



CHRIST
COLLEGE (AUTONOMOUS)
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Department of Geology and Environmental Science Christ college(Autonomous), Irinjalakuda, Thrissur



The Department of Geology was started in 1981. Postgraduate course in Environmental Sciences started in the year 2000 and the name of the department got changed to Department of Geology and Environmental Science.

FACULTIES



Dr. Subin. K. Jose

Asst. Professor and Research supervisor

Area of Specialisation:

Water quality, GIS, Biodiversity, EIA



Dr. Rekha V B

Asst. Professor and Research supervisor

Area of Specialisation:

Specialisation in Hydrogeology and Geoinformatics



Dr. Manju N J

Asst. Professor and Research supervisor

Area of Specialisation:

Environmental Microbiology, Bioremediation, Biological waste water treatment, Nitrification and Denitrification, Sustainable microbial technology, Bioreactor technology.

RESEARCH SCHOLARS



Vivek Chandran A

Research topic: Diversity and ecology of odonates in Kole wetlands, central Kerala, India.

Project: Understanding the ecology of *Disparoneura apicalis* (Fraser, 1924) in Kuruva Islands, Kerala, Southern India.



Haritha D.S.

Research topic: Assessment of saltwater intrusion along the coastal areas of Malappuram (dt), Kerala.

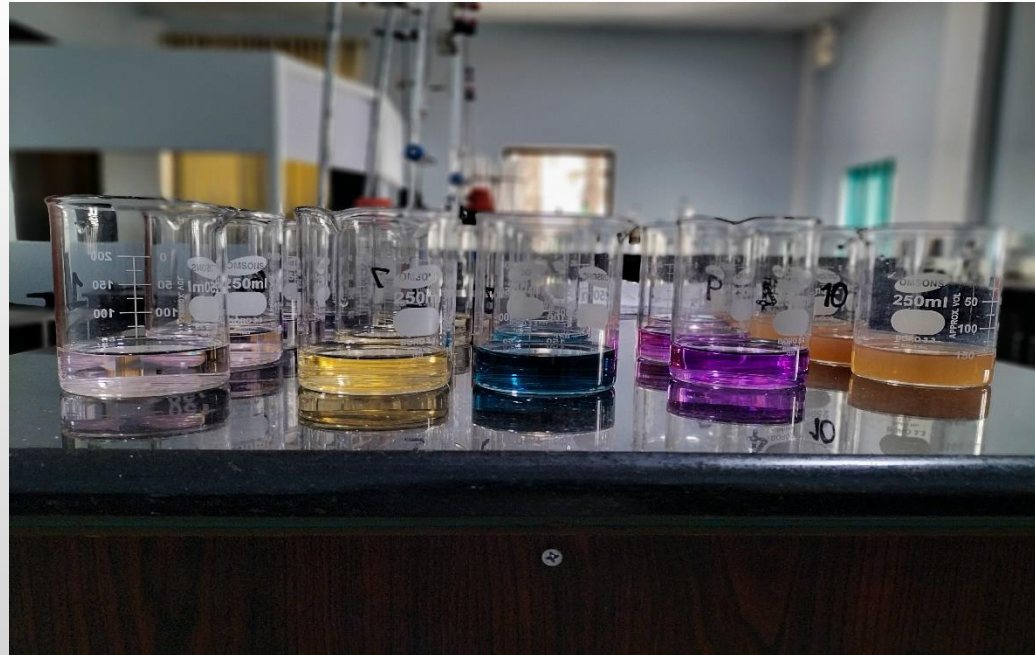


Archana M

Research topic: Flood modelling and simulation in Ernakulam District, Kerala; A Geospatial approach.

Christ Aqua Research Lab (CARL)

Christ Aqua Research Lab (CARL) is a well-equipped laboratory established under the Department of Geology & Environmental Science, Christ College (Autonomous), Irinjalakuda. The focus of CARL is to conduct research on water and water quality parameters, help governmental and non-governmental bodies with water quality consultation, biomonitoring of waterbodies and give supporting services to student projects.



Consultation services

ക്രൈസ്റ്റ് കോളെജിൽ ജല ഗുണനിലവാര പരിശോധനാ ലാബ് സജ്ജമായി

ഇരിങ്ങാലക്കുട: ക്രൈസ്റ്റ് കോളെജിൽ ജലത്തിന്റെ 21 ഗുണനിലവാര ഘടകങ്ങൾ പരിശോധിക്കാവുന്ന പരീക്ഷണശാല ഒരുങ്ങി. ഗാർഹിക ആവശ്യങ്ങൾക്കും വ്യാവസായികാവശ്യങ്ങൾക്കും ഉപയോഗിക്കുന്ന ജലത്തിന്റെ ഗുണനിലവാരം പൊതുജനങ്ങൾക്ക് ഇവിടെ പരിശോധിച്ചു കൊടുക്കപ്പെടും. ക്രൈസ്റ്റ് അക്കാദമി സെർച്ച് ലാബ് എന്ന് നാമകരണം ചെയ്യപ്പെട്ട ലാബിൽ ജലത്തിന്റെ പ്രധാനപ്പെട്ട ഭൗതിക-രാസ-ജൈവ ഘടകങ്ങൾ എല്ലാം പരിശോധിക്കാനുള്ള സൗകര്യങ്ങൾ ഒരുങ്ങിയിട്ടുണ്ട്.

കുടിവെള്ളത്തിന്റെ സുരക്ഷിതത്വം, ജലത്തിൽ അടങ്ങിയിട്ടുള്ള മാലിന്യങ്ങളുടെ തോത് എന്നിവ അറിയാൻ ലാബിലെ സൗകര്യങ്ങൾ പ്രയോജനപ്പെടുത്താം. ജലത്തിന്റെ ഗുണനിലവാരം മെച്ചപ്പെടുത്താൻ വേണ്ട മാർഗനിർദ്ദേശങ്ങളും



