# A CASE STUDY OF THE FLOOD IN ERNAKULAM DISTRICT - 2018

Dissertation Submitted to

**UNIVERSITY OF CALICUT**

In partial requirement for the award of Master of Science in

**ENVIRONMENTAL SCIENCE**

By

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# CERTIFICATE

This is to certify that the dissertation entitled **"A CASE STUDY OF THE FLOOD IN ERNAKULAM DISTRICT - 2018"** is an authentic record of the work carried out by **DEVIKA K** under guidance of **Dr. REKHA V B**, Assistant Professor Department of Geology and Environmental science, CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA in partial requirement for the award of Master of Science in Environmental Science is submitted to the University of Calicut during the academic year 2021-2023.

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# DECLARATION

I hereby declare that the project work entitled "A CASE STUDY OF THE FLOOD IN ERNAKULAM DISTRICT - 2018" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to June 2023 under the guidance and supervision of **Dr REKHA V B** Assistant Professor Department of Geology and Environmental science CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA and no part thereof been presented before, for any other degree or diploma in any university.

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# ACKNOWLEDGEMENT

First and foremost, I thank Almighty GOD, for all blessings that he has showed on me for completing this dissertation.

I wish to express my utmost and profound gratitude to my supervising guide **Dr. Rekha V B** (Assistant Professor, Department of Geology and Environmental science, Christ college (autonomous), Irinjalakuda) for her valuable guidance, support, understanding, kindness to me throughout my work, I am grateful to her for the constructive comments and careful evaluation of my thesis.

I would like to pay my deep sense of gratitude **Archana M** (Research Scholar, Department of Geology and Environmental Science, Christ College (autonomous), Irinjalakuda) for her invaluable advice, encouragement, and compassion to me during my work. I also thank her for her thoughtful analysis of my thesis and the helpful input she provided. It has been an honor to work under her direction.

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It is an honor for me to express my gratitude and appreciation to my classmates and friends for their support and love throughout the process of my study. I would like to express my sincere thanks to all the faculty and staff at Christ College, Irinjalakuda, for their assistance and necessary measures.

Finally, my family, an important inspiration for me. So, with due respect, I express my gratitude to them for always supporting and encouraging me to excel forward and achieve my goal.

# ABSTRACT

This study focused on understanding the causes, patterns, and impacts of flooding in the Ernakulam area. The primary objective is to investigate and analyze the frequency of floods in the region. To achieve this, a combination of quantitative and qualitative research techniques was employed. The study made use of various data sources, including geographic information system (GIS) mapping, historical flood records, rainfall etc. These sources provided valuable information to examine the flood events comprehensively. Additionally, in order to gather information from diverse perspectives, the researchers conducted extensive literature reviews, expert interviews, document analyses, and community surveys. By incorporating these research techniques, the study aimed to offer a holistic understanding of the flood situation in the Ernakulam area. It highlighted the existing problems and strengths related to flooding and identified viable flood management measures. The comprehensive picture painted by the study can serve as a valuable resource to guide effective flood mitigation strategies, enhance disaster management plans, and minimize the adverse effects of flooding in the region. The insights gained from this project are particularly relevant to policymakers, researchers, and other stakeholders interested in addressing the challenges posed by floods in the Ernakulam district. The study's findings can inform decision-making processes and assist in the development of informed policies and practices. Moreover, this research contributes to the establishment of a knowledge base for flood management, consolidating existing information and insights into a coherent framework.

In summary, the study aimed to understand the root causes, patterns, and effects of flooding in the Ernakulam area. It employed a combination of quantitative and qualitative research methods, incorporating diverse data sources and research techniques.

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# THERMAL STABILITY OF SOIL CARBON STORED IN DIFFERENT FOREST ECOSYSTEM OF KERALA WESTERN GHATS

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I hereby declare that the project work entitled "**Thermal stability of soil carbon stored in Different Forest Ecosystem of Kerala Western ghats**" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to June 2023 under the guidance and supervision of **Dr. S Sandeep**, Principal Scientist, Department of Soil Science, Kerala Forest Research Institute (KFRI), Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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**Deneetta Francis**

## Abstract

Research on the characteristics and attributes of soil in different forest types holds significance for effective environmental management and resource utilization. This study focused on the physico-chemical properties of soils and thermal stability of soil organic carbon in various forest types found in Kerala. A comprehensive understanding of the stability and carbon retention ability of soil aggregates of different forest types are vital for determining terrestrial carbon storage. Surface soil samples were gathered and dry sieved to segregate the macro aggregates (>250µm) and microaggregates (<250µm). The segregated aggregates were exposed to a 75-day incubation at four distinct temperatures: $25^0$C, $30^0$C, $35^0$C and $45^0$C. The texture of the forest soils varied from sandy to loamy. Soil pH was found to be acidic varying from 5.1 to 6.1 and organic carbon percentage varied from 1.2% to 18%. Activation energies for soil organic decomposition are higher in microaggregates. The microaggregates of the evergreen forest of Wayanad Plateau has the highest $Q_{10}$ value showing that the thermal dependency of the reaction increases by double.

