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1.1 Crustal Evolution and Geodynamics

1.1.1 *Metasedimentary rocks of the Kerala Khondalite Belt, Southern India: Petrology and geodynamics of their formation*

The main focus of the project is to examine metasedimentary rock formation of the KKB to understand its deposition, metamorphic evolution and geodynamics. Integrating results obtained from field, textural and metamorphic studies and geochemical studies on rock formation are envisaged to obtain knowledge on the pre-metamorphic geodynamic settings of precursor rocks. This project hinges on the rich experience of previous projects and long term research, for over two decades, in this region.

Extensive field studies were carried to document field relations between various rock types (refer adjacent figure). Wealth of new geological and structural data on different lithounits of the KKB was collected. The field traverses covered 60% of the study area and detailed studies in about 150 working quarries. Over 120 representative samples were collected. Thin sections and powdering of representative samples were carried out for petrography, microprobe and geochemical studies. Detailed petrographic studies were to classify gneiss and charnockite types (massive and arrested) based on mineralogy and field associations, recognizing of petrographic characteristics between charnockitic types (massive, arrested) occurring in different geological milieu and examination of textural and petrographic characteristics of all major rock types. Mineral paragenesis and metamorphic reactions, and classification schemes adopted in field were examined. Geochemical and isotopic studies (major, trace and geochronology) were initiated to determine the nature of precursor material and classification of types of massif charnockites and the age of metamorphism and protolith formation.

Previous studies have recorded high- to ultra-high-temperature metamorphism during Pan-African orogeny. Studies have also documented rock types of KKB to consist mainly of highly migmatitic, garnet-biotite-sillimanite gneiss, garnet-biotite augen gneiss, garnet-biotite leptynitic gneiss and cordierite-garnet-orthopyroxene gneiss. Our studies document and characterise (petrological and geochemical) supracrustal series (mostly pelitic sedimentary sequences), intrusive granitoids and abundant charnockites, collectively deformed into gneisses, within KKB. Our studies have emphasised on a detailed petrological exercise on charnockites dominating in the southernmost part of the KKB, defined as the Nagerkoil Unit by Srikanthappa et al. (1985), with special reference to their close relation to khondalite and calcgranulites. Based on petrological and geochemical signatures gneisses are divided as sodic

($K_2O/Na_2O < 1$) and potassic ($K_2O/Na_2O > 1$) varieties. We have placed special emphasis in understanding the potassic variety, which is usually coarse grained, suggestive of a magmatic origin to understand its spatio temporal relation with charnockites and associated sodic gneisses. Differences between khondalites and garnet-biotite gneisses are only in the presence and absence of sillimanite and amount of K-feldspar and garnet and controversy over origin of both exists. One of our goals is to resolve this issue. We have so far



Fig. 1.1.1.1 Field photographs from KKB: (a) Massive charnockite enclave within garnet biotite gneiss which is in conformable contact with khondalite (grt-sill-graphite gneiss); (b) Augen gneiss with large feldspar augens.

been successful in establishing the field based criteria to recognise these two types and extend the understandings to examine their role in the metamorphism and charnockite genesis. Detailed petrographic studies and geochemical studies are under way to characterise their parentage, inter-relationship and spatio-temporal relations. We are also trying to characterise the rock types in KKB with those in the north of it dominated by charnockites and hornblende-biotite gneisses, which marks a sharp hornblende-garnet boundary, suggesting a major difference in protolith composition rather than a difference in metamorphic grade.

The key metamorphic minerals in KKB are garnet, orthopyroxene ± cordierite and sillimanite. Excellent data are already available on

the mineral chemistry and PT of the region through several published work. Therefore we have not taken up EPMA studies at present. However we have initiated work on detailed EPMA work on 2-3 sample profiles to characterise element mobility and metamorphism.

More than 120 samples from the first two field studies have so far been prepared for geochemical studies. This exercise involved crushing of 2 kilos of samples to fine -230 mesh size powder utilizing jaw crusher, tungsten carbide mill and agate mortar. About 60 samples trace and major element analysis using XRF was carried out at CESS and about 35 samples were analysed for REE at NGRI, Hyderabad. The two figures presented summarise the trace and major element results from the ongoing work.

Dr. G. R. Ravindra Kumar
Funding: DST, GoI

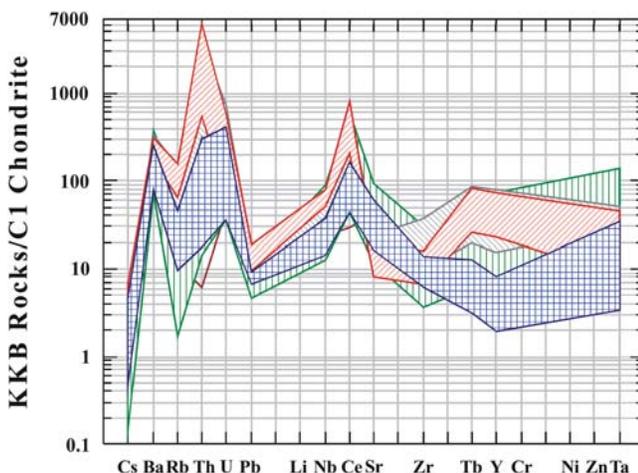
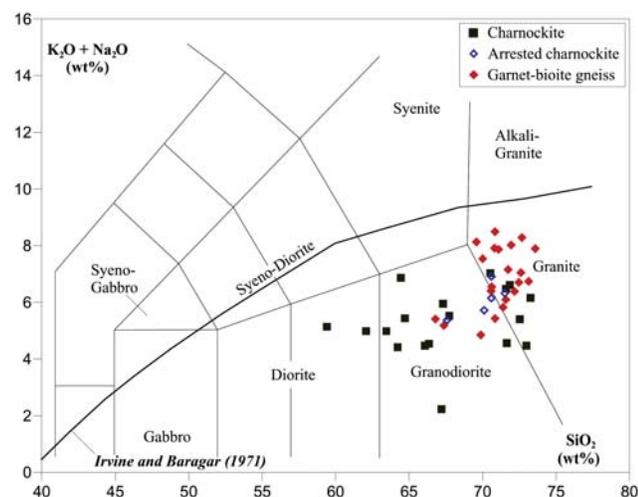


Fig. 1.1.1.2 Silica vs alkalis (top) and Chondrite normalized multi-element (grouped) diagram of KKB rocks (bottom). Note distinct grouping of various rock types in the discrimination diagrams.

1.1.2. Geochemical and palaeomagnetic studies of mafic dykes from Bundelkhand and Baster cratons, Central India: implications for lithospheric evolution and Meso & Palaeoproterozoic continental reconstructions

During this year, we have continued the geochemical and palaeomagnetic investigations initiated on the Proterozoic dyke intrusions in Bastar and Bundelkhand cratons and the late Cretaceous magmatism along the west coast of India. The work on Proterozoic dykes is under the project granted by the Department of Science and Technology, Government of India in collaboration with the Bundelkhand University. The investigations on the Cretaceous magmatism are under the project granted by the Indo French Centre for promotion of Advanced Research (IFCPAR) in collaboration with the University of Montpellier, France. A fieldwork has been carried out in Bastar craton and collected about 100 oriented core samples. These samples and the recent collection of dyke intrusions from Bundelkhand craton have been prepared for palaeomagnetic experiments. All the samples have been subjected for detailed alternate field demagnetizations at close intervals of 2.5/5 mT till the stable magnetizations are achieved. Several orthogonal projections and stereographic projections have been generated to ascertain attaining the stable magnetizations. A few representative samples have been used for temperature-susceptibility measurements in the temperature range of RT to 700°C. Both heating and cooling curves have been generated. About thirty representative samples have been selected and analyzed for major elements. Based on major element chemistry, representative samples have been chosen at different levels of fractional crystallization for



determining the rare earth and other incompatible trace elements. The samples have been analysed by ICP-MS methods. The geochemical data are compiled for further analysis to characterise the nature of magma and petrogenetic aspects. A few samples have been selected for mineral-whole rock isotopic work (Rb/Sr and Sm/Nd). Plagioclase, pyroxene and opaque fractions have been separated using heavy liquids and isodynamic separator to initiate the isotopic work.

As part of our investigations on the Cretaceous magmatism, a joint fieldwork by the Indian and French teams has been carried out during January, 2007, by the participation of Dr M. Perrin and Dr J. M. Dautria from the French team, all along the west coast of India (dykes of central Kerala, Agali-coimbatore area, north Kerala, Goan region, volcanics of St. Mary islands and Deccan traps). Sample collection included twenty palaeomagnetic sites (about ten oriented cores/blocks for a site) for directional/intensity investigations and about 3-5 kg block samples from each dyke for petrological and geochemical investigations. Important petrography features have been documented as photomicrographs. Samples have been prepared and step-wise AF demagnetization experiments have been in progress. 10 mg of fresh plagioclase and K-feldspar minerals from two most promising samples from two sites have been irradiated at Mac Master (Canada) nuclear reactor for preliminary Ar dating as test cases. These samples have been used for incremental heating and degassing in a furnace. ^{40}Ar , ^{39}Ar , ^{38}Ar , ^{37}Ar and ^{36}Ar isotopes have been measured at eight incremental temperatures between 700°C to fusion (1200°C) to generate age spectra. JR-6 Spinner magnetometer was procured and installed at Centre for Earth Science Studies. The investigators got familiarized in using the equipment by conducting measurements through AF demagnetizations of some earlier collection. Elemental geochemistry and palaeomagnetism results of the central and north Kerala Cretaceous dykes from an earlier study have been analyzed by the Indian collaborators to have better comprehension of their characteristics and significance.

The principal collaborator from India has visited the French laboratories for one month. The visit was availed to discuss many aspects of the project jointly with the French collaborators, conduct some AF demagnetization experiments using the 2G cryogenic equipment, make the test runs for Ar analysis on two samples jointly examining samples under microscope. The visit facilitated to analyze and examine the initial results jointly and discuss them in the proper local and regional geological perspective Dr. Mathew Joseph, Sr. Geologist, Geological Survey of India, Kerala Unit, Trivnadrum was selected as PDF and the offer letter was issued.

Investigators involved in the project are Dr.T. Radhakrishna and G. Balasubramoniam (from CESS), Dr. Ram Chandra,

Bundelkhand University, Jhansi; Dr (Mrs) Mireille Perrin (Principal Collaborator), Laboratoire de Tectonophysique, UMR CNRS UMII 5568, Université Montpellier II, Case Courrier 49, 34095 Montpellier Cedex 5, France; Dr. Henri Maluski (Joint Collaborator), Université de Montpellier II CC60, 34095 Montpellier Cedex 05; France; Dr. Jean Marie Dautria (Joint Collaborator), Maître de conference Université de Montpellier II CC49, 34095 Montpellier Cedex 05, France.

Dr. T. Radhakrishna

Funding: DST, IFCPAR, New Delhi, GoI

1.1.3. Tectonic and hydrologic control on late Pleistocene-Holocene land forms, plaeoforest and non-forest vegetation: Southern Kerala

It is a multi-institutional project of CESS with Vakkom Moulavi Foundation Trust (VMFT), Thiruvananthapuram and Agarkar Research Institute (ARI), Pune. The major objectives of the project are: (a) select / prepare geological and geomorphological map of Kerala between 80° and 110° latitudes, (b) select an area that has undergone subsidence and another area subjected to net uplift, based on the available data and observations, (c) identify some of the seasonal to perennial wetlands as well as other areas where fossil wood/ sub fossil logs are reported by the local residents, (d) collect representative samples of wood/sub-fossil logs and carbonised wood for C14 dating, (e) compile subsurface data of coastal plains; identify gap areas which need to be samples and (f) carry out sedimentological, palynological and limited geochemical studies with the aim of inferring depositional environments and paleoecology.

The SKSB having its origin in the Earliest Miocene is a product of a westward plunging embayment where Early to Middle Miocene and Late Quaternary inner shelf to terrestrial environments is found. The embayment has 'U' shaped cross-section and its deepest part along the coast extends from $9^\circ 25'$ to $9^\circ 35'$. Based on the thickness and distribution of sediments, the SKSB can be divided into 5 blocks, which are designated as A – E (see figure). Among the 5 blocks, the block 'D' comprising Ernakulam – Pattanam stretch has been undergoing subsidence and significant tectonic adjustment than others. This block and its offshore counterparts have undergone uplift and erosion almost up to the end of Pleistocene. However, the block is now undergoing subsidence almost in tune with the sea level rise since the last 11000 ybp which has resulted in the accumulation of $\sim 25\text{m}$ of under compacted clay and beach sand. In addition to block D, the block 'E' too has undergone uplift. This block hosts the Ashtamudi estuary and the fresh water



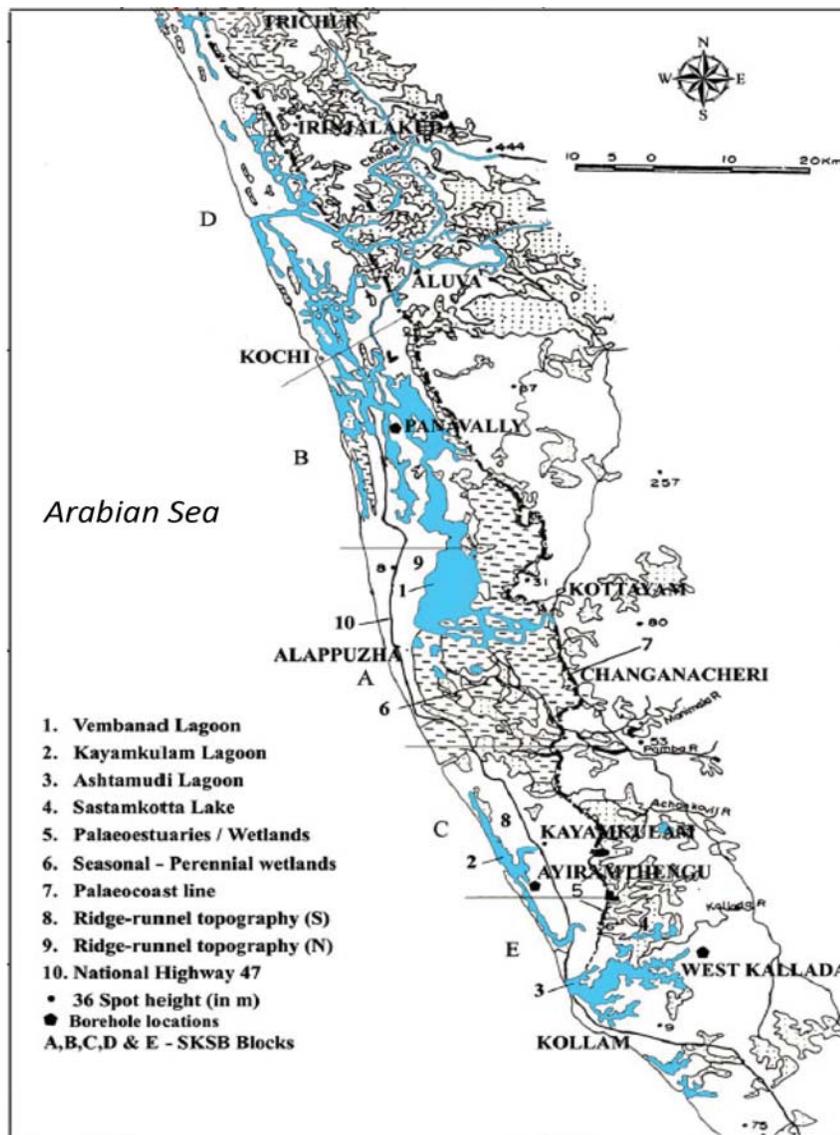


Fig. 1.1.3.1 The South Kerala Sedimentary Basin (SKSB) showing various land form features and the A to E blocks.

lakes like Sasthamkotta and Chelupola. This block forms part of the northern flank of the crust-mantle upwarp of Trivandrum – Kodaikanal region suggested earlier by Murthy and Swamy in 1978. This unwarp is manifested not only in the uplift of the block but also in the midland – highland parts as well.

Detailed mapping of the paleoforest and non-forest vegetation in the various blocks of SKSB is in progress.

Dr. D. Padmalal

Funding : KSCSTE, Thiruvananthapuram

1.1.4. Late Quaternary environmental changes in the coastal plains of southern Kerala, SW India

Quaternary Period witnessed the most dramatic changes in climate and sea level. These effects coupled with local and regional tectonics had a pronounced impact on plant and animal life, landforms, water and other non-living resources as well as, human evolution and civilization. Fortunately, the southwest coast of India, especially the Kerala coast between 8° 45' and 10° 15' north latitudes has a fairly wide (5-25 km) blanket of Quaternary sedimentaries with a maximum thickness of ~100m. This sequence, lies over the Tertiary sedimentaries, is a repository of information on the climatic changes to which the region has been subjected over the late Quaternary period. From a review of the literature it is revealed that coupled with the data already available, a comprehensive study of selected sections in SKSB could yield the best and most reliable information account of the Quaternary events of climate, sea level and vegetation, and provide reliable information on tectonics and geomorphology of the coastal lands. This multi institutional project addresses the above aspects based on data accrued from the subsurface sediments.

The key objectives of this multi institutional project are (a) establish total sedimentary stratigraphy using selected boreholes in SKSB, (b) tectonics and geomorphology of the study area to address depositional-erosional history and structural pattern in the Quaternary succession and (c) ecological and vegetation changes in the provenance and depositional environments with the help of sedimentological, palynological and geological data.

The study reveals heavy accumulation of organic matter rich sediments probably contributed by mangrove environments when the Palaeo-coastal line further away from the present position. The sea level was much lower and the rainfall was high in the Early to Middle Holocene. This observation is significant at 24-26m interval in West Kallada, 18.5m in Ayiramthengu, 31-34m level in Panavally, 10-11m in Thakazhi and a major portion of Kumarakom borehole. The presence of Pollen of *Cullenia exarillate* (*Bombacaceae*), a wet ever green forest marker of hinterlands defi-



nately indicates high rainfall. The heavy organic input probably due to a high sedimentation rate at lower intervals may be attributed to relatively high rates of weathering and erosion in the hinterlands as a result of high rainfall, since more intense southwest monsoon was prevailing during Late Pleistocene – Early Holocene.

Dr. D. Padmalal
Funding : CSIR, GoI

1.1.5. Quaternary geology and geomorphic evolution of the coastal lands of Kollam district, SW India

South of Narmada rift in the northern part of Peninsular India, there are two main offshore sedimentary basins in the shelf – the Bombay offshore basin and the Kerala-Konkan basin. The former has no representation on land, whereas the latter is represented on land by patchy discontinuous outcrops of Cenozoic sediments. The main landward extension of the offshore sedimentary basin is in the form of a curvilinear area between Kollam and Kodungallur, known as the South Kerala Sedimentary Basin (SKSB), with sediment fill of *ca* 700m thickness. About 600m of the sediments are of Early to Middle Miocene and the remaining ~100m are of Quaternary age. Although many studies exist in the case of Early to Middle Miocene sediments, studies on Quaternary sediments are scarce. Therefore, in the present investigation an attempt has been made to carry out a comprehensive study on the Quaternary

sediments of Kollam district as this segment form some of the important blocks of SKSB that conceal records of the Late Quaternary coastal evolution of the south western coast of India.

The major objectives of the study are (a) to collect and compile all the available data on the Quaternary deposits of the coastal lands of Kollam district; (b) to prepare a detailed Quaternary stratigraphic frame work/ sequence stratigraphy of the study area; (c) to unfold the Quaternary sea level changes/ events and land form evolution of the area; (d) to unravel the palaeontological and palaeoclimatic conditions of the Quaternary period; (e) to understand the origin and evolution of coastal wetlands like Sasthamkotta lake, Ashtamudy lake, Chittumala chira, Chelurpola, etc., of the area; (f) to study on the provenance / origin of the mineral resources in the coastal lands and (g) to prepare two monographs (one in English and the other in Malayalam) containing the origin and evolution of the coastal lands / coastal features of Kollam district.

The coastal lands of Kollam district comprises a spectrum of coastal landform features such as barrier beaches, estuaries (Paravur and Ashtamudi kayals), fresh water lakes and palaeo-strandlines indicated by ridge-runnel systems in the northern part. Among these various landform features, the estuaries and its over bank areas are, perhaps, the best repositories of Late Quaternary sediments. A total of 14 drilled boreholes and several shallow auger cores were collected from the study area for unfolding the Late Quaternary events to which the region has been subjected. The age of the

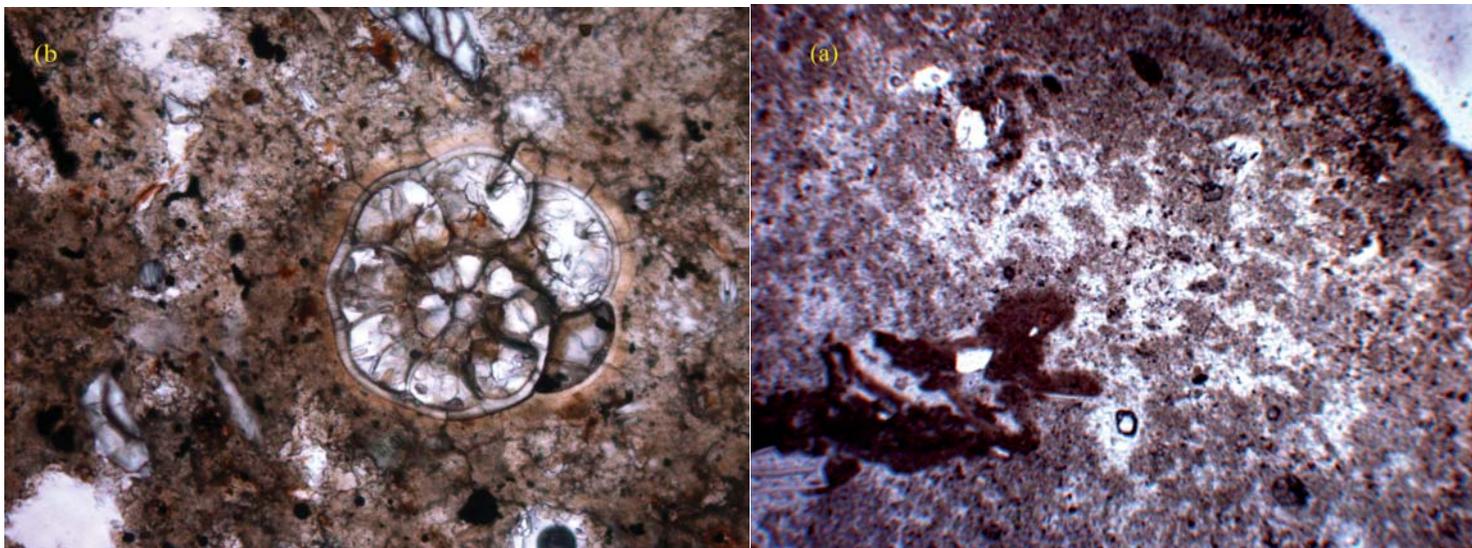


Fig. 1.1.6.1. Cross-section of nodular bodies embedded in the Early-Middle Holocene sediments of Nedungolam bore hole core near Paravur in Kollam district showing (a) organic segregation that forms the nucleus of the nodule and (b) a fully preserved foraminiferal test within the nodule.

sediments varies from Late Pleistocene to Late Holocene. The oldest sediments (41788 ± 574 YBP) occur in the northern part of the study area, especially around Thevalakkara. Red sands, whose age is yet to be determined, spread at two regions in the study area—one in the northern part around Chekkekadavu (Kallelibhagam near Karunagappally), and the other close to the southern boarder around Kappil.

The estuaries in the study area are broad and appear to be incised over the Tertiary sediments. The present study on the bore hole cores retrieved from the Ashtamudi and Paravur estuaries revealed that Holocene sedimentation in the estuarine basins begun with an organic carbon rich, peaty sediments often with partially decomposed, buried wood. The organic carbon content in the wood embedded, mud-dominated layer varies from 4.54% to 8.45% (av. 6.27%) in the Ashtamudi core (West Kallada) and 2.96% to 15.73% (av. 5.65%) in the Paravur core (Nedungolam). The Nedungolam bore hole core contains many nodular bodies rich in CaCO_3 at 18m-10m level (see Plate). Pangode clay quarry, wood occurs either in growth position and/ or in uprooted forms. The similarity in the radiocarbon dates of wood (7480 ± 80 YBP) and the embedding clays (7490 ± 90) indicates that the coastal vegetation has been buried quickly consequent to the sediment-laden water from the catchments arrested by the rising seawaters of Early- Middle Holocene period in Nedungolam bore hole core site. Detailed examination of the sediments using sedimentological, geochemical and palynological tools coupled with a systematic analysis of geomorphological features of the area is in progress.

Dr. D. Padmalal

1.2 Atmospheric Processes

1.2.1 Rainfall validation and characterization Cloud physics studies using Megha –Tropiques Data.

Monitoring of rain rate, drop size variation and its vertical profile was continued during 2007-08 year using impact type RD-80 Disdrometer, Micro Rain Radar (MRR) & manual rain gauge (MRG). Daily measurement of liquid water from rain was carried out using MRG. Radar reflectivity factor and microwave attenuation were recorded using the MRR. The Disdrometer was recalibrated at the service center in Switzerland and was shifted back to CESS, Trivandrum for continued data collection.



RD-80 Disdrometer



Micro Rain Radar



Manual Rain Gauge

Dr.G.Mohan Kumar

*Funded by: Applications Centre, Ahmedabad –Megha-Tropiques
Utilisation Project*



1.2.2. Continuous measurement of ambient carbon monoxide in a tropical coastal station

Short-term measurements in a highland valley:

CO measurements are being carried out for the past several years as part of the ISRO-GBP campaign. In addition to measurements in Thiruvananthapuram, CO measurements were carried at Braemore during 1st to 6th January 2007. Measurement site at Braemore (80



Fig. 1.2.2.1 CO analyzer (Monitor Eu-

47° N, 77° 07' E) was at an altitude of ~385m ASL. Diurnal CO at Braemore was distinct from the coast. It has only one peak in the AN hours, unlike that at Akkulam where

CO has two diurnal peaks. CO measurements during Pongala:

Enhancement in CO during massive biomass burning associated with Pongala on March 3, 2007 was observed. CO was measured in the city area, 3 km off Attukal to infer changes in CO. Overall CO envelope on Pongala day was more than that on a normal day which switched back to normalcy in 1 or 2 days.

Annual patterns of CO 2003-06:

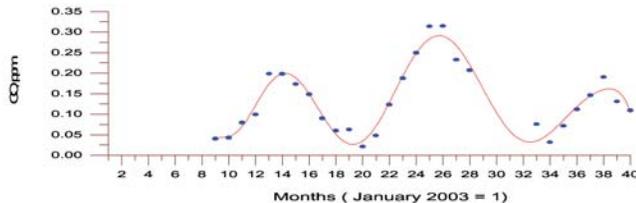


Fig. 1.2.2.2 Monthly mean variation in CO over Thiruvananthapuram (August 2003 - March 2006)

CO measurements at Thiruvananthapuram from 2003 were continued. An attempt to get CO inter-annual variation from 2003 to 2006 has been made. Monthly averages were arrived for smoothing of the data for the 3-year period from August 2003 to March 2006. Data gaps (analyser fault, campaign participations & deployment at other sites) were filled by interpolation. The annual pattern in CO for a clean coastal site shows repeated highs during the winter and lows during wet months as depicted in the adjoining figure which is a gross representation of the annual pattern for Thiruvananthapuram with a polynomial fit.

Dr.G.Moban Kumar

Funded by: ISRO-Geosphere Biosphere Programme

1.3 Coastal Processes

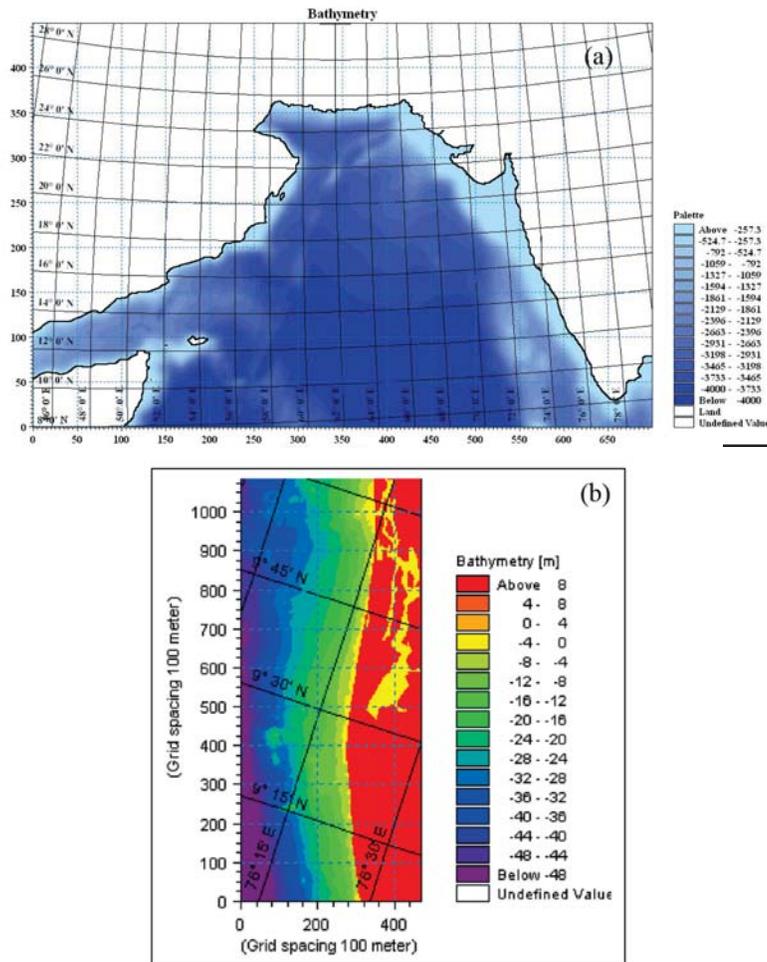
1.3.1 Study of coastal processes and hazards along Kerala coast.

This project was initiated subsequent to the 2004 tsunami. It aims to study coastal processes relevant to hazards such as storm surge and tsunami that were not studied till then. Consequent to the award of a project by Ministry of Earth Sciences on tsunami and storm surge inundation modelling and mapping for the coasts of Kerala, Karnataka and Lakshadweep, the objectives of this project were revised as: (a) study of tides and charting amphidromic points, if any, in the Lakshadweep Sea; (b) study of tsunami and storm surge inundation w.r.t coastal processes; (c) supporting ongoing programmes of coastal processes and coastal zone management wherever necessary

During the year under report, a review of the different types of coastal flooding was carried out. It has been shown that, coastal flooding associated with meteorological forcing from weather systems can be divided into three categories for convenience. The traditional term “storm surge” could be reserved just for coastal inundation from synoptic scale systems, such as tropical and extra-tropical cyclones. The word “Rissaga” is being used for coastal flooding from meso-scale systems, such as squall lines. There have been several incidents around the globe of ocean waters suddenly invading the coastal land, without any precursors or forerunners and these belong to the third category. These floodings are happening without any meteorological disturbance of any kind (either on a synoptic scale or a meso-scale) in the flooded area. In the literature, such incidents are referred to as “Rogue waves”, “Freak waves” and “Giant waves”. A new term “Kallakkadal” was proposed to refer to coastal flooding of this nature.

Basically Kallakkadal occurs on the southern coasts of India, mainly during the months of April or May (pre-southwest monsoon season). The swell generated in the southern ocean by storms near Antarctica, propagates northwards into the Arabian Sea (and the Bay of Bengal) and when it encounters a coastal current directed southward, the swell gets amplified through interaction with the current. Due to the increased wave set up, low lying areas on the coast gets flooded. When Kallakkadal occurs on days of spring tide, the flooding will be more severe. The flooding is not continuous all along the coast, because the land topography everywhere may not be conducive for flooding. These flooding incidents appear to be more severe and more frequent on the south Indian coasts than for the northern coasts. The main reason for this is the orientation of the coastline, as one moves southward, the coast curves in such





MIKE21 HD module was also initiated. Bathymetric grid comprising of Arabian Sea and part of Bay of Bengal was prepared. A regional model of size 3900 x 2500 km covering the whole of the west coast of India was set up. Local model of finer grid was setup to closely simulate the local hydrodynamic phenomena. The boundaries were transferred from the regional model to the local model. The model is intended to be used for tidal simulation after its calibration and validation

Dr. N.P. Kurian
Funding: MoES, GoI

Fig. 1.3.1.1. Model domain: (a) regional model; (b) local model

a manner that the swell waves can meet the coast in a perpendicular direction.

Though the occurrence of Kallakkadal is not well documented in the scientific literature, according to fishermen, this occurs almost every year. It occurred in 2007, towards the end of April. In 2008 too, though of relatively low intensity, it occurred during February 9-10. The flooding and inundation due to Kallakadal invites the attention of the government and media only when it affects the local population and causes damage to their property. Obviously some of the events go unnoticed and undocumented.