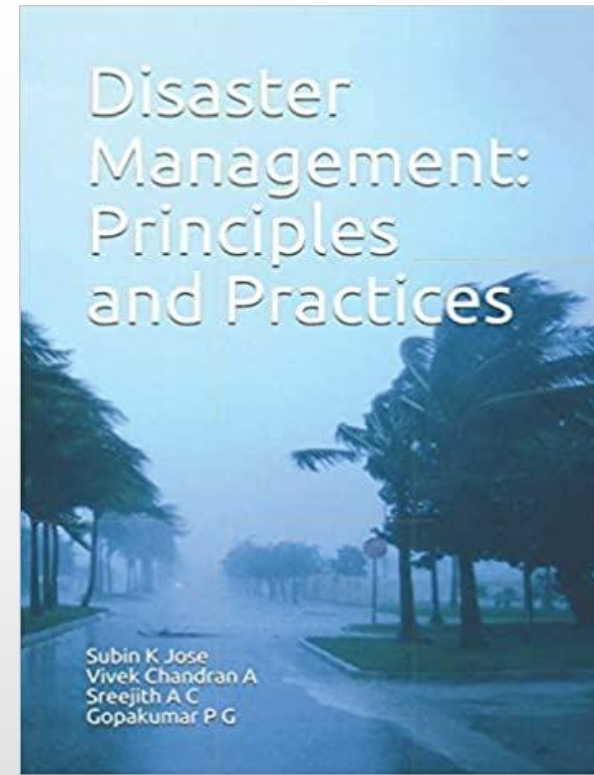
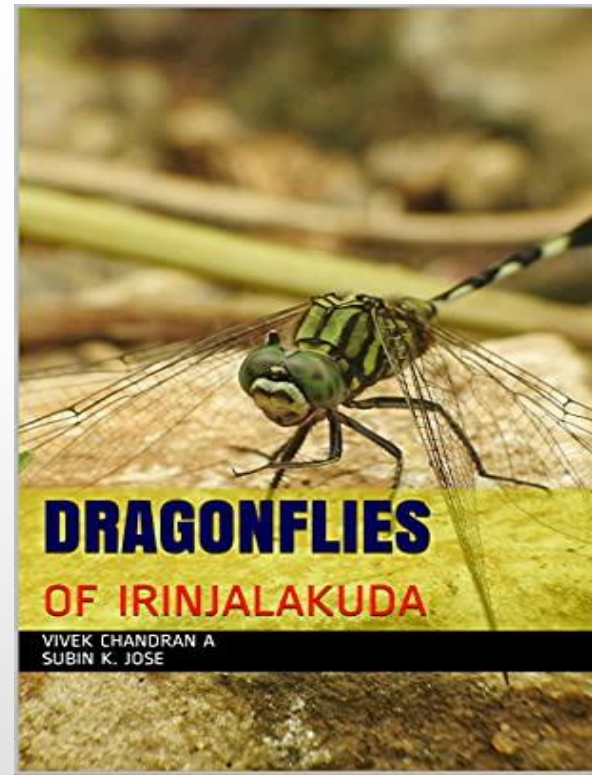
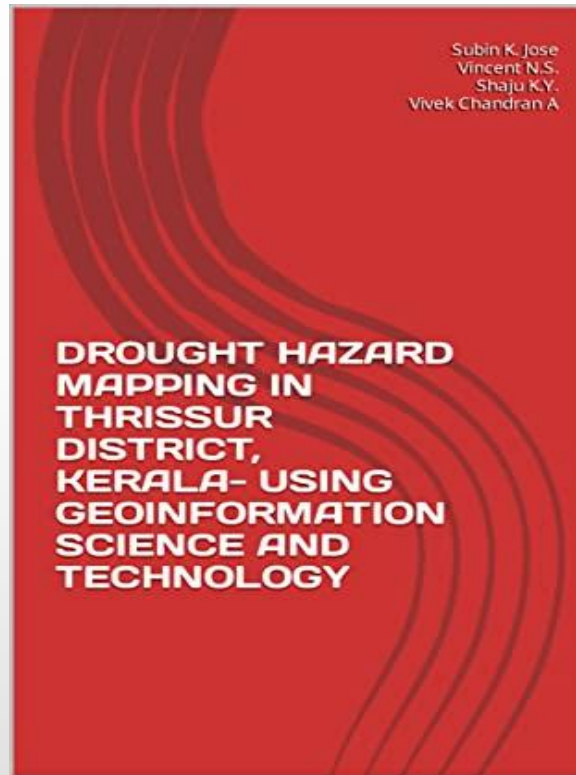
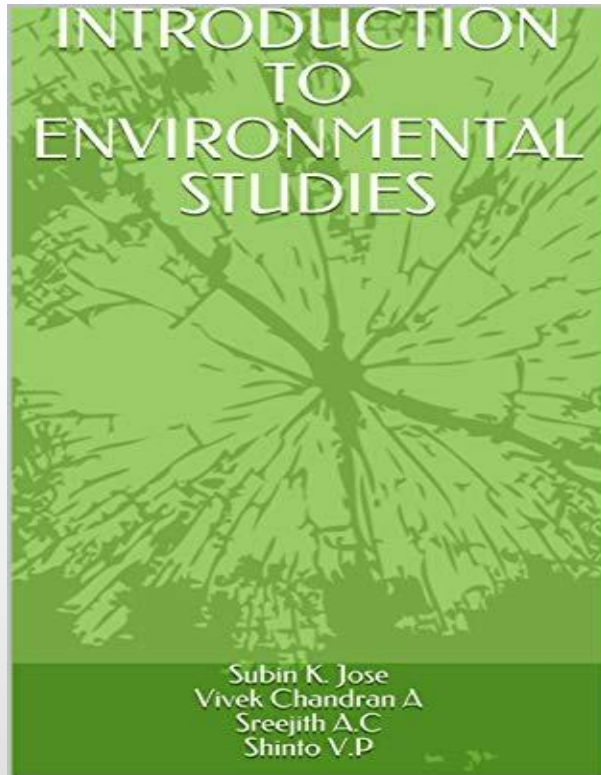
ഇരിങ്ങാലക്കുട ക്രൈസ്റ്റ് കോളെജിൽ സജ്ജമായ ജലഗുണനിലവാര പരിശോധനാ ലാബ്

ലാബിലെ ഗവേഷകർ നൽകുമെന്ന് കോളെജ് പ്രിൻസിപ്പൽ ഫാ ജോളി ആൻഡ്രൂസ് പറഞ്ഞു. ജലത്തിന്റെ നിറം, കലക്കം, വൈദ്യുതീവാഹകശക്തി, പിഎച്ച്, ലവനപദാർത്ഥങ്ങളുടെ അളവ്, അമ്ലത്വം, ക്ഷാരാംശം, കാഠിന്യം, കാൽസ്യം, മഗ്നീഷ്യം, ക്ലോറൈഡ്, ഫ്ലൂറൈഡ്,

സൾഫേഡ്, നൈട്രേറ്റ്, ഇരുമ്പ്, കോളിഫോം എന്നിവയാണ് പരിശോധിച്ചു കൊടുക്കപ്പെടുന്ന പ്രധാന ഘടകങ്ങൾ. ജല സാമ്പിളുകൾ ലാബിൽ നേരിട്ടോ കോളെജിന്റെ ഭൂഗർഭശാസ്ത്ര- പരിസ്ഥിതിശാസ്ത്ര വിഭാഗത്തിലോ ഏൽപ്പിക്കാവുന്നതാണ്.