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# Exploring the similarities in rainfall distribution patterns between the Southern and Northern Peaks of rainfall regions of Western Ghats in Kerala, India

Dissertation submitted to the

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**MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE**

Submitted by

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I **Emil Sabu** hereby declare that this project work entitled "**Exploring the similarities in rainfall distribution patterns between the Southern and Northern Peaks of rainfall regions of Western Ghats in Kerala, India**" submitted to University of Calicut in partial fulfilment of the requirements for the degree of the Master of Science in Environmental Science, in my own work and to the best of my knowledge and belief. It is a record of original research carried out by me under the guidance and supervision of **Dr. Naveena K**, scientist B, Land and Water Management Research Group, Centre for Water Resources Development and Management (CWRDM), Kozhikode.

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First and foremost, I thank Almighty GOD, for all blessings that he has showed on me for completing this dissertation.

I wish to express my utmost and profound gratitude to my supervising guide **Dr. Naveena K** (Scientist B, Land and Water Management Research Group, Centre for Water Resources Development and Management (CWRDM), Kozhikode) for his valuable guidance, support, understanding, kindness to me throughout my work, I am grateful to him for the constructive comments and careful evaluation of my thesis. It's been a privilege to work under his guidance.

I would like to pay my deep sense of gratitude to **Dr. Manoj P. Samuel**, Executive Director, CWRDM, and **Dr. Surendran U**, Principal Scientist and Head of Land and Water Management Research Group, CWRDM, for providing me the opportunity to work in Land and Water Management Research Group and for encouraging me to the highest peak.

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It is my privilege to thank my classmates and friends for their love, care, mental and physical help and encouragement during my research. I am happy to extend my gratitude to all teaching and non-teaching staff in Christ College, Irinjalakuda for their support and necessary actions.

Last but not least, my family, an important inspiration for me. So, with due respect, I express my gratitude to them for always supporting and encouraging me to excel forward and achieve my goal.

**EMIL SABU**

# ABSTRACT

There is a growing concern over the climate change which results in unprecedented shifts and extreme rainfall over the last few decades across our country. The Western Ghats region of India is indeed considered ecologically sensitive and important for understanding the impacts of climate change. This study examines distribution of rainfall and several precipitation indices across the Southern and Northern Peak regions of the Western Ghat region in Kerala, India. The research spans a 33-year period from 1990 to 2022 and utilizes statistical tests such as the Mann-Kendall Test, Sen's Slope estimator, Wallis and Moore Phase-Frequency Test, and Modified Mann-Kendall Test used to study the long-term changes. The Climpact software is employed for analyzing extreme precipitation indices. Significance is assessed through ANOVA and t-tests. The results reveal distinct patterns in rainfall distribution and trends between the Southern and Northern peaks. The Southern Peak experiences higher rainfall amounts, significant deviations from average values, and a decreasing trend, while the Northern Peak shows an increasing trend in annual rainfall. Both peaks exhibit a negative trend during the Southwest monsoon season, and there is a temporal shift in heavy precipitation from June and July to August and September. Differences are also observed in rainfall patterns, durations of dry and wet spells, and precipitation thresholds between the two regions. The significant differences in precipitation indices within and between the peaks highlight the influence of local topography, microclimatic conditions, and geographical features on rainfall characteristics. These findings contribute to our understanding of the complex dynamics within the Western Ghats and emphasize the need for localized analysis and management of rainfall patterns in the region. Considering the geographical location and the impact of the Western Ghats on rainfall patterns is crucial for comprehending and predicting extreme precipitation events in the study area.



Keywords: Western Ghats; Southern and Northern peaks; Rainfall; Precipitation Indices; Climate Change

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# IDENTIFICATION OF SOURCE OF POLLUTION AND REMEDIES FOR THEVARA PERANDOOR CANAL IN KOCHI

A project report submitted to the

**UNIVERSITY OF CALICUT**

In partial requirements for the award degree of Master of Science in

**ENVIRONMENTAL SCIENCE**

by

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കേരള സംസ്ഥാന മലിനീകരണ നിയന്ത്രണ ബോർഡ്
Committed to protection of environment

**Kerala State Pollution Control Board**

**&**

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This is to certify that the project report entitled **Identification of source of pollution and remedies for Thevara Perandoor canal in Kochi** is the bonafide work of **Mr.Ganashyam T S** under the guidance of **Dr. Manju N J** Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda in partial requirements for the award of the degree of Master of Science in Environmental Science submitted to the University of Calicut during the academic year 2021-2023.