During this period, setting up of a tide model based on the



2.1 Landslides

2.1.1 Field investigations of land disturbances in various parts of Kerala

During the 2007 South West Monsoon, widespread land disturbances occurred in Wayanad, Palakkad, Kottayam and Idukki districts of Kerala. Field investigations conducted and detailed reports with recommendations for mitigation were submitted to the government of Kerala. The main locations covered in the investigations in Wayanad district are land subsidence and piping incidences at Kunnamangalam Vayal in Meppadi grama panchayat, Valamthode village, Thachankolli colony in Thrissilleri village, Karimani & Venmani in Tavinjal Village and Narikolli & Naripara Himagiri estate in Padinjarethara Village. A very detailed study report was submitted to the Government of Kerala on the land disturbances including development of ground cracks, ground movements with rotational slides in the north Ommala area of



Fig. 2.1.1.1 Land subsidence due to piping near Banasurasagar in Padinjarethara village in Wayanad district

Agali in Palakkad district occurred during August 2007. In Kottayam district several places experienced debris flows, rock slides and soil slips causing severe damages. On the spot field investigations were conducted and consolidated reports were submitted to the government.

A report on recommending a suitable site to install the instruments for the Amritha-Antrix (ISRO) project on developing an Early Warning System for rain induced landslides was submitted. A team of scientists conducted field investigations in Munnar in



Fig. 2.1.1.2. A distant view of Vallambode landslide (Urul Pottal)

Idukki district and Amboori in Thiruvananthapuram district. A location at Munnar was recommended for the project and work on the project is under progress.



Fig. 2.1.1.3. Ground fissure observed at Kunnamangalam Vayal in Kottapadi village in Wayanad district





Fig. 2.1.1.4. A house completely damaged in land subsidence in Kunnamangalam Vayal

Sri. G. Sankar and John Mathai

2.2 Earthquakes

2.2.1 Seismic monitoring in Kerala State and the broadband station at Peechi

The broadband observatory at Peechi, operated by CESS in the campus of the Kerala Forest Research Institute (KFRI) was established in 1999, as part of a rational earthquake monitoring initiative in the peninsular India and improving the detection and location capabilities of earthquakes in the shield region. The station at Peechi (PCH) started functioning in September 1999, as one of the 10 BB stations set up by the DST. The station has been recording regional, local and teleseismic events since then. Today, the observatory at PCH is generating high quality data that is being used for studies of local and regional earthquakes as well as for crustal structure studies. The new Taurus seismograph was installed on May 2007. The system is working well. Continuous archived data, Phase picks, wave form files and catalogue of events recorded here have been sent to IMD in every six months. The observatory plays host to a remarkable number of visitors, including students and thus serve as a good educational facility to the public. It also serves to provide information on earthquakes to government agencies as well as media and general public. A digital accelerograph system (GSR-18) is also functioning in the Peechi observatory since September 2005. Data obtained can be converted into ASCII and SEISAN format and used for analysis to provide basic information for earthquake engineering.

A total of 1444 events from all over the world were recorded by the seismograph during 2007 April - 2008 March, of which 22 were from Kerala, mostly originating from a previously identified source near Wadakkancheri about 30 km from Peechi, with magnitude of the events ranging from 0.9 to 3.0 ML. One event originated from Mysore-Malavally region; Karnataka; another from Vinukonda, Andhra. Twenty-three events originated from the Andaman Nicobar region and while thirty-four events were originated from other parts India mainly, Koyna-Warna-Chandoli, Nanded region of Maharashtra and Junagadh of Gujarat. Series of tremors felt near (8 events) Wadakkanchery area during 02-12 October 2007 were the most notable among the local activity. Out of the 22 local activities 10 were from Wadakkanchery-Desamangalam area. A mild earthquake with magnitude 2.5 was recorded at Manjappetti Estate near Nedumkandam in Idukki district. None of the tremors caused

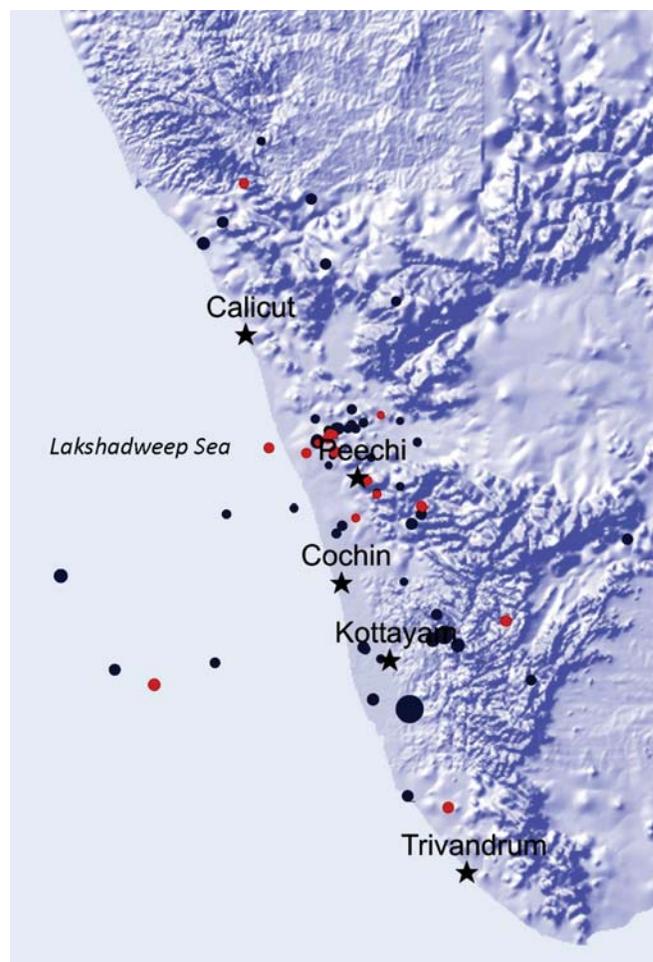


Fig. 2.2.1.1. Earth quake events recorded during 2000-2008 in the Kerala region



noticeable harm to life or property. A detailed report on the events was submitted to the Government through respective District collectors. A Hand book prepared by CESS was made available to the revenue authorities for distribution among the affected population to alleviate unnecessary fear and rumors. The details of earthquakes recorded within the Kerala State at the Peechi observatory during the period under report are given in Table 2.2.1.1.

Table 2.2.1.1. Details of earthquake events recorded in the Kerala region during April 2007 - March 2008

Sl. No	Date	Place Name	Magnitude
1	04/05/2007	Pookkottukav,Sreekrishnapuram,Palakkad	0.9
2	06/08/2007	8 km SE Peechi Station	1.8
3	14/08/2007	Mundathikode, Thalappilly Taluk, Thrissur	2.6
4	18/09/2007	22.5 km S of Peechi, near Chalakkudy	1.3
5	02/10/2007	Cheruthuruthi -Desamangalam Aea	2.4
6	03/10/2007	Desamangalam Area,Thrissur	1.0
7	03/10/2007	Desamangalam Area,Thrissur	2.4
8	03/10/2007	Desamangalam Area,Thrissur	1.5
9	05/10/2007	3.8 km SE Kunnankulam	1.9
10	06/10/2007	Cheruthuruthi -Desamangalam Aea	2.0
11	10/10/2007	Varavoor-Desamangalam Area	1.7
12	12/10/2007	Varavoor-Desamangalam Area	1.4
13	16/10/2007	Lakshadweep Sea,168km SW Peechi	3.0
14	02/11/2007	Cheruthuruthi,Thrissur	1.2
15	16/12/2007	8 km SE Peechi Station	1.4
16	11/01/2008	Near Attingal,Trivandrum	2.5
17	22/01/2008	Near northern part of Edamalayar Dam	1.8
18	30/01/2008	Nedumkandam Area, Idukki	2.5
19	11/02/2008	Lakshadweep Sea,19.5km W of Kunnankulam	2.2
20	12/02/2008	10.5 km NE Irutti	1.9
21	05/03/2008	11.5 km N Edamalayar Dam	2.0
22	24/03/2008	Near Vengapara 17 km SE Peechi	1.5

Ms. Sreekumari Kesavan

Funding: Department of Science and Technology,GoI

2.3 Lightning

2.3.1 Investigation on the cause of high lightning in Kerala

Lightning incidences kill many people every year in the State. It is estimated that more than 70 people, on an average, lose their life due to lightning every year. Proper data on loss of property, both direct and indirect, are still unavailable. Even statistics at the state level were not collected by any agency as to the number of deaths and other losses due to this natural hazard, except for some interventions by CESS in the recent past.

A field station was established ~ 400 m above sea level at Braemore in the Western Ghats in Thiruvananthapuram district to detect the formation of Cb clouds and to understand the conditions under which it forms. The field station is equipped with an auto-

matic weather station, a lightning location detector and field mill. Analysis of the data showed clear experimental evidence of instabilities occurring in the Western Ghats. The instability is seen in the simultaneous variations of pressure, air temperature and relative humidity data. It has also been identified that instability occurrence is a character of the Western Ghats weather. The project investigation has very clearly shown for the first time that the high lightning in Kerala is most probably due to the formation of convective thunder clouds because of the existence of conducive weather in the Western Ghats. Such experimental instability detection from a single weather station has not been reported. The lightning detector data from the same location has shown that on the days the instabilities were detected thunder storm was present in the region and the system formed has a spatial distribution aligned with the angle of the mountain range covering a large area.

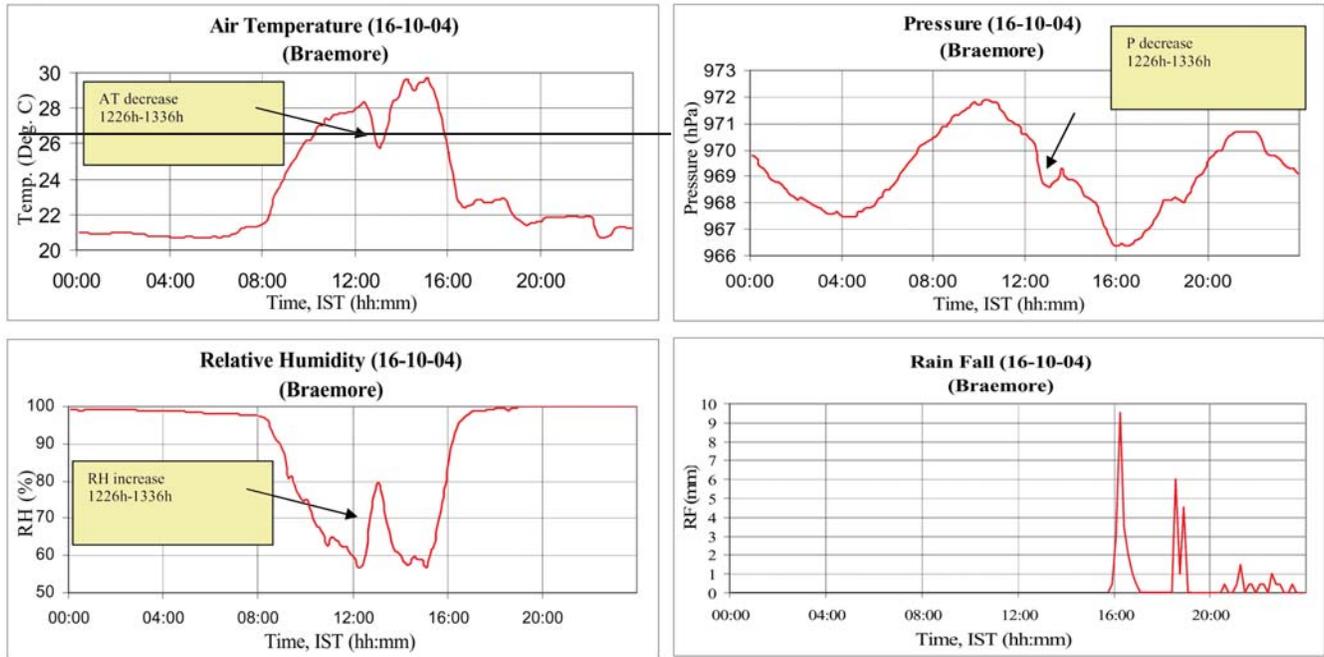


Fig. 2.3.1.1. Variations of four significant weather elements for 24 hours on 16-10-2004. Air temperature shows a prominent reduction with a maximum decrease of 2°C between 1226 h and 1336 h. Exactly at the same time and for the same duration, relative humidity shows an increase with a maximum variation of 20%. In tune with this the pressure also shows a decrease with a maximum reduction of 0.5 hPa. The data presented is indicative of an updraft involving air of large area, which is indicative of instability. This instability can lead to condensation and cloud formation, which can grow to a thundercloud. This possibly has occurred, as indicated by rain data, after a delay of the order of an hour. Lightning was also detected along with rain on that day.

Dr. S. Muralidas



2.4 Radioactivity Studies

2.4.1. Natural radioactivity risk assessment in the living environment of the people of SW coast of India

Analyses of the baseline data, collected using a gamma radiation survey meter (SM 141D, ECIL), on the natural background radiation level and indoor radon and thoron levels in the coastal environments of the west coast of Kerala and Tamil Nadu was carried out. The ambient gamma radiation levels at 1700 locations covering 77 coastal and hinter land blocks (10Km x 3Km. size) extending to a total length of about 650 km of coastal land of Kerala and Tamil Nadu states of South Indian Peninsula were determined and the mapping was extended to other areas. Using the procured 300 Solid State Nuclear Track Detector (SSNTD) based Dosimeter

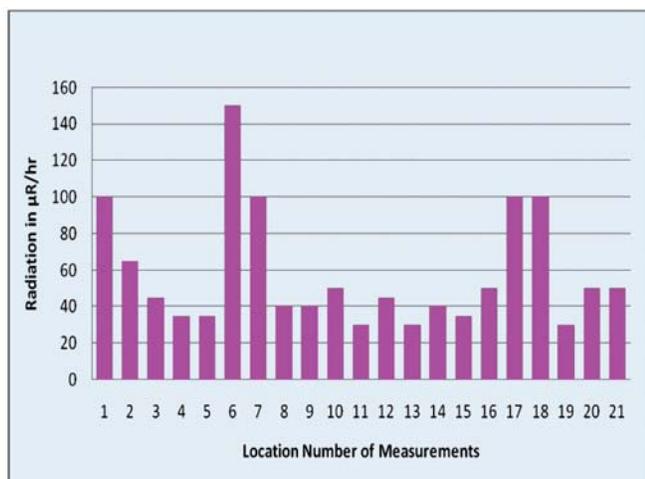


Fig. 2.4.1.1. A sample graph showing the measured ambient natural nuclear gamma radiation level in a Coastal Block (10x3 Sq.Kms) in Kanyakumari District of Tamil Nadu.

Cups, LR-115 Films, Thoron membranes, filter-paper and other accessories, the enhancement work of SSNTD Cups for radon/thoron measurements was continued 400 Cups were deployed (in 2 phases) inside the dwellings in the study area at the rate of 5 locations in each Block (10Km x 3Km. size), where maximum gamma radiation levels were noted during the scintillometer survey work. All the SSNTD Cups were retrieved from the field after a period of 3 months exposure and, the 1200 film samples were unloaded and sent to the IGCAR Lab for processing and estimation of radon / thoron concentrations. Statistical analyses of the collected data were carried out in collaboration with the Principal Collaborator Dr. Meenakshi Sundaram at IGCAR for the envi-

aged risk assessment. Based on the preliminary analyses, a few more SSNTD samplings planned at selected locations with the pending fund from BRNS, DAE and seek an extension of the project duration.

Sri.V.Muralidharan

Funding: Dept. of Atomic Energy, Govt. of India

2.5 Coastal erosion

2.5.1 Studies on Shore Protection Measures for Lakshadweep Islands

The project aims to carry out a feasibility study for implementation of a suitable shore protection structure in one of the islands of Lakshadweep through numerical modeling. The study component encompasses collection of both field and hydrodynamic data in the lagoon and adjoining sea. The work was initiated at Chetlet Island, but later changed to Kavaratti island (Fig.1) on request from the funding agency.

Preliminary work relating to the documentation of long-term shoreline changes, alongshore sediment characteristics in Chetlet Island were completed. The collection of secondary data and beach monitoring work for Kavaratti Island was initiated. ADCP, Valeport and Dobie wave gauge were deployed at two sites off Kavaratti for one month during March 2008. Data on waves and currents were collected representing the pre-monsoon condition of the study area. Short and long-term beach changes were calculated from the beach profile data. Coarse bathymetric grid of Kavaratti Island has been extracted from the C-map and Naval hydrographic charts. The latest fine grid bathymetric map of the near shore area was supplied by the Harbour Engineering Department, UT Lakshadweep. Both these maps were combined and input data file was generated for execution of the hydrodynamic model. Model set up was carried out.

The nearshore wave pattern during pre-monsoon, monsoon and post-monsoon seasons were simulated using the Spectral Wave module of MIKE21. The preliminary results indicate that part of the northern region, facing the entrance channel experiences higher wave activity during monsoon as compared to the northeastern part of the island. This corroborates well with the field observations of severe erosion in the northern region (coast adjoining the Administrative bungalow). However, further analysis is needed to identify the zones of wave convergence and divergence. Time series wave data recorded off Lakshadweep islands (DS2) were obtained from the National Data Buoy Centre, NIOT, Chennai during June

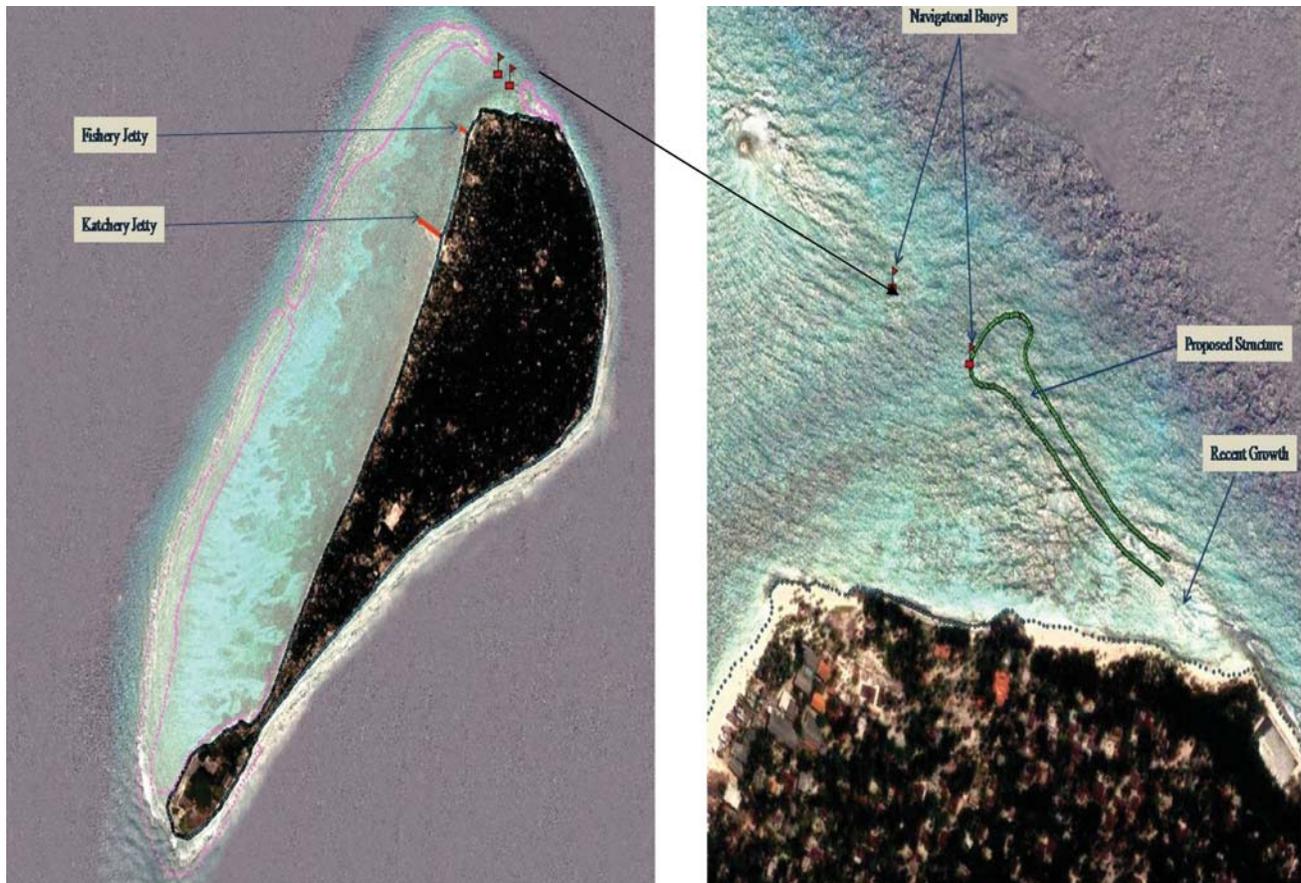


Fig. 2.5.1.1. Location map of Kavaratti Island

2008. An Interim Report was submitted to the funding agency.

Dr. T.N.Prakash

*Funding: Department of Science & Technology,
UT Lakshadweep*



2.6 Tsunami

2.6.1 Impact of tsunami on the Kerala coast and an initiative for the development of a management plan for the region.

This project was taken up to carry out mainly the post-tsunami surveys for the affected regions of Kerala in general with focus surveys on the worst affected region between Neendakara – Arattupuzha coast (Fig.2.6.1.1). This study forms part of a National programme initiated by DST, Govt. of India to understand the spatial pattern of the tsunami and their effects on coastal morphology. Though this study was completed at the end of 2007 period the work report was prepared later on.

As part of the post-tsunami field survey a bathymetric survey was carried out in the innershelf upto 50 m water depth, for a coastal stretch of about 50 km length extending over both the sides of



Fig. 2.6.1.1. Location map of the study region

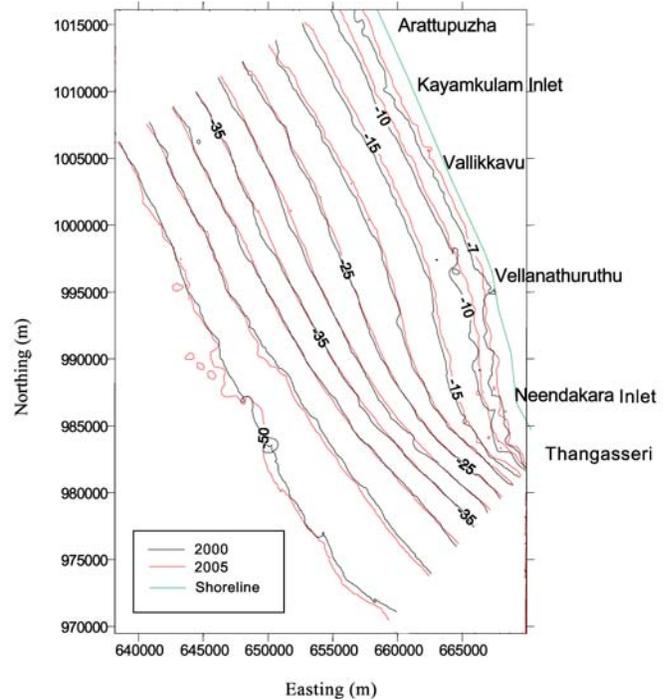


Fig. 2.6.1.2. Bathymetry of the Neendakara – Thottappally coast

the Kayamkulam inlet (Fig.2.6.1.2). The survey was carried out along transects at 1 km interval limited to 50 m water depth. Additional transects were also run at 500 m intervals in the worst affected regions adjoining Kayamkulam inlet. The bathymetric map of the Thangasseri-Arattupuzha shows a widening of the innershelf from Thangasseri towards north. In order to assess the impact of tsunami on the bathymetry, the bathymetric data available was superimposed on it. It can be seen that, in general, there is a shifting of depth contours towards shore indicating erosion of sediments and deepening of innershelf due to the tsunami. The impact seems to be maximum in the northern region, particularly in the zone off Vallikkavu, south of Kayamkulam inlet where the bathymetric changes are seen prominently even upto 45m depth. Also, in the southern sector off Neendakara-Vellanathuruthu region too, shifting of contours are seen in the 40-50m isobath region, though this is missing in the shallower locations.

Nearshore depth profiles were also collected using SLED in the selected locations along the coast. The profiles have a distinct character with a steep shore face at 1:20 above 3 m depth and then a much lower-gradient profile beyond 3 m depth. The near shore profiles for the two locations were compared with the profiles for

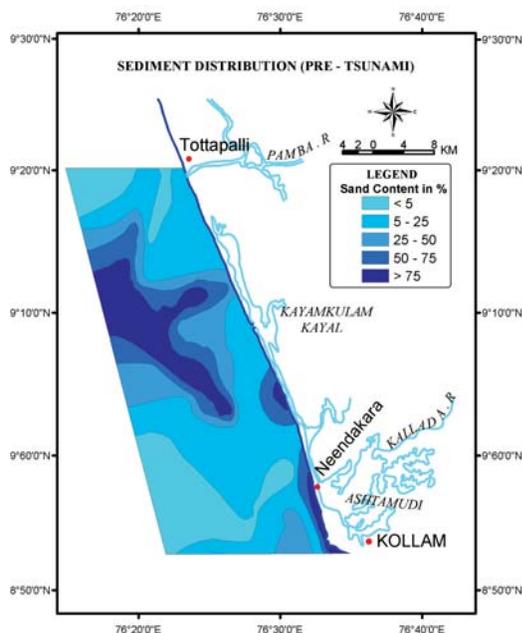


Fig. 2.6.1.3a. Distribution of Sand in the Inner shelf before tsunami (1987)

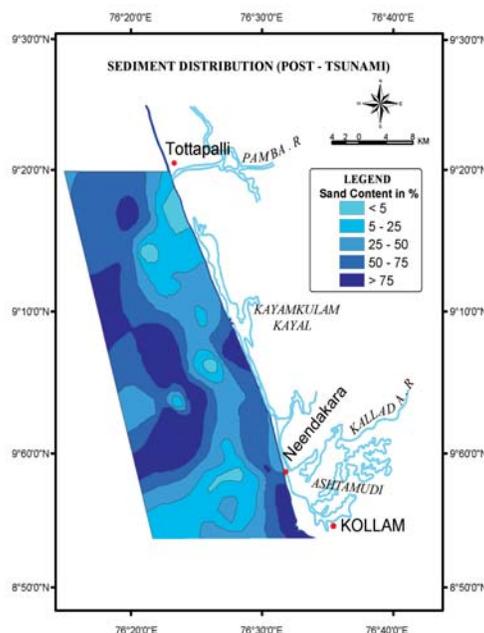


Fig. 2.6.1.3a. Distribution of Sand in the Inner shelf after tsunami (2005)

2001. Since the zone under study is dynamic and prone for seasonal and yearly changes, no impact of tsunami could be assessed with the data of 2001.

Surficial sediment samples from the same region were collected for studying changes in sediment characteristics. The analysis of the results indicates changes in the innershelf sediment characteristics with shoreward migration of sandy sediments off Kayamkulam where the impact of tsunami was most severe with run-up level up to 5m (Fig.2.6.1.3a &b).

Siltation of backwaters was also studied by taking depth measurements using echo sounder. The region stretching from Kollam to the entrance of the TS canal in the Ashtamudi estuary, which had a depth varying between 2 and 3 m during pre-tsunami has reduced the depth by 0.1 and 0.6 m after tsunami.

The canal region north of Kayamkulam inlet, which has a depth between 2 and 4 m during pre tsunami period, has reduced considerably. There are peaks of low depth immediately north of Kayamakulam inlet, Cochin yard jetty and near NTPC. The reduction was varying between 1.65 and 3.5 m. Rest of the northern part of the canal witnessed a reduction of depth varying from 0.1 to 0.6 m.

All the field data were synthesized and a final report was submitted to the Department of Science and Technology, Govt. of India. The report highlights the erosive tendency of the tsunami, which is clearly reflected in the shelf and in beach profiles.

Dr. T.N.Prakash

Funding: Dept. of Science & Technology, GoI

3 Natural Resources and Management

3.1 Water Resources

3.1.1 Hydro-chemical characterization and drinking water potential of coastal springs of Southern Kerala



Fig. 3.1.1.1. Photographs showing the springs located at Thiruvananthapuram and Kollam districts

During the past several years many localities in Kerala have been facing acute scarcity for good quality drinking water. Population explosion, conversion of wetlands to dwelling places, climate change and erratic monsoon and overall environmental degradation are the major causative factors for this water shortage. Consequently all the conventional water resources of the State are being exploited to the maximum extent. At the same time there are examples for untapped water potential like springs which are located in the coastal and midland regions of Kerala.

The present investigation envisages to understand the location, water potential and hydrochemical characteristics of spring resources that are an important natural gift. Around 200 springs are identified in Thiruvananthapuram and Kollam districts and most of them are located in the coastal-lowland segments. Nearly 100 springs have their discharge above the ground surface (flow type) and the rest of the springs with storage/protection structures (pond type). Both types of springs have rich water potential, of which the flow rate of the former type exceeds 143 liters per minute. Altogether six spring clusters were identified in the two districts. The Neyyattinkara-Venganur, Kariavattom-Chirayinkezhu, Varkala-Sivagiri and

Ayiroor-Hariharapuram are the major spring clusters of Thiruvananthapuram district while Chirakkara-Nedungolam and Kallada-Nedumpana spring clusters belong to Kollam. Besides these clusters, scattered spring distributions were also noticed in these districts.

Dr. K. Narendra Babu

3.1.2 Impacts of urbanization on soil and water resources of some selected cities of Kerala

Urbanization and unprecedented growth of population in the cities of Kerala imparts marked stress on its environmental systems. The highly contaminated storm water runoff, enriched with nutrients, toxic metallic elements and organic carbon materials deteriorates the surface water resources instantaneously and ground water resources slowly. The most urbanized cities of Kerala-Thiruvananthapuram, Kochi and Kozhikode are undergoing demand driven unscientific developmental activities causing ecological and environmental problems in the respective areas.

Thiruvananthapuram city in the south of Kerala state and Kochi Corporation in the central part and Kozhikode Corporation are on the verge of fast urbanization and development. These urban centers are now facing severe ecological impairments due to the contamination of surface water bodies and due to the unscientific disposal of heavily contaminated waste products originating from industries, townships, sewage channels etc. Deficiency of drinking water in summer season, contamination of water bodies and soil, and accumulation of solid wastes in undesired locations, etc. are some of the regular features of urbanization in these cities. The negative effects of urbanization are reflected well in the exponential rise of communicable diseases, and other types of ecological disorder.



Fig. 3.1.2.1 An urban waterbody used for dumping solid waste



Natural Resources and Management

ders like disease/mortality of fishes, decline in biodiversity and many other negative impacts. Lack of sufficient studies on the impact of urbanization on various environmental components, especially land and water is the major set back challenging formulation of wise-decision in the developmental issues of the state. The programme envisages studying the impact of urbanization on the land and water systems of three fast growing urban local bodies in the lowland physiographic region of Kerala -the Thiruvananthapuram, Kochi and Kozhikode corporations.

The major objectives are to assess the physical, chemical and bacteriological quality of ground water and surface water resources from city areas and from its surrounding regions, to delineate the difference of nutrient and trace element concentration in soils from city regions with respect to control regions, to correlate the gravity of urbanization in terms of contamination in water, soil and sediment characteristics in urban with respect to non-urban peripheral areas and to suggest strategies and management action plans for reducing the impacts of urbanization on water and soil/sediment systems.

Dr. K. Narendra Babu

3.2 Watershed Development

3.2.1 Watershed characteristics, landuse pattern and water quality parameters of upstream and selected down stream stretches of the Vamanapuram river

Major aims of the project are to work out the interrelationship between watershed characteristics, changing landuse pattern and water quality parameters of pristine catchment and the downstream section of the Vamanapuram river. Generation of primary baseline data to work out management strategies for restoration of water quality is also one of the agendas.

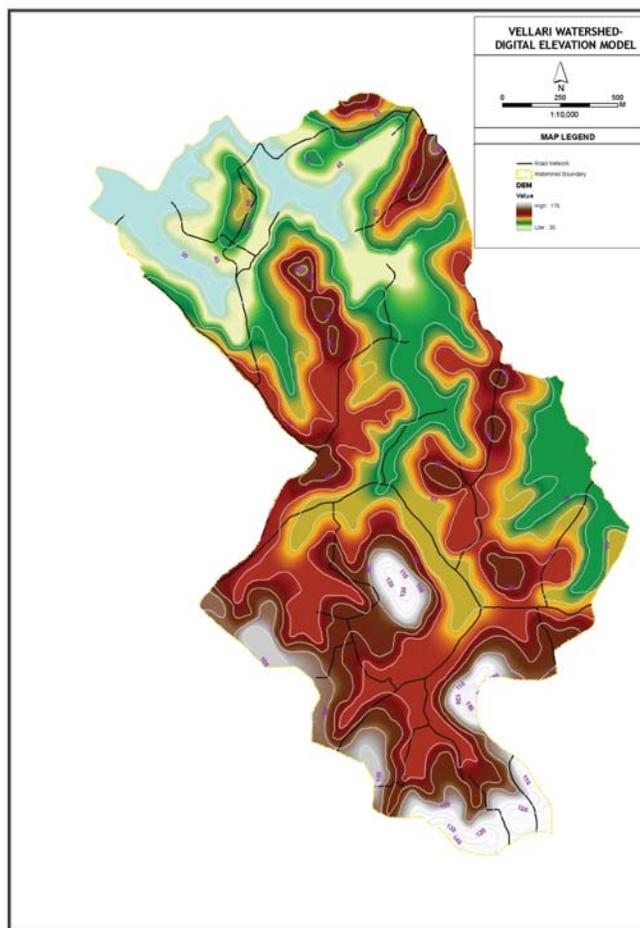
During the period under review field work was conducted for land use checking of the basin. Current landuse map was prepared using digital data (IRS P6, Feb.2005) in 1:50,000 scale. Water sampling was done (6 times) during the period and data were analysed for physico-chemical parameters with the help of the Chemical Sciences Division. Finalization and digitization of 14 thematic maps were carried out. Digital terrain model was completed and preparation of the final report initiated.

