulam and Thrissur Districts. Check dams play a significant role in enhancing water security by promoting groundwater recharge, regulating streamflow, and reducing soil erosion. Their presence supports local water availability, agricultural activities, and ecological sustainability, particularly in regions with seasonal water scarcity (CGWB, 2013).

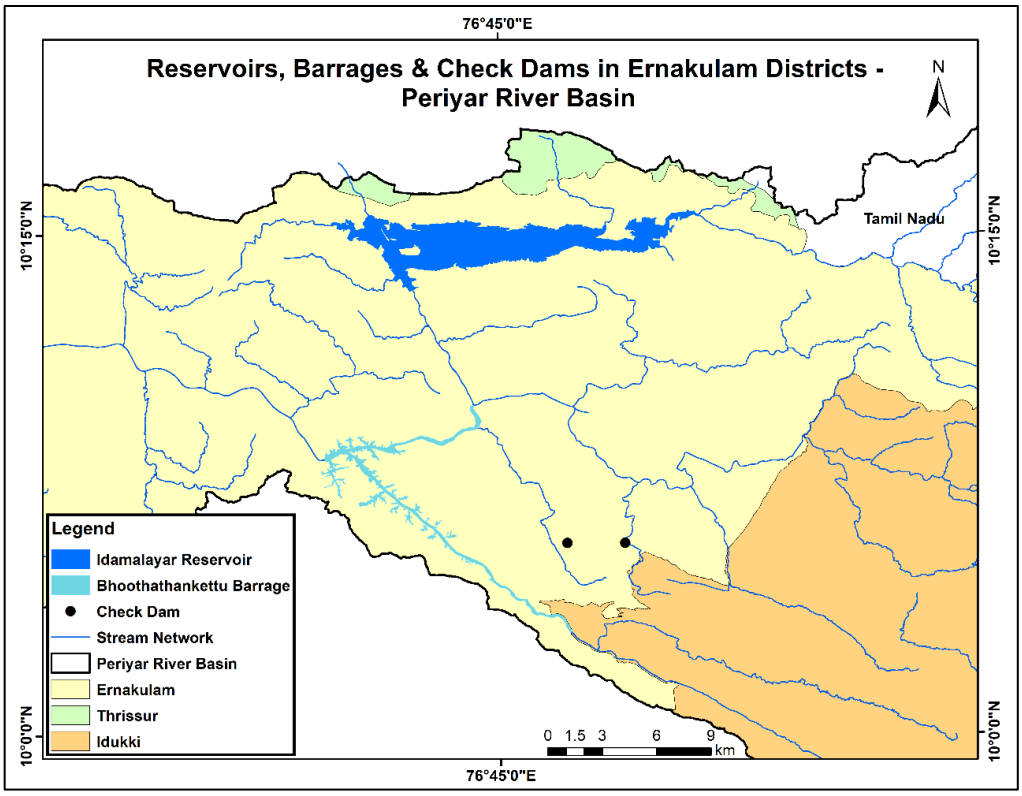

Fig 10: Map of reservoir, barrage and check dams in Ernakulam District

4.2.2 Check dams in Idukki

In Idukki Region there are a total of 127 check dams that are spread across the basin. Fig 10 illustrates the variation of the dams spread across the Idukki Region in the Periyar River Basin. While studying the spatial variability of these structures it has been observed that Adimaly has the highest number of check dams having a total of 31 structures in the Adimaly Panchayat, followed by Vandanmedu and then by Kumily, this exhibits that the structures are clustered in few regions. A detailed distribution of check dams is illustrated in table 10. In fig 11 the location of checkdams in Idukki is represented.

Table 10: Distribution of Check dams (Panchayat Wise) - Idukki District

S.No	Panchayat	Number of Check Dams
1	Adimaly	31
2	Vandanmedu	13
3	Kumily	12
4	Nedumkandam	7
5	Santhanpara	7
6	Udumbanchola	7
7	Vandiperiyar	6
8	Rajakkad	5
9	Munnar	5
10	Pampadumpara	4
11	Rajakumari	4
12	Senapathi	3
13	Elappara	3
14	Konnathady	3
15	Udumbannoor	2
16	Peerumade	2
17	Chinnakanal	2
18	Pallivasal	2
19	Upputhara	1
20	Ayyappancoil	1
21	Kattappana	1
22	Chakkupallam	1
23	Vathikudy	1
24	Vellathooval	1
25	Bisonvally	1
26	Irattayar	1
27	Kamakshy	1

While observing the data for the total water spread area it has been observed that despite having fewer number of structures Vandiperiyar has the highest value for total water spread in the region followed by Peerumade and Kumily, this illustrates that the number of structures and water spread

area need not required to go hand in hand. The variation in Number of check dams and Water spread area implies that in region there can be high density small capacity check dams and in other regions there can be low density large capacity check dams are present. Fig 12 represents the top panchayats along with their water spread area in m^2.