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Examiners:

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## CERTIFICATE

This is to certify that the project report entitled **Identification of source of pollution and remedies for Thevara Perandoor canal in Kochi** is the bonafide work of **Mr.Ganashyam T S** under the guidance of **Dr. Manju N J** Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda in partial requirements for the award of the degree of Master of Science in Environmental Science submitted to the University of Calicut during the academic year 2021-2023.

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This is to certify that **Mr. Ganashyam T. S. , Reg. No. CCAVMES010** has participated in the project conducted by the Board for the **"Identification of Source of Pollution and Remedies for Thevara Perandoor Canal in Kochi"** under my supervision and guidance in partial requirement for the award of Master of Science in Environment Science, Christ College, Irinjalakuda through University of Calicut during the Academic year 2021-2023.

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I hereby declare that this project report titled **Identification of source of pollution and remedies for Thevara Perandoor canal in Kochi** is a bonafide work done by me under the supervision of Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda and this work has not previously formed the basis for the award of any other academic qualification, fellowship or other similar title of any other University or Board.

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# ABSTRACT

In recent years, due to rapid industrialization and advanced agricultural activities, environmental degradation is becoming a major problem. Water is one of the most important and basic natural resources used in industry, agriculture, household and business. These activities result in the discharge of sewage, so accurate sewage analysis is critical to maintaining human health and safety. The sewage load of the Thevara Perandoor canal in Kochi is increased by water from all the three sectors viz. domestic, industrial and agricultural. For this purpose, three distinct sample sites of sewers adjacent to the canal were selected, analysed for sewage water quality indicators, and an inspection was made in an apartment near the canal to ensure that there was a major leak in the canal. This study was conducted to determine the surface water quality of Perandoor canal in Kochi by determining some water quality parameters (pH, EC, DO, TDS, BOD5, COD etc.). This indicates that several anthropogenic sources are responsible for the degradation of surface water quality in this region. This study reflects the actual scenario of surface water quality of Perandoor Canal, thus it helps policy planners and decision makers to adopt appropriate treatment and mitigation strategies for sustainable management of water resources in Kochi urban areas.

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# ASSESSMENT OF EFFECTIVENESS OF PROTECTED AREA MANAGEMENT OF–PARAMBIKULAM TIGER RESERVE

Dissertation Submitted to

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By

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# CERTIFICATE

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# DECLARATION

I hereby declare that the project work entitled "**Assessment of Effectiveness of Protected Area Management –Parambikulam Tiger Reserve**" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to July 2023 under the guidance and supervision of **Dr Deepu Sivadas** Scientist B, Forest Ecology Department, Kerala Forest Research Institute (KFRI), Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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Date: Greeshma C B

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**Greeshma C B**

# ABSTRACT

The Parambikulam Tiger Reserve (PTR) in the Western Ghats of India is a vital sanctuary for preserving the region's rich biodiversity and harbouring a significant population of tigers.Through a mixed-methods approach, including field surveys, data analysis, and stakeholder interviews, this research assesses various aspects of PTR's management. The study analyzes the status of the tiger population, biodiversity conservation efforts, habitat protection measures, community engagement, and the impact of ecotourism on conservation.

Results indicate that PTR's management has been successful in maintaining the core area as an inviolate zone, providing a secure breeding ground for tigers and preserving the natural integrity of the reserve. Collaborative efforts with local communities through Ecological Development Committees (EDCs) have fostered positive attitudes towards conservation, promoting coexistence between wildlife and people.Systematic monitoring of the tiger population has facilitated a comprehensive understanding of population dynamics, aiding informed decision-making for conservation strategies. Partnerships with interstate forest departments and regular habitat improvement programs have further fortified PTR's conservation endeavours.

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# UNDERSTANDING THE BIOLOGICAL DIVERSITY PROFILE OF KERALA; A RECONNAISSANCE SURVEY OF ARIMPUR PANCHAYATH IN THRISSUR

A Dissertation Submitted to

THE UNIVERSITY OF CALICUT, THENHIPALAM

In partial fulfilment of the requirement for the award of the Degree of

MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

Submitted by

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**CHRIST COLLEGE (AUTONOMOUS) IRINJALAKUDA,**

**THRISSUR - 680125**

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This is to certify that the dissertation titled **"UNDERSTANDING THE BIOLOGICAL DIVERSITY PROFILE OF KERALA; A RECONNAISSANCE SURVEY OF ARIMPUR PANCHAYATH IN THRISSUR"** is a record of original work done by **INDRA SASIKUMAR** (Reg. No. CCAVMES012), under co-guidance of **Dr Deepu Sivadas** Scientist B, Forest Ecology Department, Kerala Forest Research Institute (KFRI), Peechi in partial fulfilment of the requirement for the award of the degree of Master of Science in Environmental Science from Calicut University, Malappuram for the academic year 2021-23. The research work has not previously formed the basis for the award of any degree or any work on the part of the candidate.