Dr. Mahamaya Chattopadhyay

Funding: Western Ghats Cell State Planning Board, GoK

3.2.2 Integrated Watershed development project (Hariyali) in Chadayamangalam Block

This project is being implemented in Chadayamangalam Block for which CESS has been identified as the Support Organisation. The main objective of the project is to harvest every drop of rainwater for the purpose of irrigation and drinking water supplies and to ensure overall development of rural areas through the Gram Panchayat with regular sources of income from water harvesting and management. Employment generation, community empowerment, mitigating adverse effects of extreme climatic conditions,



3.2.2.1. Digital elevation model of Vellari watershed in Nilamel Panchayat

restoration of ecological balance, use of simple and affordable technological solutions etc. are some of the thrust areas of the project.

During the period activities related to sensitization of the



Fig. 3.2.2.1. Hariyali Programme in the Chadayamangalam Block was inaugurated by Sri N.K. Premachandran, Hon'ble Minister for Water Resources in the presence of Sri. Mullakkara Retnakaran, Hon'ble Minister for Agriculture and Sri. Chengara Surendran, M P of Adoor Constituency



Fig. 3.2.2.3. View of the Watershed Grama Sabha with active participation of women held at Chithara

programme in the Block have been carried out. Training programmes were conducted for the elected representatives of the block. Twenty watersheds were identified for treatment. They were physically demarcated on the ground. Cadastral maps were procured and activities for collection of data using local volunteers have been initiated. Training was imparted to selected volunteers with an insight into Hariyali programme, different intervention structures for water harvesting suitable to the terrain, collection of

data and mapping in cadastral base. Analysis of collected data and finalization of resource maps are in progress. Work plan with different intervention structures in each watershed for the entire Block was prepared. Special Watershed Grama Sabha was convened in 19 watersheds and was presented the work plan

Sri. John Mathai
Funding: Hariyali, Govt. of Kerala

3.2.3 Rejuvenation of A-S Canal under Hariyali programme

Under this programme, technical support was extended to the Joint Committee of Aryad and Kanjikuzhy Block panchayats. Detailed survey including filed mapping of landuse have been completed. A detailed project report (DPR) has been prepared and handed over to the Jt. Committee for onward transmission to the Department of Rural Development, Government of Kerala. The DPR covered problem analysis, objectives, proposed project activity, data generation, project design, design of action plans, organizational arrangements, tentative budget, time frame, physical target and road map to achieve the target, specific success criteria, exit protocol, project execution status, and interaction with government departments/ other projects. This document was required for the Government of India to release fund for watershed based development.

Dr. Srikumar Chattopadhyay
Funding: Hariyali, Govt. of Kerala

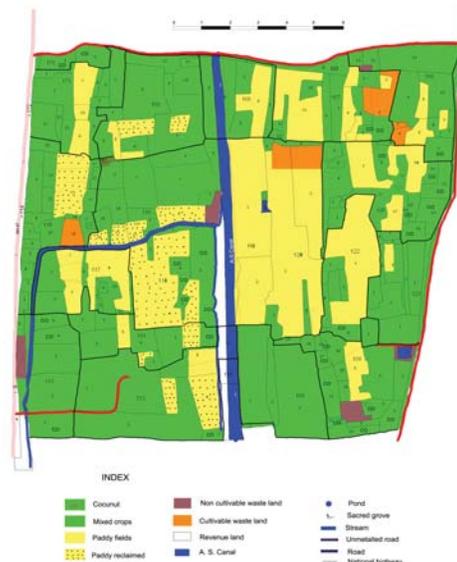


Fig. 3.2.3.1 Landuse of AS Canal region (PRM Map)



3.3 Terrain Analysis and Landuse Studies

3.3.1 Landscape evaluation in relation to fluvio-estuarine and denudational systems: A case study of Periyar basin, Kerala

The project aims to link up landscape evolution with morphogenetic processes operating within the Periyar basin that are well manifested within the bounds of river basins. Major objectives were to undertake morphogenetic analysis of Periyar river, to prepare maps on land system, to demarcate morphogenetic regions and to assimilate data through GIS analysis.

During the reporting period thematic maps pertaining to morphogenetic parameters and landuse pattern were finalised in 1:50,000 and 1:25,000 scale. Digitization of maps was accomplished. Hypsometric analysis of the drainage basin and sinuosity calculation of the main river and its tributaries were completed. Finalised the draft report and submitted to the Director.

Dr. Mahamaya Chattopadhyay

3.3.2 Geomorphic setting, landscape alteration and fluvial regime change in the Western Ghats provenance of southern Sahyadri – South of Achankovil Ar

The project primarily aims at geomorphic and landuse /landcover change mapping, analysis of drainage network and relating them with soil erosion and evaluating impacts on the fluvial regime and landform forming processes using topographical maps, multi date satellite data and GIS for the southern Sahyadri region.

During the period under review, base map showing the extent of Western Ghats limit (300 m) was prepared. Demarcation of Achankovil and Karamana watershed was done and morphometric parameters calculated. Slope, relative relief and drainage density maps were prepared in 1:50,000 scale. Landuse map using imagery (PAN & FCC) of Amboori and Kallikkad panchayats was attempted. Administrative and drainage map of the study area were completed

Dr. Mahamaya Chattopadhyay

3.3.3 Rejuvenating lateritic areas of Neyyar region in the Western Ghat region of Thiruvananthapuram using rock powder as Geonutrient for sustainable agriculture : A technological intervention

Major portion of the study area is covered by khondalites (Garnet - biotite -sillimanite gneiss with graphite) and Garnet – sillimanite - biotite gneiss (without graphite). Intercalations of charnockite

also occur in many places, . Discontinuous patches of pyroxenw granulites are also noticed at many places. Numerous pegmatite veins cut across the study area. The highest peak Agasthyamala is mainly composed of charnockitised gneiss a small patch of Tertiary sediments with lignite intercalation also occurs in the study area..

Laterite distribution

Laterite, the product of sub aerial weathering is developed over all the litho units in the study area and covers major portion (Fig.3.3.3.1). The lateritisation process involves leaching of silica, alkalis and alkaline earth with complimentary enrichment of sesquioxides and certain trace elements. Both primary laterites developed over crystalline rocks and secondary laterite developed over Tertiary sediments occur in the study area.

Mineralogy of the laterite:

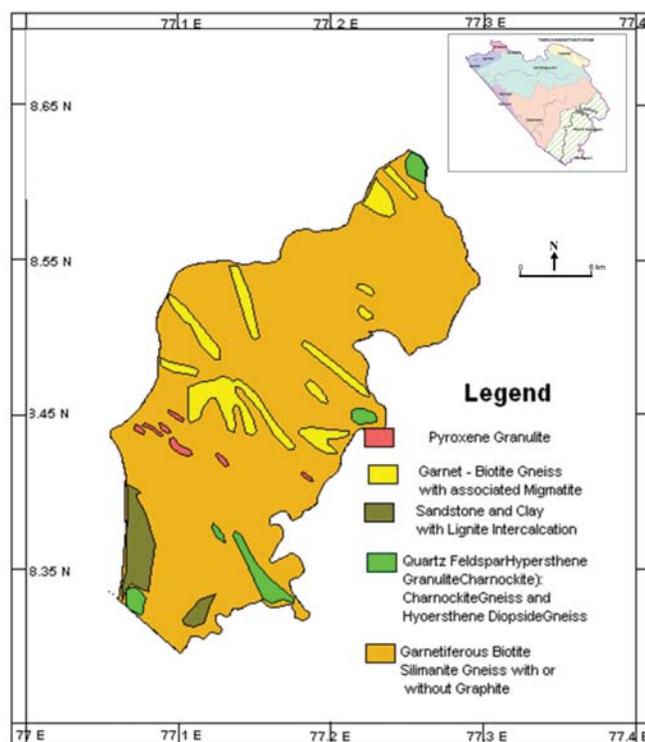


Fig. 3.3.31 Geological map of Neyyar watershed (After GSI)

Mineralogical composition of the laterites were established through X-ray diffraction analysis. Kaolinite, gibbsite, goethite, quartz, vermiculite form the major mineralogy of the studied laterites.

General description of soil series

Detailed soil distribution map of the study area was prepared. Nine soil series were identified from the study area, the details of

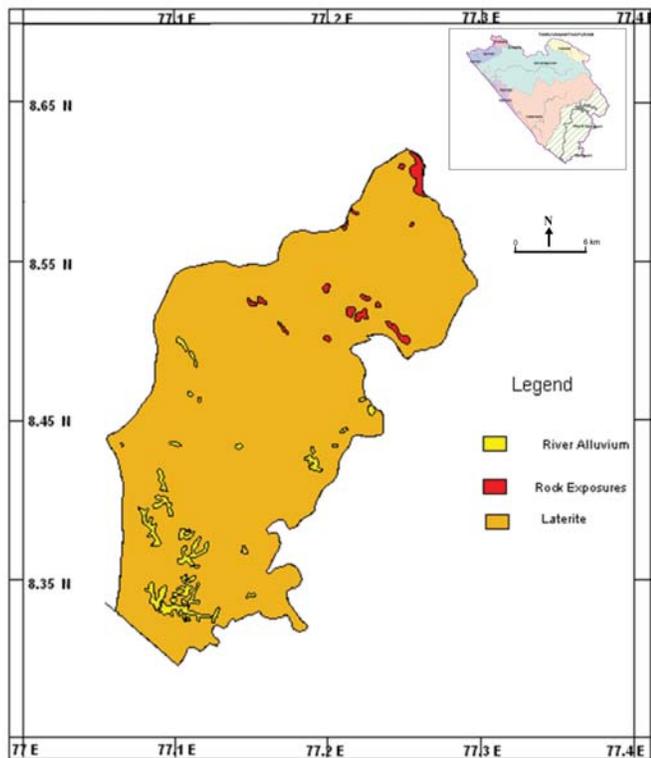


Fig. 3.3.3.2. Laterite distribution in Neyyar watershed

which are given in Fig.3.3.3.3.

Physical description and color of the laterites

Laterite is a brick red to purplish in color which has typical vermicular structure and the cavities are completely or partially filled with grayish white clay passing to ocherous. The sides of the vesicles are usually ferruginous and are deep brown in color

Dr. Narayanaswamy

Funding: Kerala State Planning Board

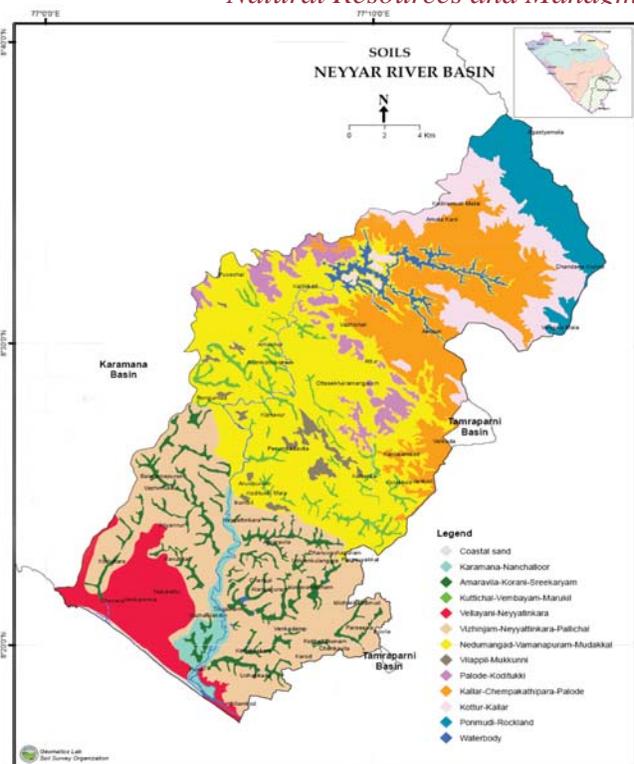


Fig. 3.3.3.3. Soil series in Neyyar watershed region

contour diagrams of 110 samples of inner shelf surface sediment samples covering 11 transects (Neendakara to Tottapally) showing different transects from beach to innershelf zone

Dr. Narayanaswamy

Funding: CSIR, Govt. of India

3.3.4 Characterisation of Indian placer deposits with special reference to the Offshore region of southwest coast of India

Completed major, trace and REE analysis of fine sediment – silt – clay(-230 Fraction) for 110 samples of inner shelf surface sediment samples covering 11 transects (Neendakara to Tottapally) viz. Neendakara, Chavara, Kovilthottam, Kayamkulam, Karunagapalli, Parakkuda Thura, Azhikal Tura, Ramancheri Tura Toppil, Arattupuzha and Trikunnappuzha. Prepared variation diagrams and



3.4 Environmental Resources

3.4.1 Landuse/Landcover change and its impact: Kakkiar – Agasthyamalai segment

This project was initiated to assess the impact of landuse / land cover change in the Kakkiar - Agasthiyamalai segment of Kerala. Major objectives of this project are (i) to assess extent of land use change since 1966-67, (ii) to analyse driving forces causing these changes, (iii) to assess impact of these changes on biophysical system, particularly on land and water and (iv) to indicate possible societal consequences due to land use changes in the study area. This project is in the final stage. All the works have been com-

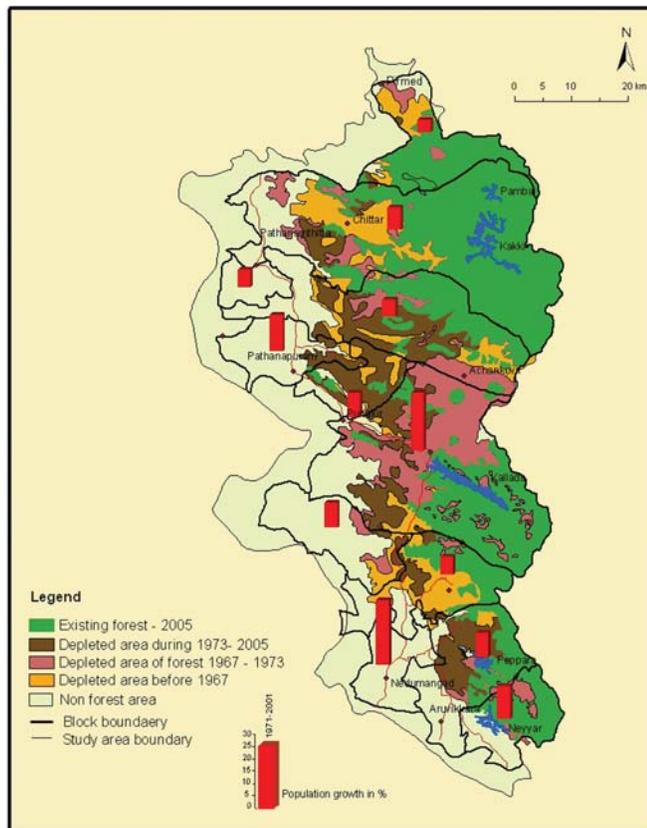


Fig. 3.4.1.1. Population growth and deforestation (1971-2001)

pleted. A set of hypotheses was tested with field data. Field level land use change has been worked out for five different segments distributed under various biophysical conditions. The final report is being prepared.

Dr. Srikumar Chattopadhyay

3.4.2 Pathiramanal Biodiversity conservation and Bio-park project: An Action Research Program

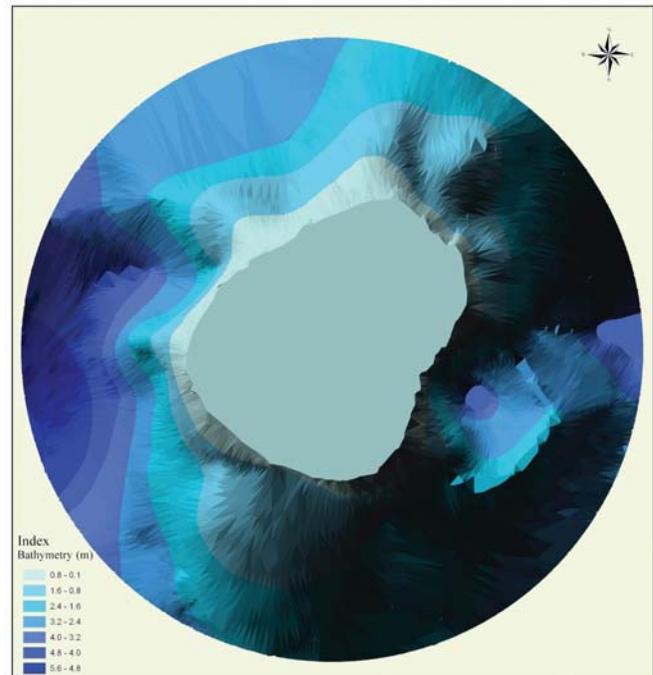


Fig. 3.4.1.1. Three dimensional view of the lake bed around the Pathiramanal island

This project sponsored by the KSCSTE has been completed and the final report was submitted. The objectives were (i) to conduct survey for generation of base line data on relief, bathymetry, micro geomorphology, landuse and soil (ii) to validate and conduct biodiversity survey, particularly plant biodiversity, (iii) to develop computerized data base for the island including plant biodiversity information system, (iv) to prepare plan for sustainable ecotourism development and (v) to plan for initiating preliminary intervention by planting mangroves. Based on our study Department of Tourism has prepared a project for ecotourism development in the island and submitted to the Govt. of India for funding. Workshop at Muhamma panchayat and tree planting ceremony at the Pathiramanal Island were organized on 5th June, 2007.

Dr. Srikumar Chattopadhyay
Funding: KSCSTE, Govt of Kerala

3.4.3 State of the environment and action plan for Kochi urban area

Kochi is the largest agglomeration in Kerala. It is the nerve centre of all commercial and economic activities in the State. The flat terrain and vast espouse of backwater and canals with small and large islands make the area vulnerable to isolation flash floods and damp environment in majority of the areas. Spatial and functional fragmentation are the key hurdles in development of the metro. The study has brought to light the urban sprawl along major corridors of the city towards the adjacent municipalities and panchayats. Expanding settlement pattern, increased occupation of runnels, reclamation of natural water bodies and long term erosion and accretion tends are noted all along the wetlands. The high economic growth exerts much pressure on available infrastructure facilities. Analysis of key sectors identified problems in water supply, sewerage, solid waste management, storm water drainage, traffic and transportation and poverty among urban poor. The situation called for improvement in social amenities and urban renewal programmes. Spatial growth trends and land utilization warrants planned development of infrastructure facilities, environmental management measures and tourism and heritage zone developments.

Dr.R.Ajaykumar Varma, Dr. C. N. Mohanan

3.4.4 Tropical freshwater myristica swamps of Kerala and its ecological and evolutionary significance

The Myristica swamps are tropical wetlands found in the valleys of Shendurney and Kulathupuzha rivers. A study has been initiated on the ecological and evolutionary aspects of this relict ecosystem still surviving in the valleys of tropical evergreen forest tracts. Detailed sedimentological and palaeo-palynological investigations



Fig. 3.4.4.1. A typical Myristica swamp near Kulathupuzha

are planned under this programme.

Dr. C. N. Mohanan

Funding: KSCSTE, Govt of Kerala

3.4.5 Heavy metal and REE abundance in edible plants of Kollam and Alappuzha district

The project aims to precisely quantify the heavy metal and REE's abundance in the edible plants grown in beach placer deposits area of Kollam and Alappuzha districts of Kerala with a view to bring out correlation, if any, between soil and plant heavy metal and REE concentrations. During the period under report field work has been carried out and plant and soil samples were collected at 3kms intervals east of Vembanad lake from Kundara to Changanassery to serve as control samples. Analysis of the samples were carried out at the National Geophysical Research Institute for REE and Heavy metals

G. Balasubramonian

3.4.6 Environmental impact assessment of inland placer mineral mining



Fig. 3.4.6.1. Beach placer deposits-Manavalakurichi

The study has been carried out by monitoring various environmental attributes in the impact zone. The activities with respect to the ongoing and projected mining scenario and their magnitude and intensity have been identified and assessed, based on which the environmental impact has been deduced. Depending on the nature, extent and potential of the impacts, management measures have been evolved and prioritized. The major impacts identified and management measures proposed have been utilized for developing environmental guidelines for placer mineral mining. The final report contains the results of the Environmental impact assessment (EIA) study carried out at Arattupuzha and Manavalakurichi regions, the former representing a non-mining prospect scenario and the latter, a mining and processing scenario for identification and standardization of environmental management measures required for placer mineral mining in the country.

Dr.R.Ajaykumar Varma, Dr. C. N. Mohanan

Funded by: C S I R, Government of India

Natural Resources and Management

3.4.7 Environmental degradation of Muvattupuzha river basin - causes, consequences and strategies for river restoration

Kerala has 44 rivers with about 6200 km² of total catchments area. The 41 west flowing rivers debouch into the Lakshadweep Sea either via the estuaries or kayals/lakes. During the last few decades most of the rivers are subjected to rapid degradation due to natural and anthropogenic reasons. The flow regimes of many of these rivers are regulated through construction of dams, barrages and embankments. Discharge of domestic and industrial effluents and other human activities in the catchments, flood plains as well as river channels have caused severe environmental problems to the river system of Kerala. If current pace of disturbances continue, it will result in irreversible environmental problems/degradation in the river basins of Kerala State.

The situation is equally alarming in the Muvattupuzha river which is flowing through the out skirt of Kochi city, the industrial capital of Kerala. Inter-basin water transfer, discharge of industrial and urban pollutants, indiscriminate sand and brick clay mining from the river basin in the midlands and low lands etc are some of the major environmental problems of Muvattupuzha basin. Inadequate data is the major lacunae in chalking out strategies for the conservation / management of this river basin.

The present study not only aims to gather the causes and consequences of environmental degradation of Muvattupuzha river but also proposes to suggest guidelines for better management leading to restoration of this river basin.

Major developmental activities. Over exploitation of the non-living resources, indiscriminate mining/quarrying activities, etc in the Kochi city, are the major problems proposed to be studied in the first phase. The primary and secondary data on mining / quarrying activities of the Muvattupuzha river basin were collected from 35 out of 69 local bodies (Fig. 3.4.7.1). Water samples from selected locations in the river stretch were collected (pre-monsoon season) and analyzed for various water quality parameters like pH, DO, BOD, Na, K, Ca, Mg, Fe, ammonia, nitrite, nitrate, phosphate, alkalinity, chloride, sulphate and silicate. The data processing and interpretation were also initiated. Water samples from the remaining seasons (monsoon and post monsoon seasons) would be collected.

Mining activity in the basin was analyzed based on the collected primary and secondary data from each local body. Fig. 3.4.7.2 shows the mining locations in one of the local bodies in the basin. The analyses shows that the hard rock mining is observed in all the three physiographic zones but the quantity of mining is quite high in the midland portion compared to the highland and lowland. It

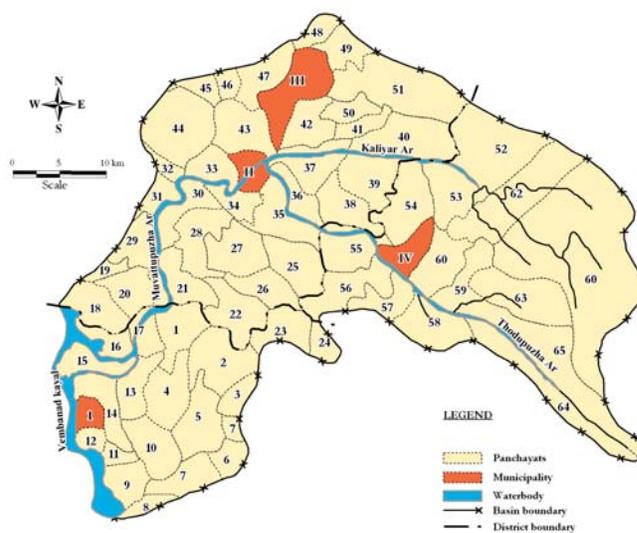


Fig. 3.4.7.1. Map showing the Muvattupuzha river basin and the location of Local Self Governments

is estimated that about 11,400 tones/day (td-1) of hard rocks are being quarried from the mapped region so far, out of which the major amount comes from midland portion. The rate of hard rock mining from highlands and lowlands are comparatively less. In the case of flood plain sand mining, six local bodies of the

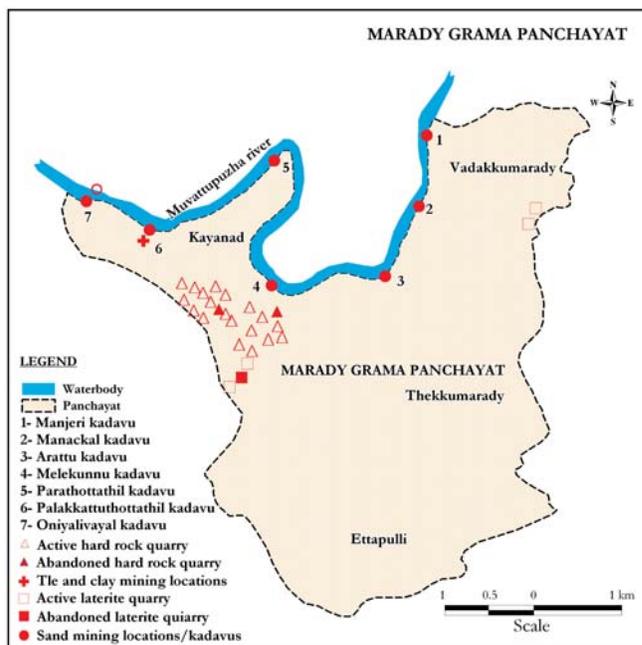


Fig. 3.4.7.2. Map showing mining locations in the Marady Grama Panchayat of Muvattupuzha river basin

lowlands are actively engaged and the mining locations are spread in Kottayam and Ernakulam districts. Majority of these mining locations are present in the Kottayam district. A total of 117 flood plain sand mining locations (both active and abandoned) are observed in the region. 2.68 x 10⁶ ty⁻¹ of sand is being mined from the active flood plain mines. More than 3000 labourers are engaged in flood plain sand mining activities. Total quantity of soil quarried from the 35 local bodies is about 4815 td⁻¹ with major share coming from midland physiographic zones. The number of laterite blocks cut from quarries of the mapped region of Muvattupuzha river basin is about 20790 per day and as in the case of hard rock and soil, midlands portion of the basin ranks first in laterite production. Soil quarries are also more confined to the midland physiographic unit of the basin. The laterite, soil and land sand quarries are confined to midlands and lowlands of the river basin. In short, majority of these mining activities are concentrated in the midland physiographic unit of the Muvattupuzha river basin. These unscientific activities cause serious degradation of the area.

Dr. K. Maya

3.4.8 State of the environment (SOE) report – Land Environment

The report on the state of the environment contains salient features of the State and its vibrant climate, vivacious hydrology, distinct geological domains and terrains, different mineral deposits, copious ground water resources, soil types and distinct agro climatic zone and multitudes of lively micro-ecosystems. It also discusses the increased pressure on land for more resources and accelerated human interventions in the form of mining, quarrying, filling of low lands along with high rainfall and undulating topography. Major environmental issues confronting the land environ-



Fig. 3.4.8.1 Wetland reclamation in progress

ment are land use change, mining, soil erosion and quality deterioration. These issues are analysed in term of their driving force pressure, present status and impacts. Population growth, migration, urbanization, industrialization and globalization are the major factors that lead to significant land use change in the State. The report recommends a comprehensive action plan for conservation and management of the limited land resources of the State and to evolve a detailed land use policy and integrated action plan.

Dr. R. Ajaykumar Varma

Funded by : KSCSTE

3.5 Environmental Pollution

3.5.1 Nitrous oxide and methane in coastal ocean and estuaries

Methane and nitrous oxide are strong greenhouse gases capable of

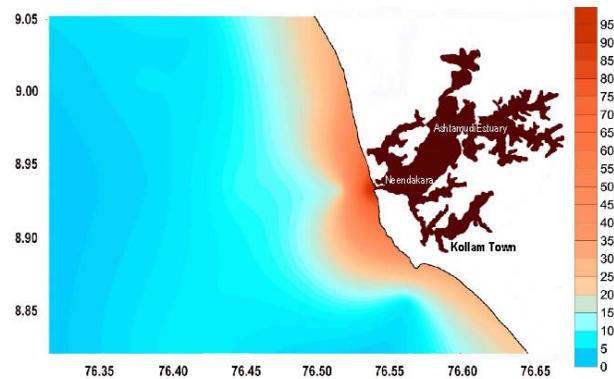


Fig. 3.5.1.1. Spread of dissolved methane in the surface waters off Neendakara

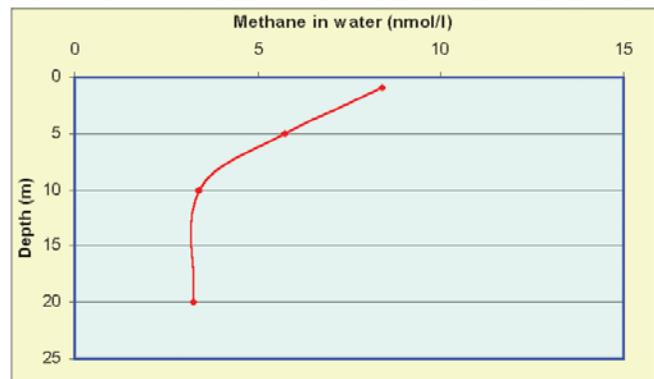


Fig. 3.5.1.2. Vertical distribution of methane in the coastal ocean off Neendakara



causing significant climate changes. Large amounts of these gases are present in the oceans, and their concentration in the coastal ocean is significantly higher than the global oceanic averages. Coastal regions including estuaries are active sources of both methane and nitrous oxide. Methane is produced during anaerobic decay of biological matter. Nitrous oxide is produced during nitrification and denitrification processes involving micro-organisms and is influenced by agricultural activities involving application of nitrogenous fertilisers.

The ongoing research programme to monitor the distribution of these greenhouse gases in the estuaries and coastal ocean aims at understanding the sources of these gases in the coastal ocean.

Measurements were carried out in the Ashtamudi estuary and coastal ocean off Neendakara coast during this period. Spatial and vertical distribution of these gases as well as related influencing water and sediment parameters in the estuarine and oceanic waters were measured. Spatial distribution of methane in the surface layers of the coastal ocean off Neendakara is given in Fig.3.5.1.1. The observed gradient in methane concentration across coast to open ocean indicates estuarine discharge as a source of methane in seawater. Vertical distribution of dissolved methane in the coastal ocean can be seen in Fig.3.5.1.2. The higher concentration observed in the surface layers also indicates estuarine discharges as a significant source of methane in the coastal waters.

Dr. E. J. Zachariah

Funding: Ministry of Earth Sciences, Govt. of India

3.6 Coastal Zone Management

3.6.1 Shoreline management plan for selected locations along Kerala coast

The issue of coastal erosion continues to be a major concern for Kerala due to its characteristic demographic and settlement pattern and coast centered economic development. Different measures, mostly seawalls, have been adopted along the Kerala coast for its protection. Based on reviews and studies on the performance of various protection measures adopted, the Central Water Commission (CWC) proposed to have a comprehensive analysis of the problem of erosion through Shoreline Management Plans (SMP) for a better and more effective coastal protection measure. Accordingly the ICMAM Project Directorate, Ministry of Earth Sciences has supported CESS to undertake studies on SMP for Muthalappozhi (Anchuthengu), Vadanappally (Munambam-Chettuwa) and Kozhikode.

The coastal stretch extending on either side of Muthalappozhi inlet

for about 16 km between Thumba and Anchuthengu-Mampally, has been selected as the first phase of the study. Muthalappozhi coast is part of an almost straight, NW-SE trending coast between Veli inlet and Varkala cliff in Thiruvananthapuram. Anchuthengu which experiences severe erosion is immediately north of the inlet while the other major eroding area is Thumba-Kadinamkulam stretch of about 6 km south of the inlet.

The study components consist of: (a) primary data collection on nearshore bathymetry, waves, tides, coastal morphology, shoreline changes, ecosystems and local requirements along the study areas and (b) recommendation of appropriate SMP based on numerical model studies.

Dr. K. V. Thomas

Funding: Ministry of Earth Sciences, Govt. of India

3.6.2 Coastal zone studies

The work plan contains four major study components, viz., i) Mapping and monitoring of the coastal zone, ii) Preparing local level map on 1:5000 scale for CRZ using remote sensing satellite data, iii) Mapping and monitoring the Marine Protected Areas, iv) Vital/Critical Coral Reefs Habitat mapping. IRS P6 LISS IV/LISS III and CARTOSAT data have been used for the study.