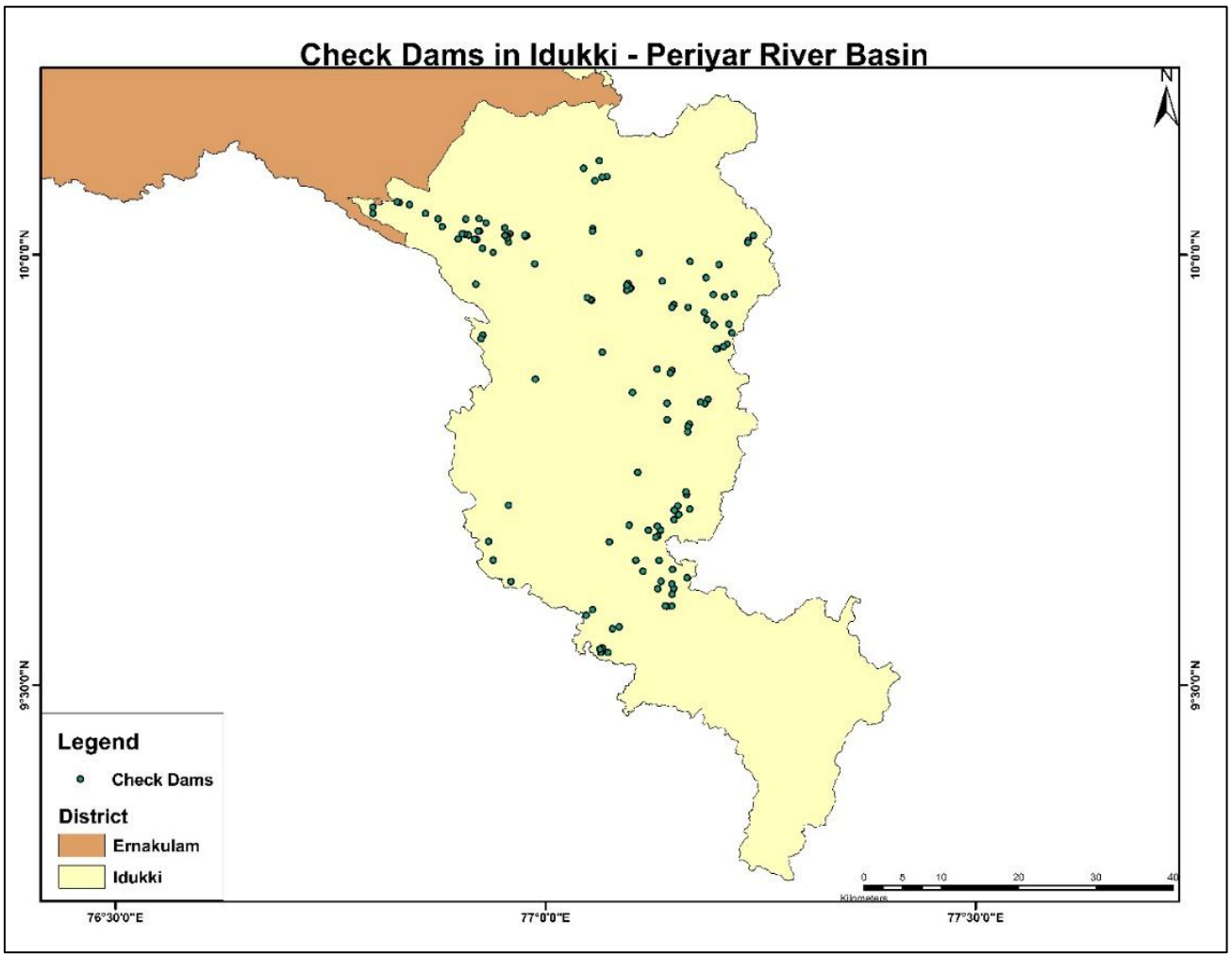

Fig 11: Distribution of Check dams in Idukki Periyar River Basin

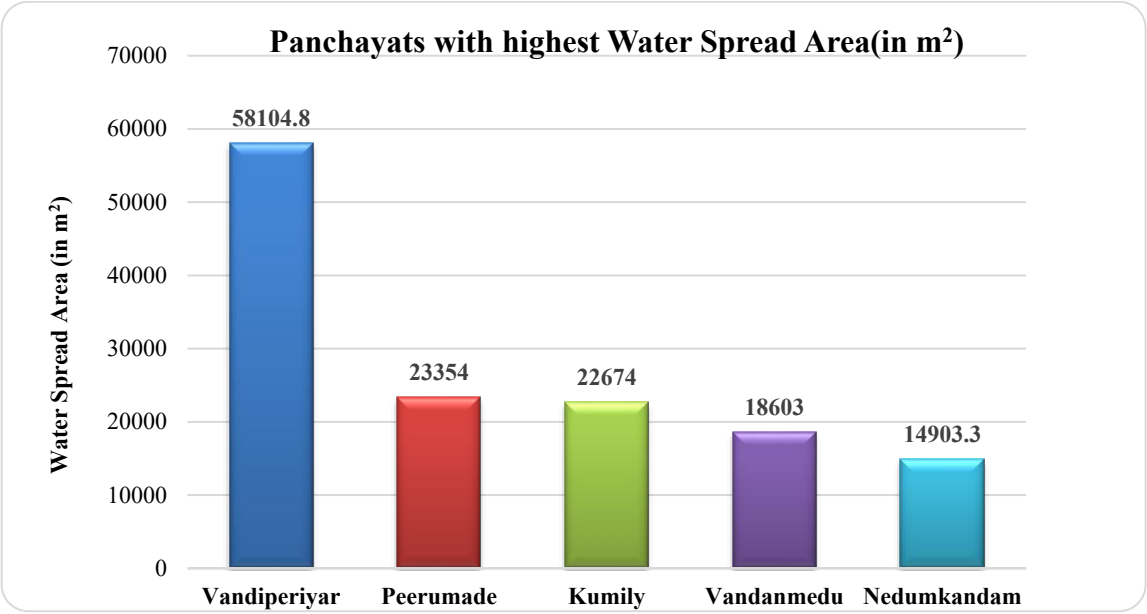

Fig 12: Panchayats with highest Water Spread Area for check dams in Idukki Periyar River Basin

4.3 **Tanks**

Tanks are man-made structures that are built to store surface runoff, which is then utilized for irrigation, domestic, livestock, and other applications. The National Waterbody Inventory classifies tanks as surface water storage systems along with ponds and reservoirs (PIB, 2023). In the subsequent section, tank distribution in the Periyar River Basin is provided. Fig 13 shows an image of tank in Idukki region

Fig 13: A tank in Idukki- Periyar River Basin (Source: Google Maps)

4.3.1 Tanks in Idukki

Tanks in Idukki constitute a major component of surface water bodies, which are traditionally used for local water storage, irrigation, and other purposes. A total of 134 water tanks were present in the Idukki region of the Periyar River Basin, and the fig 14. shows the distribution of tanks in the Idukki district of the Periyar River Basin.

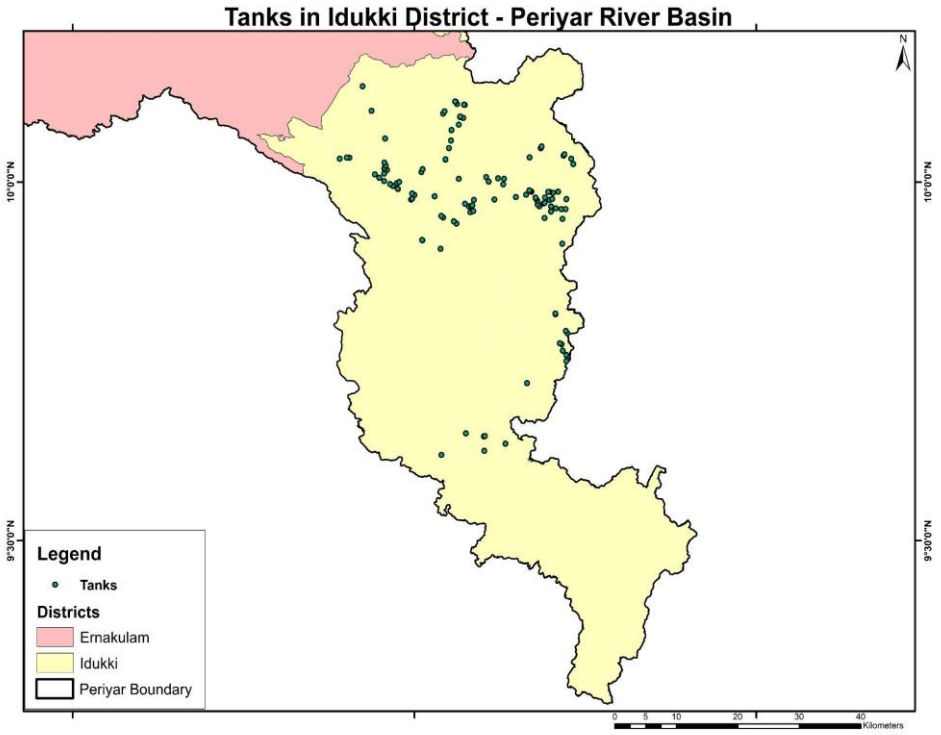

Fig 14: Tanks in Idukki-Periyar River Basin

The compiled tank data indicates that these structures vary significantly in their spatial distribution, with a heavy concentration of tanks in a few districts, leading to a localized dependence on them. The fig 15 provides a detailed distribution of tanks across each panchayat in Idukki.

The Santhanapara panchayat exhibits the highest density of tanks, followed by Adimaly and Munnar. Panchayats like Karunapuram, Vellathooval, Pallivasal, Chinnakanal, and Rajakkad exhibit a moderate tank density, and Mankulam, Bisonvally, Vathikudy, and Konnathady have a relatively lower number of tanks. This distribution suggests that tanks serve as essential storage hubs in areas where topography constrains the implementation of large-scale canal projects. These tanks primarily address local demands for drinking water, agriculture, and plantation requirements. The fig 16 illustrates the capacity distribution of tanks within Idukki District. While 84% of the tanks possess a storage capacity ranging from 0 to 100 m^3 (in terms of numbers 122), the maximum recorded capacity is 700 m^3, there are tanks that have larger capacities but they are very small in

number. The inference that most of the tanks have smaller storage capacities is an indication that they mostly meet micro-level water needs. Although the tanks are limited by their storage capacity, they play a key role in dealing with the short dry spell and reducing dependence on centralized water supply sources. When compared with storage capacity and tank density, Munnar has the highest cumulative tank storage, followed by Adimaly and Vellathooval.