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# DECLARATION

I hereby declare that this dissertation titled **"UNDERSTANDING THE BIOLOGICAL DIVERSITY PROFILE OF KERALA; A RECONNAISSANCE SURVEY OF ARIMPUR PANCHAYATH IN THRISSUR"** is a bonafide work done by me under the supervision of Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College, Irinjalakuda and this work has not previously formed the basis for the award of any other academic qualification, fellowship or other similar title of any other University or Board.

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Date:

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INDRA SASIKUMAR

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# Assessing the Impact of the Climate Change on Key Hydrological Variables in Kerala, India: An Analysis of Trends, Patterns and Interrelationships among Reference Evapotranspiration, Rainfall and Temperature

Dissertation Submitted to

THE UNIVERSITY OF CALICUT

In Partial Fulfilment of the Requirement for the award of

MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

Submitted by

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March-June 2023

**DEPARTMENT OF GEOLOGY AND ENVIRONMENTAL SCIENCE**

**CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA**

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# Assessing the Impact of the Climate Change on Key Hydrological Variables in Kerala, India: An Analysis of Trends, Patterns and Interrelationships among Reference Evapotranspiration, Rainfall and Temperature

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# CERTIFICATE

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I **Krishnapriya P G** hereby declare that this project work entitled "**Assessing the impact of the climate change on key hydrological variables in Kerala, India: An analysis of trends, patterns and Interrelationships among reference evapotranspiration, rainfall and temperature**" submitted to Calicut university in partial fulfilment of the requirement for the award of the master of science in Environmental Science, in my own work and to the best of my knowledge and belief. It is a record of original research carried out by me under the guidance and supervision of **Dr. Naveena K**, scientist B, Land and Water Management Research Group, Centre for Water Resources Development and Management (CWRDM), Kozhikode.

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**KRISHNAPRIYA P G**

# ABSTRACT

The study analysed rainfall data from 1970 to 2020, as well as maximum and minimum temperature data for the same period, to assess the climate trend in districts of Kerala. Reference evapotranspiration (ETo) was calculated using the Hargreaves method and used for trend analysis. The Hargreaves method is a widely used empirical approach for estimating reference evapotranspiration (ETo) based on temperature data. The Mann-Kendall (MK) test and Sen's slope estimator were employed to examine temporal and spatial variations in monthly, seasonal, and annual series. The distribution of rainfall and Reference Evapotranspiration (ETo) in Kerala can be spatially mapped using the IDW (Inverse Distance Weighted) interpolation method within the ArcGIS environment. Results revealed fluctuating rainfall patterns, increasing temperatures, and a rising trend in ETo. The most significant increase in ETo occurred during winter. Rainfall patterns during the south-west monsoon months undergo distinct shifts, with notable decreases in June and July and a significant increase in September. Moreover, the study observed variations in rainfall patterns across different districts of Kerala during specific months and seasons. Most districts showed an increasing trend in ETo, accompanied by rising minimum and maximum temperatures. The correlation and regression analysis conducted in the study revealed several relationships between climate variables. There was a negative relationship between rainfall (RF) and ETo, indicating that higher ETo values are associated with lower rainfall amounts. Additionally, a positive correlation was observed between maximum temperature and ETo, implying that higher temperatures contribute to increased evapotranspiration. Conversely, a negative correlation was found between minimum temperature and ETo. The findings of this study provide valuable insights into the shifts in rainfall patterns, temperature increases, and rising evapotranspiration rates, which is crucial for developing effective measures to mitigate and adapt to the changing climate in Kerala.

***Keywords*****:** Kerala; Trend analysis; Rainfall; Reference Evapotranspiration; Climate change; Temperature.

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# ABBREVIATIONS

| | | |
|---|---|---|
| AIC | : | Akaike's Information Criterion |
| ARIMA | : | Autoregressive Integrated Moving Average |
| CV | : | Coefficient of Variance |
| CWRDM | : | Centre for Water Resources Development and Management |
| ET | : | Evapotranspiration |
| ETo | : | Reference Evapotranspiration |
| IDW | : | Inverse Distance Weighted |
| IMD | : | Indian Meteorological Department |
| IPCC | : | Intergovernmental Panel on Climate Change |
| MK test | : | Mann-Kendall test |
| MMK test | : | Modified Mann-Kendall test |
| NEM | : | Northeast Monsoon |
| SD | : | Standard Deviation |
| SWM | : | Southwest Monsoon |
| Tmax | : | Maximum Temperature |
| Tmin | : | Minimum Temperature |
| WM test | : | Wallis Moore Phase-Frequency test |

# A study on pollution status of three open canals connected to Vembanad lake

A project report submitted to the

**UNIVERSITY OF CALICUT**

In partial fulfillment of the requirements for the award of the degree of Master of Science in

## ENVIRONMENTAL SCIENCE

by

**MANU SIMON**

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Kerala State Pollution Control Board
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Committed to protection of environment

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Date:

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# ABSTRACT

Water pollution is a main source of environmental pollution in our country. This is caused by harmful chemical pollutants and sewage from large- and small-scale industries, restaurants, apartments as well. In this project, areas are selected, and the apartments, restaurants, and industries that lie near the canals that are open to the lake are surveyed in order to evaluate the effect of pollution on the Vembanad Lake surrounding them. This is a project based on the Court order NGT (THE NATIONAL GREEN TRIBUNAL) ORDER 147/2022 which was undertaken by the Pollution Control Board of Ernakulam district. This is to formulate an action plan to restore water quality in Vembanad Lake areas. The selected areas are near goshree bridge, near sylcon hyper market and mullassery canal. The samples from each canal near the study areas were collected, and estimations were done. The results were loaded into a tabulated format by directly visiting the canals, and the location is marked on the map. It's challenging to develop incentives for behavior change, though. As a result, there needs to be increased awareness among the operators to limit the effluent output from restaurants, industries, and apartments, as well as to employ water-efficient techniques and/or tools to maximize water consumption. Programs for training can be assessed to determine how effective they are and to help the protocol be continually improved.

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# THERMAL STABILITY STUDY UNDER CONTINUOUS TEAK CULTIVATION, OPEN LAND AND NATURAL FOREST

Dissertation Submitted to

**UNIVERSITY OF CALICUT**

In partial requirement for the award of Master of Science in

**ENVIRONMENTAL SCIENCE**

By

**MUHAMMAD SUHAIL V.A**

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**CHRIST COLLEGE (AUTONOMOUS) IRINJALAKUDA**

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I hereby declare that the project work entitled "**Thermal stability study under continuous teak cultivation, open land and natural forest**" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to June 2023 under the guidance and supervision of **Dr. S Sandeep**, Principal Scientist, Department of Soil Science, Kerala Forest Research Institute (KFRI), Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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**Muhammad Suhail V.A**

# ABSTRACT

In this study we mainly focus on assessing total organic carbon (TOC) of various types of soil which has been collected from different plantation and forest systems of Kerala. Soil sample from surface (0-15) were collected and later subjected for air-drying, ground and sieved for further analysis. Study mainly focused on thermal stability of TOC under continuous teak cultivation soil. Experiment was setup for a total of 75 days in which soil samples were incubated at four temperatures (25℃,30℃ ,35℃,40℃) and were examined regularly in the span of prefixed time intervals. 17 soil samples from different regions of Kerala and was used for the estimation of total organic carbon and analysis of thermal stability experiment. Total organic carbon (TOC) was estimated using Walkley and Black method.

Thermal stability studies were mainly by using Arrhenius equation, activation energy and rate constants. $Q_{10}$ values were also estimated in this study. Study shows that if the activation energy is more then the temperature stability is also more and vice versa.

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# WATER QUALITY INDEX OF KONOTHUPUZHA RIVER

A project report submitted to the

**THE UNIVERSITY OF CALICUT**

In partial requirement for the award of Master of Science in

**ENVIRONMENTAL SCIENCE**

by

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Under the guidance of

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This is to certify that the project report entitled **Water Quality Index of Konothupuzha River** is the bonafide work of **Mr.Williams Raphael** under the guidance of **Dr. Manju N J** Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda in partial requirement for the award of Master of Science in Environmental Science is submitted to the University of Calicut during the academic year 2021- 2023.

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This is to certify that the project report entitled **Water Quality Index of Konothupuzha River** is the bonafide work of **Mr.Williams Raphael** under the guidance of **Dr. Manju N J** Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda in partial fulfilment of the requirements of the degree of Master of Science in Environmental Science is submitted to the University of Calicut during the academic year 2021- 2023.

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# ACKNOWLEDGEMENT

This is to express my deepest sense of gratitude to all those who have extended their timely support and helping hand in completing this study.

I express my deep sense of gratitude to Rev. Fr. Dr. Jolly Andrews CMI, the Principal of Christ College Irinjalakuda, Dr. Linto Alappat and to Dr.Subin K Jose for enabling me to carry out this work.

It has been a rare privilege for me to have worked under Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda.I express my most sincere gratitude for her timely advice, guidance and encouragement which enabled me to work with zest and zeal.

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I'm thankful to all our teachers and friends for their encouragement at various stages of the work. And my heart flows with most gratitude towards my loving parents, all the members of State Pollution Control Board, Ernakulam, who cooperated with my work.

# ABSTRACT

A Water Quality Index (WQI) is a useful statistical tool for simplifying, reporting and interpreting complex information obtained for any water body. A simple number given by any WQI model explains the level of water contamination .A water quality index carried out for Konothupuzha river on very important parameters can provide a simple indicator of water quality.The present study deals with the monitoring of variation of water quality index of Konothupuzha river. The index is used to improve the comprehension of general water quality issues, communicates water quality status and illustrates the need for and the effectiveness of protective practices. It is found that in all cases the change in WQI value follow a similar trend throughout the study period. The WQI values (33.15 – 68.51) calculated for the different samples indicate that the water is not safe for human consumption. We should implement preventive measures to reduce the threat of domestic and industrial discharges as well as agricultural activities discharges to the river inorder to restore the quality of water.