CARL is providing the service of testing water samples at nominal fees to the public. The service is available for institutions, establishments, industries and the general public. A total of 26 parameters can be tested at CARL that include physical (pH, conductivity etc.), chemical (acidity, hardness etc.) and biological (coliform, E.coli) parameters. The researchers also give advice to improve water quality.

BOOKS PUBLISHED



RESEARCH PUBLICATIONS

1st June 2021

First record of gynandromorphism in *Trithemis aurora* (Odonata: Libellulidae)

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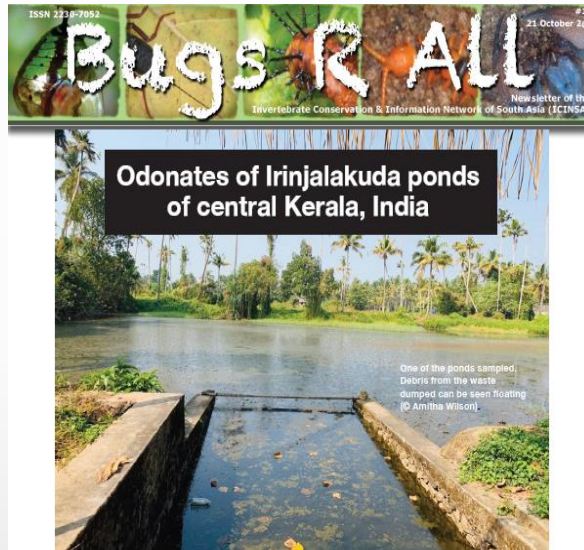
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Abstract. A gynandromorphic individual of *Trithemis aurora* is reported from a garden in Palakkad district, Kerala state, India. Its eyes, thorax, legs, wings, and abdomen show mosaic gynandromorphy. The abdomen is mostly gynochromic with the tip bearing female appendages. Detailed study of the specimen shows that female characters predominate but significant areas exhibit male characters.

Further key words. Dragonfly, Anisoptera, mosaic gynander, androchromism

Introduction

Gynandromorphs are genetically chimeric individuals consisting of adjacent male and female tissues, thus differing from intersexes which are genetically uniform (NARITA et al. 2010). Gynandromorphism is a rare phenomenon in nature and is readily detected in species that show sexual dimorphism. In arthropods, gynandromorphs have been recorded in crustaceans (FARMER 2004), arachnids (e.g., PALMGREN 1979; COKENDOLPHER & SISSON 1988; LABRUNA et al. 2002) and insects (e.g., MORGAN & BRIDGES 1919; NIELSEN 2010; GJERSHAUG et al. 2016). In dragonflies, gynandromorphism has been reported in at least 55 cases (cf. review by MARTENS & WILDERMUTH 2021). This phenomenon is conspicuous in species that exhibit marked sexual colour dimorphism such as *Crocothemis servilia* (Drury, 1770) (YOKOTA & ASAHINA 1953; FUTAHASHI 2017; RENJITH & CHANDRAN 2020), *Brachythemis contaminata* (Fabricius, 1793) (JOSHI et al. 2020) or *Neurothemis tullia* (Drury, 1770) (SHOME et al. 2019). Here we report on a case of phenotypical mo-



Dragonflies and damselflies (Odonata) are good indicators of the freshwater ecosystem health because of their amphibious life history, relatively short generation time, high trophic position, and diversity (Corbet 1993). Ponds are home to a diverse community of specialized plants and animals and are hence of great conservation concern. Through land-use changes, ponds have been disappearing rapidly and the remaining ponds are often threatened by contamination and eutrophication, with negative consequences for pond-dependent taxa like Odonata (Janssen et al. 2018). Irinjalakuda is a municipal town in Thrissur

District, Kerala, India. Irinjalakuda has a number of public and private ponds like most parts of the state. Twenty man-made ponds with public access were selected randomly in and around Irinjalakuda for sampling odonates (Figure 1 & Table 1).

The fieldwork was done in the post-monsoon season (November 2019–February 2020). Each pond was visited between 09 AM and 11 AM in sunny weather. The observers walked along the banks of each pond at constant pace for 30 minutes and recorded the species and the number of individuals seen. All individual odonates observed

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Dragonflies and damselflies (Insecta: Odonata) of the Kole Wetlands, central Kerala, India

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Abstract: A year-long study was conducted at the Kole Wetlands, a Ramsar site in central Kerala to document the diversity of dragonflies and damselflies and understand their seasonality. Checklist survey method was used to sample adult odonates in 30 randomly chosen locations. A total of 44 species (30 dragonflies and 14 damselflies) belonging to 33 genera and eight families were recorded in the study area. Species richness showed a peak in the post-monsoon season and a dip in the summer. The observations support the value of the Kole Wetlands in providing valuable resources for Odonata.

Keywords: Conservation, insect diversity, Ramsar site, seasonality, wetlands.

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Competing interests: The authors declare no competing interests.

Author details: A. Vivek Chandran is a PhD scholar at the Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda. His specific fields of interest are taxonomy and ecology of odonates. Subin K. Jose is an Assistant Professor at the Department of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda. His research interests are remote sensing, GIS and landscape ecology. Sujith V. Gopalan is a conservation biologist with research focused on evolution, ecology, population genetics, phylogeny and systematics of amphibians and odonates of the Western Ghats.

Author contributions: SC and SVG designed the study. AVC and SVG collected data from the field. AVC analyzed the data. AVC, SC and SVG wrote the paper.

Acknowledgements: We thank Subin K.S. for helping us in the field. We are indebted to Society for Odonate Studies (SOS), Kerala for the encouragement and technical support. Viki and Aki are thankful to Kerala State Biodiversity Board and Centre of Science and Technology for Rural Development (COSTFORD), Thrissur, respectively, for providing the financial support for the fieldwork.



An Overview of Seawater Intrusion along the Coastal Districts of Kerala – A Case Study

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Abstract: As seawater intrusion is one of the biggest problems the world is facing today because this process can directly affect the availability of good quality drinking water. This present study focused on studying the seawater intrusion status along all the coastal districts in Kerala, for that recent years data was used and from the study it is clear that all the coastal districts in Kerala are facing the problems due to seawater intrusion.

Key Words: Seawater intrusion, Kerala, seawater intrusion processes, investigation methods, prevention.