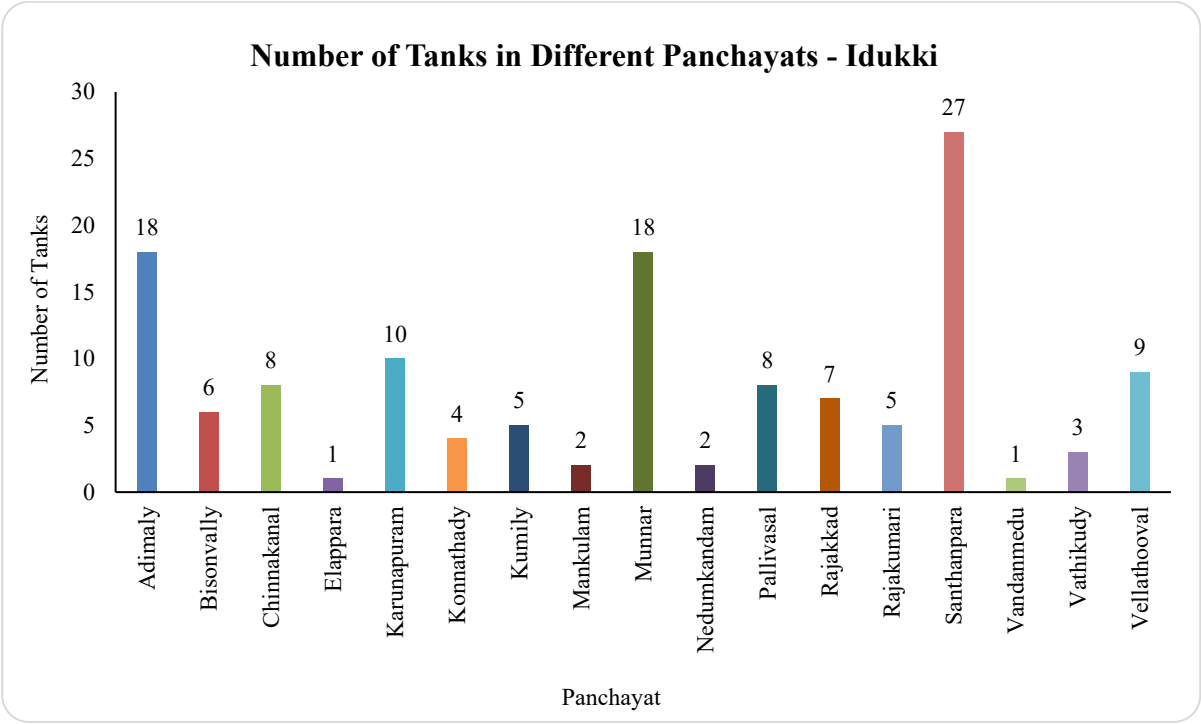

Fig 15: Tank Density in different Panchayats in Idukki

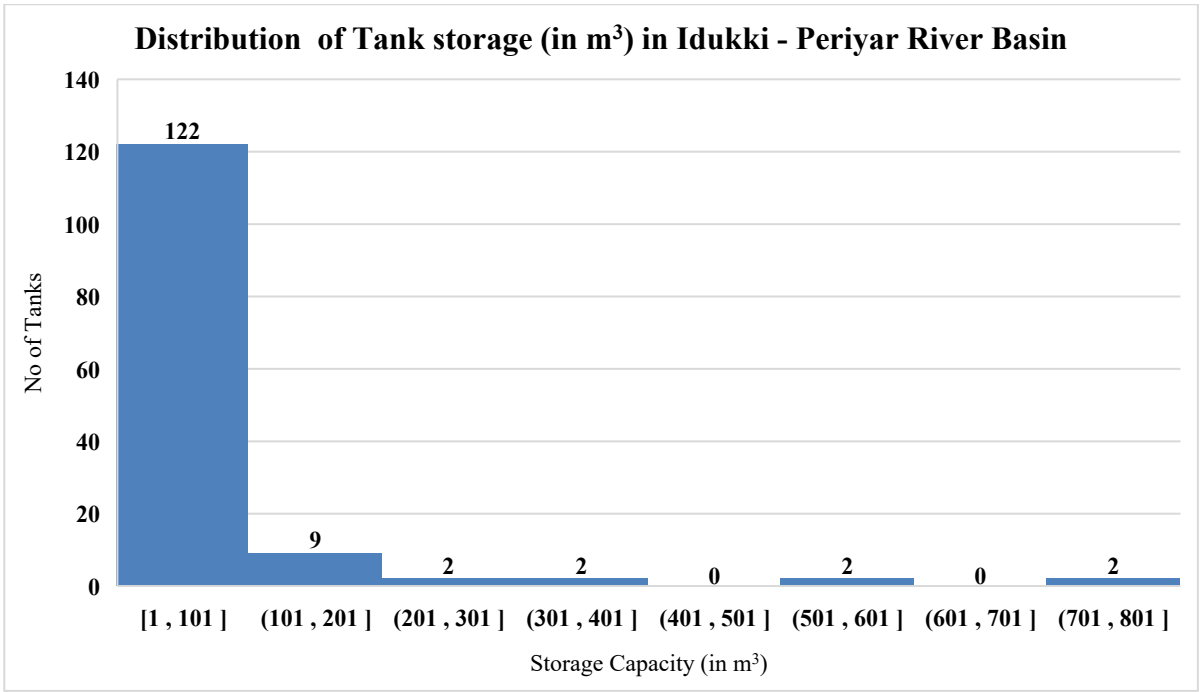

Fig 16: Tanks Storage Distribution in the Idukki -Periyar River Basin

4.4 Lakes

Lakes can be defined as waterbodies that are land locked and usually are freshwater reserves. Lakes can get saline due to groundwater inputs or due to evaporation (Mitra et al, 2014).

4.4.1 Lakes in Idukki District

In Idukki District there are two lakes found in the region. They are Wagamon lake in Azutha block and Devikulam Lake in Devikulam Panchayat of the Idukki district. They have about 5 hectares of cumulative water spread and are areas of major tourist interest and provide recreational activities such as boating. Fig 18 represents the location of these lakes in the Periyar River Basin Fig 17 a and b depict the areal extent of the Lakes. They are comparatively smaller lakes when compared with the counter parts in the basin.

Fig 17.a: Aerial Imagery of Wagamon Lake

Fig 17.b: Aerial Imagery of Devikulam Lake/Sita Devi Lake

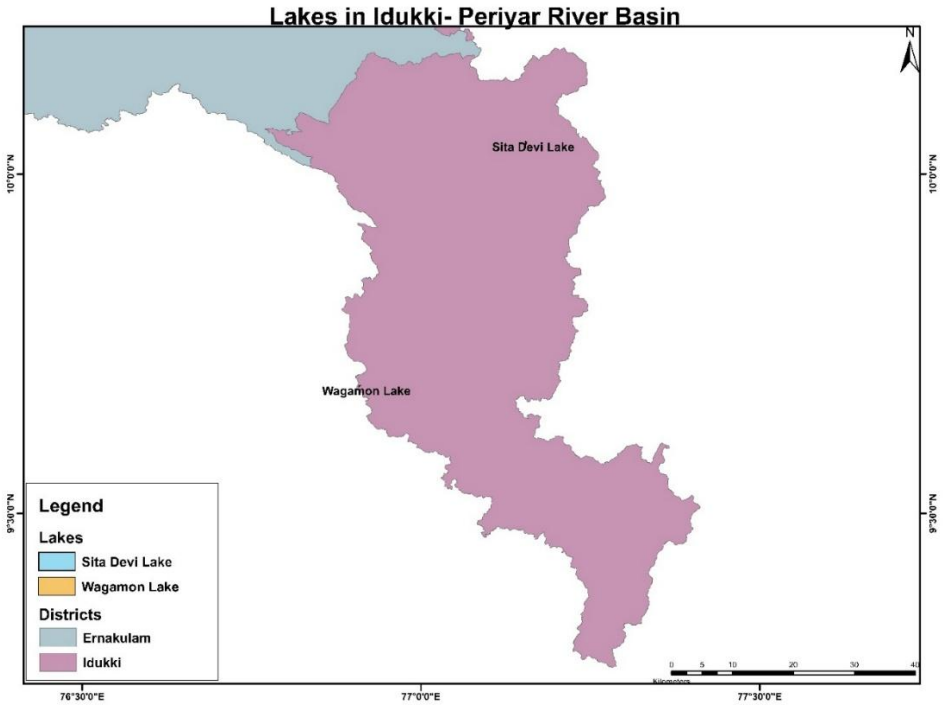

Fig 18: Lakes in Idukki – Periyar River Basin

4.4.2 Lakes in Ernakulam and Thrissur Districts

A total of 3 lakes is present within the Ernakulam and Thrissur Districts of the Periyar River Basin, naming Vembanad Lake, Kodungallor Lake and Malayattoor Lake. Of these, Vembanad Lake and Malayattoor Lake are entirely located within Ernakulam District, while other lake extends across Thrissur District and parts of Ernakulam District (Fig 19). Together, these three lakes contribute approximately 52% (99.4 km²) of the total water spread area of all water bodies mapped in the Ernakulam and Thrissur Districts. Among them, Vembanad Lake is the largest, accounting for 65.6% of the total lake area, whereas Malayattoor Lake occupies a very small area, contributing only 0.2% of the total lake area as illustrated in Fig 20.