Mapping and monitoring of the coastal zone of Kerala Lakshadweep group of islands: Main objective is to prepare coastal wetland maps between HTL and LTL and coastal landuse above HTL on 1:25,000 scale using IRS P6 data. 27 IRS P6 images were re-projected from WGS-UTM to GCS and preliminary interpretation was completed. Georeferencing of 79 images and landuse classification of 10 topogrids were completed.

Preparing local level map on 1:5000 scale for coastal regulation zone using remote sensing satellite data: Main objective is to develop a methodology for CRZ demarcation at cadastral level in 1:5000 scale for implementation at the parcel-level using CARTOSAT data. Micro-level CRZ mapping of one toposheet area (1:25000 scale) was carried out using the hybrid product of QuickBird data (resolution of 0.60 m for PAN and 2.5 m for MSS) in the Kochi area using the CARTOSAT Data for one toposheet area of Thiruvananthapuram. Static position of Principal Reference Points (PRP) was recorded for a continuous period of 3 days using dual frequency receivers of Differential Global Positioning System (DGPS). Continuous co-terminus data from the nearest IGS station was downloaded along with the precise ephemeris for computing ITRF coordinates of our base station with respect to IGS stations.

The GCP positions were occupied in short static mode using single

frequency GPS receivers. Data from the base station and the Rover Station were processed for computing the WGS-84 spherical coordinates with sub-metre accuracy. QuickBird image were re-referenced using the GPS coordinates. The georeferenced image was then used as reference frame for registering cadastry. Seamless spatial representation of the cadastry and images were carried out through edge matching techniques. The georeferenced cadastry was digitized and final seamless map was reproduced in 1:4000 scale with administrative boundaries up to ward level with survey fields and survey numbers.

Sensor merging of 0.60 m PAN and 2.5 m MSS QuickBird satellite image was carried out for obtaining a hybrid product of 2.5 m resolution. Using visual interpretation of satellite data, the thematic layers such as transport-network, landuse/land cover, assets/buildings as discernible from imagery were derived. The attribute information was geo-linked to the database. Thematic layers thus derived were integrated with the cadastral layer.

CRZ maps were prepared in 1:4000 scale with the complete road network, establishments, seawall locations, landuse/land cover etc. In the sea coast 200- and 500-m regulation lines were drawn parallel to the HTL uniformly all along the coast. Around the dense mangroves (>1000 m² area), a 50-m buffer zone and a CRZ line around the river/creek was drawn.

Mapping and monitoring the Marine Protected Areas: Landuse map of the RAMSAR sites of Kerala viz., Vembanad Lake, KOL lands, Kuttanad area and Pazhayangadi were completed.

Eco-morphological zonation of Vital/Critical Coral Reefs Habitat of Lakshadweep Islands: Satellite data used for classifying the coral reefs were subjected to geometric and radiometric image correction and image enhancement. Unsupervised classification was carried out followed by supervised classification. Contextual editing was also done wherever errors were encountered during classification.

The images were geometrically corrected to ensure proper comparison between different images. In order to obtain radiometrically comparable apparent spectral radiance data, suitable digital values of each band in all images were transformed into real numbers using the spectral calibration data. Unsupervised classification was carried out on rationed hybrid images/PCA images. A total of about 75 classes were taken for the classification of the images. Signature evaluation of the reef features observed on the field was carried out in the laboratory and on the basis of the spectral properties of the features, supervised classification (using Maximum Likelihood classifier) was performed for all images.

Methodology and classification system as developed by SAC has been adopted in this study. After radiance correction, ecomorphological zones of Bangaram, Kavaratti, Agatti Reefs were classified using LISS IV/LISS III Image and field verification

were carried out. Ecomorphological classification of the coral islands of Lakshdweep islands are under various stages of completion. Landuse classification of Bangaram and Kavaratti; L IV – Kavaratti, Bangaram, Agatti, Minicoy and vectorization of landuse classes were completed. CRZ maps were prepared for Kavaratti and Minicoy Islands from the IKONOS Image. Layout map for Kavaratti and Agatti islands were set.

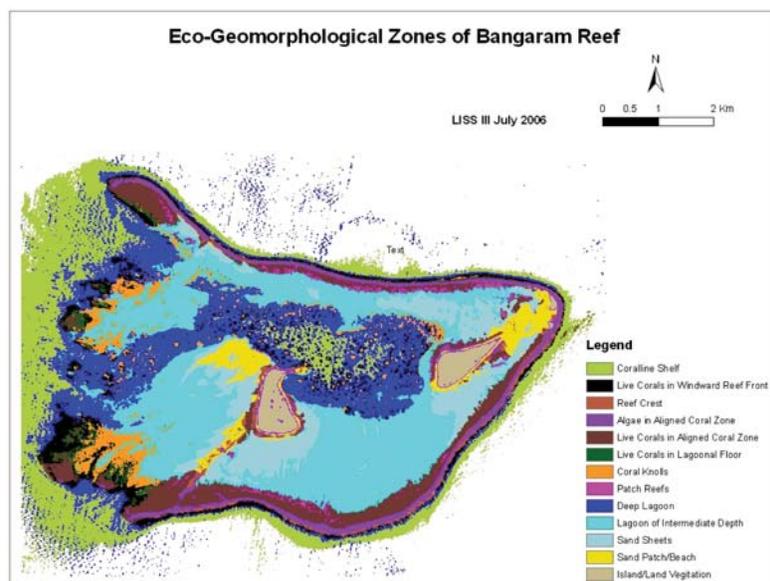


Fig. 3.6.2.1. Eco-geomorphological zones of Bangaram reef, Lakshadweep islands

Dr.M.Samsuddin

Funding: Space Application Centre, Ahmedabad

3.7 Pollution Studies

3.7.1 Coastal Ocean Monitoring and Prediction System (COMAPS)

The Ministry of Earth Sciences, Government of India has initiated a surveillance programme entitled “COMAPS” for identifying ecologically sensitive coastal areas along the Indian coast receiving heavy influence of untreated toxic pollutants of industrial and anthropogenic origin. CESS is entrusted with the task of monitoring along the southwest coast of India, Arabian Sea extending from Veli to Karwar. Sampling was carried out by employing research cruises in Coastal Research Vessel (CRV) – Sagar Purvi and Sagar Paschimi. Hot spot transects allotted are Veli,



Kochi, Vallarpadam, Mangalore and annual sampling at Kavaratti atoll of Lakshadweep union territory. Sample collections for Hydrochemical, Marine Biological and Microbiological characteristics were undertaken from near shore, 1, 3, 5 and 10 Kms from shore. Hourly studies in a semi-diurnal cycle of 12 hrs duration was also kept active at hot spot transects. The pollutants especially of anthropogenic and industrial origin found increasing in Veli, Neendakara, Kochi and Mangalore are well documented. The salient features identified from the recent studies results are as follows.

Studies on chemical characteristics revealed that Veli, Kochi and Mangalore stations have low oxygen saturation due to the inflow of industrial effluents and sewage waste. In Kochi transect the enrichment of heavy metals was observed in the sediments due to the discharge of effluents from Eloor industrial area and municipal discharge. Near shore region of most of the stations were polluted with respect to anthropogenic sources. The levels of nitrite and nitrate were found to be low in all the stations and were more pronounced in the offshore regions. It is to be concluded that

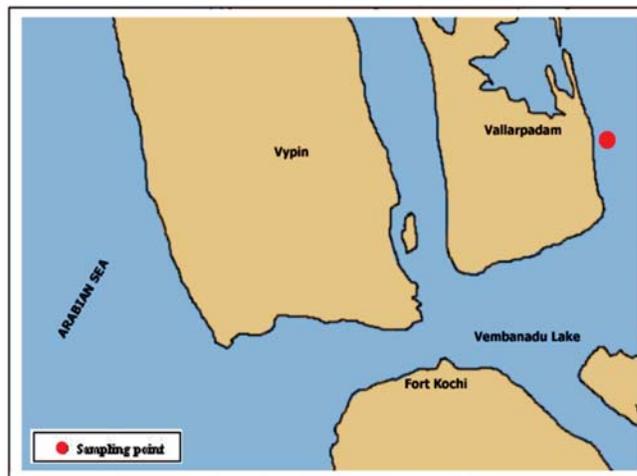


Fig. 3.7.1.2 Sampling point at Vallarpadam

denitrification happens in the Arabian Sea. The study on biological characteristics showed that Neendakara, Ponnani, Kozhikkode, Mangalore and Karwar were comparatively more productive than other stations. Fish larvae and fish eggs found in large numbers in these productive stations revealed the major breeding habits of pelagic species. Zoobenthos count was recorded low in all seasons at Kochi transect, which may be due to the heavy stress associated with dredging activities. Microbial pollution was comparatively very high in Mangalore and Kochi especially towards the shore region, which clearly indicates the influence of anthropogenic activity.

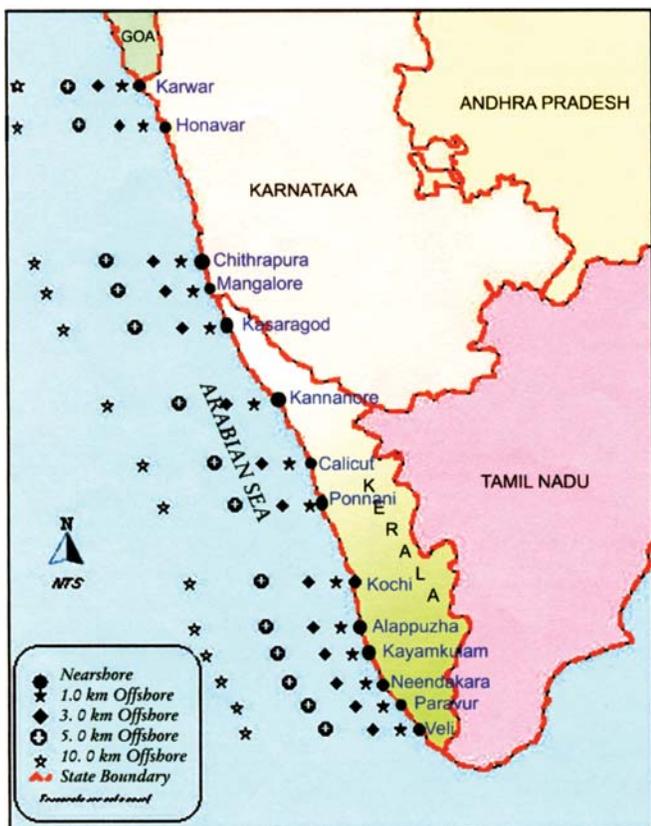


Fig. 3.7.1.1. Sampling points along South-West coast

Kavaratti, the third largest island in the Lakshadweep is the capital city of this 'Coral Paradise' of the Union territory of India. It is an attractive centre for tourists, marine biologists and ichthyologists. The marine bio diversity consisting of sea grass bed, 104 species of Scleractinian corals, mangroves and 603 species of fishes is a major attraction. This was supported by the physico-chemical, biological and microbiological characteristics of the surrounding sea. Considering the water chemistry in recent years and based on our study in selected areas an increase in inorganic phosphate, salinity and sea water temperature was noticed. The effect of this may be one among the myriad reasons for coral bleaching. In certain sampling spots higher turbidity was observed due to stronger wave action and disposal of domestic waste especially along the lagoons. The water is clear except in some areas very close to the coast. The water shows slight turbidity due to the removal of the fine loose material from the coast.

Oceanographers studying this region point out that Lakshadweep is a silent victim of global warming. The low topography of these islands makes them very sensitive to sea level rise. The productivity

levels do not vary much in all stations, which is supported by the standing crop of phytoplankton. The phytoplankton genus such as *Asterionella*, *Coscinodiscus* and *Rhizosolenia* dominated in all sampling stations. Zooplankton was represented in majority by Harpactoid and Calanoid copepods. Among zoo benthos, a coral was found in abundance. Bacterial population was found higher in all water samples in shore, especially total coliforms and faecal coliforms, which may be due to the entry of anthropogenic wastes in connection with the developing tourism activities. However towards offshore *Vibrio cholerae* and *Vibrio parahaemolyticus* showed their abundance

Dr. P. P. Ouseph

Funding: Ministry of Earth Sciences, Govt. of India

3.7.2. Geochemical investigations on anthropogenic mercury and other heavy metals in Vembanad lake sediments

The Vembanad Lake with many rivers debouching into it is a unique fluvial regime. Pamba, Achankovil and Manimala rivers in the Southern region and the Meenachil and Periyar rivers in the northern region join the lake. Thus, most of the natural sediment supply of these rivers are deposited in the lake and only a small portion reaches the sea. The industrial growth, rapid urbanization, heavy dependence on chemical fertilizers and pesticides, lack of proper solid waste management system etc. put severe environmental stress on this fragile ecosystem.

The geo-chemical investigation of sediments from the hydrosphere of the Vembanad region, therefore, become a major subject of interest in research as it will reflect the current quality of the system and provide information on the impact of man. A research project on the geochemical investigations on anthropogenic mercury and other heavy metals like lead, cadmium, copper, zinc etc. was taken up. This two year research programme also studies the seasonal variation of water chemistry for the pre-monsoon and post-monsoon seasons.

The chemical analysis of heavy metals revealed that the maximum concentration of total mercury in lake water varied from 10 ng/l (monsoon) to 20 ng/l (non-monsoon). The total mercury concentration in the Periyar river water samples varied from 50 – 130 ng/l. Very high total mercury concentration was observed only at certain stations in Periyar river and in the Cochin estuary area. The untreated effluent discharge from different industries located on

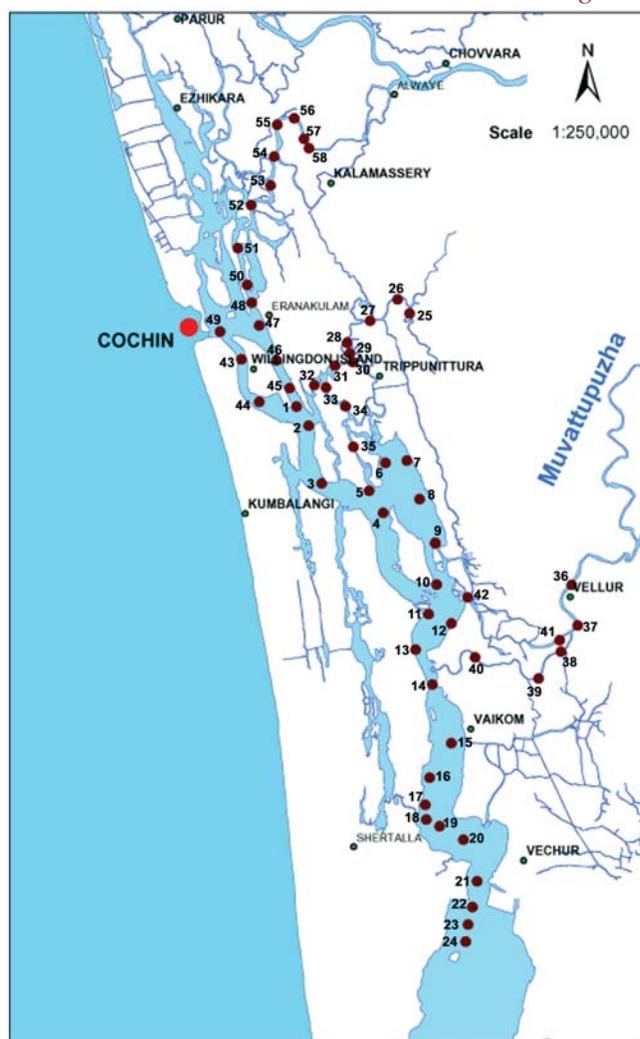


Fig. 3.7.2.1. Sampling locations in the Vembanad estuary

the banks of the river may be the main source of mercury pollution in the region

The maximum values for lead were noticed in water samples during non-monsoon months (2.1 – 2.6 ng/l). The mean concentration of cadmium was obtained for non-monsoon samples varied from 0.38 to 0.39 ng/l and the low mean value was recorded in monsoon season (0.28 ng/l). The copper content in lake water varied from 0.004-78.4 ng/l and is high during non-monsoon season. The Cochin estuary and Periyar river samples contain more copper than other samples. The Periyar river showed a minimum copper concentration of 6.3 ng/l and a maximum of 78.4 ng/l.

Total mercury in Vembanad lake sediments varied from 0.002 to 0.13 mg/g with a mean value of 0.03 mg/g. Higher values in lake sediments (0.13 mg/g) were obtained during pre-monsoon. During all the seasons the mean sediment total mercury concentration has shown very little change and higher values were obtained for the sediments of Periyar river (0.12-12.20 mg/g). The mean concentration of mercury in Periyar river sediment was 2.65 mg/g.

Total mercury and other heavy metals were determined in several fish samples of various types available in the study area. Various parts of fish samples (gills, flesh and alimentary canal with liver) were analyzed for total mercury. Total mercury (THg) was observed high mainly in fishes such as *Arius arius*, *Etroplus suratensis* etc., which are bottom feeders and omnivores. In *Arius arius* maximum concentration was obtained in alimentary canal (7.5ppm) whereas in *Etroplus* it is in gills (3ppm). The THg concentration in *mugil cephalus* is minimum in flesh (0.5ppm) and maximum in gills (1.5ppm). *Macrobrachium rosenbergii* showed a maximum concentration of 1.69ppm. Mercury, which is one of the major toxic heavy metals that undergoes methylation in the aquatic environment by both biotic (micro organisms) and abiotic processes can bio accumulate and bio magnify in the food chain.

Dr. P. K. Omana

3.8. Biophotonic applications

3.8.1. Clinical trial to detect oral pre-cancer using oxygenated hemoglobin diffuse reflectance ratio

Early detection of premalignancy is of great clinical significance in the management and treatment of cancers affecting the oral cavity. Visual examination by an experienced clinician followed by biopsy and cytology is the current accepted practice for detection of oral cancer or its precursors. However, visual inspection does not permit identification of microscopic epithelial alterations, and it is often a difficult task for even experienced clinicians to determine the most malignant location for biopsy. This leads to multiple biopsies to the discomfort of patients.

In contrast, diffuse reflectance spectroscopy (DRS) is a simple, low-cost, and noninvasive modality for distinguishing oral precancer. DRS diagnosis of cancer is based on detection of vascularization and local architectural changes occurring at the cellular and sub-cellular levels during tissue transformation. This is made possible by illuminating the tissue with white light and studying the spec-

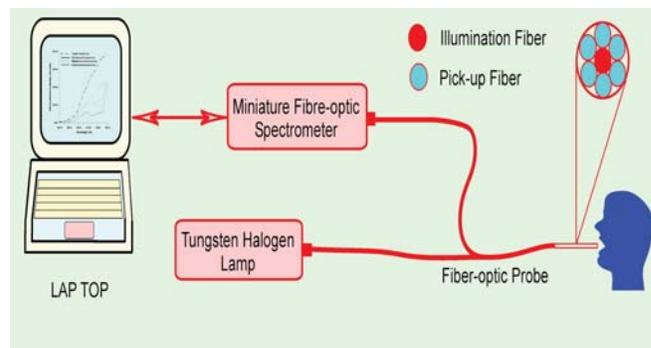


Fig. 3.8.1.1. Schematic of the compact and portable DR spectroscopy system developed in CESS.

tral components of the radiation emitted due to a combination of multiple elastic scattering and absorption within the tissue. Towards this we have carried out clinical trials at the Regional Cancer Center (RCC), Trivandrum using a compact and low cost DRS system to diagnose oral cavity precancer. In this optical biopsy technique, the DR spectral ratio R_{545}/R_{575} of oxygenated hemoglobin absorption at 545 and 575 nm is used for detection and grading of malignancy.

The experimental setup for DR studies (Fig. 3.8.1.1) comprises of a tungsten halogen lamp, which acts as the white light source and a fiber-optic spectrometer for recording DR from the interrogated tissue. The bifurcated optical fiber guides the light emission from the lamp to the lesion through a 3-m-long fiber optic cable that has a central fiber to deliver the excitation beam and six surrounding fibers to collect DR. The collected DR from tissue is detected by a CCD array in the spectrometer with a resolution of 8 nm and recorded on a laptop using proprietary software.

The DR spectra were recorded from 29 patients having malignant lesions at various anatomical locations in their oral cavity. Site-specific spectra of 35 healthy volunteers were measured and used as control. The spectra of patients were grouped as per histology into hyperplasia, dysplasia and squamous cell carcinoma (SCC) that encompass mild, moderate and poorly differentiated SCC. Fig. 3.8.1.2 a,b shows the mean DR spectra recorded from the buccal cavity and dorsal tongue in various patients grouped according their grades. The diffuse reflectance spectra show dips at 545, and 575 nm due to oxygenated hemoglobin absorption. Further, it is found that the DR spectral intensity decreases with increasing grades of malignancy for all types of tissues (Fig.3.8.1.2).

In an earlier study on ex vivo samples of oral mucosa, we have observed that the grade of tissue malignancy could be determined from the diffuse reflectance intensity ratio R_{545}/R_{575} at the

oxygentaed hemoglobin absotption maxima. A detailed study of the mean diffuse reflectance spectra from different anatomical sites of the oral cavity has shown that gingiva and alveolus mucosa show lower reflectance intensities, whereas spectra from buccal mucosa and dorsal tongue have maximum reflectance. This neces-

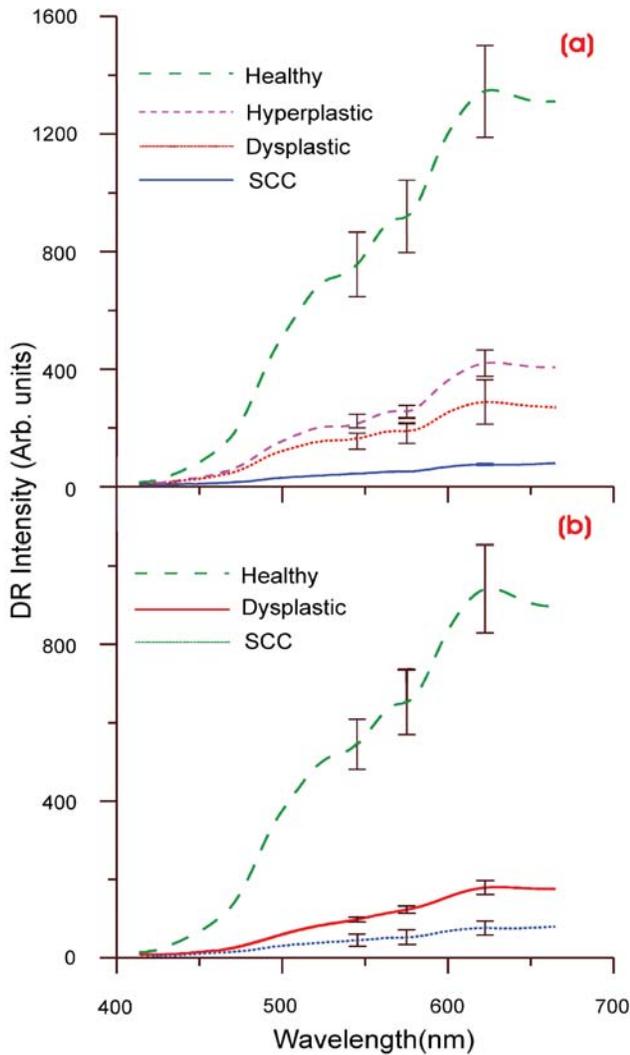


Fig. 3.8.1.2. Average DR spectra of patients grouped according to varying grades from a) buccal mucosa (SCC-12 sites, dysplasia-3 sites and hyperplasia-7 sites) of 13 patients and b) dorsal tongue (SCC-7 sites and dysplasia-3 sites) of 6 patients. The healthy spectra represents site-specific mean of 10 measurements each in 36 volunteers. The error bars relate to the standard deviations at 545, 575 and 622 nm (maximum of the DR spectra) for different tissue types.

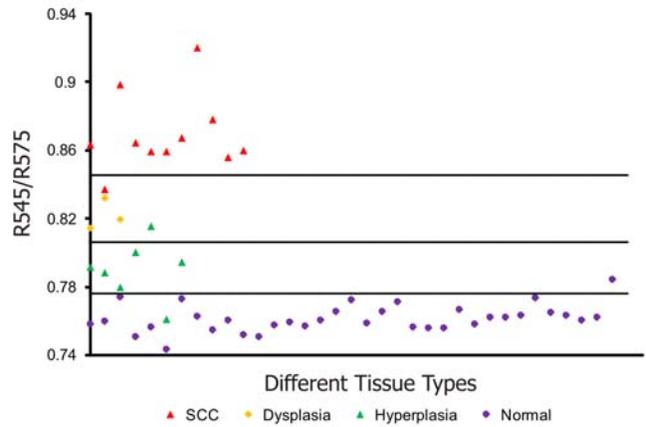


Fig. 3.8.1.3. Site-specific DR spectral ratio scatter plots discriminating different grades of cancer from 21 buccal mucosal sites in 12 patients.

sitated the need to use site specific ratio values in the detection of malignancy using the R545/R575 ratio. Fig. 3.8.1.3 shows the scatter plot diagram of the R545/R575 ratio that differentiates different grades of buccal mucosa in a clinical trial on 12 patients. Discrimination lines between different grades of cancer are drawn based on the mean ratio values of the adjoining grades depicted in figure. Fig. 3.8.1.4 shows the combined scatter plot ratio from different anatomical locations of patients with differing grades of oral cavity cancer. Blind tests were conducted in a different group of patients to establish the applicability of the DR ratio scatter plot in real-time detection of the grade of cancer non-invasively without the need for tissue biopsy.

As compared to scatter plots that use the mean DR ratio from all

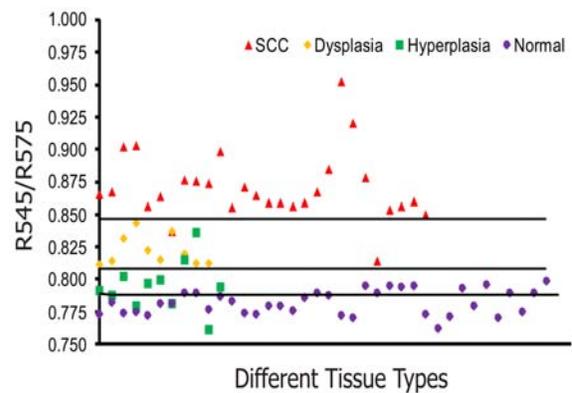


Fig. 3.8.1.4. Combined DR spectral ratio scatter plot discriminating different grades of cancer from 48 sites in 29 patients compared with the mean normal values in 36 healthy volunteers



anatomical sites, those using site-specific data show improved sensitivity and specificity for early diagnosis and grading of oral cancer. In the case of buccal mucosa, using scatter plots of R545/R575 ratio, we obtained a sensitivity of 100% and specificity of 86% for discriminating precancer (dysplasia) from hyperplasia, and a sensitivity of 97% and specificity of 86% for discriminating hyperplasia from normal. This study could further establish the applicability of DR Spectroscopy further, in diagnosing tongue cancer where techniques based on laser-induced fluorescence has very poor discrimination capability. The great advantage of using optical spectroscopy based techniques in cancer diagnosis is that the results are available in real-time as compared to conventional biopsy guided histology. The technique is cost effective and most suited for oral and cervical cancer screening applications through community centers in large population.

Dr. N. Subhash

Funding: Department of Science and Technology

3.8.2 Sunlight induced multi-spectral fluorescence imaging of plants

Environmental changes such as increase of UV radiation due to ozone depletion, global warming caused by the green house effect, and chemical pollutants influence plant health and growth. Considering the importance of photosynthesis, carbon cycle and the closely linked hydrological cycle, plant and vegetation monitoring is one of the highest priority research areas for conservation of earth environment. Our studies during the last decade have shown that vegetation fluorescence reflects the physiological status of plants and we have applied the laser-induced fluorescence technique in classification of plants, identification of vegetation characteristics, in detecting nutrient or water stress and in studying the impact of air pollution on plants. On the other hand, sunlight as a light source for inducing plant fluorescence and for passive remote sensing of vegetation characteristics through field and space missions is gaining acceptance recently.

This project envisages development of a multi-spectral fluorescence imaging system to detect solar radiation induced plant fluorescence from different types of vegetation, to characterize them and to correlate the results with photosynthetic parameters of vegetation. This optical instrumental setup could aid in passive remote sensing of vegetation through the measurement of fluorescence at selected Fraunhofer lines followed by digital processing of fluorescence images. The study would cover vegetation health monitoring along with measurement of photosynthetic function in different plant types with respect to their altitude and climatic variability.

One of the most globally debated issues at the moment is that of global warming and climate change, and the impact that human

activity is exerting on natural earth processes. Increase in atmospheric carbon dioxide, one of the main greenhouse gases, is related to excess fossil fuel consumption and undesirable land-use changes. Measurements of the rate of increase in atmospheric carbon dioxide compared to calculations of global carbon dioxide emissions suggest that a large proportion of the emitted carbon dioxide is being absorbed into terrestrial carbon pools through photosynthesis and related processes. However, in order to predict future trends we need to understand much more about the carbon cycle, and how different plants react to changes in the composition of the atmosphere and climate variability.

To understand more about photosynthetic function occurring in plants, it would be ideal to measure sunlight induced fluorescence, which is directly related to actual photosynthetic activity. Solar induced fluorescence occurs when part of the energy absorbed by chlorophyll in vegetation is re-emitted at longer wavelengths as fluorescence. This would provide a direct measurement of the vegetation's ability to absorb atmospheric carbon dioxide, which, if mapped at global scales, would lead to greatly improving our understanding of the carbon cycle and climate change. However, sunlight induced fluorescence signal is very weak compared to reflected sunlight, and highly sensitive imaging instrumentation is required to detect fluorescence in the presence of strong sunlight. Considering all these aspects we have designed an EMCCD camera (LUCA R, 1024x1024 pixels, Andor, UK) based sunlight induced multi-spectral fluorescence imaging (SIMFI) system. We propose to carryout imaging at different Fraunhofer emission wavelengths with the help of a liquid crystal tunable filter (LCTF) that has a band width of 10 nm and is continuously tunable in the 400-720 nm range. Sunlight induced fluorescence of plants will be determined using the Fraunhofer line discrimination technique.

Stresses due to environmental parameters in selected species of plants grown in different altitudinal zones in our State will be studied using the SIMFI system. The chlorophyll fluorescence image intensity ratios and environmental parameters will be correlated with the photosynthetic functioning of the investigated plants.

Dr. N. Subhash

3.9. GIS Applications in Natural Resources Management

3.9.1 Generation of natural resources and environmental database for local level planning

Main focus of the programme is to prepare Natural Resources and Environmental database (NREDB) on 1:12,500 scale and disseminate spatio-temporal information on land and water resources thus generated for sustainable development of natural resources. The project envisages use of remote sensing technology and geographical information system (GIS) for the generation of reliable and timely information on natural resources. The present study is aimed at preparing different thematic layers on natural resources using satellite images, other collateral data and field observations, which would lead to drawing up of a location-wise resource based perspective plan for sustainable development. This project was jointly executed by CESS and Kerala State Remote Sensing and Environment Centre under the coordination of the Kerala State Planning Board and guidance/inputs from ISRO and Regional Remote Sensing Service Centre, Bangalore. Utilizing the high resolution IRS P6 RESOURCESAT satellite data and GIS, a digital natural resource database and atlas has been brought out for the entire stretch of the Kerala State in 1:12,500 scale. As part of this database state-level seamless digital layers such as, administrative boundaries, hill shade, relief, relative relief, slope, rock types, transport network, landform, spatial extent of various landuse categories such as paddy fields, tea/coffee/rubber/coconut plantations, broad settlement zones, hills, plateaus and valleys, watershed, transport network, landslide prone areas, Panchayat-wise spatial distribution of popu-

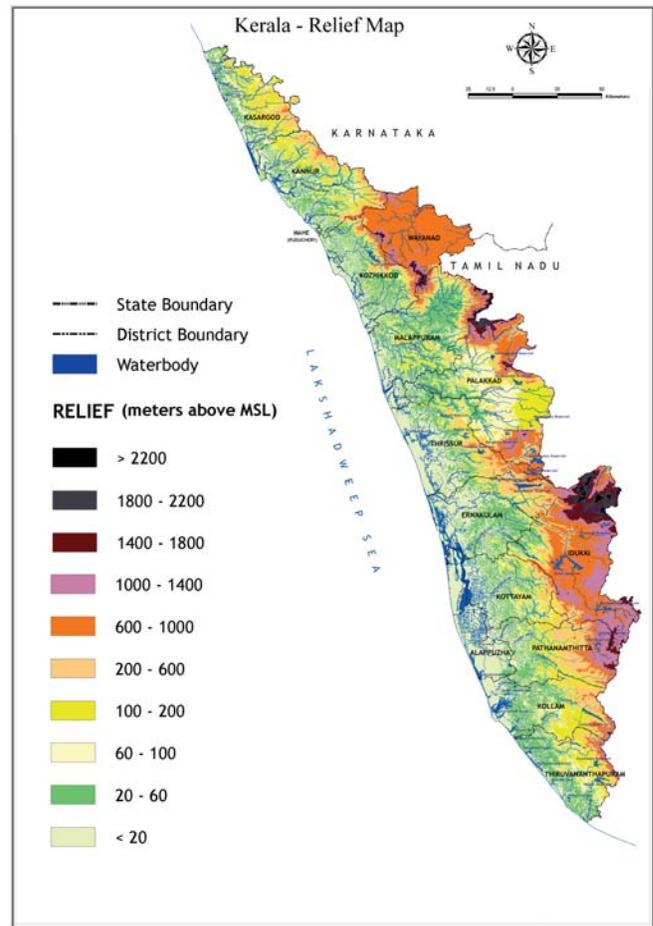


Fig. 3.9.1.2. A relief map of Kerala included in the digital atlas

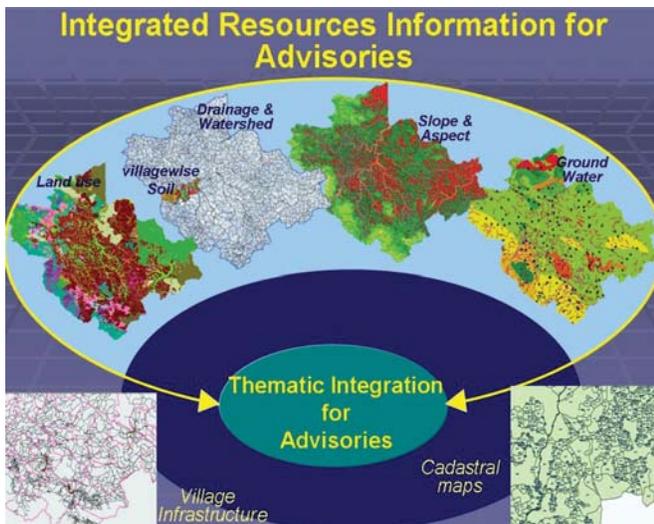


Fig. 3.9.1.1. Flow diagram showing the project objectives

lation density, literacy, male-female ratio, occupation structure has been generated.