1. INTRODUCTION

According to (Werner et al. 2013), Seawater intrusion is the movement of seawater towards the land, which can happen due to prolonged changes or sudden changes such as increased pumping of groundwater, sudden climatic changes, fluctuations in sea level etc. According to (Van Dam 1999), seawater intrusion is in a steady state or it is a transient process and later the freshwater gets replaced by seawater, the rate of outflow of freshwater and the rate of inflow of saline water can be equal. So in a groundwater system the volume of saline water increases with the decrease of freshwater. Natural factors as well as human activities and rapid urbanization exacerbates the rate of seawater intrusion so remedial measures have to be taken immediately to prevent further encroachment of saline water (Hussain et al. 2019). Good quantities of work have been conducted to understand the seawater intrusion process around the world (Alfarrah and Walravens 2018; Barlow and Reichard 2010; Priyanka and Mahesh 2015; Dhakate et al. 2016, Pujari and Soni. 2009). In this present work, an attempt has been made to explain the process, methods to identify salinity intrusion and an overview of seawater intrusion studies in Kerala in recent years has been reviewed.

2. SEAWATER INTRUSION PROCESS

There is a seawater - freshwater interface exists between and along where sea and fresh water interact. The mixing zone in coastal aquifers is a key factor between freshwater and seawater (Michael et al. 2005). The hydraulic contact between the aquifer and the sea exists, hence under normal conditions freshwater flows from the land to the sea, but under certain conditions inversion of this natural process occurs and that results in seawater intrusion (Sykes and Ramesh 2012). This hydrostatic balance is well explained by Ghyben (1888) and Herzberg (1901). In simple terms this Ghyben-Herzberg relation can be stated as, in an

unconfined aquifer if the water table is lowered by 1 m, the saltwater-freshwater interface will rise up to 40 meter (Freeze and Cherry 1979).

General considerations to prevent seawater intrusion according to (Todd 1974) include, total annual extraction must be less than annual recharge near the coast, concentrated abstraction must be avoided, to avoid or limit seawater up coning protective layers must be installed and protected, protection of aquifer recharge sources, forever prevention, well construction must be done carefully for conserving protective layers, filling abandoned wells and boreholes with cement or clay, careful plumbing and rest schedule. Process and the expense of improving water quality in an already salt affected well is high.

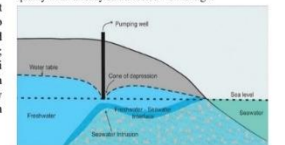


Fig. 1: Seawater intrusion into the coastal aquifer

2.1 Investigation Methods of Seawater Intrusion

2.1.1 Geophysical Methods

The difference in electrical resistivity of freshwater (> 54m) and saltwater (0.24m) makes it possible for studying subsurface salinity distribution. Electromagnetic methods (EM) and direct current (DC) resistivity methods are used for this investigation (Werner et al. 2013). Groundwater which is not affected by saline water shows low electrical conductivity value and electrical and electromagnetic methods are used



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Section A: Environmental Science

Research Article

Urban Green Space Analysis and Change Detection Using Geoinformatics

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Received: 12 July 2017; Revised: 24 July 2017; Accepted: 28 July 2017

Abstract: Green areas are vital in determining the quality of urban environment as they influence physical health of citizens and for instance, some are also used as recreational areas. In the process of land use planning for almost all cities, allocation of urban land to green space has become an important policy issue. More specifically, urban green spaces as a class of land use is defined as places within the extent of an urban area that provide opportunities for outdoor recreation and enjoyment or simply pockets of vegetation in the city environment. Mapping and monitoring of urban green spaces is a prerequisite for effective management and protection of urban environment. Change detection is a technique used in GIS and Remote sensing techniques Landsat ETM-7 and OLI - 8 images used for change detecting Supervised maximum likely hood classification LU/LC which have may occur between a time interval (2000 to 2015) in Thrissur corporation The LU/LC of both years has been delineated using and classified maps were crossed to generate an urban green cover changes Normalized difference vegetation index (NDVI) has been employed for detection of change area and quantification of the amount of decline or increase in urban greenery 2000-2015 The analysis shows an overall decrease in the total green space of the study area from 54.2% (2010) to 48.1% (2015). The land use analysis showed that there is a substantial increase in built up and other non-green areas Zonal wise analysis was also carried out to know delineate the most effected localities in terms of green space conversion as a part of development.

Key words: Remote sensing, Green areas, Thrissur, Normalized difference vegetation index

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LANDSLIDE SUCCEPTIBILITY ANALYSIS OF KOTHAMANGALAM-MUNNAR HIGHWAY USING GEOINFOEMATICS

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**Kerala University of Fisheries and Ocean studies (KUFOS), Kochi.

ABSTRACT

Landslides occur in a large variety of forms depending on the type and speed of movements, the material involved and the triggering mechanism. The research area comprises an area of 77 km road stretch Kothamangalam-Munnar highway (NH49) of Kerala and it was situated at in two districts Idukki and Ernakulam. The present study tries to identify different landslide prone areas in Kothamangalam-Munnar highway (NH49) of Kerala by using Remote Sensing and GIS. In the present study raster based weightage method was carried out for the preparation of landslide susceptibility zonation map. For the study data utilized include survey of India Topographic maps, Indian Remote Sensing Satellite data and Rainfall data from the Indian Meteorological Department. In this study a set of 6 instability factors corresponding to the causative factors for the instability were prepared using remote sensing information and topographic sheets. Different thematic layers such as slope, aspect, elevation, drainage density, landuse and rainfall were created for the preparation of landslide susceptibility zonation map. The accuracy of landslide prediction map was verified by field investigation using GPS.

Key words: Landslide, Geographic Information System, Remote Sensing, Disaster, Prediction

INTRODUCTION

Natural disasters such as landslides, earthquakes, flood, drought, cyclone, volcanic eruptions, environmental degradation etc are of global phenomenon. Most of the countries are experiencing either one or more disasters at regular interval. International Decade for Natural Disaster

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POLLUTION STRESS ASSESSMENT OF OXBOW LAKE IN KERALA

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ABSTRACT

An oxbow lake is a U-shaped body of water that forms when a wide meander from the main stem of a river is cut off, creating a free-standing body of water. Oxbow lakes are Shallow open waters. They are small bodies of standing or gently flowing water that represent a transitional stage between lakes and marshes. "Kanichan thura" at Vynthala is considered to be the only one naturally formed "Ox-bow" lake in Kerala. Now the pollution load of this lake is high due to anthropogenic activities. Physical and chemical properties of water are the most important factors responsible in shaping the biotic communities. A shift in the desired level of physico chemical properties affect the productivity chain adversely and as a result the entire aquatic productivity equilibrium is disturbed. The present study identify the water and sediment pollution level by analysing the different water and sediment quality parameters. The different water parameters analysed are pH, TDS, conductivity, alkalinity, acidity, BOD, COD etc. During the present study realized that the oxbow lake at Kanichanthura is a precious natural resource. It holds The ox-bow lakes are very potent biologically and thus are capable to generate better economic environment, provided certain management practices are employed. At the present, as the lakes are poorly managed. The lake is under threat. It needs urgent care and protection as it is a part of our natural heritage and should remain as specimen for the generations to come.