Vembanad Lake, the largest lake in Kerala, has an approximate open water spread area of about 230 km², though the extent varies seasonally and with hydrological conditions. The part of Vembanad Lake extends across several administrative units within the basin, including the Mulavukad, Kadamakkudy, Ezhikkara, Chittattukara, Kottuvally, Vadakkekkara, Pallippuram, Kuzhuppilly, Edavanakkad, Nayarambalam, Njarakkal, and Elamkunnapuzha Gram Panchayats, as well as parts of the Kochi Municipal Corporation.

Kodungallor Lake is located primarily within the Thrissur District and spreads over Kodungallor Municipality and the Poyya, Puthenchira, Vellangallur, Poomangalam and Padiyur Gram Panchayats. Malayattoor Lake is situated within the Malayattoor–Neeleeswaram Gram Panchayats

of Ernakulam District. Both Vembanad Lake and Kodungallor Lake are hydrologically connected to the Periyar River. The Periyar River bifurcates near Aluva, where one distributary, the Marthandavarma Branch, flows into Vembanad Lake, while the other branch drains directly into the Arabian Sea.

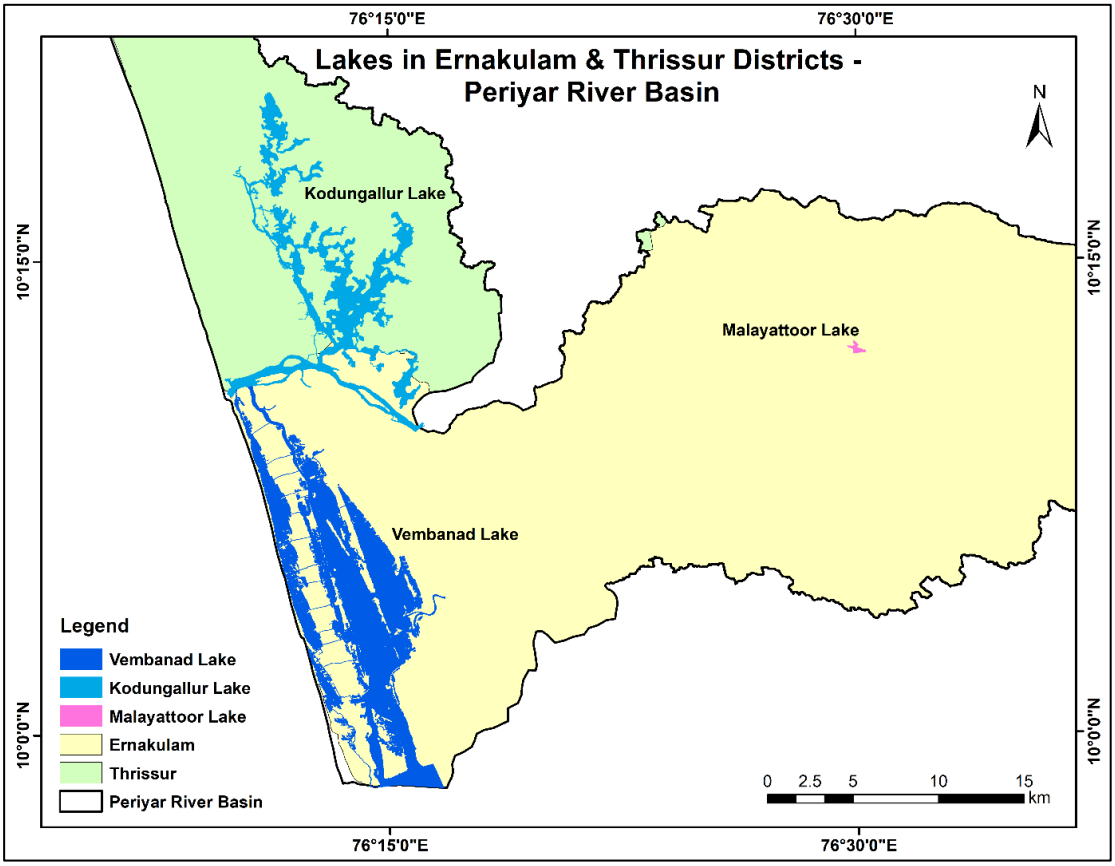

Fig 19: Spatial extent of lakes Ernakulam and Thrissur

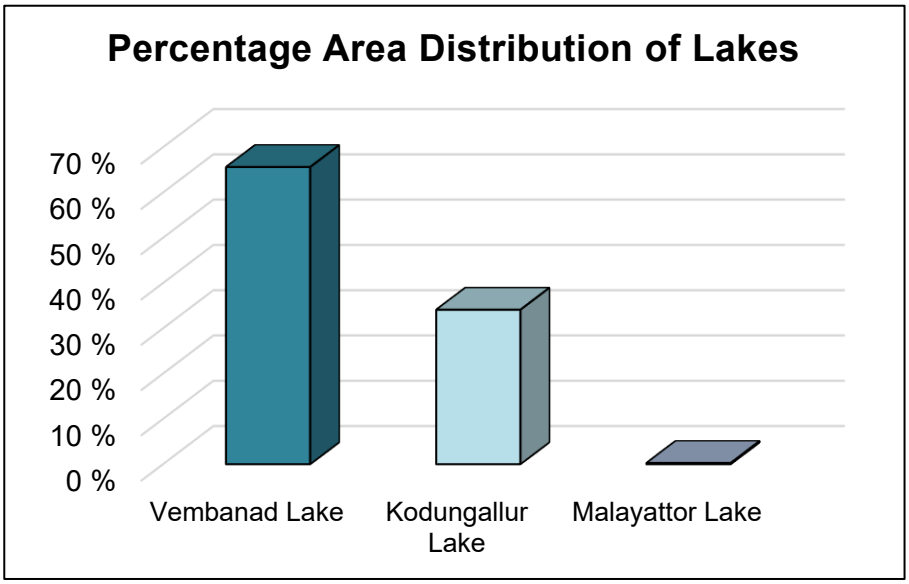

Fig 20: Percentage area distribution of lakes Ernakulam and Thrissur

4.5 Wetlands

Wetlands are the transitional ecosystems where the land and water meet and are characterized by soils that are saturated or least inundated for at least some part of a year. They provide various ecologoical services such as flood mitigation, coastal storm protection, water quality improvement, and groundwater aquifer recharge (Hoverman, & Johnson, 2012). Wetlands are often described as the “Kidneys of Landscape” (Mitsch et.al,2015).

4.5.1 Wetlands in Ernakulam and Thrissur

The Vembanad–Kol Wetland complex is the largest brackish, humid tropical wetland ecosystem in Kerala, located along the Malabar Coast and extending across the Ernakulam, Alappuzha, and Thrissur Districts, between 9°16′–10°36′ N latitude and 76°01′–77°35′ E longitude (SWAK, 2017). The wetland system comprises Vembanad Lake, Kuttanad and the Kol lands, which are fertile low-lying agricultural areas situated approximately 0.5–1.0 m below mean sea level (Remani, 2010).

The Vembanad-Kol wetlands receive inflows from ten rivers such as Keecheri, Puzhakkal, Karuvannur, Chalakudy, Periyar, Muvattupuzha, Meenachil, Manimala, Pamba and Achencoil where all of which originate from the Western Ghats. These rivers are steep, fast-flowing, and predominantly monsoon-fed. They descend from the highlands over steep gradients exceeding 60 m/km and transition into midland and lowland stretches with gentler slopes of approximately 1 m/km (SWAK, 2017). Among them, the Periyar River, with a basin area of 5,216 km², is the largest river draining into the wetland complex. Within the Periyar River Basin, the Vembanad–Kol wetland occupies an area of approximately 45.48 km² (Fig 21). The present extent of the Vembanad–Kol wetlands represent a fragmented remnant of a historically extensive network of estuaries and interconnected river floodplains that once extended between Thrissur and Arattupuzha until the early 19th century. Large-scale conversion of wetlands for agriculture, human settlements, and infrastructure development, particularly port-related activities during the last century has resulted in significant fragmentation, with several areas losing their characteristic wetland functions.