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# ASSESSMENT OF EFFECTIVENESS OF PROTECTED AREA MANAGEMENT OF - CHIMMONY WILD LIFE SANCTUARY

Dissertation Submitted to

## UNIVERSITY OF CALICUT

In partial requirement for the award of Master of Science in

## ENVIRONMENTAL SCIENCE

By


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## Reg. No: CCAVMES001




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## Batch: 2021-2023

Under the Guidance of


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I hereby declare that the project work entitled "**Assessment of Effectiveness of Protected Area Management – Chimmony Wildlife Sanctuary**" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to July 2023 under the guidance and supervision of **Dr Deepu Sivadas** Scientist B, Forest Ecology Department, Kerala Forest Research Institute(KFRI),Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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# ACKNOWLEDGEMENT

I take immense pleasure to express my sincere and deep sense of gratitude to my guide **Dr Deepu Sivadas,** Scientist B, Kerala Forest Research Institute for his timely guidance which enabled me to complete this work successfully. I shall be thankful to him for his valuable suggestions and encouragement given to me throughout this investigation.

I express my gratitude to my project guide **Dr Subin K Jose**, Head of the Department of Environmental Science, Christ College (Autonomous), Irinjalakuda for the valuable advice and support throughout this project work.

I express my sincere thanks to all staffs of Forest Ecology department, friends and colleagues, of my college and KFRI for their various helps and cooperation during the work and to all those who have contributed directly or indirectly for successful completion of the work.

Finally, I would like to thank my family and friends for their constant encouragement, understanding, and patience throughout this research journey.

**Amrutha M U**

# ABSTRACT

Protected areas play a crucial role in conserving biodiversity and maintaining ecological balance. Among these areas, Chimmony Wildlife Sanctuary in Kerala, India, stands as an important sanctuary nestled in the Western Ghats, a region known for its ecological significance. This study aims to assess the management effectiveness of Chimmony Wildlife Sanctuary in achieving its conservation goals. By evaluating the sanctuary's management practices and their impact on biodiversity, habitat preservation, and sustainable resource use, the study seeks to provide valuable insights into the conservation efforts in this protected area. The research examines the challenges faced by the management, including human-wildlife conflicts, encroachments, and tourism pressures, and evaluates the outcomes of relocation efforts for local communities. By understanding the successes and shortcomings of management strategies, this study contributes to enhancing the conservation and sustainable development objectives of Chimmony Wildlife Sanctuary and offers valuable lessons for protected area management worldwide.

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# EFFECT OF MILD REAGENTS ON RAW MICA MODIFICATION

Dissertation Submitted to

**UNIVERSITY OF CALICUT**

In partial requirement for the award of Master of Science in

**ENVIRONMENTAL SCIENCE**

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I hereby declare that the project work entitled "**Effect of mild reagents on raw mica modification**" submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to June 2023 under the guidance and supervision of **Dr. S Sandeep**, Principal Scientist, Department of Soil Science, Kerala Forest Research Institute (KFRI), Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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# ACKNOWLEDGEMENT

I take immense pleasure to express my sincere and deep sense of gratitude to my guide **Dr. S Sandeep, Principal Scientist, Department of Soil Science, Kerala Forest Research Institute** for his timely guidance which enabled me to complete this work successfully. I shall be thankful to him for his valuable suggestions and encouragement given to me throughout this investigation.

I am extremely thankful to **Navya Murali**, Research Scholar, Kerala Forest Research Institute for her guidance and suggestions throughout my work.

I express my gratitude to my project guide **Dr. Rekha V.B**, Asst. Professor, Dept. of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda for the valuable guidance and encouragement throughout the course of this work. I place on record my profound gratitude to **Dr. Subin K Jose**, Head of the Department of Environmental Science, Christ College (Autonomous), Irinjalakuda for the valuable advice and support throughout this project work.

I would also like to thank **Soumya S** of Centre for Analytical Instrumentation Kerala (CAI – K), KFRI for helping me during the analysis.

I express my sincere thanks to all staffs of soil science department, friends and colleagues, of my college and KFRI for their various helps and cooperation during the work and to all those who have contributed directly or indirectly for successful completion of the work.

My acknowledgment would not be complete without acknowledging my parents. Any attempt at any level can't be satisfactorily completed without the support, guidance, and constant inspiration of my parents.