KEYWORDS: Oxbow Lake, Pollution, Kanichanthura, Natural Resource

INTRODUCTION

The origin of ox-bow lake is a complex phenomenon and in this process many natural and human forces are involved. The genesis of the formation of lake basins has been identified as constructive, destructive or obstructive by geomorphologists and they have attributed seven main reasons for their origin, such as (i) Tectonic activities (ii) land slides (iii) glacial activity (iv) drifting activity (v) volcanic activity (vi) solution activity and (vii) fluvial activity. Thus nomenclature for such lakes has originated from United States and is derived from resemblance in shape to the wooden U-shaped collar placed around the neck of a draft-ox and attached to the yoke (Hutchinson 1957) Oxbow lakes belong to semi-natural wetlands (Zofia Molnar 2013), which are rare in South India as well. Oxbow lakes are Shallow open waters. They are small bodies of standing or gently flowing water that represent a transitional stage between lakes and marshes. They vary greatly in physical and chemical composition. Its surface is free of vegetation except for aquatic macrophytes. Unlike lakes, the water temperature in shallow open waters is uniform, without any stratification. Shallow open waters are usually connected to sources of groundwater and receive additional inputs from runoff, precipitation and other water bodies. Their depth is usually less than 2metres. Shallow open waters are characteristic of intermittently flooded, permanently flooded or seasonally stable water regimes. They may dry out due to water losses from seepage or evaporation (Foote Lee *et al.* 1996). Wetlands are one of the most threatened habitats of the world. Wetlands in India, as elsewhere are increasingly facing several anthropogenic pressures. Thus, the rapidly expanding human population, large scale changes in

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Water Quality Mapping of Coastal Aquifers in Central Part of Peninsular India Using Geographic Information System

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¹Geology and Environment science, Christ college, Irinjalkuda

²Centre for Earth Research and Environment Management, Kochi

Abstract: The coastal tract of central Kerala, India comprises of Tertiary sediments and the phreatic aquifer here acts as an important source of drinking water. The most important climatic feature in the region is the monsoon, which has great influence on the quality of the groundwater. Water samples were collected during pre-monsoon and post-monsoon seasons from open wells and quality analyses including bacteriological studies were carried out. Groundwater quality maps were prepared based on GIS. The groundwater quality classification maps of the study area reflect the areal extent of each zone accurately and the variations in each parameter. Application of GIS further helped in delineating the potential potable groundwater zones of the area. The study revealed the inferior quality of groundwater in most of the coastal belt and also prevalence of E. coli in drinking water.

Keywords: coastal aquifer, groundwater quality, GIS

I. Introduction

Groundwater is one of the most important natural resources necessary for humanity. It is vital for the existence of mankind but faces acute shortage. Groundwater is that invisible supply of water that seeps beneath the surface of the ground, collects in natural underground reservoirs known as aquifers, and is the source of water in springs and wells. It provides almost a third of all freshwater on earth. It is threatened, however, by pollution, water mismanagement and exploding populations just as the world's remaining sources of freshwater are endangered. Groundwater resources are dynamic in nature as they grow with the expansion of irrigation activities, industrialization, urbanization etc. As it is the largest available source of fresh water lying beneath the ground it has become crucial not only for targeting of groundwater potential zones, but also monitoring and conserving this important resource. The expenditure and labour incurred in developing surface water is much more compared to groundwater, hence more emphasis is placed on the utilization of groundwater, which can be developed within a short time. Besides targeting groundwater potential zones it is also important to identify suitable sites for artificial recharge usage cycle. When the recharge rate cannot meet the demand for water, the balance is disturbed and hence calls for artificial recharge on a country wide basis (Saneera *et al.* 2006). With the world's population explosion, increasing pollution and wide-scale mismanagement of freshwater supplies, a critical water shortage may occur within the next 50 years and hence counter-measures are essential. The slow penetration of pollutants has been called a "chemical time bomb." It threatens humankind. Another danger is that of saltwater intrusion: the displacement of fresh water in coastal aquifers by seawater. The problem is acute in some coastal regions and for small islands. India with its long coastline also faces this problem. Another important aspect is water quality. Improvements in existing strategies and the innovation of new techniques resting on a strong science and technology base will be needed to eliminate the pollution of surface and ground water resources, to improve water quality and to step up the recycling and re-use of water. Science and technology and training have also important roles to play in water resources development in general. Water is one of the most crucial elements in developmental planning. As the country prepares itself to enter the 21st century, efforts to develop, conserve, utilize and manage this important resource have to be guided by national perspectives.

The problems faced by the coastal zone of Kerala, where the present study area falls, are unique among all other states of India in mainly due to its high density of population and peculiar geological setting. The hydrogeological environment along this 560 km long coast with its backwater, lagoons, estuaries and barrier islands is complex in nature. The groundwater development along the coast has been increased many fold during the last four decades to meet the increase in requirements as a result of population growth, industrial development and change in lifestyle.

GIS is an effective tool for the integration of various data and hence has multifarious uses in geological studies. The GIS offers unique opportunities to integrate spatial data from different sources with the natural resources management models (Goodchild, 1993). GIS has been put to effective use in delineating groundwater potential zones in many earlier studies, Saraf and Choudhary (1998); Sarkar *et al.* (2001); Khan and Moharana (2002); Srivastava *et al.* (2004). Application of GIS for groundwater resource assessment has also been reported

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SPATIOTEMPORAL LANDCOVER CHANGE ANALYSIS IN PEPPARA WILDLIFE SANCTUARY, WESTERN GHATS, INDIA

SUBIN K. JOSE¹, GOPAKUMAR P.G^{2*}

¹Department of Environmental science, Christ college, Irinjalakuda, joesubin@gmail.com.

²Department of Geology, Christ college, Irinjalakuda, * corresponding author

Abstract: Land cover, defined as the assemblage of biotic and abiotic components on the Earth's surface, is one of the most crucial properties of the Earth system. Vegetation is a vital component of the natural environment. Terrestrial vegetation includes natural ecosystems, such as native forests and woodlands, shrub lands, grasslands and wetlands. Information on land cover is fundamental to many national/global applications including watershed management and agricultural productivity. Thus, the need to monitor land cover is derived from multiple intersecting drivers, including the physical climate, ecosystem health, and societal needs. Tropical forests have undergone rapid land cover changes especially in the last few decades. Terrestrial forest is one of the major factors in the global carbon balance, and therefore in global climate change. Change in forest cover may also have affected past climates on regional or sub-continental scales. Forest cover change accelerates the climate change and global warming. The present study analyses the Landcover change in the Peppara wildlife sanctuary for a period of forty years using GIS and Remote sensing techniques.