Ecologically, the Vembanad–Kol Wetland is renowned for its high biodiversity and supports the third-largest wintering waterfowl population in India, making it a critical habitat for migratory birds. The diverse habitat types within the wetland enable the support of a wide range of flora and fauna, including several species of high conservation significance. Hydrological connectivity with riverine and coastal systems creates a salinity gradient within the estuarine environment, providing

favourable conditions for species migration and reproduction. The wetland catchment forms part of the Western Ghats biogeographic region, which is recognized as one of the world's 25 biodiversity hotspots (Myers et al., 2000). In addition to its ecological significance, the wetland sustains fisheries, agriculture and allied livelihoods and supports more than half of the population of Kerala either directly or indirectly through ecosystem services. In recognition of its international importance, the Vembanad–Kol Wetland was designated as a Ramsar Site of International Importance in 2002 under the Ramsar Convention on Wetlands (1971), which promotes the conservation and wise use of wetlands.

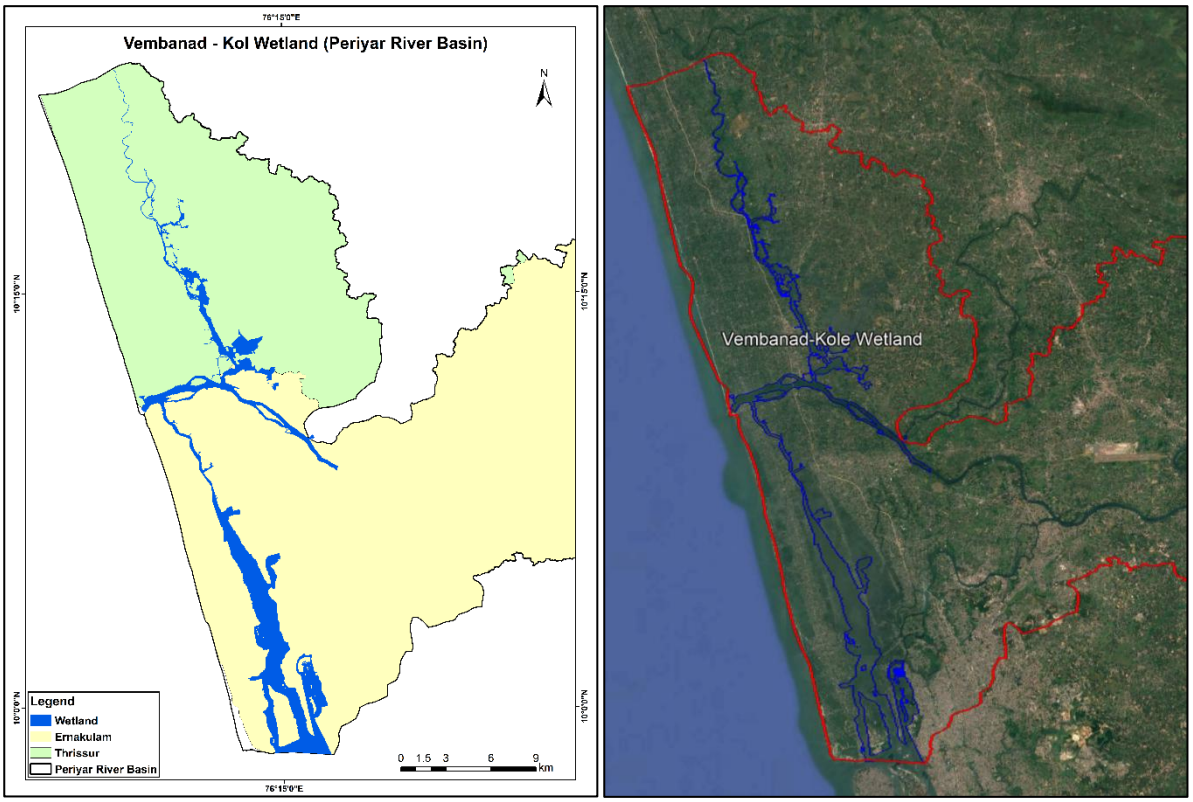

Fig 21: Extent of the Vembanad–Kole Wetland (left) and corresponding aerial imagery (right) in the Periyar River Basin

4.6 Ponds

There has been a lack of common definitions of ponds all over the globe. Ponds are shallow water body ranging from 1 m^2 to to less than 5 hectares in area associated with a depth less than 5 m and has about less than 30% emergent vegetation (Richardson et al, 2022).

4.6.1 Ponds in Ernakulam and Thrissur

A total of 2,190 ponds were identified within the basin, of which 1,486 (67.85%) are in Ernakulam District, while the remaining 704 (32.15%) occur in Thrissur District (Fig 22). With respect to the

areal extent, the total pond area amounts to 3.37 km², of which 84.84% lies within Ernakulam District and 15.16% within Thrissur District of the Periyar River Basin. The fig 21 shows the percentage distribution of the ponds in this region. At the local administrative level, Kodungallur Municipality in Thrissur District records the highest number of ponds (128), followed by Perinjanam Grama Panchayat (104) in Thrissur District and Asamannoor Grama Panchayat (100) in Ernakulam District. In terms of areal extent panchayats in Ernakulam District - Ayyampuzha Grama Panchayat accounts for the largest share (8.31% of the total pond area), followed by Elamkunnapuzha Grama Panchayat (7% of the total pond area) and Koovappady Grama Panchayat (6.10% of the total pond area). Detailed data regarding the number and area of these ponds are provided in Table 11 and Table 12.

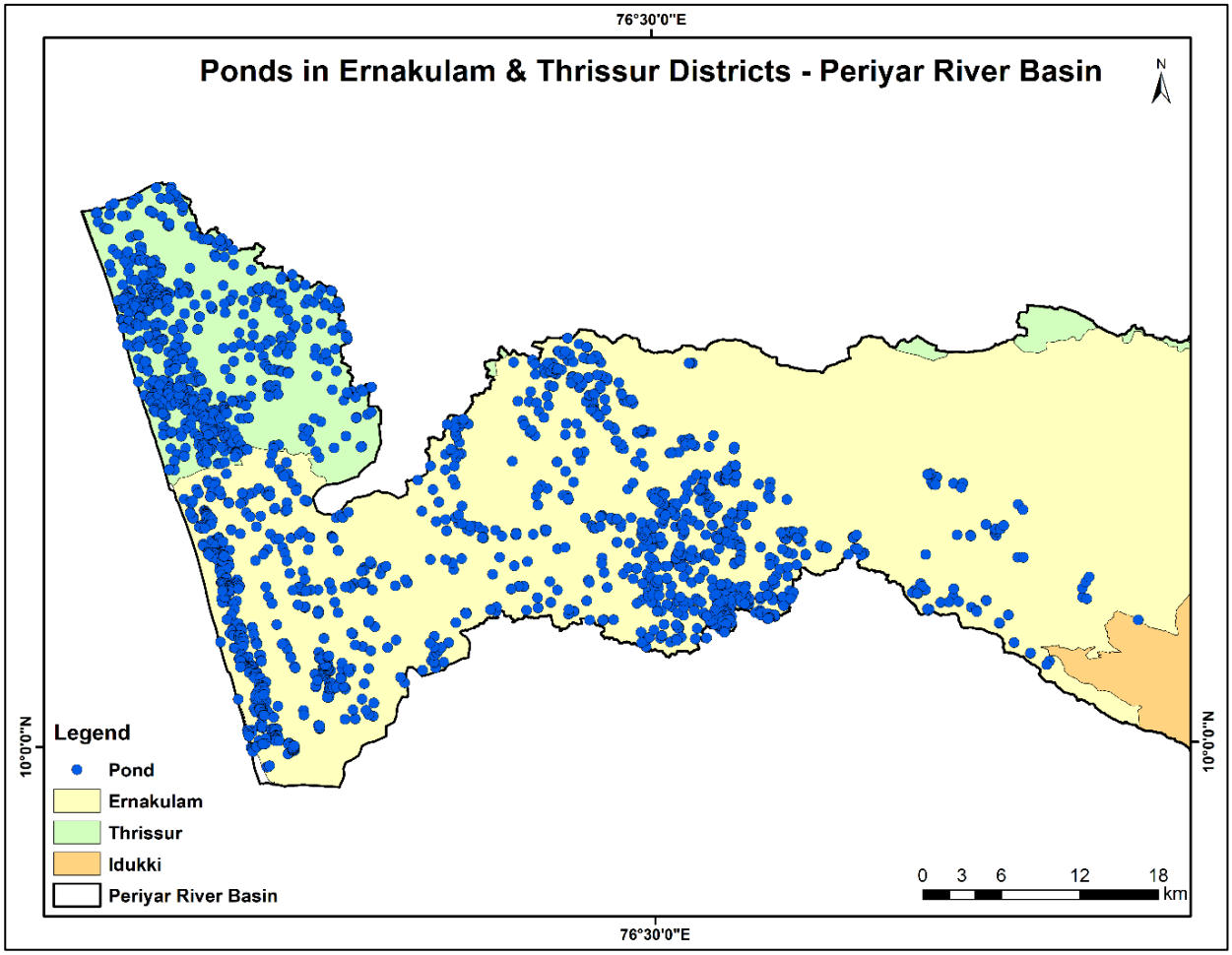

Fig 22: Location map of ponds in the Ernakulam and Thrissur Districts

Ponds are predominantly distributed in rural areas, where 90% (1,977) of the total ponds are located, accounting for 93.7% of the total pond area. Urban areas contain only 10% (213) of the ponds, contributing 6.6% of the total pond area, indicating the dominance of pond-based surface water resources in rural parts of the basin. As illustrated in Fig 23 the distribution of ponds varies significantly by local body type;