**Amrutha Suresh**

# ABSTRACT

Clay minerals have a special set of features, including high cation exchange capacities, catalytic properties, plastic behaviour when moist, are characterised by their small particle size, which is typically less than 0.002 micrometres, and their high surface area to volume ratio. Inorganic salt activation plays an important role in modifying the microstructure and improving the surface properties of clay minerals. The surface properties of mica were investigated using water and sodium citrate, two mild leaching agents for different time intervals.

Chemical activation could gradually expand the interlayer distance of mica due to the leaching of cations and weakened interlayer forces. Characterization is done using XRD (X ray diffraction), AAS (Atomic absorption spectroscopy) and Flame photometry techniques. X ray spectra shows an increase of d spacings in water and salt treated mica which indicates recrystallization and and emergence of new mineral components with a higher interlayer space. AAS and Flame photometry determines an increase in concentration of elements in leached solution indicates mineral dissolution. Maximum leaching of concentration of elements results in altering the layers, increasing surface area and porosity.

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# Air Quality Index of Kochi Based on Brahmapuram Fire Incident

A project report submitted to the

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In partial fulfillment of the requirements for the award of the degree of Master of Science in

**ENVIRONMENTAL SCIENCE**

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This is to certify that **Mr. Ashin Saji, Reg. No. CCAVMES003** has participated in the project conducted by the Board for the **" Air Quality Index of Kochi based on Brahmapuram Fire Incident"** under my supervision and guidance in partial requirement for the award of Master of Science in Environment Science, Christ College, Irinjalakuda through University of Calicut during the Academic year 2021-2023.

KERALA STATE POLLUTION CONTROL BOARD
GANDHI NAGAR
COCHIN-682 020
DISTRICT OFFICE-1

ENVIRONMENTAL ENGINEER

# DECLARATION

I hereby declare that this project report titled is **Air Quality Index of Kochi Based on Brahmapuram Fire Incident** a bonafide work done by me under the supervision of Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda and this work has not previously formed the basis for the award of any other academic qualification, fellowship or other similar title of any other University or Board.

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# ACKNOWLEDGEMENT

This is to express my deepest sense of gratitude to all those who have extended their timely support and helping hand in completing this study.

I express my deep sense of gratitude to Rev. Fr. Dr. Jolly Andrews CMI, the Principal of Christ College Irinjalakuda, and to Dr. Subin K Jose for enabling me to carry out this work.

It has been a rare privilege for me to have worked under Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda. I express my most sincere gratitude for her timely advice, guidance and encouragement which enabled me to work with zest and zeal.

I sincerely thank State Pollution Control Board, Ernakulam, where my project has been done. I give special obligation and indebtedness to Environmental Engineer Sreelakshmi P. B., of State Pollution Control Board, Ernakulam. I am very thankful to my team members Ganashyam T.S , Manu Simon , Williams Raphael.

I'm thankful to all our teachers and friends for their encouragement at various stages of the work. And my heart flows with most gratitude towards my loving parents, all the members of State Pollution Control Board, Ernakulam, who cooperated with my work.

# ABSTRACT

Monitoring the air quality involves determining the types and amounts of pollutants present in the atmosphere in accordance with established air quality guidelines. By keeping track of air contaminants, air quality monitoring enables us to improve air quality. Air pollution has an appalling effect on human health and our planet as a whole. This study quantifies air pollution using a parameter – Air Quality Index based on Bramhapuram incident. Eight different air pollutants parameters are also measured using the data from monitoring stations Eloor and Vyttilla. The data from February to June is used to determine the effect of the Bramhapuram incident in Kochi.

# Air Quality Index of Kochi Based on Brahmapuram Fire Incident

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# SHORELINE CHANGE ANALYSIS ALONG THE COASTAL AREA OF THRISSUR DISTRICT, KERALA

**UNIVERSITY OF CALICUT**

In partial fulfillment of the requirements for the degree of Master of Science in

**ENVIRONMENTAL SCIENCE**

by

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This is to certify that the project report entitled SHORELINE CHANGE ANALYSIS ALONG THE COASTAL AREA OF THRISSUR DISTRICT, KERALA is the bonafide work of Ms. ASWATHY K V under the guidance of Dr. Subin k jose Assistant Professor, Head of the Department of Geology and Environmental Science and Haritha D S, Research scholar Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda in partial fulfilment of the requirements of the degree of Master of Science in Environmental Science is submitted to the University of Calicut during the academic year 2021-2023

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## ACKNOWLEDGEMENT

This is to express my deepest sense of gratitude to all those who have extended their timely support and helping hand in completing this study.

I express my deep sense of gratitude to **Rev. Fr**. **Dr. Jolly Andrews** CMI, the Principal of Christ College Irinjalakuda, **Dr. Linto Alappat** and to **Dr.Subin K Jose** for enabling me to carry out this work.

It has been a rare privilege for me to have worked under **Dr.Subin k jose**, Assistant Professor, Head of the Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda. I express my most sincere gratitude for his timely advice, guidance and encouragement which enabled me to work with zest and zeal.