Digital database of this magnitude at a State-level has been implemented for first time in the country. Being integrated in GIS, periodic changes in the landuse practices, updation of areas of reclamation, transport/drainage network etc. can be performed and analyzed with great ease. This spatial database would be highly useful for preparation of district/block/panchayat level development plans by the local self governments and in identifying priority areas for Science & Technology interventions aimed at improving the livelihood conditions of common man in Kerala, particularly in Rural Sector.

In a public function held on 13th March 2008 at Mascot hotel, the Hon'ble Chief Minister of Kerala Sri. V.S. Achuthanandan released the Natural Resources and Environmental Atlas and digital data-



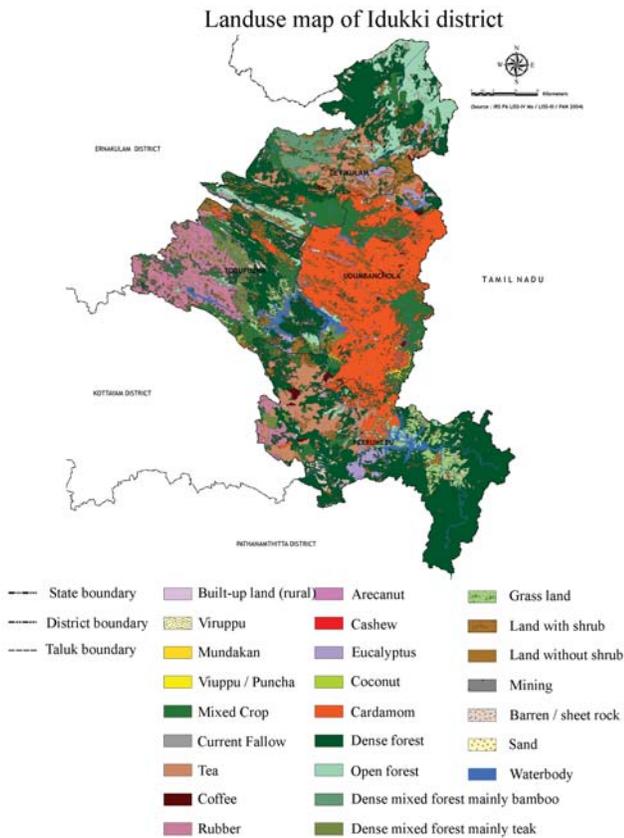


Fig. 3.9.1.3. Landuse map of Idukki district

base by handing over a copy to Prof. Prabhat Patnaik, Vice Chairman, Planning Board. The meeting was presided over by ISRO Chairman Dr.G.Madhavan Nair and felicitation was given by the VSSC Director, Dr.K.Radhakrishnan, KSCSTE executive Vice President Dr.E.P.Yesodharan Secretary, Planning & Economic Affairs Sri. Teeka Ram Meena and ISRO-EOS Director Dr.V.Jayaraman. Sri.P.K.Mohanti IAS, KSREC Director welcomed the gathering. CESS Director, Dr.M.Baba gave a brief account of the NREDB project and Dr.M.Samsuddin principal investigator of the project performed the vote of thanks.As part of the function, a half day workshop on the natural resource database was also held.The project has been completed and final report submitted.

Dr. M. Samsuddin

Funding: Indian Space Research Organization & State Planning Board, Govt. of Kerala

Collaborator: Kerala State Remote Sensing & Environment Centre

3.9.2 Preparation of city base maps for the five Municipal Corporations of Kerala

The five city corporations in the State will soon be equipped with GIS based high resolution spatial information system for efficient property tax management, infrastructure planning and develop-

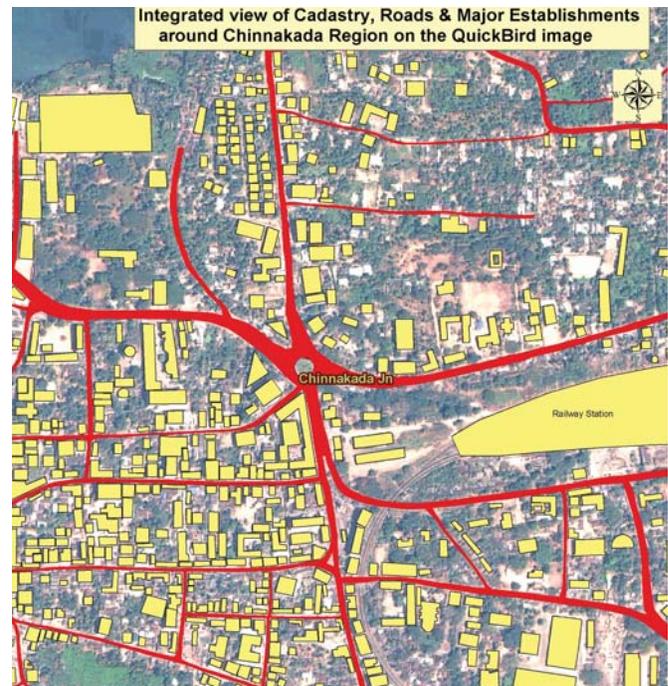


Fig. 3.9.2.1. Map showing survey plot level information of Kollam Corporation

ment and improved delivery of various civic services. CESS is playing a pivotal role in preparing base maps for preparation of cadastral level information for the Kerala Sustainable Urban Development Project (KSUDP), a project assisted by the Asian Development Bank.

CESS has prepared base maps that can accommodate survey plot level information for 5 Municipal Corporations of Kerala Viz., Thiruvananthapuram (142 km²), Kollam (58 km²), (Kochi (88 km²), Thrissur (101 km²), and Kozhikkod (84 km²), covering a total area of about 400 km² (fig. 3.10.2.1). QuickBird satellite images of 0.6 metre resolution were georeferenced using the DGPS data. Seamless mosaic of the cadastry (in 1:3960/5000 scale) of the town were prepared and rectified with reference to the QuickBird images. The cadastry has been vectorized and quality checking and geodatabase conversion has been accomplished Digital thematic

layers such as road network, drainage, landuse and landmark buildings and individual built-ups were generated from the fused image. Intensive field work was carried out for asset verification, assigning attribute, locating additional landmark assets on the initial maps prepared from image and verification of transport network. The thematic layers thus finalised were integrated with cadastral layer providing administrative boundaries up to ward level with survey plots in GIS domain for enabling data retrieval and query processing at a later stage.

The digital layers of the five City Corporations of Kerala was reproduced in hardcopy and softcopy formats. The digital output is made into interoperable shape file and geodatabase for integration with other spatial/non-spatial data. The project has been completed and final report submitted.

Dr.K.K.Ramachandran

Funding: Kerala Sustainable Urban Development Project, GoK

3.9.3 Creation of a digital data bank at CESS

Objective of the project is to create state-of-the-art facilities for efficient management and retrieval of desired data and to develop a digital data bank of spatial and non-spatial data in conformity with NSDI framework. Collection, verification, standardization and organization of spatial/non spatial digital data already avail-

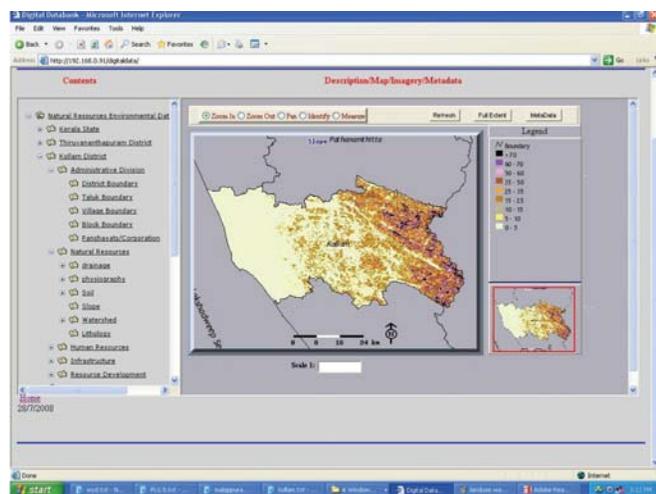


Fig.3.10.3.1. Screenshot of the Web Application for viewing GIS data

able in CESS for future use is also envisaged in this programme. As part of efforts to make the data bank contents web enabled, the metadata browser developed earlier has been modified. The modified version makes use of ASP.NET, HTML, UMN Mapserver

and CSharp software. The Mapserver is open source software. It consists of the Webserver, database server and other scripting languages that are used to request the data to the server. The NSDI metadata utility software is used for generating metadata information. The prototype web application developed is being tested in the CESS intranet. It has facilities to zoom in and out, pan, identify, measure distance, view metadata etc.

Developed Mapserver based Web Application for viewing GIS data in CSharp and ASP.NET language using a web browser is shown. Metadata preparation and enhancements are underway. In addition to ArcGIS format, enhancements for browsing spatial data in Mapinfo and Geomedia formats, were incorporated in the Mapserver. CSharp and ASP.NET based web application, its performance and features are being enhanced. Creation of metadata on spatial data of different districts is under progress.

V. N. Neelakandan

3.9.4 Spatial and non-spatial database for health surveillance in the Vengannur Grama Panchayat

Health Information System (HIS) is essentially for capacity development at community level for a healthy Participatory Geographical Information system building. Main objective of the programme is to generate a comprehensive spatial data base (resource and health relates data) at cadastral level and spatial/non-spatial data integra-



Fig. 3.10.4.1. Screen shot of the information system

Natural Resources and Management

tion in a customized environment with facilities to integrate, analyze, query and extract user required information according to the will and wish of the user.

IRS P6 data were used to delineate spatial features and the socio-economic aspects. The disease parameters were collected by training women health volunteers. The questionnaire covered 189 variables. The spatial and attribute data were integrated in ArcGis Platform. Quality of the vector layers of spatial and attributes data were ensured at different levels by convening meetings of the elected representatives, health workers, resource persons, doctors and health staff. The attribute data thus collected were fed through an interface developed in Oracle RDBMS and spatially linked in a standard structure for integration in HIS.

B. K. Jayaprasad

Collaborator: Achuthamenon Centre for Health Science Studies, Thiruvananthapuram

3.9.5 Cadastral Level Decision Support System for Management of Natural Resource in Thiruvananthapuram District

Integration district-level of land and water resource information in a cadastral base, through application of Geoinformatics with particular focus on local-level development in the urban/rural areas of Thiruvananthapuram District in the objective of this project. It is also proposed to develop attribute as well as spatial information base for various levels of urban/rural planning, develop standards with regard to database data exchange format and provide decision support system for planning and to establish a resource information Centre with support of Panchayat functionaries/peoples' representatives.

Digital layers based on IRS-P6 satellite data and topographic sheets and micro slope generated for the Thiruvananthapuram District. A customised application has been developed using VB and access data base for entering 145 field attributes. Debugging was taken up. Plan documents, sketches, ward delineation details, asset register and PRM Maps were collected from local bodies. The completed survey sheets were collected from elected representatives of the wards.

Project staff were trained and deployed project staff in the field for collecting secondary data from all the Panchayats. 80% of development documents were collected from the Local Bodies of Trivandrum District. Data entry was taken up. Second phase data

collection questionnaire at ward level has been completed. Ward level socioeconomic disaster and infrastructure data collection work was initiated.

B. K. Jayaprasad

3.9.6 Spatial information system for Kasaragod District of Kerala

During the period under report, the project was completed and the final report and atlas were submitted. The project generated a spatial information system for Kasaragod district in digital as well as hard copy format. Spatial data derived from Survey of India topographic maps on 1:50,000 scale, Geological Survey of India, Cen-

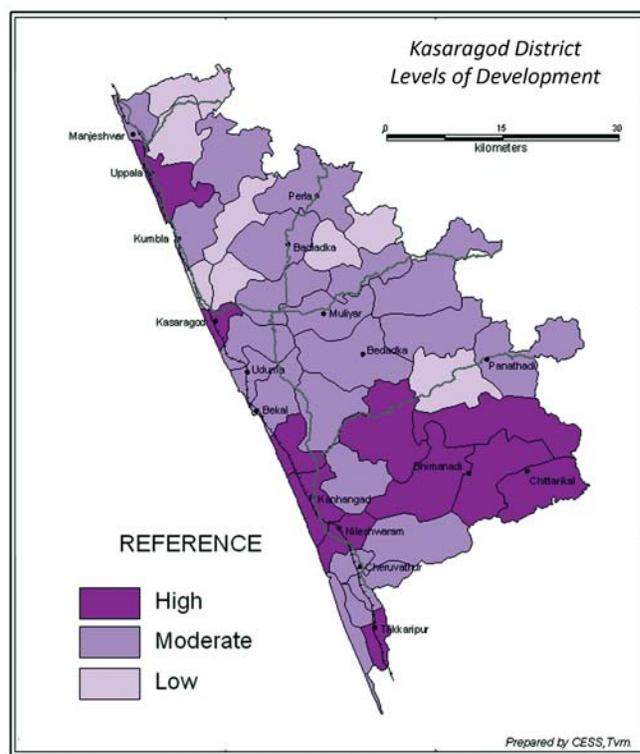


Fig. 3.9.6.1. Map showing levels of development in Kasaragod district

tral Survey Department, Central Groundwater Department, Kerala State Landuse Board, Kerala State Soil Conservation Department, statistical data from the Directorate of Economics and Statistics, Census of India data, IRS LISS III digital data etc. were used in the creation of the digital database. The thematic maps included in the atlas are : Study area, Location with taluks, Location with Blocks,

Location with Panchayats, Relief, Drainage, River basins, Mean annual Rainfall, Geology, Slope, Aspect, Geomorphology, Soil, Depth to ground water, Ground water yield, Land capability, land use/land cover, Total population, Density of Population, Households, Sex ratio, Total literacy, Male literacy, Female literacy, Total Illiterates, Male Illiterates, Female Illiterates, total scheduled caste population, Male scheduled caste population, Female scheduled caste population, Total scheduled tribe population, Male scheduled tribe population, Female scheduled tribe population, Total workers, Male workers, Female workers, Total main workers, Male main workers, Female main workers, Total marginal workers, Male marginal workers, Female marginal workers, Total non-workers, Male non-workers, Female non-workers, Total cultivators, Male cultivators, Female cultivators, Total agricultural labourers, Male agricultural labourers, Female agricultural labourers, Total workers in household industry, Male workers in household industry, Female workers in household industry, Total other workers, Male other workers, Female other workers, Transportation network, Livestock-Cattle, Livestock-Buffalo, Livestock-Fowls, Types of houses-Concrete, Types of houses-Tiled houses, Types of houses-Thatched houses, Electrified houses, Development Regions- Communication, Development Regions-Health facilities, Development Regions- Financial institutions, Development Regions-Cultural facilities, Over all development regions and Places of tourism interest.

Abalya Sukumar

3.9.7 Resource atlas of Thiruvananthapuram district, Kerala

The project has been completed during the period under report. Resource atlas is a collection of multi-coloured thematic maps showing distribution / utilization of resources. The atlas included themes like natural resources, human resources, resource development, infrastructure and regional development and will be a ready reference for the administrators and planners. The maps were prepared in digital format using Geographic Information System (GIS). The following 75 maps were included in the atlas: Taluks, Community Development Blocks, Panchayats and urban centres, Relief, Drainage, Geology, Mean annual rainfall, River basins, Slope, Aspect, Geomorphology, Soil types, Total population, Density of population, Households, Total literacy, Male literacy, Female literacy, Total scheduled caste, Male scheduled caste, Female scheduled caste, Total scheduled tribe, Male scheduled tribe, Female scheduled tribe, Total workers, Male workers, Female workers, Total main workers, Male main workers, Female main workers, Total

Cultivators, Male cultivators, Female cultivators, Total agricultural labourers, Male agricultural labourers, Female agricultural labourers, Total population under household industry, Male population under household industry, Female population under household industry, Total other workers, Male other workers, Female other workers, Total marginal workers, Male marginal workers, Female marginal workers, Total marginal cultivators, Male marginal cultivators, Female marginal cultivators, Total marginal agricultural labourers, Male agricultural labourers, Female agricultural labourers,

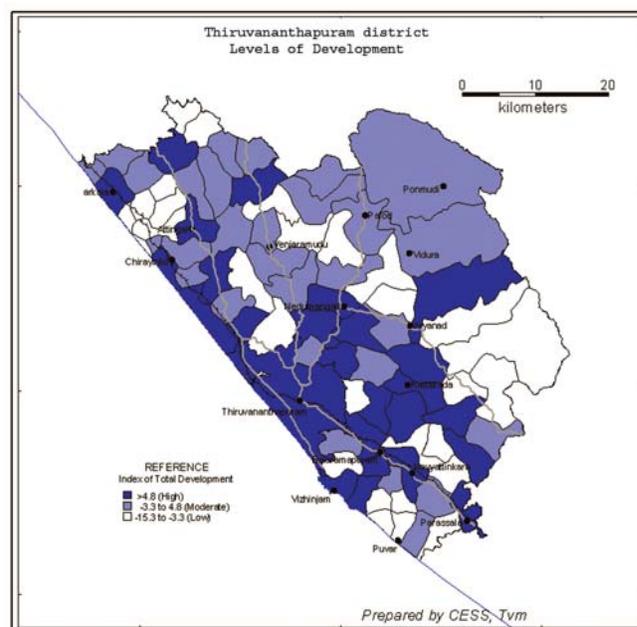


Fig. 3.9.7. Map showing levels of development in Thiruvananthapuram district

Total marginal workers in household industry, Male marginal workers in household industry, Female marginal workers in household industry, Total marginal other workers, Male marginal other workers, Female marginal other workers, Development of demographic aspects, Development of educational facilities, Development of Health (Homeo and Ayurvedic), Development of Health (Allopathy), Development of Financial institutions, Development of Communications, Development of other facilities, Total development, Cattle population, Buffalo population, Goat population, Fowl population, Road and Railway network, Tourism, Thiruvananthapuram City-Wards, Thiruvananthapuram City – Relief and drainage, Thiruvananthapuram City – General land use/land cover, Thiruvananthapuram City – Density of population.

B.Sukumar



4.1 Environmental Studies

4.1.1 Environmental implications of decentralized governance

Under this programme a State of the Environment Report and Action Plan of three Grama Panchayats and three Municipalities and a draft report on the Environmental Impact Assessment of Model Projects have been prepared and submitted to the funding agency..

R. Ajayakumar Varma and Dr. C. N. Mohanan
Funding: Local Self Government Department, GoK

4.2 Coastal Regulation Zone

In recognition to our expertise in the field of Coastal Zone Management, CESS has been authorised by the Govt of India as one among the institutes selected to demarcate the High Tide Line and Low Tide Line for the purpose of Coastal Regulation Zone (CRZ). CRZ Reports are being prepared through identifying the coastal ecosystems and delineating the High Tide Line (HTL) and Low Tide Line (LTL). It also includes identification of different categories of Coastal Regulation Zones based on landuse, landform and status of development. The CRZ maps are prepared in cadastral scale for easy interpretation by implementing agencies. DGPS control points are relied upon for rectification and data input.

The extent of influence of tidal action in the water bodies is determined based on salinity. The HTL and LTL are determined from geomorphologic signatures such as berms crests, tidal flats and cliffs. The sensitive coastal ecosystems such as mangroves, sand dunes, tidal flats, fish breeding grounds, etc are identified and their spatial extent demarcated. The CRZ report and maps help the decision making authorities to identify the areas for conservation and protection and for development in the coastal zone.

CRZ mapping has been undertaken for different departments and public undertakings in the State such as Kerala Coastal Zone Management Authority, Harbour Engineering Department, Local Self Government (Urban Development) Department, Kerala Police, Calicut Development Authority, Kozhikode Corporation, Tourism Department, Goshree Island Development Authority and Bakel Resort Development Corporation. The Cochin Port Trust, National Highway Authority, Indian Rare Earths Ltd, Coast Guard and Maharashtra State Road Development Authority are some

other organisations for which CRZ mapping has been undertaken. In addition to this a major CRZ mapping programme is being carried out for the Govt of Maharashtra. Work was also done for private concerns such as Reliance, Essar Oils, Tata Power, Indian Petrochemicals, Pioneer Jellice, Ganesh Benzo Plast, Adithya Environmental Services, Somatheeram Resorts and Escapade Resorts.

Technical support was provided to KSCSTE and Kerala Coastal Zone Management Authority on numerous issues connected with Coastal Regulation Zone, such as court cases, expert opinion on violations and CRZ clearances.

K. V. Thomas
Funding: Various Agencies

4.3. Environmental Impact Assessment (EIA)

4.3.1 Rapid EIA study for the proposed air strips at Andrott and Minicoy Islands in Lakshadweep.

Rapid EIA study has been undertaken for the proposed airport at Andrott and Minicoy Islands of Lakshadweep. As part of the study, the project details have been compiled, baseline environmental status monitored, environmental impacts identified and assessed and mitigation measures delineated. Studies have also been conducted to examine alternative sites, evaluate the project benefits and assess the risks involved in the project. Based on the results, detailed plans were evolved for disaster management and environmental monitoring and management.

At Minicoy, the site proposed is in the Coastal Regulation Zone and is the only site where acquisition is minimal and favoured by the local inhabitants. The site is also vulnerable to high waves and require engineering protection, which is prima facie feasible. The EIA study found that the project has only marginal adverse impacts during the construction phase and the same will be slightly beneficial during the operational phase.

At Andrott, the site proposed is not in the Coastal Regulation Zone and is devoid of habitation, but require land acquisition. The environmental impacts during construction and operational phases are minimally adverse. However, the environmental sce-



nario will improve appreciably with the implementation of environmental management plan.

Dr .R. Ajaykumar Varma and Dr. C. N. Mohanan
Funding: Lakshadweep Administration, U.T. Lakshadweep

4.3.2. Rapid EIA study for the proposed Vallarpadam Container Terminal Moolampilly to Chathanad road

An environmental impact assessment study has been conducted for the proposed link road from Moolampilly Island to Chathanad in Goshree Island Development Authority area at Kochi. The details of the project have been compiled based on information collected from the proponent. Impact assessment has been carried out by monitoring the baseline environmental status of the area and by identifying and assessing the impacts due to various activities proposed during construction and operation phases of the project.

Dr. R. Ajaykumar Varma and Dr. C. N. Mohanan
Funding: Goshree Island Development Authority



5.1 Grant-in-aid Projects

Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Fund Received during the year Rs. in lakh
1.	GPS campaign for crustal movements in and around Palaghat gap "shear zone" southern India	Dept. of Science & Technology, Govt. of India	Sri. K. R. Unnikrishnan	Geosciences	Dr. C. M. Harish Dr. C. P. Rajendran Dr. Kusala Rajendran	2001-2007	8.00	Nil
2.	Investigation on the causes behind electric conductivity variations	Dept. of Science & Technology, Govt. of India	Dr. S. Muralidas	Atmospheric sciences	Dr. S. Sampath	2000-2007	9.98	0.05
3.	Upgradation and operation of broadband seismological observations in the peninsular shield of India	Dept. of Science & Technology, Govt. of India	Dr. Kusala Rajendran	Geosciences	Dr. C. P. Rajendran, Dr. K. R. Unnikrishnan Smt. Sreekumari Kesavan	2006-2009	13.40	NIL
4.	Subsurface Flux of coastal water and management of costal aquifer	Dept. of Science & Technology, Govt. of India	Dr. D. S. Suresh Babu	Marine Sciences	Dr. A. L. Ramanathan Dr. Chudaeva Valentina Anatolyevna Dr. S. Chidambaram	2006-2009	10.12	NIL
5.	Tracking the past disasters and tsunami along the parts of Tamil Nadu coast	Dept. of Science & Technology, Govt. of India	Dr. Terry Machado	Marine Sciences	Sri. P. Aravahi	2006-2009	16.33	NIL
6.	Metasedimentary rocks of the Kerala khondalite belt, Southern India petrology and geodynamics of their formation	Dept. of Science & Technology, Govt. of India	Dr. G. R. Ravindra Kumar	Geosciences		2006-2009	17.85	NIL
7.	Continuous measurement of atmospheric carbon monoxide at Thiruvananthapuram, a tropical site	Indian Space Research Organisation	Dr. G. Mohan Kumar	Atmospheric Sciences	Dr. S. Sampath	2002-2007	11.73	NIL
8.	Coastal Ocean Monitoring and Prediction System (COMPAS) along Kerala and Lakshadweep coast	Dept. of Ocean Development GOI	Dr. P. P. Ouseph	Chemical Sciences		2003-2007	163.00	9.00
9.	Coastal ocean monitoring and prediction system	Ministry of Earth Sciences , Government of India	Dr. P. P. Ouseph	Chemical Sciences		2008-2013	19.96	NIL
10.	Assimilative capacity of urban air and noise environments of Thiruvananthapuram	Science, Technology & Environment, Govt. of Kerala	Shri. V. Muraleedharan	Atmospheric Sciences	Sri. V. N. Neelakantan Sri. V. Shravan Kumar	2001-2006	2.58	NIL



Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakhs	Fund Received during the year Rs. in lakhs
11.	Coastal engineering strategy for shore protection for Kerala	DOD/KSCSTE	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian Dr. T. N. Prakash Dr. T. S. Shahul Hameed	2003-2007	81.47	NIL
12.	Preparation of high-resolution bathymetry for the Kerala coast	Dept. of Ocean Development Govt. of India	Dr. N. P. Kurian	Marine Sciences		2006-2007	--	1.99
13.	Integrated Coastal and Marine Area Management (ICMAM) west coast (Munambam to Kanyakumari stretch in Kerala)	Dept. of Ocean Development Govt. of India	Dr. N. P. Kurian	Marine Sciences	Dr. K. V. Thomas Dr. K. K. Rsmachandran Dr. T. S. Shahul Hameed	2002-2007	83.00	NIL
14.	Development and application of shoreline change model for shoreline management	Department of Science & Technology, Govt. of India	Dr. T. S. Shahul Hammed	Marine Sciences	Dr. N. P. Kurian Dr. K. V. Thomas Dr. M. Samsuddin Shri. R. Mahadevan	2002-2006	29.00	NIL
15.	Remote sensing data analysis and GIS application	Indian Space Research Organisation	Dr. M. Baba (Coordinator) Dr. M. Samsuddin (PI)	Geomatics Lab	Dr. K. K. Ramachandran Shri. V. N. Neelakandan Dr. C. M. Harish Shri. S. Sidharthan	2002-2006	57.00	NIL
16.	Evaluation for appropriate technology based utilisation of laterite horizons in Neyyar watershed in western ghat region as water harvesting structure	Western Ghat Cell, Planning Board	Dr. Narayanaswamy	Geosciences	Dr. Terry Machado	2007-2010	6.95	4.51
17.	Evaluation of agrotypologies in Kerala	Science, Technology & Environment Department	Dr. P. V. S. S. K. Vinayak	Base Camp, Kochi	Dr. V. Sasikumar Dr. S. Sampath	2002-2006	3.36	NIL
18.	Charcterisation of Indian placers	Central Mining Research Institute, CSIR	Dr. Narayanaswamy	Geosciences	Dr. D. S. Suresh Babu	2003-2007	18.85	NIL
19.	Enviommmental impact assessment of inland placer mineral mining	Central Mining Research Institute, CSIR	Dr. R. Ajayakumar Varna	Environmental Sciences	Dr. C.N. Mohanan Sri. K. Raju Sri. G. K. Suchindan	2003-2007	83.41	NIL
20.	Integrated coastal zone management plan preparation for the selcted placer mining sites in the country	Central Mining Research Institute, CSIR	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian Dr. T. N. Prakash Dr. T. S. Shahul Hameed Dr. Terry Machado	2003-2007	16.80	NIL
21.	Natural radioactivity risk assessment in the living environment of the people of South west coast of India	Department of Atomic Energy	Shri. V. Muraleedharan	Atmospheric Sciences	Shri. K. Vijayakumar Shri. K. J. Mathew	2003-2006	9.30	NIL



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Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakhs	Fund Received during the year Rs. in lakhs
22.	Tectonic evaluation of Panvel flexure using paleoseismologic techniques	Department of Atomic Energy	Dr. Kusala Rajendran	Geo Sciences	Dr. C. P. Rajendran	2003-2006	11.50	NIL
23.	Rainfall validation & characterization and cloud physics studies using megha tropiques data	Department of Space Government of India	Dr. G. Mohan Kumar	Atmospheric Sciences	Dr. S. Sampath Shri. R. Harikumar	2007-2010	22.50	3.30
24.	Landuse/landcover changes and water quality: A case study in the Western Ghat provenance of Central-south Kerala rivers	Western Ghat Cell, Planning Board	Dr. K. Soman	Resource Analysis		2004-2006	4.38	NIL
25.	Generation of Natural Resources and Environmental Database for local Level Planning in Kerala	State Planning Board ISRO	Dr. M. Samsuddin	Geomatics Lab	Dr. K. K. Ramachandran Sri. John Mathai Sri. V. N. Neelakantan Sri. B. K. Jayaprasad	2004-2008	67.70	NIL
26.	Developing spatial and temporal constraints on earthquake I Gujarat using palaeoseismological techniques	Department Science Technology, Govt. of India	Dr. C. P. Rajendran	Geosciences	Dr. Kusala Rajendran	2004-2007	13.40	0.50
27.	Resource evaluation and inventory of manufactured sand form Trivandrum district, Kerala	Department Science and Technology, Govt. of India	Dr. D. Suresh Babu	Geosciences	Sri. B. K. Jayaprasad	2005-2007	1.88	0.84
28.	Computation of annual ground water discharge through the western coastal zone of Tamil Nadu	Department Science and Technology, Govt. of India	Ms. Asha Rani	Geosciences		2005-2008	5.04	NIL
29.	Impact of Tsunami on the Kerala coast and an initiative for development of a management plan for the region	Department Science Technology, Govt. of India	Dr. M. Baba		Dr. T. N. Prakash Dr. N. P. Kurian Dr. Srikumar Chattopadhyay Dr. A. S. K. Nair Sri. C. K. Sasidharan	2005-2006	11.50	NIL
30.	Numerical simulation - aquifers	Department Science Technology, Govt. of India	Dr. D. S. Suresh Babu	Geosciences		2005-2006	6.50	0.51
31.	Chemical loading into reservoirs: Investigations from selected watersheds of Periyar basin in Western Ghats, Kerala	Ministry of Environment and Forest, Govt. of India	Dr. M. N. M. Nair	Chemical Sciences	Dr. D. S. Suresh Babu Dr. R. Ajaykumar Varma Dr. C. N. Mohanan	2005-2008	10.30	1.03
32.	Demarcation of vulnerability line (on pilot scale) along the coastal stretches of India based on the recommendation of prof. M. S. Swaminathan committee report	Ministry of Environment and Forest, Govt. of India	Dr. T. S. Shahul Hameed	Marine Sciences		2007-2007		NIL
33.	Preparation of city base maps for 5 Municipal Corporations of Kerala	Kerala State Sustainable Urban Development Programme, GoK	Dr. K. K. Ramachandran	Geomatics Lab	Dr. M. Samsuddin Sri. B. K. Jayaprasad Sri. John Mathai Sri. V. N. Neelakandan Dr. C. M. Harish	2006-2007	54.96	31.42



Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Fund Received during the year Rs. in lakh
34.	A model system for management and disposal of Sewage in the Lakshadweep Island, India	Union Territory of Lakshadweep	Dr. M. N. M. Nair	Chemical Sciences		2005-2007	42.65	NIL
35.	Enviromental monitoring of water sediment quality parameters in Cochin harbour	Cochin Port Trust	Dr. P. P. Ouseph	Chemical Sciences		2006-2007	3.99	1.77
36.	CSIR senior research fellowship to Shri. J. Rupananda Mallia	Council of Scientific & Industrial Research	Dr. N. Subhash	Atmospheric Sciences		2006-2007	10.95	2.01
37.	Palaeointensity and India & Reunion/Marion plume activity in India Project	Project 32072 (IFPR)	Dr. T. Radhakrishna	Geosciences		2006-2009	22.45	18.79
38.	Assessment of environmental impact of sand mining in the rivers of Pamba & Manimala, southwest coast of India	Kerala State Council for Science, Technology and Environment	Ms. S. Sreeba	Environmental Sciences		2006-2008	0.30	NIL
39.	Environmental management plan for Alappuzha-Sherthalai canal and Kanjikuzhy Gramapanchayat-a participatory action research programme	Kerala State Council for Science & Technology	Dr. Srikumar Chattopadhyay	Resources Analysis		2008-2010	7.50	4.24
40.	Pathiramanal Biodiversity	Kerala State Council for Science, Technology and Environment	Dr. Srikumar Chattopadhyay	Resources Analysis		2006-2007	4.67	NIL
41.	Cadastral scale CRZ maps for urban areas in Kerala: phase 1 - Kozhikode, Kollam & Trivandrum corporation and Varkala Municipality	Kerala State Council for Science, Technology and Environment	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian Dr. D. Raju Sri. S. Mohanan Sri. M. Rameshkumar	2006-2007	6.98	NIL
42.	Tectonic and hydrologic control on late Pleistocene Holocene landforms, paleoforest and nonforest vegetation: Southern Kerala	Kerala State Council for Science, Technology and Environment	Dr. K. M. Nair, Vakkom Moulavi Foundation Dr. D. Padmalal	Enviromental Sciences		2006-2008	0.20	0.08
43.	Understanding the seismotectonics of the Adaman & Nicobar subduction zone in realtion to other subduction zones	Kerala State Council for Science, Technology and Environment	Ms. Anu. R	Geosciences		2006-2008	0.30	NIL
44.	Rejuvenation and utilisation of Alappuzha - Sherthalai canal for participatory development and poverty alleviation: A watershed based development approach	Hariyali Programme	Dr. Srikumar Chattopadhyay	Resources Analysis		2007-2007	2.44	2.44
45.	Hariyali project - technical assistance for identification of watersheds in Chadayamangalam block panchayat and preparation of detailed project report	Hariyali Programme	Shri. John Mathai	Geosciences		2007-2010	1.49	1.49



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Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Fund Received during the year Rs. in lakh
46.	Watershed project evaluation	Scheduled Caste & Scheduled Tribe Dept.	Dr. V. Nandakumar	Geosciences		2008-2009		0.14
47.	Value - addition of selected placer minerals (Ilmenite & Zircon) with special reference to the "Kayamkulam - Thottapally" deposit of Kerala	Council of Scientific & Industrial Research	Dr. D. S. Suresh Babu	Marine Sciences	Dr. T. N. Prakash	2005-2008	4.18	2.30
48.	Late quaternary environmental changes in the Coastal Plains of Southern Kerala, Southwest India	Council of Scientific & Industrial Research	Dr. D. Padmalal	Environmental Sciences	Inter institutional project. AGI, Pune, VMFT and CESS, Trivandrum	2005-2007	0.09	0.10
49.	SOE REP, Preparation - phase II	KSCSTE	Director			2006-2007	0.00	NIL
50.	Tsunami and storm surges inundation modelling and mapping for the coasts of Kerala, Karnataka and Lakshadweep	Ministry of Earth Science, Govt. of India	Dr. N. P. Kurian	Marine Sciences	Dr. T. N. Prakash Dr. K. V. Thomas Sri. B. K. Jayaprasad Dr. T. S. Shahul Hammed	2006-2007	27.80	2.82
51.	Coastal zone studies	Space Application Centre, Ahmedabad	Dr. M. Samsuddin	Geomatics Lab	Dr. T. N. Prakash	2006-2007	36.00	4.30
52.	Watershed characteristics, landuse pattern and water quality parameters of upstream and selected downstream stretches of the Vamanapuram river	Western Ghats Cell, Kerala State Planning Board	Dr. Mahamaya Chattopadhyay	Resources Analysis		2006-2008	2.05	NIL
53.	Nitrous Oxide and methane in coastal ocean and estuaries	Ministry of Earth Sciences	Dr. E. J. Zachariah	Atmospheric Sciences	Dr. P. P. Ouseph Dr. C. S. P. Iyer	2007-2010	18.48	NIL
54.	Shoreline management for Kerala coast	Ministry of Earth Sciences	Dr. K. V. Thomas	Marine Sciences		2008-2013	176.63	20.73
55.	Impact of landscape alterations on watersheds and ecosystem implications - a case study from the western ghats provenance of Idukki district, Kerala	Western Ghat Cell Planning Board	Dr. K. Soman	Resources Analysis		2006-2009	7.20	NIL
56.	Environmental monitoring and management plan with regard to dredging operations of the Travancore Cements Ltd, Kottayam	Travancore Cement Limited	Dr. P. P. Ouseph	Chemical Sciences		2008-2009	0.31	0.25
57.	Studies on shore protection measure for Lakshadweep Islands	Union Territory of Lakshadweep	Dr. T. N. Prakash	Marine Sciences	Mrs. Sheela Nair Dr. T. S. Shahul Hammed Dr. K. V. Thomas	2007-2009	25.48	25.48
58.	NREDB Atlas and Digital database for Kerala State	Indian Space Research Organisation	Dr. M. Samsuddin	Geomatics Lab		2008-2009	2.10	2.10



5.2 Consultancy Projects

Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Fund Received during the year Rs. in lakh
1.	CRZ status report for Fishing Harbours at Cheruvathur, Chettuwa, Chellanam & Arthungal.	Harbour Engineering Department	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2008	1.94	1.94
2.	CRZ status report on Demarcation of HTL/LTL for proposed special Eco Zone.	Pan India Paryatan Ltd.	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	27.00	27.00
3.	CRZ status report for resort development at Maradu, Kochi .	M/s K.G.A.E. Estate Management Pvt. Ltd.	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	1.35	1.35
4.	CRZ status report and demarcation of HTL/LTL	M/s Mundra Port special economic zone Ltd.	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	25.50	25.50
5.	Demarcation of HTL & CRZ status report for sites at Srivardhan Ratnagiri & Rajpur	M/s Aditya Environmental Services Ltd	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	4.65	4.65
6.	Demarcation of HTL and LTL and CRZ Status report	M/s Bhaasuram Resorts Pvt. Ltd. Poovar	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	0.93	0.93
7.	Demarcation of HTL/LTL and CRZ status report for the Tata Power Company Ltd.	Thermal Power Plant in Maharashtra	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	6.60	6.60
8.	Preparation of CRZ status report of Arattupuzha sea coast and the banks of Kayamkulam Backwater	IRE Ltd. Chavara, Kollam	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	1.95	1.95
9.	Demarcation of HTL/LTL for pipeline laying at Rewas and Pirwadi, Maharashtra	M/s IPCL Maharashtra	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	5.85	5.85
10.	Demarcation of HTL/LTL and CRZ report	Somatheeram Research Institute and Ayurveda Hospital (P) Ltd., Trivandrum	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007-2008	0.60	0.60
11.	Demarcation of HTL/LTL and CRZ report for Gelatine Plant at Cuddalore	M/s Pioneer Jellice India Pvt. Ltd. Tamil Nadu	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	3.15	3.15
12.	Demarcation of HTL/LTL and CRZ report for a steel plant at Paradeep	M/s Essar Steel Ltd. Mumbai	Dr. K. V. Thomas	Marine Sciences	Dr. N. P. Kurian	2007	7.20	7.20



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Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Fund Received during the year Rs. in lakh
13.	Demarcation of HTL/LTL and CRZ report for Jetty development sites at Nerul and Ferry Wharf	MSRDC, Govt. of Maharashtra	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007-2008	4.65	4.65
14.	Preparation of CRZ report for resort development in Paravoor, Kollam	Dr. Joe Johnson	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007	0.96	0.96
15.	Demarcation of HTL/LTL/CRZ for pipeline crossing along Kakinada Guntur	Reliance Gas transportation infrastructure Ltd. Navi Mumbai	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	9.00	9.00
16.	Demarcation of HTL/LTL and CRZ status report for international convention centre at Trivandrum	Chalet hotels Ltd.	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007-2008	1.05	1.05
17.	Demarcation of HTL/LTL and CRZ status report	Berggruen Hotels pvt. Ltd.	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007-2008	0.90	0.90
18.	Demarcation of HTL/LTL and CRZ status report	M/s Poovar Lagoon, Pozhiyoor	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007	0.97	0.97
19.	Demarcation of HTL/LTL	M/s Reliance Industrial infrastructure Ltd. JNPT, Mumbai	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007-2008	3.00	3.00
20.	Demarcation of HTL/LTL	M/s Ganes Benzo Plast Ltd. at Mumbai	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2007-2008	2.85	2.85
21.	Demarcation of HTL/LTL	M/s Games Benzo Plast Ltd. at JNPT Mumbai	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	1.80	1.80
22.	Preparation of CRZ status report for the Nuclear Power Project at Kundankulam	Nuclear Power Corporation of India Ltd. Tamil Nadu	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	3.15	3.15
23.	Preparation of CRZ status report	Kuttippuram Kannur NH upgradation scheme of National Highways Authority of India, New Delhi	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	7.50	7.50
24.	Preparation of CRZ status report for resort development at Muzhupilangad Kannur	M/s Tourist resorts (Kerala) Ltd.	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	1.35	1.35
25.	Preparation of CRZ status report for report for project at Nagarcoil,	M/s Escapade Resorts Pvt. Ltd, Kochi	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	1.50	1.50



Sl. No.	Project Title	Funding Agency	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakhs	Fund Received during the year Rs. in lakhs
26.	Preparation of CRZ status report for resort development at Vayalar, Alappuzha,	M/s Vasu Coco & Resorts, New Delhi	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	1.34	1.34
27.	Preparation of CRZ status report of Panmana Ayinivalikulungara village of Kollam (Dist.) I	Indian Rare Earths Ltd., Chavara Kollam	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	3.90	3.90
28.	Preparation of CRZ status report	Boat building and repair workshop at Chavara	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	0.67	0.67
29.	HTL/LTL delineation for townshipat Chaferi, Retnagiri in Maharashtra	M/s. JSW Energy (Retnagiri) Limited	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	6.75	6.75
30	CRZ status report for Prestige Forum Mall at Maradu, Cochin	M/s. Thomson Realtors Pvt. Ltd., Cochin	Dr. K. V. Thomas	Marine Sciences	N. P. Kurian	2008	1.65	1.65

5.3 Plan Projects

Project Code	Project Title	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Expenditure during the year Rs. in lakh
PLAN 205	Landuse-landcover change, its impact on biophysical system and environmental consequences: case studies in two sensitive zones of Northern Kerala (Kakkiar - Agastymalai hill tract)	Dr. Srikumar Chattopadhyay	Resource Analysis		2004-2006	4.80	0.81
PLAN 206	Heavy metal and REE abundances in edible plants of heavy mineral areas of Kollam and Alappuzha districts, Kerala	Shri. G Balasubramonian	Training & Extension	Shri. V. Vasudevan	2003-2006	12.64	0.02
PLAN 211	Creation of digital data bank at CESS	Shri V. N. Neelakantan	Geomatics Lab	Dr. C. M. Harish Dr. M. Samsuddin Dr. K. K. Ramachandran Shri. S. Sidharthan	2003-2006	12.10	0.66
PLAN 219	Studies on agro-ecological regions of Palakkad District, Kerala	Dr. E. Saravanan	Training & Extension	Shri V. Shrivankumar	2004-2006	8.70	1.19
PLAN 231	Cadastral level decision support system for management of natural resources in Thiruvananthapuram district	Sri. B. K. Jayaprasad	Geomatics Lab	Sri. John Mathai Sri. V. N. Neelakantan Dr. K. K. Ramachandran Dr. C. M. Harish	2005-2009	59.64	6.86
PLAN 232	State of the environment and action plan for kochi urban area	Dr. Ajayakumar Varma	Environmental Sciences	Dr. Ajayakumar Varma Dr. C. N. Mohanan Dr. M. N. M. Nair	2005-2009	52.12	9.55



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Project Code	Project Title	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Expenditure during the year Rs. in lakh
PLAN 233	Development of integrated coastal zone management plans	Dr. K. V. Thomas	Marine Sciences	Dr. K. V. Thomas Dr. Srikumar Chattopadhyay	2005-2009	21.95	2.22
PLAN 234	Measurement of Cloud parameters and cloud modelling	Dr. V. Sasikumar	Atmospheric Sciences	Dr. V. Sasikumar Dr. S. Murali Das	2005-2010	187.37	7.14
PLAN 239	Preparation of district level natural hazard zonation maps for Kerala	Shri. John Mathai	Geosciences	Shri. John Mathai Dr. Srikumar Chatopaydhyay	2005-2009	19.65	3.47
PLAN 240	Study of coastal processes and hazard along Kerala coast with particular reference to disaster preparedness	Dr. N. P. Kurian	Maime Sciences	Dr. N. P. Kurian Dr. K. V. Thomas	2005-2009	13.04	3.58
PLAN 250	Exploring interrelationship between enviornmental degradation and poverty: selected micro level case studies across Kerala	Dr. Srikumar Chattopadhyay	Resources Analysis	Sri. C. K. Sasisharan Smt. C. Sakunthala	2007-2010	24.28	1.13
PLAN 251	Geomorphic setting, landscape alterations and fluvial regime change in the Western Ghats provenance of southern Sahyadri south of Achankovil Ar	Dr. Mahamaya Chattopadhyay	Resources Analysis	Smt. C. Sakunthala	2007-2010	25.06	0.40
PLAN 252	Mapping of coastal cliffs and their vulnerability between Kanyakumari and Mangalore, south west coast of India	Dr. A. S. K. Nair	Marine Sciences	Shri. G Sankar Shri. John Paul	2007-2010	25.06	0.26
PLAN 253	Impacts of Urbanization on soil and water Resources of some selected cities Kerala	Dr. K. Narendra Babu	Chemical Sciences	Dr. D. Padmalal Dr. K. Maya Dr. K. Raju	2007-2009	6.60	0.76
PLAN 254	Quaternary geology and geomorphic evolution of the coastal lands of Kollam district, SW india	Dr. D. Padmalal	Enviornmental Sciences	Dr. K. Narendrababu Sri. B. Sukumar Dr. K. Maya	2007-2010	19.00	1.79
PLAN 255	Tropical freshwater myristica swamps of Kerala and its ecological and evolutionary significance	Dr. C. N. Mohanan	Environmental Sciences	Dr. D. S. Suresh Babu	2007-2009	15.00	0.60
PLAN 256	Hydrochemical charcterization and drinking water potential of the coastal springs of southern Kerala	Dr. K. Narendra Babu	Chemical Sciences	Dr. D. Padmalal	2007-2009	10.00	0.72
PLAN 258	Data bank on estuarine and river systems of Kerala	Dr. M. N. M. Nair	Chemical Sciences		2007-2009	10.55	0.61



Project Code	Project Title	Principal Investigator	Division	Co-Investigators	Project Period	Total Outlay Rs. in lakh	Expenditure during the year Rs. in lakh
PLAN 259	Application of Neutral Network in pattern classification of remotely sensed images	Sri. K. J. Mathew	Atmospheric Sciences		2008-2010	7.58	0.13
PLAN 260	Sunlight - induced Multi-spectral fluorescence Imaging System for vegetation assessment	Dr. N. Subhash	Atmospheric Sciences	Dr. C. N. Mohanan	2007-2010	26.5	1.33
PLAN 261	Human - Induced land modifications and its impacts: A study in Thodupuzha taluk - Idukki district Kerala	Dr. K. Raju	Training & Extension	Shri. G. Sankar Dr. V. Nandakumar	2007-2010	5.98	0.98
PLAN 262	Environmental degradation of Muvattupuzha river basin - causes, consequences and strategies for river restoration	Dr. K. Maya	Environmental Sciences	Dr. D. Padmalal Dr. K. Narendra Babu	2007-2009	11.22	0.98
PLAN 263	Solar ultraviolet - B and atmospheric trace constituents in relation to climate change	Dr. G. Mohan Kumar	Atmospheric Sciences	Dr. S. Sampath	2007-2013	20.25	0.15
PLAN 264	Mini atlas of Kerala	Dr. Srikumar Chattopadhyay	Resource Analysis		2007-2008	1.70	NIL
PLAN 265	Characterization of laterites of Kerala and preparation of laterite distribution map	Dr. Narayanaswamy	Geosciences		2007-2010	15.09	1.35
PLAN 266	Quaternary evolution of the coastal plains of southern Kerala	Shri. John Paul	Marine Sciences	Dr. A. S. K. Nair Dr. D. S. Suresh Babu	2007-2010	36.50	0.15

5.4 R & D Infrastructural Projects

Project Code	Project Title	Co-ordinator	Division	Allotment for the year (Rs. lakh)	Expenditure during the Year (Rs. lakh)
PLAN 101	XRF facility	Director		27.60	7.99
PLAN 102	Upgradation of Geosciences laboratories	Dr. T. Radhakrishna	Geosciences	6.55	1.62
PLAN 103	Strengthening of Ecological laboratory	Head, ESD	Environmental Sciences	2.05	0.86
PLAN 104	Upgradation of Electronic and Instrumentation laboratory	Head, ASD	Atmospheric Sciences	11.75	4.03
PLAN 105	Upgradation of Chemical laboratory	Head, CSD	Chemical Sciences	19.95	8.12
PLAN 106	Upgradation of Library facilities	Head, TED/ Librarian	Library	23.60	34.92
PLAN 107	Publication of monographs/memoirs/annual reports/newsletters	Director		5.70	1.20



List of Projects

Project Code	Project Title	Co-ordinator	Division	Allotment for the year (Rs. lakh)	Expenditure during the Year (Rs. lakh)
PLAN 108	Upgradation of training/extension/exhibition/LAN and other technical facilities	Head, TED	Training & Extension	6.55	2.16
PLAN 110	Seminar/workshops/meetings	Director		3.25	2.54
PLAN 111	Marine Laboratory infrastructure development	Head, MSD	Marine Sciences	44.40	3.04
PLAN 112	Geomatics Laboratory infrastructure development	SIC, GML	Geomatics Lab	24.09	9.75
PLAN 114	PLacer Mineral Testing Laboratory	Head, MSD	Marine Sciences	36.40	6.51

5.5 R & D building Infrastructural Projects

Project Code	Project Title	Co-ordinator	Division	Allotment for the year (Rs. lakh)	Expenditure during the Year (Rs. lakh)
PLAN 109	Construction of Sophisticated Analytical Facility Building	Registrar		21.00	32.85
PLAN 109 (1)	Construction of compound wall and road	Registrar		15.00	----
PLAN 119	Recreation facilities at CESS	Secretary, Recreation Club		1.00	NIL
PLAN 120	Upgradation of centralised Air Conditioning and facilities of CESS buildings	Dy. Registrar, Stores		2.80	NIL
PLAN 122	Construction of parking shelter	Registrar		10.00	NIL
PLAN 123	Upgradation/ repair and maintenance of toilets	Dy. Registrar, Stores		0.50	NIL
PLAN 124	Upgradation of EPABX system	Registrar		2.50	NIL



Project Code	Project Title	Co-ordinator	Division	Allotment for the year (Rs. lakh)	Expenditure during the Year (Rs. lakh)
PLAN 126	Garden development and landscaping	Registrar		2.00	NIL
PLAN 128	Upgradation of electrical installations and facilities and upgradation/purchase of a new DG set	Registrar		1.00	0.91
PLAN 150	Construction of water tank and modification to the existing water supply scheme	Registrar		15.00	15.00
PLAN 151	Replacement of damaged cast iron stair case in the administrative building	Registrar		1.50	NIL
PLAN 152	Upgradation of computer facility in administration block	Registrar		5.00	NIL
PLAN 153	Upgradation of security area and rooms	Registrar		1.00	NIL
PLAN 154	Upgradation of path way to canteen	Registrar			NIL
PLAN 155	Upgradation of the canteen	Dy. Registrar, Stores			NIL
PLAN 156	Construction of compound wall in the land at Ernakulam	Registrar			30.82
PLAN 157	Construction of additional floor in the Scientists blocks	Dy. Registrar, Stores			NIL



6.1 CESS Research Council reconstituted

The Research Council of CESS was reconstituted with Dr. Shailesh R Nayak, Director, Indian National Centre for Ocean Information Services (INCOIS), Ministry of Earth Sciences, Hyderabad as Chairman. Other members are Dr. Prithvish Nag, Director, National Atlas & Thematic Mapping Organization, Prof. V. Sundar, Head, Department of Ocean Engineering, IIT, Madras, Dr. V.S. Hegde,

Dy. Director, ISRO Headquarters, Dr.P.V.Joseph, Visiting Professor, Cochin University of Science and Technology and Dr. V. Prasannakumar, Head, Department of Geology, University of Kerala. Dr.M.Baba, Director, CESS is the Member Convenor. The first meeting of the reconstituted Council was held during 4-7 June, 2007.



The Research Council of CESS in session during its biennial meeting at CESS during January 9-11, 2008. Sitting from left to right are Dr.M. Baba, Dr. Prasanna Kumar, Dr. Prithvish Nag, Dr. Shailesh Nayak, Prof. V. Sundar and Dr. P. V. Joseph

6.2 CESS participated in the ICARB Campaign

CESS participated in the Integrated Campaign for Aerosol Radiation Budget and Trace Gasses coordinated by the Vikram Sarabhai Space Centre to measure the Carbon monoxide in the marine atmosphere over Bay of Bengal and Arabian sea. CESS also monitored the surface ozone during the campaign that was conducted under the ISRO-Geosphere Biosphere Programme involving twentyseven research institutions in the country, including the PRL Ahmadabad, IITM Pune, IIT Kanpur, India Meteorological Department, etc.

6.3 Participation in Training Programmes

Sri. S. Sidharthan has successfully completed three online Courses organised by the World Bank Institute, Washington in partnership with the National Institute of Disaster Management, New Delhi. The courses were on: (a) Community based Disaster Risk Reduction (b) Safe Cities and (c) Damage and Reconstruction Needs-assessment.

6.4 Visiting Faculty

Dr. Srikumar Chattopadhyay served Department of Geography, University of Calcutta as visiting fellow from 10th to 13th March, 2008 and delivered four lectures: 1) Sustainable development 2) Watershed Management 3) Coastal Zone Management and 4) Environmental ethics.

6.5 Ph. D Students

Student	Topic	Research Guide	University
Abilash P. P.	Characterisation of marine pollution along the southern coast of Kerala using macrobenthic assemblages	Dr. P. P. Ouseph	Cochin
Anjali R.	Study of ambient atmospheric carbon monoxide in the tropics	Dr. G. Mohan Kumar	Kerala
Harikumar R.	Study on tropical rainfall with special reference to rain drop size distribution & integral rain parameters	Dr. S. Sampath	Cochin
Jayanthi J. L.	Laser Induced Fluorescence imaging for cancer diagnosis	Dr. N. Subhash	Kerala
Prasanth M.	Physio-chemical characteristics and speciation of heavy metals in the selected upland reservoirs of Periyar river basin	Dr. M. N. M. Nair	Cochin
Shiny S. T	Spectroscopic investigation of tooth caries & demineralization	Dr. N. Subhash	Cochin
Shamji V. R.	Shoreline change modeling with special reference to south west coast of India	Dr. N. P. Kurian	Cochin
Sinosh P. K	Studies on pesticide residues in the Periyar river basin	Dr. M. N. M. Nair	Cochin
Sreeba S.	Environmental impacts of sand mining: A case study in the river catchment of Vembanad lake	Dr. D. Padmalal	Cochin
Vishnu R. Praveen S.S.	Electrical characteristics of lightning & thunder storms Numerical modeling of tsunami inundation along the Kerala coast	Dr. G. Mohan Kumar Dr. N. P. Kurian	Kerala Cochin
Arjun S.	Amphidromes and shallow water tides of Arabian sea	Dr. N. P. Kurian	Cochin
Asa Rani L	Hydrology and dynamism of freshwater saltwater interface between kollamkode and Knyakumari, Tamil Nadu	Dr. N. P. Kurian	Kerala
George Thomas	The development of urban neat island in a tropical, coastal city	Dr. E. J. Zachariah	Kerala
Sreejith C. S.	Evolution of the lower crust in the neoproterozoic Kerala Khondalite Belt (KKB), Southern India: Petrological and geochemical constraints and implications for Gondwana assembly	Dr. G. R. Ravindrakumar	Kerala
Sudhanand V. S.	Studies on pathogenic enteric bacteria and their seasonal distribution with special reference to public health along selected estuaries of Southern Kerala coast	Dr. P. P. Ouseph	Kerala
Divya G Mohan	Studies on variation of elemental concentration in different soil types of Kannur district	Dr. (Mrs) Ansom Sebastian	Kerala
Rupananda Mallia	Photo diagnosis of oral malignancy using LIF & DRS	Dr. N. Subhash	Cochin
Udayakumar P.	Distribution of heavy metals in marine environment and its bioaccumulation along the central and northern coast of Kerala	Dr. P. P. Ouseph	Cochin
Tiju I Varghese	Evolution of Astamudi estuary during the Holocene and its implication to Southwest coastal India	Dr. T. N. Prakash	Cochin
Balachandran K. P.	Causes behind atmospheric electrical conductivity variations	Dr. S. Muralidas	MG



6.6 M.Sc / B. Tech. / M.Tech. dissertations

Name of Students	Affiliation	University	Topics of Dissertation	Supervisor
Ms. Prabeena. V	All Saints' College, Trivandrum	Kerala University	Soil chemistry of some selected farm lands of Thiruvananthapuram district	Dr. K. Narendra Babu
Mr. Sabin. A	Christian College Kattakada	Kerala University	Behavior of Atmosphere Trace Gases (surface ozone and carbon monoxide) at a coastal site, Thiruvananthapuram	Dr. G. Mohan Kumar
Geethumol K. G. Arun Kumar Kunjur Madhavan P.N Anish. C.R Anoop V.M Sreekanth. K.S Vinod. R.V Vineeth C.S	IIT Roorke	IIT Roorke	Palia Magnetism and Geochemistry principles and applications	Dr. T. Radhakrishna
Vipin Jacob Joseph	Anna University, Chennai	Anna University	Coastal sediment analysis	Dr. Terry Machado
Diji V. Savitha N.	National Institute of Technology Calicut	Calicut	Geo-environmental analysis of the Nilukottamala debris flow, Marudhonkara Panchayat, Kozhikode district	Dr. G. Sankar
Femine Treesa. K	School of Earth and Atmospheric Sciences	Madras University	Training in Geo Information System & Remote Sensing	Smt. Ahalya Sukumar
Johnson Scaria John	T.K.M. College of Engineering, Kollam	Kerala University	A study of detailed breakwater as a coastal protection measure for Kerala coast	MSD
Jose.N.R	Mahatma Gandhi University	M.G. University	A software tool for Rainfall simulation	Dr. V. Sasikumar
Ajith Kumar. C.G	Thanthai Hans Roever College, Tamil Nadu		Semi-Diurnal variation of water quality parameter in Mangalore estuary, Karnataka	Dr.P.P Ouseph
Deepthi. S	Christian College, Kattakada	Kerala University	Variation of hydrological characteristics in relation to the pollutants off Mangalore, Karnataka, India	Dr.P.P Ouseph
Jeeja. S.S	Christian College, Kattakada	Kerala University	Study of multi level clouds during south west monsoon	Dr.V. Sasikumar
Sabitha.C	Christian College, Kattakada	Kerala University	Charcterstics of cloud base height during south west monsson using ceilometer CL 31	Dr.V. Sasikumar
Linikrishna. K.L	University College, Tvm	Kerala University	Diurnal variation of mixing hei ght	Dr.V. Sasikumar
Kavitha. M.T	Christian College, Kattakada	Kerala University	Tenturi and heavy mineralogy of the coastal sands of Thiruvanathapuram district	Dr. D. Padmalal
Mrinalini Gopolakrishnan	Christian College, Kattakada	Kerala University	Investigation of dental erosion by beverages using curve fitting of laser – induced florescence emission	Dr. N. Subhash
Dharsana K. S.	Christian College, Kattakada	Kerala University	Monitoring of dental erosion by beverages using florescence spectral ration	Dr. N. Subhash
Dhanesh. K.V.	K.S. Rangasamy College of Arts and Science		Physico-chemical and microbiological; indicators and their response to environmental stress in Vallarpadam island	Dr. P.P. Ouseph
	K.S. Rangasamy College of Arts and Sciencè		Semidiurnal dynamis of bacterial indicators and their response to environmental stress in Vallarpadam island	Dr. P.P. Ouseph



Name of Students	Affiliation	University	Topics of Dissertation	Supervisor
Anusree. S.S Ajimol. T.Y	S.N.D.P. Yogam College	M.G. University	Generation of a multi-level voltage train	Dr. S.Muralidas
Jose Philip	University College, Thiruvananthapuram	Kerala University	Disaster Mangment plan for Local Self Government of Kerala- A case study in Talanadu Grama Panchayat Kottayam District with special reference to Landslides	Sri. G. Sankar
Vishnu R.			Study of electrical characteristics of Thunderstorms and lightning	Dr. S. Murali Das
Neelima	Mangalore University	University of Mangalore	Coastal regulation zone mapping shoreline changes and landuse pattern of Thriuvananthapuram Corporation	Dr. K. V. Thomas
Sreekanth. K.	Mangalore University	University of Mangalore	Shoreline changes, landuse land cover pattern and coastal regulation done mapping of Kollam Corporation	Dr. K. V. Thomas
Ambili.T.M.	Govt. Women's College, Tvm.	Kerala University	Carbondioxide emissions for industries in Kerala	Dr. E.J. Zachariah
Anu. G.S.	Govt. Women's College, Tvm.	Kerala University	Carbondioxide emissions for automobiles in Kerala	Dr. E.J. Zachariah
Harikumar. B	St.Xavier's College, Thumba	Kerala University	Variation of air temperature within an urban area	Dr. E.J. Zachariah
Sheena. P.	Karpagam Arts and Science College		Spatial variation of water quality in Bharathapuzha river: a comparative study of river water quality with nearby well water	Dr. K Nareendra Babu
Sreesanth. M. Asha. S	University of Kerala	Kerala University	Fluorescence and diffuse reflectance spectroscopic techniques for tracking morphologic changes of oral mucosa	Dr. N. Subhash
Joice K Joseph	Mahatma Gandhi University	M.G. University	Disaster management plan for Moonilavu Gram Panchayat , Kottayam district with special reference to landslides (Urulpottal)	Shri. G. Sankar
Tinu Rose Francis	Mahatma Gandhi University	M.G. University	Disaster management framework for Local Self Government with special reference to landslides- A case study in Tikoy Gram Panchayat	Shri. G. Sankar
Deepu Jacob	JJ College of Arts & Science	Bharathidasan University	Behaviour of Green house gases, carbon monoxide and surface ozone at tropical sites	Dr. G. Mohan Kumar
Ansy. S.	All Saints' College	Kerala University	Environmental appraisal of a fresh water swamp forest	Dr. C.N. Mohanan
Rahmath. Z.	All Saints' College	Kerala University	Ecological study on a myristica swamp in Kulathupuzha	Dr. C.N. Mohanan
Divya. B.J.	Sree Narayana College, Sivagiri	Kerala University	Effect of PH on the release of iron from the sediment of a fresh water lake: a case study in Vellayani, lake, Thiruvananthapuram	
Sarimol. S.	Sree Narayana College, Sivagiri	Kerala University	Release of phosphorus from sediment under different pH conditions: a study in Akkulam lake, Thiruvananthapuram	
Varsha P. Sheeba. S.B.	University of Kerala	Kerala University	Generation of a specific time varying signal using embedded controller	Dr. S. Muralidas
Anusha. I.M. Sindhu Raj	S.N.D.P. Yogam College	Kerala University	Signal Processor and automatic relay control	Dr. S. Muralidas



Name of Students	Affiliation	University	Topics of Dissertation	Supervisor
Deepa V.	Govt. College for Women, Tvm	Kerala University	Ozone as a trace has in the earth's atmosphere (Tropical Indian Region)	Dr. G. Mohankumar
Aneesh. A.D. Sumi. S.	University of Kerala	Kerala University	Handwritten character recognition using correlation coefficient in MATCAB	Shri. K.J. Mathew
Sakthi Rajan. S. Libin Mathew Ukken	Anna university	Anna University	A summer training programme for industrial exposure in 'Coastal Sediment Analysis'	Dr. T.N. Prakash
Asha. T. Greeshma A.G. Hanza Ashraf Jitha Mohan Vijay Gopal. G. Vikhyath V. Mallan	Cochin University of Civil Engineering	CUSAT	Engineering characteristics of land demarcated under Special Economic Zone (SEZ) in Kerala in the special reference to Kakknad, Kochi	Dr. A.S.K. Nair
Benzon. K.B.	S.N.D.P. Yogam College	M.G. University	Distance measurement using Ultrasonic Sound	Shri. K.J Mathew
Maya.V.Panikar	IIT Roorke	IIT Roorkee	Palia Magnetism and Geochemistry principles and applications	Dr. T. Radhakrishna
Saritha G. Nair	Karpagam Arts and Science College, Coimbatore	Bharathiar	Spatial variation of water quality in Bharathapuzha river: a comparative study of river water quality with nearby well water	Dr. K. Narendrababu
Manjuma. K.S.	S.N. College, Chengannur	Kerala	Regional variation of ground water quality in Thiruvananthapuram city and surrounding areas	Dr. K. Narendrababu
Praveena. V.	S.N. College, Chengannur	Kerala	Soil chemistry of some selected farm lands of Thriuvananthapuram city and surrounding areas	Dr. K. Narendrababu
Reshma. B.	S.N. College, Chengannur	Kerala	Water chemistry of selected temple pond waters in Thiruvananthapuram city region	Dr. K. Narendrababu
Reshmy. O.	S.N. College, Chengannur	Kerala	Hydrochemistry of selected spring water resources of Varkala	Dr. K. Narendrababu
Dhanya Viswanath.	S.N. College, Chengannur	Kerala	Impact of urbanization on the surface water quality of Thiruvananthapuram city	Dr. K. Narendrababu

6.7 Training programmes / Seminars

Srikumar Chattopadhyaya at the instance of Total Energy Security Mission (TESM), State Planning Board, GoK organized training programme for 30 selected students having M.A/ M.Sc in Geography and Geology to interpret maps for preparation of an inventory of small hydro sites in the State during 21-22 January, 2008. Associated personnel: Dr. Mahamaya Chattopadhyay and C Sakunthala.