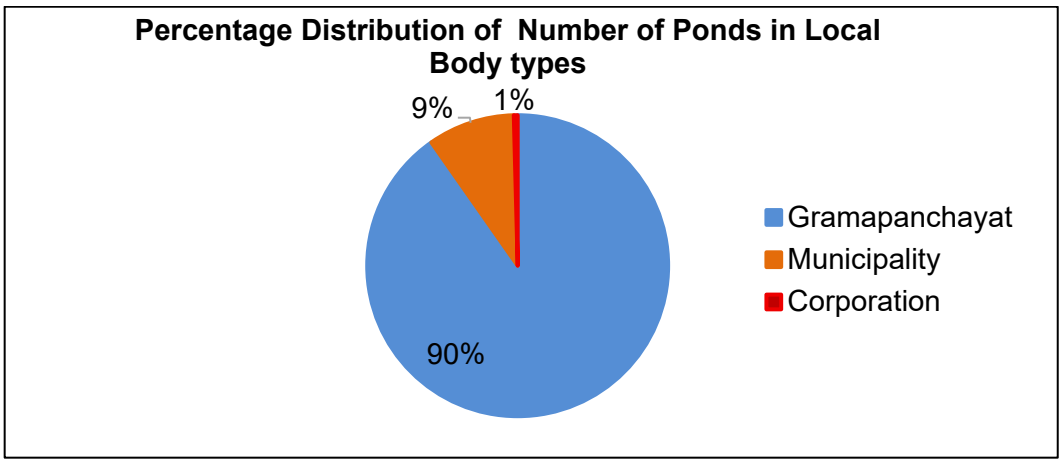

Fig 23: Percentage distribution of number of ponds in local body types the Ernakulam and Thrissur district

Table 11. Local body-wise distribution of ponds in Ernakulam District – Periyar River Basin

Sl. No.	Local body	Type	No. of Ponds	Percentage of Ponds	Water spread area (in m^2)	Percentage of water spread
1	Kochi (C)	Corporation	9	0.41	8000	0.24
2	Alangad	Grama Panchayat	25	1.14	35000	1.04
3	Asamannoor	Grama Panchayat	100	4.57	99000	2.94
4	Ayyampuzha	Grama Panchayat	68	3.11	280000	8.31
5	Chendamangalam	Grama Panchayat	12	0.55	8000	0.24
6	Chengamanad	Grama Panchayat	7	0.32	19000	0.56
7	Cheranalloor	Grama Panchayat	30	1.37	49000	1.45
8	Chittattukara	Grama Panchayat	9	0.41	9000	0.27
9	Choornikkara	Grama Panchayat	2	0.09	2000	0.06
10	Edathala	Grama Panchayat	1	0.05	5000	0.15
11	Edavanakkad	Grama Panchayat	26	1.19	7000	0.21
12	Elamkunnapuzha	Grama Panchayat	91	4.16	236000	7.00
13	Ezhikkara	Grama Panchayat	7	0.32	3000	0.09
14	Kadamakudy	Grama Panchayat	54	2.47	90000	2.67
15	Kadungalloor	Grama Panchayat	6	0.27	26000	0.77
16	Kalady	Grama Panchayat	12	0.55	62000	1.84

17	Kanjoor	Grama Panchayat	6	0.27	17000	0.50
18	Karukutty	Grama Panchayat	14	0.64	53000	1.57
19	Karumallur	Grama Panchayat	6	0.27	24000	0.71
20	Keerampara	Grama Panchayat	22	1.00	73000	2.17
21	Keezhmad	Grama Panchayat	11	0.50	36000	1.07
22	Koovappady	Grama Panchayat	80	3.65	206000	6.11
23	Kottappady	Grama Panchayat	86	3.93	107000	3.17
24	Kottuvally	Grama Panchayat	23	1.05	99000	2.94
25	Kunnukara	Grama Panchayat	4	0.18	3000	0.09
26	Kuttampuzha	Grama Panchayat	41	1.87	46000	1.36
27	Kuzhuppilly	Grama Panchayat	43	1.96	6000	0.18
28	Malayattoor Neeleeswaram	Grama Panchayat	31	1.42	148000	4.39
29	Manjapra	Grama Panchayat	7	0.32	7000	0.21
30	Mookkannur	Grama Panchayat	47	2.15	129000	3.83
31	Mudakuzha	Grama Panchayat	82	3.74	162000	4.81
32	Mulavukad	Grama Panchayat	23	1.05	14000	0.42
33	Nayarambalam	Grama Panchayat	48	2.19	4000	0.12
34	Nedumbassery	Grama Panchayat	21	0.96	144000	4.27
35	Njarakkal	Grama Panchayat	28	1.28	2000	0.06
36	Okkal	Grama Panchayat	12	0.55	14000	0.42
37	Pallippuram	Grama Panchayat	80	3.65	48000	1.42
38	Parakkadavu	Grama Panchayat	12	0.55	46000	1.36
39	Pindimana	Grama Panchayat	13	0.59	51000	1.51
40	Puthenvelikara	Grama Panchayat	15	0.68	34000	1.01
41	Rayamangalam	Grama Panchayat	68	3.11	85000	2.52

42	Sreemoolanagaram	Grama Panchayat	8	0.37	38000	1.13
43	Thuravoor	Grama Panchayat	1	0.05	1000	0.03
44	Vadakkekkara	Grama Panchayat	15	0.68	17000	0.50
45	Varapuzha	Grama Panchayat	5	0.23	11000	0.33
46	Vazhakulam	Grama Panchayat	8	0.37	5000	0.15
47	Vengola	Grama Panchayat	12	0.55	50000	1.48
48	Vengoor	Grama Panchayat	96	4.38	138000	4.09
49	Angamaly	Municipality	11	0.50	12000	0.36
50	Eloor	Municipality	8	0.37	22000	0.65
51	Kalamassery	Municipality	13	0.59	29000	0.86
52	North Paravur	Municipality	9	0.41	18000	0.53
53	Perumbavoor	Municipality	18	0.82	22000	0.65

Table 12. Local body-wise distribution of ponds in Thrissur District – Periyar River Basin

Sl. No.	Local Body	Type	No. of Ponds	Percentage of Ponds	Water spread area (in m^2)	Percentage of water spread
1	Aloor	Grama Panchayat	9	0.41	12000	0.36
2	Annamanada	Grama Panchayat	7	0.32	32000	0.95
3	Edathiruthy	Grama Panchayat	11	0.50	8000	0.24
4	Edavilangu	Grama Panchayat	58	2.65	10000	0.30
5	Eriyad	Grama Panchayat	36	1.64	9000	0.27
6	Kaipamangalam	Grama Panchayat	37	1.69	12000	0.36
7	Karalam	Grama Panchayat	3	0.14	4000	0.12
8	Kattur	Grama Panchayat	16	0.73	25000	0.74
9	Kuzhur	Grama Panchayat	4	0.18	15000	0.44
10	Mala	Grama Panchayat	20	0.91	24000	0.71