Keywords: GIS, Remote sensing, vegetation, wildlife sanctuary.

1. INTRODUCTION

The composition, diversity, and structure of vegetation are the key determinants in assessing biological diversity of forest ecosystems. Vegetation is the source of primary production which plays a direct role in water and nutrient cycling, and interacts strongly with other biotic components. Vegetation has also been identified as a specific target for the calculation of critical loads/levels. The composition and structure of vegetation can serve as bio-indicators for environmental changes to ecosystems that echo the interactions between human activity and the natural environment (Zhang *et al.*, 2008). The land cover and landscape change in semi-arid and arid environments often reflects the most significant impact on the environment due to excessive human activity (Zhou *et al.*, 2008a and Zhou *et al.*, 2008b). Terrestrial forest is one of the major factors in the global carbon balance, and therefore in global climate change (Francyet *al.*, 1995; Fang *et al.*, 2001). Change in forest cover may also have affected past climates on regional or sub-continental scales. Forest cover change accelerates the climate change and global warming (Ruddiman, 2003). Land use/land cover is a fundamental variable that impacts the forest fragmentation and isolation of habitats, which is being linked with human and physical environments (Girirajet *al.*, 2010). Forest cover changes may have been important consequences for natural and forest landscapes through their impacts on soil and water quality, biodiversity, and global climatic systems (Chen *et al.*, 2001). Vegetation mapping is a product of the development of remote sensing, initially through aerial photography, remote sensing technology, because of the benefits it offers wide area coverage, frequent revisits, multispectral, multisensor, and storage in digital format to facilitate subsequent updating and compatibility with GIS technology proved very practical and economical means for an accurate classification of land cover (Nafesseret *al.*, 2010, Lillesand and Kiefer, 1999). Forest cover change detection techniques have been developed for monitoring land cover dynamics from remotely sensed imagery (Coppin *et al.*, 2004; Lu *et al.*, 2004, Roy and Roy, 2010). The present analysis of land use and land cover

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TIME SERIES DROUGHT VULNERABILITY MAPPING IN PALAKKAD DISTRICT, INDIA- USING GEOINFORMATION SCIENCE AND TECHNOLOGY

SUBIN K. JOSE*, SHINTO S*, TITTO VARUGHESE**

*Geology and environmental science, Christ College, Irinjalakuda,

**Corresponding Author :Department of Chemistry, Christ College, Irinjalakuda

ABSTRACT

Drought is one of the major environmental disasters, which have been occurring in almost all climatic zones and damage to the environment and economies of several countries has been extensive and death toll of livestock unprecedented. Drought damages are more pronounced or prominent in areas where there is a direct threat to livelihoods. The advanced technologies like remote sensing and geographical information system are very essential to identify the drought condition. Remote sensing and geographic information system have significantly aided identification of drought vulnerable areas in the recent past. Drought is one of the natural disasters having an impact on both the economy and the society, with its long-standing problems. Drought by nature is a result of inter-related parameters. The study is based on the concept that the severity of the drought is a function of rainfall, hydrological and physical aspects of the landscape. In the present study a Geographic Information Systems (GIS) and remote sensing based tool for drought vulnerability assessment at a micro level has been developed. Drought vulnerability is a concept which shows the likelihood of damages from hazard in a particular place by focusing on the system status prior to the disaster. Drought vulnerability has been viewed as a potential for losses in the region due to water deficiency at the time of drought. In this study the vulnerability of drought in Palakkad district (2008 to 2018) is investigated by providing vulnerability maps which demonstrates spatial characteristics of drought vulnerability.

Key words: Drought, Geographic Information System, Remote Sensing, Vulnerability Maps

INTRODUCTION

Drought is one the climatic as well as natural disasters common all over the world. Droughts have disastrous impact on the economy and can affect the largest segment of the society, which may last for months and in some cases several years (Reza, 2010). Drought is more often like a cancer on the land, mute but sure assaulter that seems to have no marked beginning or ending; a malaise slowly engulfing the community and often leaves just as gradually (Sergio, 2007). Drought may be categorized as continuing disasters and as the time passes, the situation may further deteriorate. The continuing disasters include prolonged droughts and crop failure (Vasanthavigar *et al.*, 2011). These continuing disasters or drought affects a very large area. The droughts may compound longstanding problems of deforestation, encroaching desertification, soil erosion, forced migration, malnutrition, epidemics and loss of life over

RESEARCH ARTICLE

OPEN ACCESS

Drought Vulnerability Detection And Mapping In Thrissur District, A Part Of Southern Western Ghats, India- Using Geoinformatics

Subin K. Jose*, Dhanya .K.N*

*Geology and environmental science, Christ College, Irinjalakuda,

Corresponding Author: Subin K. Jose

ABSTRACT

Drought is an insidious phenomenon. Unlike rapid onset disasters, it tightens its grip over time, gradually destroying an area. In most cases, drought can last for many years. The impacts of drought vary from lack of adequate drinking water, loss of vegetation, loss of farmland, loss of livestock and loss of life due to famine or dehydration. Drought can be divided into four categories of meteorological, hydrological, agricultural and socio-economic. In this study the vulnerability of drought in Thrissur district is investigated by providing vulnerability maps which demonstrates spatial characteristics of drought vulnerability. Thrissur is also called as "cultural capital of Kerala", south India. The modern technology used in present system for drought prone area identification is remote sensing and geographic information system. Drought is one of the climatic, natural disasters, having an impact on both the economy and the society, with its long-standing problems. Drought by nature is a result of inter-related parameters. The study is based on the concept that the severity of the drought is a function of rainfall, hydrological and physical aspects of the landscape, leading to meteorological, hydrological and physical drought. In the present study a Geographic Information Systems (GIS) and remote sensing based tool for drought vulnerability assessment at a micro level has been developed. The result of this study can be used for preparedness planning and for allocating resources for facing droughts in this region.