Srikumar Chattopadhyaya on request from the Department of Geography, Kannur University organized a project clinic for a group of M.A/ M.Sc students in Geography to develop their projects during 12-18 February, 2008. Associated Personnel: Dr. Mahamaya Chattopadhyay and C Sakunthala with co-operation from scientists of GSD and TED.

B. Sukumar conducted two days' training in the Dept. of Environmental Remote Sensing and GIS, Madurai Kamaraj University, Madurai on Village level Resource Mapping in the month of September 2007.

Sri. B.K.Jayaprasad has imparted training for the surveyors in Palakkad and Alappuzha Municipalities for tax mapping under MOUD-UNDP programme for KILA using high resolution QuickBird satellite data.

Dr.R.Ajayakumar Varma and Dr. C. N. Mohanan organized a two day State level training workshop on 'State of the Environment Reporting of Grama Panchayats' at Eangandiyoor, Trichur during June 16-17, 2007.

Dr. R.Ajaykumar Varma delivered a talk on Technology Options for Solid Waste Management in the state level training programme to the District level technical team organized by Kerala Total Sanitation and Health Mission on 25 April 2007

Srikumar Chattopadhyaya organised a Seminar on Pathiramanal biodiversity conservation biopark development project in collaboration with the Muhamma Gram Panchayat (plan prepared for Pathiramanal biodiversity conservation bio park project) at the Muhamma on 5 June, 2007



Name of Student	Affiliation	University	Topic of dissertation	Supervising Scientist
Viji Varghese	Christain College, Kattakada	Kerala	Heavy metal accumulation in the Akkulam, Veli lake Trivandrum, a case study	Dr. M.N.M. Nair
Lekshmi S Pillai	Devasom Board College Kollam	Kerala	Hydrochemistry of Sasthamkottah lake the impact of Human interventions	Dr. K. Narendra Babu
Tinu Thomas	Bishop Moore College, Mavelikkara	Kerala	Hydrological and microbiological characteristic of the polluted zones of Karamana river and its impacts on near by well water, Thiruvananthapuram, Kerala: A case study	Dr. P. K. Omana
Jisha J Pillai	Malabar Christian College, Calicut	Calicut	A study on water and sediment quality in the industrial zone of Periyar River, Kerala	Dr. P. K. Omana
Kalaraj	University College, Trivandrum	Kerala	Geology & Geomorphology of Tolikuzhi catchment with special reference to Ground water recharge	Shri. John Mathai
Jose Philip	University College, Trivandrum	Kerala	Disaster Management plan for local self Government of Kerala- A case study in Talanadu Grama Panchayat Kottayam District with special reference to landslides	Shri. G. Sankar
Vipina P.V	University College, Trivandrum	Kerala	Shoreline changes of Trivandrum district using Remote sensing and Geographic Information System	Shri. B. K. Jayaprasad
Anjana.S	All Saint's College, Trivandrum	Kerala	Landuse changes in the coastal areas of TVM district using Remote sensing and Geographic Information System	Shri .B.K Jayaprasad

6.8. Studentship for P.G. Students

The CESS, as part of its efforts to improve research aptitude among students in different areas of earth sciences, has introduced studentships to support post graduate students. The programme was active also during the year 2007-08. The P.G students were nominated by the Departments of Universities and Government / aided colleges in the disciplines of Geology / Geography / Chemistry / Physics / Environmental Sciences / Computer Applications / Geophysics / Oceanography / Atmospheric Sciences / Mathematics for doing their dissertation / internship in CESS as part of the coursework. During the year studentship was awarded to 10 students selected from over 50 applications received. The studentship given was Rs. 2000/-per month for a maximum period of six months.

6.9 Membership in Committees

Dr. Ajayakumar Varma

Member of the Expert Committee constituted by the Department of Environment, Government of Kerala, to study the environmental aspects of M/s. K S I L

Convener of Drafting Committee and member of the River Basin Consultation Committee constituted by the Water Resource Department, Government of Kerala for drafting the Water Policy and holding the river basin consultation. Member of the Working Group constituted for preparing Environmental Policy of Kerala.

Chairman of the Subject Committee on 'Drinking water, Sanitation and Solid Waste Management' in the State Level Technical Advisory Group constituted for the implementation of Decentralized Planning Programme in 11th Five Year Plan.

Member of the Committee to study the environmental issues due to Iron and Steel Industries at Kanjikode, Palakkad..

Member of the Committee to prepare standards, specifications and cost norms for solid waste treatment plants.

Member of the multi-disciplinary study team for investigating the recurrent phenomenon of discolouration of Periyar river.

Dr. M. Baba

Member, Tsunami Core Group of the National Disaster Management Authority.

Member of the Expert Team constituted by the Ministry of Home



Academic Activities

Affairs, Government of India to prepare an Action Plan for mitigating the impact of natural disasters along Tuticorin-Kanyakumari coast.

Member of the Panel of Experts 2007-2009 for 'Dissemination of Information' by NISCAIR Research Council, CSIR, New Delhi.

Member, Kerala Science Congress Committee (since 2003)

Member, NNRMS Standing Committee on Ocean Resources, Dept. of Space (since 2000)

Member, Editorial Board of International Journal of Coastal Research, USA (since 1995)

Member of Ministry of Environment & forest's Expert Committee for Infrastructural Development and Miscellaneous Projects (1998-2007)

Member, National Coastal Zone Management Authority, Ministry of Environment and Forests, Government of India (since 1999)

Member, Technical Expert Committee on Flood Control and Coastal Erosion Prevention, Government of Karnataka (since 2000)

Member, CZM Authority of Kerala (since 2000)

Member, Irrigation Design and Research Board (IDRB), Government of Kerala (since 2003)

Member, Editorial Board of Indian Journal of Remote Sensing (since 2006)

Member of Dam Safety Authority of Kerala (since 2006)

Member of Disaster Management Authority of Kerala (since 2007)

Dr. Srikumar Chattopadhyay

Chairman of the State Technical Advisory Group on Land Water, Biomass, Watershed Management, Agriculture and Irrigation
Special Invitee, Total Energy Security Mission, State Planning Board, Govt. of Kerala

Joint Editor, Annals, National Association of Geographers, India (Since 2005)

Member, plan, committee on Fisheries, Environment and Ecosystem, State Planning Board, Govt. of Kerala (Since 2006)

Member, Working group on Urban Infrastructure, State Planning Board, Govt. of Kerala (Since 2006)

Sri. G. Sankar

Member of the expert committee constituted by the Government of Kerala to inquire into the pipe burst of the Panniyar Hydroelectric Project

Dr. K. V. Thomas

Member of the expert committee to study coastal erosion of Poonthura by the Water Resources Department, Government of Kerala.

Member, Lakshadweep Coastal Zone Management Authority

Member, Task Force on Fisheries Infrastructure, Fisheries & Port Department, GoK

Member, Varkala CRZ Monitoring Team, LSG Dept., Gok.

Member, KCZMA subcommittees for inspecting and reporting CRZ violation and compliances.

Dr. N. P. Kurian

Member, Tsunami Core Group of the National Disaster Management Authority.



7.1 Library

The CESS library serves as an excellent information resource in the field of Earth Sciences. Collection building is one of the most important functions of the Library that supports the academic and research activities of the Centre. The collection of the Library include both printed and digital resources which consists of books, journals, back volumes, CDs, VCDs, Proceedings, Standards, CD ROM database, Maps & Atlases, Theses, Project Reports, Reference Books, Annual Reports etc. In addition to the scientific community of the CESS, users from other R&D Institutes and Universities also made use of the Library.



During the year the Library has continued its mission of facilitating creation of new knowledge through acquisition, organisation and dissemination of Library materials. In this period, 34 books were added to the collection. Library subscribed to 15 international and 27 Indian journals. In addition to this, many journals were being received as gratis. Library was actively engaged in creation of digital contents. The digital contents of the Library include electronic journal articles, VCD films, CD ROM database, conference proceedings etc. The CD ROM database – GEOBASE published by Elsevier contains abstracts of articles spanning from 1994-2005. Old and obsolete Library materials were weeded out and special care was taken to neatly maintain the Library stacks to facilitate users to locate the desired document quickly.

Library offered Selective Dissemination of Information (SDI), Literature Search, Reference Service, Library Membership, Reprint Service, Press Clipping Service and Document Delivery Service to users. An email alert is sent to the requesting Scientist(s) about the arrival of publication requested by them. Library has taken institution membership in various reputed libraries so as to enable the users to visit such libraries and use the resources available there. In addition, Library offered Current Awareness Services such as list of new additions, useful article display, faculty publications display, display of scholarship, fellowship information, forthcoming conferences, seminars etc.

The Library is using the software SOUL, which is an integrated multi-user Library management system that supports all in-house operations of the Library. The software has different modules like Acquisition, Catalogue, Circulation, Serial Control, Online Public Access Catalogue (OPAC) and Administration. Bibliographic records of books available in the Library can now be accessed through this OPAC module. One personal computer has been provided for users to search the OPAC. Search can be done by using different access points like title, author, accession number, subject, ISBN, publisher, class number etc. The search can be refined by using other parameters also. The database of books is being updated on day-to-day basis with details of recently acquired books. WEBOPAC module has been developed and incorporated with the software so as to enable users to search Library materials from their desktop inside the campus. In addition to the Library collection, details of all in-house project reports in the Library were also included in the database.

During the period, one apprentice trainee and two project fellows joined in the Library. The professional assistant in the Library has resigned. Two revolving stands were purchased to display the newly added books and other documents.

7.2 Publication in Journals, Proceedings and Books

7.2.1 In Journals

Aneesh, V. R., Mohankumar, G. and Sampath, S. (2008) 'Spatial distribution of atmospheric carbon monoxide over Bay of Bengal and Arabian Sea: Measurements during pre-monsoon period of 2006', *J. Earth Syst. Sci.* 117, No. 4, pp 449–455

Babu, K. N., Padmalal, D., Maya, K., Sreeja, R. and Arun, P. R. (2007) 'Quality of surface and ground water around tile and brick clay mines in Chalakudy river basin, southwestern India', *Jour. Geol. Soc. India*, 169: pp 279-284.

Babu, N., Suresh Babu, D. S. and Mohan Das, P. N. (2007) 'Impact of tsunami on texture and mineralogy of a major placer deposit in southwest coast of India, *Environmental Geology*', 52, pp 71-80.

Black, K. P., Kurian, N. P., Mathew, J. and Baba, M. (2008) 'Open coast monsoonal beach dynamics, *Journal of Coastal Research*', 24 (1), pp 1-12.

Chattopadhyay, M. (2007) 'Morphometric analysis of Periyar river, Kerala, India, *The Geographer, Aligarh Muslim University, Aligarh*', vol.54, No.1. pp 1-16.

Chattopadhyay, S. and Shrivankumar, V. (2007) 'Marine fisheries in Kerala: A geographical analysis, *Transactions, Institute of Indian Geographers*', Pune Vol 29, no 2, pp 119-130

Chattopadhyay, S. and Suresh Kumar S. (2007) 'Fractal dimensions of selected coastal water bodies in Kerala, south coast of India - A case study, *Indian Jour. of Marine Sciences*', Vol. 36 (2), pp 162-166.

Devavrathan, S., Sukumar, B., Ahalya Sukumar, and Shrivankumar, V. (2006) 'Regional variations of development in Thiruvananthapuram district, *The Indian Cartographer*', Vol.25, pp 285-289.

Hameed, T. S. S., Kurian, N. P., Thomas, K. V., Rajith, K. and Prakash, T. N. (2007) 'Wave and current regime of the south west coast of India, *Jour. of Coastal Research*', 23(5), 1167-1174.

Harikumar, R., Sasi Kumar, V., Sampath S. and Vinayak P.V.S.S.K., 2007 'Comparison of drop size distribution between stations in Eastern and Western coasts of India', *J. Ind. Geophys. Union*. Vol. 11 No.2, pp 11-116

Mahesh Mohan and Omana, P. K. (2007) 'Statistical analysis of water quality data from a Ramsar site - the Vembanad backwaters, SW coast of India, *Asian Journal of Microbial Biotech*', Ev.Sc.Vol.9 (2), pp 313-320

Mallia, R. J., Shiny, S. T., Anitha, M., Rejnish Kumar, R, Paul, S., Jayaprakash, M. and Subhash, N., 'Oxygenated hemoglobin diffuse reflectance ratio for in vivo detection of oral precancer, *J. Biomedical Optics*, 13 (4), 041306-1, Jul-Aug 2008, (DOI: 10.1117/1.2952007).

Mallia, R. J., Shiny, S. T., Anitha, M., Rejnish Kumar, R, Paul, S., Jayaprakash, M. and Subhash, N., 'Laser-induced autofluorescence spectral ratio reference standard for early discrimination of oral cancer, *Cancer*, 112(7), 1503-1512, 2008, (DOI:10.1002/cncr.23324).

Mallia, R. J., Shiny, S. T., Anitha, M., Rejnish Kumar, R, Paul, S., Jayaprakash, M. and Subhash, N., 'Oral premalignancy detection using autofluorescence spectral ratios', *Oral Oncology Suppl.* 2(1), pp 259–260.

Maya, K., Babu, K. N., Padmalal, D. and Seralathan, P. (2007) 'Hydrochemistry and dissolved nutrient flux of small catchment rivers, south – west India', *Journal Chemistry and Ecology*, 23(1): pp 13-27.



- Mohan Kumar, G., Sampath, S., Jeena, V. S. and Anjali, R., 2008 'Carbon Monoxide Pollution Levels at Environmentally Different Sites', *J. Ind Geophys. Union*, 12(1), pp 31-40.
- Rajendran, C. P., Rajendran, K. R., Anu, Earnest Anil, Terry Machado, Mohan, P. M. and Jeffrey Freymueller, (2007) 'Crustal Deformation and Seismic History associated with the 2004 Indian Ocean Earthquake: A Perspective from the Andaman–Nicobar Islands', *Bulletin of the Seismological Society of America*, Vol. 97, No. 1A, pp S174–S191.
- Ruta, B. Limaye, Kumaran, K. P. N., Nair, K.M. and Padmalal, D. (2007) 'Non-pollen palynomorphs as potential environmental indicators in the Late Quaternary sediments of the west coast of India', *Current Science*, 92(10): pp 1370-1382.
- Sasidharan C. K. (2007) 'Introducing Social water management concept in Water Management of Rural Area: Example from Tirurangadi Block, Kerala, 'Groundwater 2007'', Vol.II, pp 15-22.
- Sasi Kumar, V., Sampath S., Vinayak P.V.S.S.K. and Harikumar R., 2007 'Rainfall intensity characteristics at coastal and high altitude stations in Kerala', *J. Earth Syst. Sci*, 116. No. 5, pp 451-463
- Shiny, S. T., Mallia, R. J., Mini, J. and Subhash, N., (2007) 'Investigation of in vitro dental erosion by optical techniques, Lasers in Medical Science', (DOI 10.1007/s10103-007-0489-z).
- Subhash, N. (2007) 'Optical Spectroscopy – An emerging technology for dentistry, In: Contemporary Optics and Optoelectronics' (eds. P. P. Sahu and P. Deb), Tata McGraw Hill, New Delhi, pp 79-81.
- Ahalya Sukumar., Sukumar, B., Devavrathan, S. (2006) 'Spatial distribution of sex-ratio and occupational structure of female population of Kerala, The Indian Cartographer', Vol.25, pp 273-275.
- Ahalya Sukumar. and Sukumar, B. (2007) 'Occupational structure of Female population in Tamil Nadu', *Indian Cartographer* Vol.27 pp 294-298
- Sukumar, B., Ahalya Sukumar. and Devavrathan, S. (2006) 'Delineation of drought prone areas in Palakkad district, Kerala using satellite imagery', *The Indian Cartographer*, Vol.25, pp 175-178.
- Sukumar, B. and Ahalya Sukumar. (2007) 'Mapping Agriculturally Drought prone areas using satellite imagery in GIS environment: A study in the Kasaragod district of Kerala', *Indian Cartographer* Vol.27 pp 184-188.
- Suresh Babu, D. S., Padmalal, D. and Arun, P. R. (2007) 'Watershed analysis of two forest catchments from Western Ghats, south India and its significance for mitigation of reservoir siltation', *Jour Geol. Soc. India*, Vol.69, No. 5, pp 1077-1087
- Murty, T. S., Kurian, N. P. and Baba, M. (2008) 'Roles of reflection, energy trapping and secondary undulations in the tsunami on Kerala coast', *International Journal of Ecology and Development*, 10 (S08), pp 100-114.
- Nanda Kumar, V., Mohan Kumar, G., Narendra Babu, K. & Jeena, V. S. 'Short term behaviour of Meteorological parameter in the low and high lands of the Kerala State', *Journal of Soil and Water Conservation Society*, Vol. 6, No.4, Dec. 2007, pp 176-181
- Naseema Beegum, S., Moorthy, K. K., Babu, S. S., Mohan Kumar, G., Sampath, S., Aneesh, V.R., 2008 'Impact of a mountain grassland fire on the concentration of aerosol black carbon and carbon monoxide near the surface at a remote coastal location', *J. Atmos. Res.* 88, pp 46–55.

Library and Publications

Prakash, T. N., Black, K. P., Mathew, J., Kurian, N. P., Thomas, K. V., Hameed, T. S. S., Vinod, M. V., and Rajith, K. (2007) 'Nearshore and Beach Sedimentary Dynamics in a Placer-Dominated Coast, Southwest India, *Journal of Coastal Research*', V. 23 No.6, pp 1391–1398.

Rajendran, C. P., Kusala Rajendran, Terry Machado, Satyamurthy, T., Aravazhi, P. and Jaiswal Manoj, (2006) 'Evidence of Ancient Sea Surges at the Mamallapuram Coast of India and Implications for Previous Indian Ocean Tsunami Events', *Current Science*, Vol. 91, No. 9. pp 1242-1246

7.2.2 In Proceedings

Ajayakumar Varma R., Nair, M. N. M. and Dr. Aji, A. T. 2007. "State of Pollution of the Wetlands of Kerala – A Review". Proc. Kerala Environment Congress, Centre for Environment and Development, Trivandrum.

Ajayakumar Varma. R. 2007 "A database on solid wastes of Kerala initiating programmes for prevention of land pollution and upgradation of environment". Proc. Ntl. Workshop "Fertility Evaluation for Soil Health Enhancement" organized by Soil Survey Department on September 11 – 13, 2007.

Aneesh, V. R., Mohan Kumar, G. and Sampath, S. 2007 "Campaign mode measurement of atmospheric carbon monoxide over Bay of Bengal and Arabian Sea", 19th Kerala Science Congress, Kannur, Jan 29-31, 2007. pp 829-831.

Anjali, R., Mohan Kumar, G. and Sampath, S. 2008 "Enhancement in ambient carbon monoxide at a clean coastal site in response to biotic material burning in a proximal location – An empirical relation, National Space Science Symposium", Ottu, Jan 28-31, 2008. pp S1-129.

Anjali, R., Sampath, S. and Mohan Kumar, G. 2007 "Characteristics of Atmospheric Carbon Monoxide", ACCLINT – 2007, Ahmedabad. pp 48-49.

Chattopadhyay, M. 2008 "Generation of biophysical data for sustainable management: A case of Kall Ar watershed, Kerala, India. In: Abstract vol. of International seminar on "Landuse /landcover change and Agro biodiversity". National PG College, Dept of Geography, Lucknow, March, 2008, p 56.

Chattopadhyay, S. and Chattopadhyay, M. 2007 "Geomorphology of Kerala: An overview. In: International workshop (IGCP-514) on fluvial and Marine processes of Cenozoic and Formations of Placers. Centre for Earth Science Studies", November, 2007. pp 64-71.

Chattopadhyay, S., Sasidharan, C. K., Sakunthala, C. and Sachin, R. 2006 "Disaster Management: Lessons for Tsunami with a case study of Alappad – Arattupuzha segment, National Seminar on Tsunami changes on the Marine system", Environmental and Socio-economic status of Coastal people. Pp 51-63.

Jayanthi, J. L., Mallia, R. J., Thomas, S. S., Aparna, G. N., Baiju, K. V., Kumar. R., Mathews, A. and Subhash, N. "Applicability of discriminant analysis in the grading of oral mucosa", Abst. Swadeshi Science Congress 2008, Trivandrum, HS-17. pp 26-27 (Best Paper Award)

Jayaprasad, B. K., Tanish Brown, Jojo Jose, Samsuddin, M. and Biju Soman, (2008) 'A. Participatory health GIS- A case study in Vengannur grama panchayat, Kerala', 20th Kerala Science Congress, pp 599-601.

Majumdar, A. K., Mathur Yash, Kierteer Sundar Bhoi., Barnwal, J. P. and Narayanaswamy, (2007) 'Performance Evaluation of floatex density separator to treat placer minerals. Proceedings of PLACER – 2007. pp.219-223', Macmillan Advanced Research Series, Macmillan India Ltd



Maya, K., Padmalal, D., Babu, K. N., and Sreeja, R. (2008) 'Limeshell mining from Vembanad Lake, Kerala, problems and prospects', Proc. of 20th Kerala Sci. Congress, pp 362-365.

Mohan Kumar, G., Sampath, S., Jeena, V. S. and Anjali, R. (2007) 'Carbon Monoxide Pollution Levels at Environmentally Different Sites', IGU Annual Convention, Kurukshetra University, Haryana, November 22nd to 23rd 2007. pp 37

Nair, K. M., Padmalal, D. and Kumaran, K. P.N. (2007) 'Response of post-middle Miocene Tectonics on stratigraphy and geomorphology of offshore-onshore regions of SW coast of India'. Proceedings of the International Workshop (IGCP-514) on Fluvial and Marine processes of Cenozoic and Formation of placers, pp 17-20.

Narayanaswamy, and Mallik, T. K. (2007) 'Heavy mineral studies of the Inner Shelf area Off Chavara, Kerala – A preliminary note, Proceedings of PLACER – 2007'. pp.91-97, Macmillan Advanced Research Series. Macmillan India Ltd.

Shiny, S. T., Jayanthi, J. L., Thomas, J., Mallia, R. J., Aparna, G. N. and Subhash N, 'Characterization of dental caries by fluorescence spectroscopy'. Abst. Swadeshi Science Congress 2008, Trivandrum, HS-16, p 26.

Singh, H.N., Neelakandan, V. N. and Sharavan Kumar, V. (2007) 'GIS - based seismic microzonation of

7.2.3 *In Books*

Chattopadhyay, M. (2007) 'Watershed characteristics and their implications on riverine ecology – A comparative analysis of two catchments in the Vamanapuram river, Kerala. Compendium volume on "Natural resource management and livelihood systems", Western Ghats Cell, Planning and Economic Affairs Dept. Govt of Kerala, Trivandrum, pp 315-320.

Chattopadhyay, M. (2007) 'RS-GIS application in road mapping Samples from Thiruvananthapuram district, Kerala. In: Modelling in Resource Management and Environment through Geomatics' (ed. Sharma, H.S. & Binda, P.R.). Concept publishing Co. New Delhi, pp 256-260.

Chattopadhyay, S. (2007) 'Application of fractals in geomorphology. In Modelling in Resource Management and Environment through Geomatics' (ed. H S Sharma and P R Binda), Concept Pub. Co. New Delhi, pp 261-166

Chattopadhyay, S. and Chattopadhyay, M. (2007) 'RS-GIS application in generation and synthesis of environmental statistics: A case of Ittikara river basin, Kerala. In Modelling in Resource Management and Environment through Geomatics' (ed. H S Sharma and P R Binda), Concept Pub. Co. New Delhi, pp 102-112

Chattopadhyay, S. and Sakuntala, C. (2007) 'Urbanisation process in Kerala: Search for an explanation. City Society and Planning' (Eds. B. Thakur, G Pomeroy, C. Cusack and Sudhir K Thakur) Concept Pub. Co. New Delhi pp 224-246

Subhash, N. (2007) 'Optical Spectroscopy – An emerging technology for dentistry, Contemporary Optics and Optoelectronics (eds. P. P. Sahu and P. Deb), Tata McGraw Hill, New Delhi', pp 79-81.

Sukumar, B. and Ahalya Sukumar. (2005) 'Palaeogeomorphic studies of Tambraparni river mouth using satellite imagery and GIS, Quaternary Climatic Changes and Landforms', edited by Chandrasekar, Manonmanian Sundarnar University, Tirunelveli, pp 369-377. Terry Machado, and Narayanaswamy, (2007) 'Participatory natural resource utilization and its implication. Proceedings of Natural resource management and livelihood support system'. A Compendium of selected research papers and articles, Western Ghats Cell, pp 6 – 17.



Library and Publications

Vinayak, P.V.S.S.K. and Narayanaswamy, (2006) 'Agroclimatic characterization of Mannarkad block of Palakkad district. Proceedings of Natural resource management and livelihood support system (A Compendium of selected research papers and articles', Western Ghats Cell), pp 328 – 335.

7.3 Books

Biju Kumar. A and Ajaykumar Varma, R (2007) 'Plastics and Environment' (*In Malayalam*) published by DC Books, p.108.

7.4 Project Reports

Pathiramanal biodiversity conservation and biopark project: An action research programme. CESS-PR-11-2007. Final report submitted to KSCSTE Srikumar Chattopadhyay

Prepared detailed project report (DPR) of the Hariyali project on Rejuvenation of A-S canal. Srikumar Chattopadhyay

Landscape evaluation in relation to fluvio-estuarine and denudational system: A case study of the Periyar basin, Kerala. Report submitted to the Director, August, 2007. The report contained 103 pages including 32 figures, 84 tables, 16 plates, and 12 appendices. Mahamaya Chattopadhyay

Shoreline Management Plan for Munambam - Kayamkulam sector, South West coast of India (Dr. N. P. Kurian et al.)

Land disturbances in Kunnamangalam Vayal, Meppadi, Wayanad district during SW Monsoon, 2007 (Shri. G.Sankar)

Formulation of model development master plans for selected local bodies in coastal plain area (Dr. R. Ajayakumar Varma and Dr. C. N. Mohanan)

Feasibility of Quarrying Operations at Kottukunnu, Nellanadu (Project Report : Dr. Ajayakumar Varma)

Environmental Impacts of Mining and Processing of China clay: A Case Study from Velichikkala, Kollam District Kerala (Project Report: Dr. D. Padmalal)

Environmental Impacts of Hard rock quarry and crusher unit at Attani, Narippara in Padinjarethara GP, Wayanad District, 2008. Report submitted to the Department of Local Self Government, Government of Kerala. (Sri. G. Sankar, Dr. R. Ajayakumar Varma and Dr. C. N. Mohanan)

7.5 Consultancy Reports

Ajaykumar Varma, R., Mohanan, C. N., John Mathai and Thomas, K. V. Environmental Implications of Decentralized Governance

Ajaykumar Varma, R., Mohanan, C. N., Muralidas, S., Unnikrishnan, K. R., Thomas, K. V. Rapid Environmental Impact Assessment study for the proposed Air strips at Andrott and Minicoy Islands in Lakshadweep

Thomas, K. V., Kurian, N. P., Raju, D., Badaress, K. O. and Manu M. Nair, CRZ Status Report and High Tide Line and Coastal Regulation Zone for a proposed resort at Thekkumbhagam, Kollam for Ashtamudi Resorts (P) Ltd.

Thomas, K. V., Kurian, N. P., Raju, D., Mohanan, S., and Badaress, K. O., CRZ Status Report for 'Moolapilly-Chathanad Road',



Kochi for Goshree Islands Development Authority.

Thomas, K. V., Kurian, N. P., Raju, D., Badaress, K. O., Manu M. Nair., Anitha, P. M., CRZ Status Report and High Tide Line, Low Tide Line and Coastal Regulation Zone of Ozhinhalappu, Kanhangad in Kasaragod District, Kerala for Chapri Resorts and Hotels Pvt Ltd.

Thomas, K. V., Kurian, N. P., Raju, D., Badaress, K. O., Manu M. Nair. and Raj Rajendran., CRZ Status Report Coastal Regulation Zone Status Report for a proposed at Sasthamkari, Panavalli, Alappuzha for Touch Earth

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O. and Manu M.Nair., CRZ Status Report and High Tide Line and Coastal Regulation Zone for a proposed resort at Thekkumbhagam, Kollam for Ashtamudi Resorts (P) Ltd.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O. and Mohanan, S., CRZ Status Report for 'Moolampilly-Chathanad Road', Kochi for Goshree Islands Development Authority.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O., Manu M. Nair. and P.M.Anitha, CRZ Status Report and High Tide Line, Low Tide Line And Coastal Regulation Zone of Ozhinhalappu, Kanhangad in Kasargod District, Kerala for Chapri Resorts and Hotels Pvt Ltd.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O., Manu M. Nair. and Raj Rajendran., CRZ Status Report Coastal Regulation Zone Status Report for a proposed resort at Sasthamkari, Panavalli, Alappuzha for Touch Earth Projects Pvt Ltd & Glitter Homes Pvt Ltd, Kochi.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O., CRZ Status Report for a proposed hotel at Maradu, Ernakulam for K.G.A. Estate Management Pvt Ltd.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O., CRZ Status Report and Delineation of HTL, LTL and CRZ for the Construction of Jetty at Shirse on the banks of Vaghotan River in Rajapur, Maharashtra for Aditya Environmental Services Pvt Ltd.

Thomas K.V., Kurian, N. P., Mohanan, S., Badaress, K. O. and Saritha, S., CRZ Status Report of Mining Block at Cheriashhekal in Alappad for IREL, Chavara, Kollam.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O., Manu M. Nai. and Anitha, P. M., CRZ Status Report and High Tide Line and Coastal Regulation Zone for pipeline route through mandve-rewas-karanaja-uran, Maharashtra for Indian Petrochemicals Corporation Ltd, Nagothane.

Thomas K.V., Kurian, N. P., Raju, D., Mohanan, S. and Badaress, K. O., CRZ Status Report Demarcation Of HTL/LTL for Somatheeram Research Institute & Ayurveda Hospital, Thiruvananthapuram.

Thomas K.V., Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and Demarcation of High Tide Line For Gelatin Plant Development Site At Cuddalore, Tamil Nadu for Pioneer Jellice India Private Limited, Cuddalore.

Thomas K.V., Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, S., CRZ Status Report and Demarcation Of High Tide Line And Low Tide Line For Locations Of Passenger Water Transport At Ferry Wharf, Mumbai & Nerul, Navi Mumbai for MSRDC Government Of Maharashtra, Mumbai.

Thomas K.V., Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and High Tide Line and Coastal Regulation Zone of Perumpuzha in Paravoor, Kollam for Dr. Joe Johnson.



Library and Publications

Thomas K.V, Kurian, N. P., Raju, D., Mohanan, S., Badaress, K. O. and Saritha, S., CRZ Status Report for International Convention Centre at Akkulam, Thiruvananthapuram for Chalet Hotels & Properties (Kerala) Pvt Ltd, Thiruvananthapuram.

Thomas K. V., Kurian, N. P., Raju, D., Mohanan, S., Badaress, K. O. and Manu M. Nair., CRZ Status Report and High Tide Line and Coastal Regulation Zone for the proposed fishery harbour at Chettuwa for Harbour Engineering Department, Govt Of Kerala

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and Delineation of HTL, LTL and CRZ for the proposed Port & Ancillary Infrastructure Development at Mundra in Gulf of Kachchh, Gujarat – Report 1 for Mundra Port and Special Economic Zone Ltd.

Thomas K.V, Kurian, N. P., Raju, D., Mohanan, S. and Badaress, K. O., CRZ Status Report for Bhasuram Resorts Pvt. Ltd. at Kulathur, Thiruvananthapuram.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Manu M. Nair., CRZ Status Report and High Tide Line and Coastal Regulation Zone for the proposed Thermal Power Plant at Dehrand/ Shahapur, Maharashtra for the Tata Power Company Ltd.

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and Delineation Of HTL, LTL and CRZ for a bridge across Manori Creek from Borivali to Gorai in Mumbai, Maharashtra for Mathur Enterprises, Mumbai.