11	Mathilakam	Grama Panchayat	56	2.56	17000	0.50
12	Padiyur	Grama Panchayat	19	0.87	105000	3.11
13	Perinjanam	Grama Panchayat	104	4.75	17000	0.50
14	Poomangalam	Grama Panchayat	10	0.46	6000	0.18
15	Poyya	Grama Panchayat	15	0.68	22000	0.65
16	Puthenchira	Grama Panchayat	47	2.15	35000	1.04
17	Sreenarayanapuram	Grama Panchayat	51	2.33	23000	0.68
18	Valappad	Grama Panchayat	10	0.46	4000	0.12
19	Vellangallur	Grama Panchayat	18	0.82	12000	0.36
20	Velukara	Grama Panchayat	28	1.28	21000	0.62
21	Irinjalakkuda	Municipality	17	0.78	32000	0.95
23	Kodungallur	Municipality	128	5.84	67000	1.99

4.6.2 Ponds in Idukki District

A total of 1855 ponds were in Idukki District of the Periyar River Basin (fig 24). The ponds have a total water of about 24 hectares or 0.24 km^2, this is very small in comparison to the spread area of reservoirs. These ponds are acting as small scale storage ponds and are focused on meeetig the local requirement for irrigation drinking and other small-scale purposes. The panchayats where the maximum ponds are is in Vandanmedu panchayats, the distribution of ponds in different panchayats is represented in fig 25. It has also been clear from the distribution that there are few panchayats where the number of ponds is very high in comparison to other regions. When studying about the water spread in the region it has been observed that the water spread area is higher for regions of higher number of ponds. Table 13 gives detailed information on the waterspread area and number of ponds in panchayats of Idukki district of Periyar River Basin.

In table 12 the number of ponds in a particular panchayat to total panchayat is represented in terms of percentage, similarly the water spread area is also represented as the cumulative waster spread area of ponds in the panchayats to the total water spread area of all the ponds in the Idukki region.

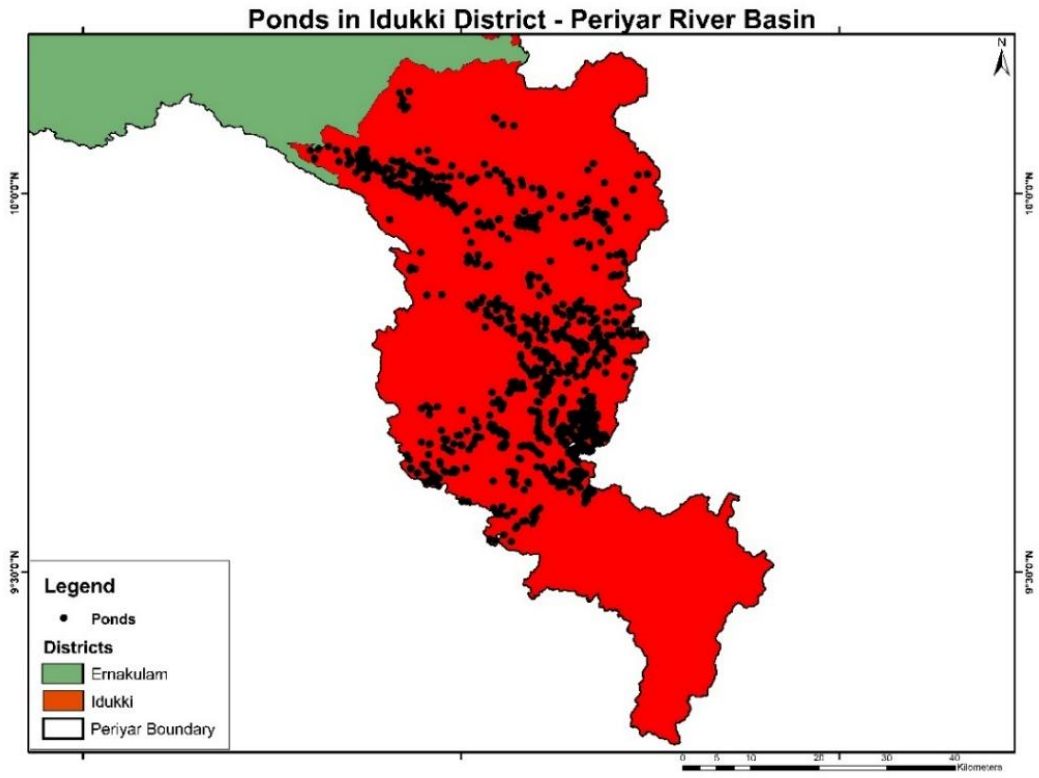

Fig 24: Location of Ponds in Idukki - Periyar River Basin

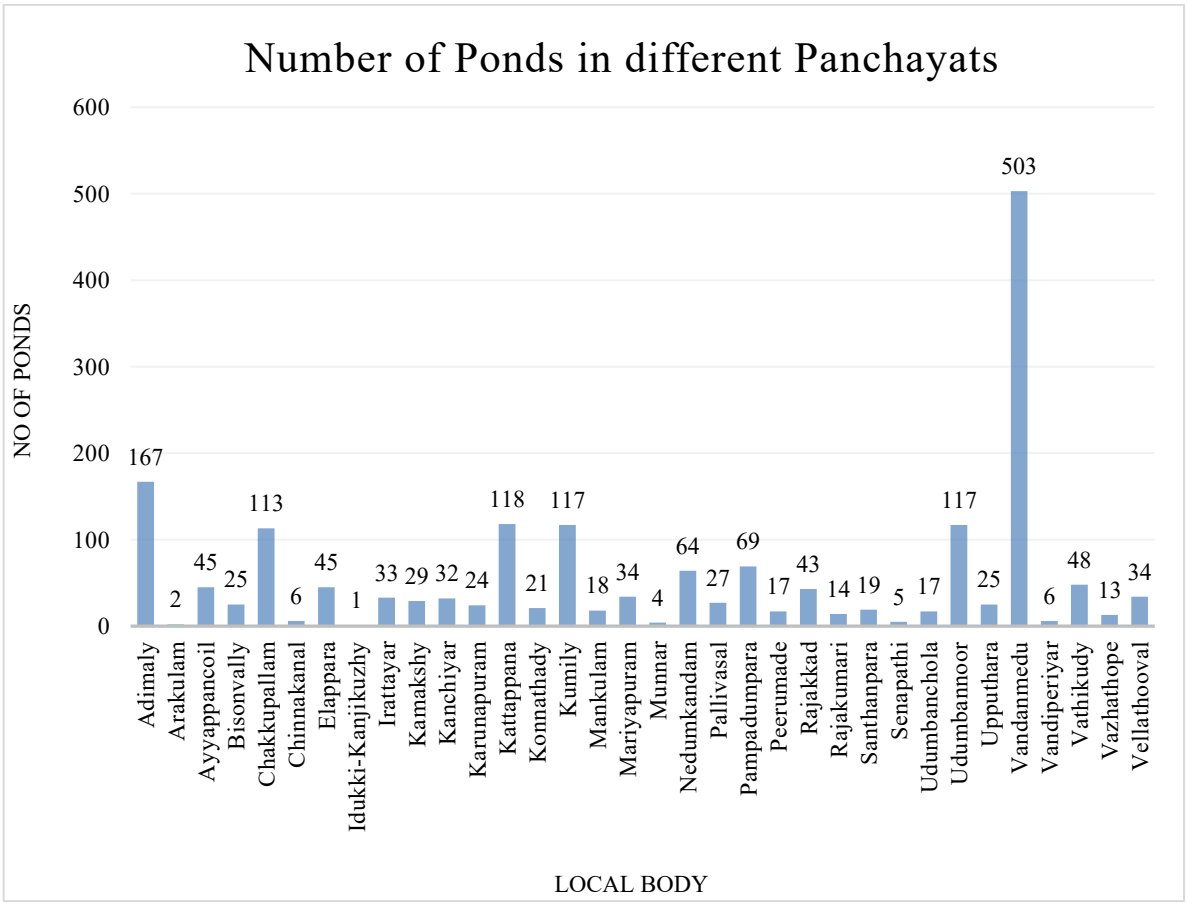

Fig 25: Number of Ponds in different Panchayats in Idukki Periyar River Basin

Here we can easily see the Vandanmedu has highest number of ponds as well as highest water spread, similarly this holds true for most case. There are peculiar observations like in the case of Ayyapancovil region, Upputhara, Kanchiyar, Karnupuram etc, despite having a large lower number of ponds have comparatively higher water spread area, emphasizing that the ponds in these regions have higher dimension thus having higher water spread area despite low number of ponds.