Key words: Drought, Geographic Information System, Remote Sensing, Vulnerability Maps

Date Of Submission:16-11-2018

Date Of Acceptance:30-11-2018

I. INTRODUCTION

Drought is considered by many to be the most complex but least understood of all natural hazards, affecting more people than any other hazard (Abdel Aziz Belal 2014). Drought risk is a product of a region's exposure to the natural hazard and its vulnerability to extended periods of water shortage (Nishadi, 2015); drought is a normal, recurring feature of climate - it occurs in virtually all climatic regimes. Drought occurs on high as well as low rain fall areas. Drought is a temporary phenomenon, in contrast to aridity, which is a permanent feature of the climatic and is restricted to low rainfall areas. Drought is a phenomenon occurred by reduction in the amount of precipitation over time, usually a season or more in length; other climatic factors are also associated with it in many regions, which aggravate the severity of the event. It also related to the timing, effectiveness of the rains. Thus, each drought year is unique in its climatic characteristics and impacts (somya rajawat, 2016). Technology of GIS-MCE can combine multiple source information associating with agriculture meteorological drought risk and achieve measurable result. Satellite remote sensing provides a synoptic view of the land and a

spatial context for measuring drought impacts, which have proved to be a valuable source of spatially continuous data with improved information for monitoring vegetation dynamics (Elham Asari *et al.*, 2014). GIS is an information system that is designed to work with data referenced by spatial or geographic coordinates. GIS combined with MCE (Multi-Criteria Evaluation) can achieve measurable evaluation of drought risk. Karamouz *et al.*, 2015, introduced Technologies for evaluating agriculture meteorological drought risk with GIS-MCE. The results indicated that technology of GIS-MCE can combine multiple source information associating with agriculture meteorological drought risk and achieve measurable result. Satellite remote sensing provides a synoptic view of the land and a spatial context for measuring drought impacts, which have proved to be a valuable source of spatially continuous data with improved information for monitoring vegetation dynamics. Ganesh *et al.*, 2018 used the newly developed LULC methodology to determine the effects of drought in specific classes with great precision.

According to Jerrod *et al.*, 2016, Earth observation satellites could prove useful for the

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Origin and Spatial Distribution of Fluoride in Aquifers of Ambalapuzha Basin, Alappuzha District, Kerala, South India

Aikara Varkey George ; Ponnamma Narayanapillai Ajithkumar ; Vadakkepurakkal Balakrishnan Rekha ✉

Journal of Geography, Environment and Earth Science International, Page 1-11

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Abstract

The present study is an attempt to find out the origin, occurrence and distribution of fluoride content in deep aquifers of Ambalapuzha river basin of Ambalapuzha Taluk. Comparison of the past tube well data with present data, at various localities of the study area shows a drastic increase in fluoride to hazardous level in recent years. Critical analysis of the data reveals that out of 15 tube wells, in all the 14 tube wells, fluoride is much above permissible limit. When cations and anions of the tube well samples were plotted in the piper diagram, replacement of K by Na is clearly indicated. Water type identified with in the study

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THE SILVER LINING OF COVID-19 (SARS-COV-2) LOCKDOWN: LOWER POLLUTION LEVELS AND HEALING ENVIRONMENT

MEENU K. MOHAN,

M.Sc, Dept. of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda

Dr. N. J. MANJU,

Asst. Prof., Dept. of Geology and Environmental Science, Christ College (Autonomous), Irinjalakuda

"I believe that there is a subtle magnetism in Nature, which, if we unconsciously yield to it, will direct us aright." Henry David Thoreau

One Earth, One Planet, One family; in one way or another we are all interconnected to the mother earth in a quite inseparable manner. As exemplified in the above quote, whenever the earthlings try to deviate from the nature's track or heedlessly move on in search of new realms of developments, it directs us *aright*. The world is on a process of metamorphosis, it changes restlessly and whenever it changes, the nature has given us the tools or chance to make our thoughts and actions towards a positive recuperation of planet. In the present scenario, the whole world is tied in a single knot of destiny, in a quite ineluctable nexus of mutuality as *Dr. Martin Luther King* has said once, whatever effects one directly, affects all indirectly! Yes, The pandemic COVID-19!

The whole world is doing their best to stop the spread of SARS-CoV-2 virus and are on a mission to flatten the curve of exponential spread of the virus. We are taking a blow as the virus spreads out, people are self-isolated from the public, and the drastic quarantine measures makes an unusual silence everywhere! A stark opposite of the daily mad rush in our cities in the name of economic development. As per reports of Agence France – Presse on 25th March 2020 around 2.6 billion people – one third of the human population are under some form of lockdown. Though situation seems pretty bleak, and many lives lost in the fight, there is a

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DR. SUBIN K JOSE
DEPT. OF GEOLOGY AND ENVIRONMENTAL SCIENCE
CHRIST COLLEGE, AUTONOMOUS, IJK

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Assistant Professor
Department of Geology & Environmental Science
Christ College (Autonomous), Irinjalakuda
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Diagnostic Procedures for the Isolation of Pathogenic Bacteria from Fish & Shrimp
Dr. Sreedharan K
Scientist, ICAR
Central Institute of Fisheries Education
Mumbai, Rohat Centre - Haryana
21-09-2021, 02.30 pm

Co-ordinator
Dr. Gigi Poulse
Assistant Professor & Head

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*Graduate students, Department of Zoology,
St. Aloysius College, Thrissur.*



*Post graduate students, Department of
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RESEARCH HIGHLIGHTS

സുന്ദരിയാണ് ഈ സിന്ദൂരത്തുമ്പി

തൃശ്ശൂർ ▶ ആൺ-പെൺ കോശങ്ങൾ ഇടകലർന്നു വരുന്ന അത്യുപരിവ പ്രതിഭാസവുമായി സിന്ദൂരത്തുമ്പി. ഇതിങ്ങാലക്കൂട ക്രൈസ്റ്റ് കോളേജിലെ പരിസ്ഥിതിശാസ്ത്ര ഗവേഷണമേധാവി സുബിൻ കെ. ജോസ്, ഗവേഷകൻ വിവേക് ചന്ദ്രൻ എന്നിവരുടെ പഠനത്തിൽ 'ഗൈനാൻഡ്രോമോർഫിസം' എന്നറിയപ്പെടുന്ന പ്രതിഭാസമാണിതെന്ന് വ്യക്തമായി. ജനിതകവൈകല്യമായാണ് ഇത് കണക്കാക്കപ്പെടുന്നത്. അതേസമയം, ഇത്തരം ജീവികളെ പ്രകൃതിയിൽ അപൂർവമായേ കാണാറുള്ളൂ എന്ന് പഠന സംഘം പറയുന്നു. മണ്ണാർക്കാട് കാരാക്കുത്ത് വിട്ടിൽ അജയ് കൃഷ്ണ എന്ന പത്താംക്ലാസ് വിദ്യാർഥിയാണ് തുമ്പിയെ ആദ്യം കാണുന്നത്. തുടർന്ന് ഗവേഷകരുടെ ശ്രദ്ധയിൽപ്പെടുന്നു. പെൺവിഭാഗത്തിന്റേതുപോലെ മഞ്ഞനിറത്തിൽ കണ്ട തുമ്പിയുടെ വലതുകണ്ണിന്റെ പാതി, മറ്റു ചില ഭാഗങ്ങൾ, വലതുചിറകുകളിലെ ഞരമ്പുകൾ എന്നിവ ആൺതുമ്പിയിലെന്നപോലെ പിങ്ക് കലർന്ന ചുവപ്പായിരുന്നു.