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# UNDERSTANDING THE BIOLOGICAL DIVERSITY PROFILE OF KERALA; A RECONNAISSANCE SURVEY OF EDAVILANGU PANCHAYATH IN THRISSUR

A Dissertation Submitted to

THE UNIVERSITY OF CALICUT, THENHIPALAM

In partial fulfilment of the requirement for the award of the Degree of

MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

Submitted by

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**Reg. no. CCAVMES005**

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I hereby declare that this dissertation titled **"UNDERSTANDING THE BIOLOGICAL DIVERSITY PROFILE OF KERALA; A RECONNAISSANCE SURVEY OF EDAVILANGU PANCHAYATH IN THRISSUR"** is a bonafide work done by me under the supervision of Dr. Manju N J, Assistant Professor, Department of Geology and Environmental Science, Christ College, Irinjalakuda and this work has not previously formed the basis for the award of any other academic qualification, fellowship or other similar title of any other University or Board.

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I express my deep sense of gratitude to Rev. Fr. Dr. Jolly Andrews CMI, the Principal of Christ College Irinjalakuda, for enabling me to carry out this work and to Dr. Subin K Jose, Head of the Department, for his valuable suggestions for this work.

It has been a rare privilege for me to have worked under Dr.Subin K Jose, Assistant Professor, Department of Geology and Environmental Science, Christ College, Irinjalakuda. I express my most sincere gratitude for her timely advice, guidance and encouragement which enabled me to work with zest and zeal.

I sincerely thank Kerala Forest Research Institute, Peechi, Thrissur, where my project has been done. I give special obligation and indebtedness to Dr.Deepu Sivadas, Scientist B, Forest Ecology & Biodiversity Conservation Division, KFRI, Peechi.

I'm thankful to all our teachers and friends for their encouragement at various stages of the work. And my heart flows with most gratitude towards my loving parents, all the members of KFRI, Thrissur, who cooperated with my work.

CHANDNI SHASHI MENON

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# ASSESSMENT OF EFFECTIVENESS OF PROTECTED AREA MANAGEMENT OF -PEECHI VAZHANI WILD LIFE SANCTUARY

Dissertation Submitted to

**UNIVERSITY OF CALICUT**

In partial requirement for the award of Master of Science in

**ENVIRONMENTAL SCIENCE**

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# DECLARATION

I hereby declare that the project work entitled "**Assessment of Effectiveness of Protected Area Management – Peechi Vazhani Wildlife Sanctuary**"submitted to University of Calicut in partial requirement for the award of Master of Science in Environmental Science, was carried out by me during the period of April 2023 to July 2023 under the guidance and supervision of **Dr Deepu Sivadas** Scientist B, Forest Ecology Department, Kerala Forest Research Institute(KFRI),Peechi and no part thereof been presented before, for any other degree or diploma in any university.

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I express my gratitude to my project guide **Dr Rekha V B**, Asst. Professor, Dept. of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda for the valuable guidance and encouragement throughout the course of this work. I place onrecord my profound gratitude to **Dr Subin K Jose**, Head of the Department of Environmental Science, Christ College (Autonomous), Irinjalakuda for the valuable advice and support throughout this project work.

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**Christy M B**

# ABSTRACT

Globally protected areas are crucial for the Millennium Development Goals and provide opportunities for conservation and restoration projects. With over 100,000 protected areas covering around 12% of the Earth's surface, these areas are essential for conserving biodiversity and ensuring the environment's sustainability. However, their coverage varies significantly between nations and ecoregions, and many sites are now threatened by development. Kerala, for example, has a significant forest cover, with Wayanad having the most greenery among the 14 districts.

Protected areas are designated for their natural, ecological, or cultural importance, and are essential for conserving biodiversity and preventing the decline of the planet's ability to sustain human life. They provide essential ecosystem services such as water, food, clothing, housing, transportation, and medications. Protected areas also serve as sanctuaries and strongholds for many species, ensuring ecological resilience and protecting humans from climate-related disasters.

Protected areas also serve as major sources of revenue, providing jobs and means of subsistence for the tourism sector, and supporting industries producing outdoor gear. They also safeguard resources with significant economic value, such as water and fisheries. Preserving species in protected areas increases the likelihood of new drugs being discovered.

Protected areas offer various benefits to society's culture, ecology, spirituality, and science, including maintaining biodiversity and halting extinction disasters. Successful agrobiodiversity conservation in protected areas, including traditional protected areas with crop wild relatives and on-farm areas, is essential for preserving populations, species, and genetic variety. However, these areas face challenges such as climate change, development beyond designated boundaries, water scarcity and pollution, invasive species, and disrupted wildlife movement pathways.

Instilling a conservation ethic in today's youth is crucial for the future of protected areas, as they will be subject to neglect and encroachment. By promoting conservation and promoting responsible use of natural resources, protected areas can continue to provide valuable benefits for society and the environment.

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