Table 13: Distribution of Ponds and water spread area in Idukki -Periyar River Basin

Panchayat	Number of Ponds	Percentage of Ponds	Water spread Area(in m^2)	Percenatage Water Spread
Adimaly	167	9	23191.07	9.57
Arakulam	2	0.11	43.94	0.02
Ayyappancoil	45	2.43	17555.98	8.01
Bisonvally	25	1.35	2258.62	0.51
Chakkupallam	113	6.09	10785.54	2.44
Chinnakanal	6	0.32	169.09	0.04
Elappara	45	2.43	8996.39	2.09
Idukki-Kanjikuzhy	1	0.05	33.33	0.01
Irattayar	33	1.78	3770.78	0.89
Kamakshy	29	1.56	2404.50	0.58
Kanchiyar	32	1.73	8019.78	1.93
Karunapuram	24	1.29	2369.64	0.58
Kattappana	118	6.36	16864.68	4.16
Konnathady	21	1.13	1369.27	0.35
Kumily	117	6.31	26224.50	6.78
Mankulam	18	0.97	1878.64	0.52
Mariyapuram	34	1.83	2904.33	0.81
Munnar	4	0.22	511.27	0.14
Nedumkandam	64	3.45	4707.48	1.32
Pallivasal	27	1.46	912.15	0.26
Pampadumpara	69	3.72	9331.63	2.67
Peerumade	17	0.92	2794.30	0.82
Rajakkad	43	2.32	4568.94	1.35
Rajakumari	14	0.75	818.50	0.25
Santhanpara	19	1.02	2271.04	0.68
Senapathi	5	0.27	1167.88	0.35
Udumbanchola	17	0.92	2225.87	0.68
Udumbannoor	117	6.31	1942.48	0.59
Upputhara	25	1.35	2505.27	0.77
Vandanmedu	503	27.12	75874.31	23.54
Vandiperiyar	6	0.32	646.56	0.26
Vathikudy	48	2.59	1306.60	0.53
Vazhathope	13	0.7	485.75	0.2
Vellathooval	34	1.83	1539.27	0.63

5 Management and Conservation Strategies

5.1. Policy and Planning Integration

Effective conservation of water bodies requires their integration into regional and basin-level planning and policy frameworks. The waterbody inventory generated through this atlas provides a reliable spatial database that can support informed decision-making in land-use planning, watershed development, and infrastructure projects. Since the data compiled is at local body level i.e. Grama panchayat, this helps in identification of priority zones and targeted interventions be made possible exclusive to that region. Strengthening regulatory mechanisms to prevent encroachment, pollution, and unplanned land conversion around water bodies is essential. In addition, protecting water bodies from illegal waste dumping is crucial for maintaining their ecological and hydrological functions. Active participation of local communities along with effective monitoring by local administrative bodies can play a significant role in preventing pollution and ensuring the long-term conservation of these water resources. The enforcement of buffer zones and incorporation of waterbody protection measures into local development plans will contribute to the long-term sustainability of surface water resources in the Periyar River Basin.

5.2 Community Participation

Community participation plays a crucial role in the sustainable management and conservation of water bodies. Involving local communities, self-help groups and local governance institutions in monitoring, maintenance and restoration activities enhances a sense of ownership and responsibility toward water resources. Awareness programmes, participatory planning, and capacity-building initiatives can promote responsible water use and encourage community-led conservation efforts. Such participatory approaches are particularly important for the protection of small and medium water bodies, which are closely linked to local livelihoods and water security.

The present atlas serves as an important resource for various stakeholders involved in water resource management. By providing detailed information on the location, number, and areal extent of water bodies within each local administrative unit, the report enables communities, local self-government institutions, and government agencies to better understand the spatial distribution of these resources. This information can support planning, monitoring, and prioritisation of conservation and restoration activities at the local level, thereby facilitating more effective and informed water resource management.

6 Summary and Recommendation

This report is a comprehensive approach to provide the digital record of the waterbodies that are in the Periyar River Basin. This record includes check dams, ponds, lakes, wetlands, and reservoirs their waterspread area Since the report focuses on the local bodies this will be helpful in creating a long-term plan for sustainable development and to take up efforts to locate and drive measures which requires an additional focus.

The Idukki district of Periyar River Basin accounts for 2136 total water bodies. Though small in number the water spread area is dominated by reservoirs. The share of reservoirs is vastly contributed by Idukki reservoir and then followed by Mullaperiyar reservoir These large reservoirs act as the primary reservoirs and play a major role of stream flow regulation and flood control. Also, the Idukki Reservoir accounts for the largest hydroelectric power generated. Dams like Anayirankal, Mattupetty, and Ponmudi act as secondary reservoirs playing their role in regulation for a limited region and account to hydro power generation. The lower dams act as storage and diversion dams in the region. Also, there has been a significant drop in total capacity of water stored in dam the total drop in Idukki region is about 60% of original design capacity. This drop is primarily due to sediment deposition over a long period of time which possess threat water availability, power generation and flow regulation.

Thus, it is recommended that the sedimentation assessment and capacity assessment must be done in regular intervals also it should be noted that Idukki reservoir must be taken as a priority. The water demands on reservoirs should be lowered by creation of more tanks, ponds etc. to store and deliver the water for local needs.

A total of 138 tanks is there in the Idukki district of the Periyar River Basin. Tanks serve as localized storage system that provides supplies for the requirements of region whether that be drinking water supply or for livestock or for irrigation. When the storage characteristics of these tanks are studied upon it becomes clear that the storage is not even and most tanks have a lower capacity of storage. It is also important to note that a higher number of tanks in a panchayat doesn’t always have a higher cumulative storage as in such regions many tanks of smaller capacities are found. This is illustrated in the case of Munnar and Adimali where in the number of structures are limited but they have higher storage when compared to panchayats having a

higher number of tanks

For improving capacities, it becomes essential that a timely assessment of tanks remove any amount silting and to prevent any reduction in the capacities of tanks. Panchayats with large number of tanks and a lower storage capacity should be focused on having tanks with larger storage and deepen the existing ponds to expand the storage capacities.

Of the 1855 ponds in the Idukki region the distribution follows a similar pattern like that of tanks concentration of ponds in few regions along with higher concentration and few regions with lower numbers. The number of ponds and cumulative storage goes hand in hand, as it is observed that higher number of ponds yields a higher cumulative storage. Ponds in this region act as localized adaptive water resource management measure which is a response to stress due to erratic seasonal variation in precipitation and undulating terrain. The ponds also play a vital role in meeting the water demand of plantations in the Idukki region, as the supply of irrigation water by canal network in the rugged terrain is difficult.

The check dams even though fewer in number in comparison to ponds they significantly contribute to the water spread area. The region with large water spread area are generally planation estates and are aimed to support crops like cardamom, pepper tea coffee etc. It becomes essential to add check dams to the water resource planning system as they are actively contributing to regulation of flow. Periodic monitoring of health of the structure and carrying out of minor repair works must be taken by local bodies and communities. The check dam with higher water spread area must be considered as a priority zone as check dams influence the sediment transport and account for the recharge of groundwater. This also makes them more vulnerable to sediment deposition and requires cyclic maintenance and desilting to ensure the proper health of the check dams. For

A total of 2,198 water bodies were identified within the Ernakulam and Thrissur Districts of Periyar River Basin, where ponds forming the dominant category by number, indicating their importance in local water storage and groundwater recharge. The spatial analysis indicates a predominantly rural distribution of water bodies, reflecting their close association with agricultural landscapes and domestic water use. Ernakulam District exhibits a higher concentration of surface water bodies than Thrissur District, highlighting intra-basin variability.

In contrast, larger water bodies such as reservoirs, lakes and wetlands occur less frequently but account for a substantial proportion of the total water spread area and play a key role in hydrological regulation, irrigation, hydropower generation and ecological sustainability. Major hydraulic structures, including the Idamalayar Reservoir and the Bhoothathankettu Barrage, are central to basin-level water management by supporting flow regulation, irrigation, and energy generation, while the Vembanad-Kol wetland system performs critical ecological functions and sustains livelihoods.

Based on these findings, conservation strategies should prioritize the protection and restoration of small and medium water bodies, which are highly vulnerable to encroachment, siltation etc. The application of remote sensing and GIS for periodic monitoring is essential for detecting spatial and temporal changes and supporting evidence-based planning. Strengthened coordination among water management agencies and local self-governments will further enhance sustainable water resource management.

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