2019-ൽ ഇത്തരം മൊരു വയൽത്തുമ്പിയെ തൃശ്ശൂർ കോലനിലങ്ങളിൽ കണ്ടെത്തിയിരുന്നു. എന്നാൽ, വിശദമായ പഠനം നടത്താനായില്ല. സ്വിറ്റ്സർലാൻഡുകാരനായ തുമ്പിഗവേഷകൻ ഹൻസ്രൂവേദി വിൽഡർമുത്തിന്റെ സഹായത്തോടെ അന്താരാഷ്ട്ര ശാസ്ത്രപ്രസിദ്ധീകരണമായ 'ഓഡോണേറ്റോളൊജിക്ക'യിൽ അപൂർവ കണ്ടെത്തൽ പ്രസിദ്ധീകരിച്ചിട്ടുണ്ട്.

ആൺ-പെൺ കോശങ്ങൾ ഇടകലർന്ന് വരുന്ന തുമ്പിയെയാണ് മണ്ണാർക്കാട് കണ്ടെത്തിയത്



മണ്ണാർക്കാട് കണ്ടെത്തിയ അപൂർവ സിന്ദൂരത്തുമ്പി

Newspaper report on Gynandromorphic Dragonfly studied by researchers of Christ Aqua Research Lab (CARL)

PROJECTS



केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

Tech 45A/RPRS/RDS/Projects/ 181

15th June, 2020

- To
- 1) Dr. K Haribabu, Assistant Professor
Department of Chemical Engineering
National Institute of Technology Calicut
Kozhikode, Kerala.
 - 2) ✓ Dr. Manju N J, Assistant Professor
Department of Environmental Science & Geology
Christ College, Irinjalakuda
Thrissur, Kerala.

Sub: Project proposals recommended for financial support under Environmental Compensation (EC) Fund: Field- scale demonstration project to bio remediate heavily polluted natural drains in Kerala using a combined engineering approach of aeration, microorganisms and biofilm blocks.

Ref: CPCB, R&D Division letter no. PCP/06/EC/2019-20/11331, dated 23rd January, 2020.

Madam/ Sir,

This has reference to the project proposal submitted to CPCB for financial support under the utilization of Environmental Compensation (EC) Funds. The project entitled "Field-scale demonstration project to bio remediate heavily polluted natural drains in Kerala using a combined engineering approach of aeration, microorganisms and biofilm blocks." is considered for financial support by CPCB. The project proposes to demonstrate in-situ bioremediation in Canolly canal or its major drains in Kozhikode, Kerala. It is requested to submit your willingness to take up the above project in coordination with CPCB, Regional Directorate, Bengaluru, Kerala State Pollution Control Board (Regional & District Offices, Kozhikode), Irrigation Division (EK Canal), Kozhikode and Municipal Corporation of Kozhikode. The project shall be implemented as per the guidelines issued for the utilization of National Green Tribunal EC Fund.

Project Title	Project Coordinators & fund allocation
Field- scale demonstration project to bio remediate heavily polluted natural drains in Kerala using a combined engineering approach of aeration, microorganisms and biofilm blocks. (Outsourced).	Dr. K Haribabu, Assistant Professor, (Chemical Engineering), National Institute of Technology Calicut, Kozhikode, Kerala. (Rs.83,83,500/-)
Proposed budget: Rs.1,27,75,396/-	Dr. Manju N J, Assistant Professor, (Environmental Science), Christ College, Irinjalakuda, Thrissur, Kerala. (Rs.43,91,896/-)
Timeline: As per the pert chart enclosed	

क्षेत्रीय निदेशालय (दक्षिण) : निम्न भवन, ए-ब्लॉक, प्रथम एवं द्वितीय तल, थिम्माश रोड, 7th डी ब्री, शिवनगर, बेंगलूरु - ५६० ०१९.
Regional Directorate (South) : "Nisarga Bhawan", A-Block, 1st & 2nd Floors, Thimmaash Road, 7th D - Main, Shivnagar, Bengaluru - 560 079.
दूरभाष / Telephone : 080-23233730, 23233827, 23233996, 23233600, 23232559, 23226002, 23222539, Fax : 080-23234059
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प्रधान कार्यालय : पॉलिश भवन, पूर्वी अर्जुन नगर, दिल्ली- ११० ०३२.
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केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

By Speed Post/ E.mail

F.No. Tech 45A/RPRS/RDS/Projects/ 2022-23/ 179

08th June, 2022

- To
- 1) Dr. K Haribabu, Assistant Professor
Department of Chemical Engineering,
National Institute of Technology Calicut, Kozhikode, Kerala.
 - 2) ✓ Dr. Manju N J, Assistant Professor
Department of Environmental Science & Geology

Dr. Manju N.J, Assistant Professor, selected as the coordinator of a multi-institutional research project entitled "Field – scale demonstration project to bioremediate heavily polluted natural drains in Kerala using a combined engineering approach of aeration, microorganisms and biofilm blocks" with financial support from CPCB, Delhi.



Save Our Species Programme
Conservation Action Centre
International Union for Conservation of Nature (IUCN)
28, rue Mauverney
1196 Gland
Switzerland

Chief Wildlife Warden
Kerala Forests and Wildlife Department
Government of Kerala

Gland, December 16, 2021

The International Union for Conservation of Nature (IUCN) hereby confirms the selection of **VIVEK CHANDRAN A**, PhD candidate at Christ College (Autonomous), Irinjalakuda and his project application "**Understanding the ecology of *Disparoneura apicalis* (Fraser, 1924) in Kuruva Islands, Kerala, southern India**" for a Research Support Grant under the Fondation Segré Conservation Action Fund 2021 call for proposals.

I hope that this information will be useful to you and remain at your disposal if necessary.

Best regards,

Ana Nieto
Head, Species Conservation Action
Conservation Action Centre
International Union for Conservation of Nature (IUCN)

Vivek Chandran A, research scholar awarded Research Support Grant under the Fondation Segré Conservation Action Fund 2021 by IUCN



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