Thomas K.V, Kurian, N. P., Raju, D., Mohanan, S., Badaress, K. O. and Manu M. Nair., CRZ Status Report and High Tide Line and Coastal Regulation Zone for the proposed fishery harbour at Cheruvathur for Harbour Engineering Department, Govt Of Kerala

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and High Tide Line and Coastal Regulation Zone for the proposed fishery harbour at Chellanam for Harbour Engineering Department, Govt of Kerala

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and High Tide Line and Coastal Regulation Zone for the proposed fishery harbour at Arthungal for Harbour Engineering Department, Govt of Kerala

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report and Demarcation of High Tide Line and Coastal Regulation Zone for the proposed Steel Plant Site at Paradeep for Essar Steel, Orissa Ltd.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report and Demarcation of High Tide Line and Coastal Regulation Zone for the Pipeline Route across Corangi-Enamadurru-Upputeru rivers, Kakinada, Guntur for Reliance Gas Transportation and Infrastructure Ltd. (RGTIL).

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report and Demarcation of HTL/LTL for a hotel at Chowara in Kottukal Village, Thiruvananthapuram, Kerala for Berggruen Hotels pvt. Ltd., Thiruvananthapuram.

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and Demarcation of High Tide Line, Low Tide Line and CRZ for the proposed LPG pipeline from Liquid Cargo Jetty through JNPT for M/s. Bharat Petroleum Corporation Ltd.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report and Demarcation of High Tide Line for the Nuclear Power Project Site at Kudankulam in Radhapuram Taluk, Tirunelveli District, Tamil Nadu for Nuclear Power Corporation of India Ltd.

Thomas K.V, Kurian, N. P., Raju, D. and Badaress, K. O., CRZ Status Report and Delineation of HTL and LTL for storage facilities on Nhava Creek bank of Ganesh Benzoplast Ltd in JNPT, Navi Mumbai, Maharashtra for Ganesh Benzoplast Ltd, Mumbai.



Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O., Sreekanth, .K., Abhi.R.Aravind. and Neelima,T., CRZ Status Report and High Tide Line and Coastal Regulation Zone for Upgradation & Widening of NH-17 Kannur-Kuttiapuram Sector for National Highway Authority of India.

Thomas K.V, Kurian, N. P., Raju, D., Mohanan, S. and Badaress, K. O., CRZ Status Report and Demarcation of High Tide Line for Resort Development at Chothavila, Agastheeswaram at Nagarcoil, Tamil Nadu for Escapade Resorts Pvt Ltd, Cochin.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report for a proposed resort at Ettupura in Vayalar, Alappuzha for M/S Vasu Coco & Resorts, New Delhi.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O., Saritha, V. K., Sarath, L.G., CRZ Status Report for Alappad - Panmana Heavy Mineral Deposit Holdings of Kollam district for IREL, Chavara.

Thomas K.V, Kurian, N. P., Raju, D., Mohanan, S. and Badaress, K. O., CRZ Status Report and High Tide Line and Coastal Regulation Zone for a proposed boatyard at Chavara, Kollam for Bright Metal Works, Kollam.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report and High Tide Line and Coastal Regulation Zone for Township and Power Plant (Expansion) Project area between Nandivade and Chaferi in Taluka and District Ratnagiri, Maharashtra for JSW Energy (Ratnagiri) Limited, Maharashtra.

Thomas K.V, Kurian, N. P., Raju, D., Badaress, K. O. and Saritha, V. K., CRZ Status Report for a proposed shopping Mall at Kundannur, Maradu, Ernakulam for M/s Thomsun Realtors (P) Ltd, Ernakulam.

Dr . R. Ajayakumar Varma, Dr. C. N. Mohanan, Dr. K. V. Thomas, Dr. S. Muralidas, Dr.M. N. M.Nair, Mr. K. R. Unnikrishnan and Dr. P. V. S. S. K.Vinayak, Environmental impact assessment of proposed Airport at Minicoy Island, Union Territory of Lakshadweep, 2008. Report No. CESS - PR- 01- 2008, submitted to the Administrator, UTL, Kavaratti.



8.1 Release of the Digital Resource Atlas and Database and workshop on Digital Database of Natural Resources for Kerala State

A digital resource database and atlas was brought out for the entire stretch of the Kerala State in 1:12,500 scale, utilizing the high resolution IRS P6 RESOURCESAT satellite data and GIS (Geographic Information System). The Hon'ble Chief Minister of Kerala Sri. V. S. Achuthanandan released the digital resource atlas and database by handing over the copies to Prof. Prabhat Patnaik, Vice Chairman, and Planning Board on March 13, 2008 at the Mascot Hotel, Thiruvananthapuram. The function was presided over by Dr. G. Madhavan Nair, Chairman ISRO. Dr. K. Radhakrishnan, Director, VSSC, Dr. E. P. Yesodharan, Executive Vice President, KSCSTE, Sri. Teeka Ram Meena

IAS, Secretary, Planning & Economics Affairs and Dr. V. Jayaraman, ISRO-EOS Director offered felicitations Dr. M. Baba, Director CESS gave a brief account of the NREDB project. Sri. P. K. Mohanti, IAS, Director, KSREC welcomed the gathering and Dr. M. Samsuddin Principal Investigator of the project proposed the vote of thanks. State level and district level planning officers participated in the half day workshop held as part of the programme. Dr. M. Baba, Director, CESS, Dr. M. Samsuddin, Scientist-in-Charge, Geomatics Laboratory, CESS, Sri. P. G. Divakar, Head, RRSSC, Bangalore and Sri. A. Nizamuddin, Assistant Director, Landuse Board made presentation on digital data base generation and utilisation. The session was chaired Dr. V. S. Hegde, Deputy Director, EOS-ISRO, Bangalore.



Sri. V. S. Achuthanandan, Hon'ble Chief Minister of Kerala addressing the gathering during the release of the Digital Atlas and Database for Kerala.

8.2 International Workshop on Fluvial and Marine Processes of Cenozoic and Formation of Placers

The International workshop on 'Fluvial and Marine Processes of Cenozoic and Formation of Placers' was organized by Centre for Earth Science Studies, Thiruvananthapuram with a two day conference in CESS, four days of field work between Kanyakumari and Goa and a concluding session at Goa Univesity. Delegates from India, Srilanka, China, Russia and Australia took part in the workshop. The workshop was organized as part of the International Geoscience Correlation Programme (IGCP), a joined endower of the UNESCO and International Union of Geological Sciences (IUGS). The Hon'ble Minister for Irrigation and Water Resources, Government of Kerala, N. K. Premachandran inaugurated the workshop on November 1st, 2007. The inaugural session was presided over by Dr. E. P. Yesodharan, the Executive Vice President of the KSCSTE. An



Sri. N. K. Premachandran, Hon'ble Minister for Irrigation inaugurates the International Workshop on Fluvial and Marine Processes of Cenozoic and Formation of Placers at CESS

overview of IGCP was presented by Dr. N. G. Patyk-kara (Russia), Project Coordinator, IGCP-514. Dr. M. Prithviraj, Director, Department of Science and Technology, Government of India, Dr. M. Baba, Director, CESS, Dr. N. P. Kurian, Head, Marine Sciences Division, CESS and Dr. D. S. Suresh Babu, Scientist, CESS and the Organizing Secretary of the Workshop spoke on the occasion.

The inaugural session was followed by technical session on 'Niotectonism, Glaciations and River Metamorphosis' consisting of four papers. The second technical session on 'Submergence of River channels in Costal zone' consisted of three paper presentations. The third session on Paleochannels and formation of Mineral Resources had four presentations.

The penultimate session was on 'Role of rivers in offshore placer genesis' with three papers and the last technical session was on 'Modern Fluvio-marine processes and exploration of Placer deposits' with five presentations. The technical sessions were followed by four days of field tour in the Kerala, Tamilnadu and Goa region. Visit to the layers of bauxite, glace, sandstone and laterite at the Karichal cliff session, laterites on the Khondalite basement at Arvipuram, placer deposit at Manavakurichi, Teri Formation or ancient sand dunes at Muttom, Warkallai formation at Varkala cliff region, the clay deposists at Kundara and visits to Ashtamudi kayal, Sasthamkotta kayal and Indian Rare Earth factory at Chavara were the highlights of the first two days of tour. The third day was dedicated to a cruise in the Vembanad Lake, the largest estuary in



A view of the delegates during their field visit at Goa





A view of the delegates of the workshop on Fluvial and Marine processes Kerala, in a house boat. The final field excursion was at Aguada headland, Bardez, Goa. The parent rocks of meta sediments and basic dykers were found exposed in this wave cut platform area. Primary depositional features of Precambrian age and recent erosional features were visible. Boxwork and honeycomb structures were seen among other interesting features.

8.3 Seminar on biodiversity conservation and responsible Eco-tourism for Pathiramanal - World Environment Day 2007

A multidisciplinary research programme on Pathiramanal, an island in the Vembanad lake, falling within the administrative boundaries of Muhamma Grama Panchayat, has been completed by CESS with the financial assistance of the Kerala State Council for Science



Dr.T. M. Thomas Isaac, Hon'ble Minister for Finance during the seminar on 5 June 2007 at Muhamma

Technology and Environment (KSCSTE). Subsequently, the Centre has prepared an action plan with the cooperation of the Grama Panchayat, to protect the biodiversity and to promote responsible ecotourism in Pathiramanal. This tiny island with an area of just 24 ha, is a heaven for hundreds of rare migratory birds. The islands is home for 88 species of birds, 160 species of plants, 23 varieties of spiders and 34 types of butterflies besides supporting 58 types of fishes in the surrounding water.

This joint project envisaged scientific conservation and restoration of the flora and fauna with peoples' participation to make the island a sought-after tourist destination. Environmental manage-



A view of the biodiversity of the Padiramanal island

underway as part of the project. Establishing a gateway at Kaipuram boat jetty, a natural history museum, an aquarium, a butterfly park, bird watching tower, a wilderness walk, a floating walkway around the island and rejuvenating the freshwater pond are some of the other schemes to be implemented soon as per recommendations given by CESS. The Agricultural University, The Kerala Forest Research Institute and the FIRMA, an NGO, will be developing different programmes to achieve the project goals. The Tourism Department executes the project with the Muhamma Grama Panchayat undertaking the overall management.

CESS observed this year's World Environment Day (June5, 2007) by organizing a seminar at Muhamma and presenting the action plan for Pathiramanal. Dr. T. M. Thomas Issac, Finance Minister, Government of Kerala inaugurated the seminar. The government, according to the minister, has already made budgetary allocation of Rs. 50 lakhs to start the implementation of plans. The Minister also informed that the Government has plans for conservation of mangroves and other plant species. Through another



ment plan and computerized information system have been developed for the island. Peripheral intervention of regeneration and programme Govt. of India has agreed to support this unique initiative with Rs. 5 crores. The seminar was attended by 300 people composed of stakeholders, local people, panchayat functionaries, NGO activists, representatives of the research institutions and the departments of tourism and fisheries. Dr. Sri Kumar Chattopadhyaya, Scientist, CESS coordinated the project.

8.4 Workshop on the preparation of 'State of Environment Report for Panchayats

Developmental programmes aimed at rapid economic growth and improvement in the standard of living of people affects the environment of a locality. Impact on the environment could be big or small and it could be negative or positive. In most cases, in our country, such impacts are often ignored or not properly taken care of before launching a developmental programme. The lack of environmental considerations during implementation of developmental projects is one of the major reasons for the worsening state of the environment. Uncontrolled and unscientific sand mining and quarrying activities, reclamation of wetlands and other water bodies, increased water pollution, increase in solid waste, damages to the ecology and bio-diversity, rapid spreading of contagious diseases, etc. are some of the major threats every region of

our State currently face. A large number of cases are pending in different courts that have stalled many projects and programmes aimed at economic development on environmental grounds.

CESS has initiated a programme jointly with the people and NGOs in the state for environmental evaluation and impact assessment of developmental programmes at the local level. Such an exercise will result in scrutiny of the projects and lead to viable suggestions and guidelines. Preparation of the State of Environment of Panchayats, thus, will lead to proper implementation of programmes and sustainable growth.

Besides solving many problems locally, global environmental protection and better understanding of our own environment would be other outcomes.

The State level inauguration of the training of trainers programme coincided with a workshop on the preparation of a report on the 'State of Environment, for peoples representatives, NGOs, officials etc., of Engandiyur Panchayat in Thrissur district during 16-17 June, 2007. Dr. Ajaykumar Varma and Dr. C. N. Mohanan, Scientists of CESS coordinated the programme, with assistance from the Local Administration Department, Kerala Sastra Sahitya Parishad. Dr. M. Baba, Director, CESS inaugurated the programme.



Dr. M. Baba, Director, CESS inaugurating the workshop at Engandiyur Panchayat in Thrissur district on 16 June 2007



8.5 Conference / Workshop / Symposium / Seminar

Name	Conference/Symposium/Seminar	Title of the Paper
Dr. R. Ajayakumar Varma	Kerala Environmental Congress on May 8, 2007 organised by Centre for Environment Development, Trivandrum	State Pollution of the Wetlands of Kerala- A Review
Dr. R. Ajayakumar Varma	Workshop on Urban Sanitation Policy organised by the Ministry of Urban Development Ministry of India during 12-13 June, 2007	NIL
Dr. R. Ajayakumar Varma & Shri. V. Muralidharan	Seminar on Solid Waste Management and Dioxin Emission Control organised by National Institute of Interdisciplinary Science & Technology (NIIST), CSIR at Trivandrum on 22nd October, 2007	NIL
Dr. R. Ajayakumar Varma	Workshop on 'All aspects of R&D in Rural Water Supply and Sanitation Sector' organized by Department of Drinking Water Supply Ministry of Rural Development , Government of India at NewDelhi during 7-8 December, 2007	NIL
Dr. R. Ajayakumar Varma	National Workshop on Status Protection on Coral Reefs in India (STAPCOR) at Kadamat, Union Territory of Lakshadweep during 21-23 January, 2008	Enviornmental onitoring of Lakshadweep Island- A decode of inputs from CESS
Dr. Mahamaya Chattopadyay	International Geographical Union(IGU) seminar on Land use- land cover change and agro biodiversity organised by Department of Geography, University Lucknow March, 2008	Generation of biophysical data for sustainable land Management - A case study of Kallar Water Shed Kerala, India
Dr. Narayanaswami	National Seminar on Exploration, Exploitation, Enrichment Coastal Placer Minerals held at Durgapur	Heavy Minerals studies of Innershell area off Chavara, Kerala- A Preliminary note
Dr. T. N. Prakash	International seminar on Crustal Evolution Sedimentary Processes and Metallogeny organised by SDM College of Engineering and Geol. Soc. of India, Bangalore during 28-30 November, 2007	Dynamics of beach placers of SW coast of India
Sri. C. K. Sasidharan	National Seminar on 'Ground Water 2007 - Agricultural Development and Rural Drinking Water' organized by the All India Central Ground Water Board Officers Association at Bhopal during 4-5 April, 2007	Introducing social water management concept in water management of rural area: example from Turangadi Block, Kerala
Sri. B. Sukumar	XXVII INCA International Congress organized by the National Hydrographic Office held at Vishakapatnam, A. P. from 21 and 23 November, 2007	NIL
Dr. Srikumar Chattopadhyay	The total energy workshop organized by State Planning Board at Trivandrum on 19th November, 2007	NIL
Dr. Srikumar Chattopadhyay	As a special invitee attended the meeting of Total Energy Security Mission held at the office of the LSG Minister on 26th March, 2008	NIL
Dr. Srikumar Chattopadhyay	International Geographical Union seminar on 'Landuse Land Cover Change and Agro- Biodiversity' organized by the Department of Geography, National Post Graduate College, Lucknow, chaired a session on 'Agrobiodiversity and Biodiversity: Challenges and Responses' on 7-8 March, 2008	Role of panchayats in planning for sustainable land use: exploring the frontiers with examples from kerala'
Dr. Srikumar Chattopadhyay	NCSTC-Network, DST, Government of India organized national orientation workshop as a master resource person to finalise the activity guide at Kolkata on 15-16 March, 2008	NIL



8.6 Invited Lectures

Dr. R. Ajayakumar Varma

Chaired session on Technology and Environmental Sciences during the 20th Kerala Science Congress 2008 held at Thiruvananthapuram.

Dr. M. Baba

Inaugurated the national seminar on 'National Self Reliance - Frontier Areas in Science and Technology' of 'Swasraya Bharath 2007' and delivered the inaugural address at Kochi on October 15, 2007.

Chaired a session on 'Coastal Protection' and gave a talk on the topic in the SAARC Workshop on 'Coastal and Marine Risk Management Plan for South Asia' held at Goa during 27-28 March 2008.

Chaired the workshop on 'Coastal Vulnerability Mapping' organised in India International Centre, New Delhi by MoEF on March 18, 2008.

Chaired session on Earth System Sciences, during the 20th Kerala Science Congress 2008 held at Thiruvananthapuram.

Dr. Srikumar Chattopadhyay

Attended a national seminar on "Recent changes in deltaic environment" organized by the department of Geography, University of Calcutta, chaired a technical session and served as a panelist in the discussion on "Environmental resource management and social justice" (14 -15 March, 2008)



9.1 Earth Day

The focal theme of Earth Day 2007 was 'Global warming and climate change'. The global warming due to green house effect has altered the global atmospheric processes and patterns. The world today is facing the massive environmental challenge to maintain a habitable Earth. CESS, as it has been in the past, observed Earth



Students get a feel of the Micro rain radsr and Disdrometer installed in the Atmospheric Sciences Division for rainfall and climate related studies

Day on April 23, 2007. Two hundred children and teachers from different schools in and around Thiruvananthapuram city were invited. Fifteen laboratories of the Centre were opened to the public. Two video films on natural hazards produced by CESS were screened.

There was a lecture by Dr. S. Muralidas in the after noon. A quiz competition for students was organised in the Morning. A talk on the conservation efforts of Pamba, the holy river of Kerala, was made by Sri. N. K. Sukumaran Nair, General Secretary, Pamba Samrakshana Samiti, after the competition. Dr.E.P.Yesodharan, Executive Vice President, KSCSTE gave the Earth Day message to the students, guests and staff of CESS and gave away the prizes to the winners of Quiz competition. The meeting was chaired by Dr. M. Baba, Director, CESS and Dr. D. S. Suresh Babu, Scientist offered the vote of thanks.

9.2 National Science Day

CESS observed the National Science Day 2008 with the focal theme 'Understanding Planet Earth' by organizing lectures, filmshow and laboratory visits. Post Graduate students invited from various colleges of Thiruvananthapuram participated. The talks were

on 'Integrated Water Management', 'A Geo-environmental Journey through Kerala' and on 'Placer Minerals of Kerala'. 'A scar in the mountains' a documentary film made by CESS on landslides in the Western Ghats of Kerala was also shown. After the laboratory visits, Dr. M. Baba, Director, CESS addressed the students. Earlier, Sri. G. K. Suchindan, Head, Training and Extension Division, introduced the focal theme to the gathering.



Students interacting with scientists at the Remote Sensing and aerial photo interpretation lab of CESS on the National Science Day 2008.

9.3 Exhibitions

CESS participated in the following exhibitions:

- ❖ Earth Science Expo-2007 held during November 21-24, 2007 at the University Student's Center, Thiruvananthapuram, organized by the Geology Old Students Association (GOSAN), University of Kerala.



Students at the CESS stall at the GOSAN exhibition



❖ Exhibition organized by the Revenue Department in connection with the inauguration of State Disaster Management Authority from 9-10 May, 2007 at Central Stadium, Thiruvananthapuram.

❖ 'Suvarnavarsham', organised by the city police, Kochi at the Cochin Marine Drive during 20-25, August 2007.

Exhibition organised by

❖ Malabar Botanical Gardens, Kozhikode,

❖ 20th Kerala Science Congress 2008 at Thiruvananthapuram

9.4 *Other activities*



Sri.K.R.Satheesan, Clerical Assistant of the Centre has won second prize in the all Kerala essay competition organised to commemorate the 50th anniversary of the first democratically elected government in Kerala conducted at the University College, Trivandrum.

10.1 Distinguished visitors

Dr. Terry Healy in CESS



Dr. Terry Healy, Research Professor of Coastal Environmental Science, Coastal Marine Group, University of Waikato, New Zealand visited CESS during December 10-11, 2007. Dr. Healy is a leading expert in the field of coastal erosion, inlet and inner shelf sedimentation processes, dredging issues for port and marine development planning. Dr. Healy delivered a talk in the Earth Science Forum of CESS on December 10, 2007. His talk focussed on performance evaluation of numerical modelling and enhancing coastal function by sensible set back for open duned coasts. Dr. Healy also joined a discussion on set back line demarcation with Dr. T.S. Murty and scientists of the Marine Sciences Division. Dr. Healy visited a few of the laboratories of CESS and had wide ranging discussions with the scientists.

Lakshadweep Administration

Shri. B. V. Selvaraj IAS, Administrator, Union Territory of Lakshadweep visited CESS to have discussions with the scientists on the ongoing projects related to the islands and for further strengthening of the UT's relationship with the Centre. The administrator expressed appreciation for the ICZM Plan prepared for the eleven inhabited islands of the Territory. Shri. Selvaraj discussed in detail the management action needed for safe and scientific disposal of the sewage for the Kavaratti island under the UNDP sponsored pilot project. He pointed out that sewage disposal is a



Shri B. V. Selvaraj IAS, Administrator, Union Territory of Lakshadweep (centre) having discussion with Dr. M. Baba, Director, CESS during his visit in the Centre. Dr. M. S. Syed Ismail Koya, Director, S & T Department, UT Lakshadweep

major problem faced by the island because of their miniscule size and fragile ecology. He had detailed parleys with the scientists on the innovative protection mechanisms required for the islands beaches. Administrator appreciated the involvement of CESS in the National Tsunami Warning System and also requested to give priority in undertaking the tsunami modeling programme for Lakshadweep Islands.

Legislative Committee on Environment in CESS

The Legislative Committee on Environment, Government of Kerala, under the chairmanship of Shri. Rajaji Mathew Thomas MLA, visited the Centre to discuss and evaluate the R&D activities related to environmental issues faced by the State. Shri. M. Hamsa, Shri. V. D. Satheesan, Shri. V. Surendran Pillai and Shri. A. M. Yousuf are the other MLA members of the Committee interacted



The Legislative Committee on Environment visited CESS on 26 September 2007

with the scientists of CESS. Discussions were mostly related to the impact of sand mining and rock quarrying in Kerala. The Committee was very keen to understand the issues associated with the availability of river sand and its alternative sources, like mining of palaeo river channels, rock sand, sand from the off shore regions, etc. The members expressed concern over the eroding banks of rivers and increasing river pollution. The Committee appreciated the efforts of CESS in preparing the sand mining status reports for 10 districts in the State. The Committee was informed that CESS will continue with the river sand auditing studies only after obtaining government approval to the methodology it had submitted, as stipulated in the River Protection Act, 2003. Detailed discussions were also held on the environmental and other hazards posed by hundreds of rock quarries in the State, in the light of



possible threats of earth tremors and landslides. CESS briefed the Committee about the findings of the studies carried out in this area and suggested speedy action plans for bringing in improved regulations. The Committee appreciated CESS for undertaking this important work.

Special Lecture by Dr. P. V. Joseph



Dr. P. V. Joseph, Visiting Professor, CUSAT and a Member of the CESS Research Council gave a talk in the Earth Science Forum on ‘South-West Monsoon and its relation with the oceans’ on 27 August 2007.

Chinese delegation

Prof. Yufei Wang, Prof. Li Chengsen, Prof. Yi Teng Yao and Prof. Yang Jian from the Chinese Academy of Science along with three Chinese students and Dr. K. P. N. Kumaran, Senior Scientist, Agarkar Research Institute, Pune visited CESS on March 4, 2008. The team’s visit, sponsored by INSA, was to study the palaeoclimate



The visiting professors from the Chinese Academy of Sciences and Dr. K. P. N. Kumaran of the Agarkar Research Institute, Pune were having discussions with the Director and scientists of CESS.

of the west coast of India. The visiting scientists held discussions with the Director and senior scientists of CESS. Dr. K. M. Nair former Director of CESS and Dr. D. Padmalal, Scientist, CESS accompanied the visiting delegation during their field trip in southern Kerala.

10.2 Other visitors

Prof. Natalia Patykkara, Institute of Geology of Oredeposites, Petrography, Minerology and Geochemistry, Russian Academy of Sciences, Moscow visited CESS on 2/11/2007

Prof. V. S. Chamyae Department of Geology University of Baroda, Vadodara visited CESS on 07/08/2007

Dr. A. K. Kamra, Emiriturs Scientist of IITM, Pune visited CESS on 24/08/2007

Forty students and five teachers from NRPM Higher Secondary School, Kannampally Bhagam, Kayamkulam visited CESS on 3rd November 2007.

Sixty-six students and two staff members from the Government College of Technology, Department of Civil Engineering, Coimbatore visited CESS on 6th September 2007 as part of their industrial visit.



11.1 Statutory Committees

11.1.1 Research Council

Dr. Shailesh R Nayak Director Indian National Centre for Ocean Information Services, Hyderabad	Chairman
Dr. Prithvish Nag Director, National Atlas & Thematic Mapping Organisation Kolkatta	Member
Prof. V. Sundar Head, Department of Ocean Engineering, IIT, Madras	Member
Dr. V. S. Hegde Deputy Director ISRO, Headquarters	Member
Dr. P. V. Joseph Visiting Professor Cochin University of Science & Technology, Kochi	Member
Dr. V. Prasannakumar Head, Department of Geology University of Kerala	Member
Dr. M. Baba Director Centre for Earth Science Studies Thiruvananthapuram	Member & Ex-Officio Convener

11.1.2 Management Committee

Dr. M. Baba Director Centre for Earth Science Studies Thiruvananthapuram	Chairman
The Director Centre for Water Resources Development & Management, Kunnamangalam, Kozhikode	Member



Sri. G. P. Ramachandran Additional Secretary General Administration Department Government of Kerala	Member
Dr. T. Radhakrishna Head, G S D Centre for Earth Science Studies Thiruvananthapuram	Member
The Controller of Administration Kerala State Council for Science, Technology & Environment Thiruvananthapuram	Member
Sri. P. Sudeep Registrar Centre for Earth Science Studies Thiruvananthapuram	Member Convener

11.2 Internal Committees

11.2.1 Heads of Divisions

Dr. M. Baba Director	Chairman
Dr. S. Sampath Atmospheric Sciences Division	Member
Sri. G. K. Suchindan Training & Extension Division	Member
Dr. N. P. Kurian Marine Sciences Division	Member
Dr. K. Soman Resouces Analysis Division	Member
Dr. P. P. Ouseph Chemical Sciences Division	Member
Dr. T. Radhakrishna Geosciences Division	Member
Dr. M. Samsuddin SIC, Geomatics Laboratory	Member
Dr. R. Ajaykumar Varma Environmental Sciences Division	Member
Sri. P. Sudeep Registrar	Member
Sri. C. K. Sasidharan SIC, Technical Cell	Convenor

11.2.2 Editorial

Dr. N. Subhash	Chairman
Dr. V. Sasikumar	Member
Sri. Abdunnasar	Member
Sri. C. K. Sasidharan	Member
Sri. S. Sidharthan	Convenor

11.2.3 Purchase

Dr. S. Sampath	Chairman
Sri. P. Sudeep	Member
Sri. John Mathai	Member

11.2.4 Library Management

Director	Chairman
All Heads of Divisions	Members
Deputy Registrar, Accounts	Member
SIC, Technical Cell	Convenor

11.2.5 Library Stock Verification

Sri. V. N. Neelakantan	Chairman
Dr. Narayanaswamy	Member
Ms. Ahalya Sukumar	Member



Committees

11.2.6 Canteen

Dr. N. Subhash	Chairman
Sri. V. Muralidharan	Member
Sri. S. Devadas	Member
Ms. Ahalya Sukumar	Member
Sri. A. Gopinathan	Convenor

11.2.7 Toposheet Verification

Dr. E. J. Zachariah	Chairman
Dr. K. Raju	Member
Sri. K. J. Mathew	Member

11.2.8 Plan Project Evaluation & Monitoring

Dr. S. Sampath	Chairman
Dr. S. Chattopadhyay	Member
Dr. R. Ajay Kumar Varma	Member
Sri. John Mathai	Member
Dr. K. V. Thomas	Member
Dr. K. Narendra Babu	Member
Dr. M. Samsuddin	Member
Sri. G. Balasubramonian	Member
Sri. C. K. Sasidharan	Convenor

11.2.9 Stock Verification (CESS)

Dr. E. J. Zachariah	Chairman
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Sri. M. Ismail	Member
Sri. K. Surendran	Member
Ms. P. Prabhavathy	Member
Ms. S. Lyla Beevi	Member
Sri. K. Ravikumar	Convenor



12.1 Director's Office

Dr. M. Baba	Director
Sri. N. Rajasekharan Nair	P. A to Director
Sri. C. K. Sasidharan	Scientist-C & SIC, TC
Sri. S. Sidharthan	Scientist-C & SIC, WIC
Sri. V. Krishnan	Typist (Gr. II)
Sri. N. Unni	Helper (Gr. II)
Sri. V. Chandran Nair	Helper (Gr. II)
Sri. G. Krishnan Nair	Driver (Gr. II)

12.2 Atmospheric Sciences Division

Dr. S. Sampath	Scientist-F & Head
Dr. N. Subhash	Scientist-F
Dr. E. J. Zachariah	Scientist-F
Dr. V. Sasikumar	Scientist-E2
Dr. S. Muralidas	Scientist-E2
Dr. G. Mohan Kumar	Scientist-E2
Sri. V. Muralidharan	Scientist-E2
Sri. K. Vijayakumar	Scientist-E1
Sri. K. J. Mathew	Scientist-E1
Sri. Mohammed Ismail	Technical Officer (G2,Gr.3)
Sri. T. K. Krishnachandran Nair	Technical Officer (G2,Gr.3)
Ms. P. Prabhavathy	Stenographer (Gr 2)

12.3 Chemical Sciences Division

Dr. P. P. Ouseph	Scientist-F & Head
Dr. M. N. Muralreedharan Nair	Scientist-E2
Dr. K. Narendra Babu	Scientist-E2
Dr. P. K. Omana	Scientist-E2
Sri. K. Surendran	Stenographer (Gr. II)

12.4 Environmental Sciences Division

Dr. R. Ajaykumar Varma	Scientist-E2 & Head
Dr. C. N. Mohanan	Scientist-E1
Dr. D. Padmalal	Scientist-C
Dr. K. Maya	Scientist-C
Ms. K. Prasanna	Typist (Gr. I)

12.5 Geomatics Laboratory

Dr. M. Samsuddin	Scientist-F & S I C
Dr. V. N. Neelakantan	Scientist-E2
Dr. K. K. Ramachandran	Scientist-E2
Dr. C. M. Harish	Scientist-E2
Sri. B. K. Jayaprasad	Scientist-B

12.6 Geosciences Division

Dr. T. Radhakrishna	Scientist-F & Head
Sri. John Mathai	Scientist-F
Dr. C. P. Rajendran	Scientist-E2
Dr. Narayanaswamy	Scientist-E2
Dr. Kusala Rajendran	Scientist-E2
Sri. G. Sankar	Scientist-E2
Sri. G. R. Ravindrakumar	Scientist-E2
Dr. V. Nandakumar	Scientist-C
Dr. D. S. Suresh Babu	Scientist-C
Sri. S. S. Salaj	Technical Officer
Sri. R. Karunakaran Nair	Helper (Gr. II)

12.7 Marine Sciences Division

Dr. N. P. Kurian	Scientist-F & Head
Dr. K. V. Thomas	Scientist-E2
Dr. A. S. K. Nair	Scientist-E2
Dr. T. N. Prakash	Scientist-E2



Staff Details

Dr. T. S. Shahul Hameed	Scientist-E2
Dr. X. Terry Machado	Scientist-E2
Sri. V. Vasudevan	Scientist-E1
Ms. L. Sheela Nair	Scientist-E1
Sri. John Paul	Scientist-C
Sri. S. Mohanan	Technical Officer (G2,Gr.3)
Sri. A. Vijayakumaran Nair	Technical Officer (G2,Gr.3)
Sri. M. Ajith Kumar	Technical Officer (G2,Gr.3)
Sri. M. Ramesh Kumar	Technical Officer (G2,Gr.3)
Ms. K. G. Omana Amma	Typist (Gr. II)
Sri. Louis Williams	Helper (Gr. II) (VCL)

12.8 Resource Analysis Division

Dr. K. Soman	Scientist-F & Head
Sri. B. Sukumar	Scientist-E2
Dr. Srikumar Chattopadhyay	Scientist-E2
Sri. Shravan Kumar	Scientist-E1
Ms. Ahalya Sukumar	Scientist-E1
Dr. Mahamaya Chattopadhyay	Scientist-C
Ms. C. Sakunthala	Technical Officer (G2,Gr.3)
Ms. A. Balkeez	Typist (Gr. I)
Sri. P. C. Sasikumar	Helper (Gr. I)

12.9 Training & Extension Division

Sri. G. K. Suchindan	Scientist-F & Head
Sri. G. Balasubramonian	Scientist-E2
Dr. E. Saravanan	Scientist-E1
Dr. Ansom Sebastian	Scientist-E1
Dr. K. Raju	Scientist-B
Sri. R. Sivaraja Pillai	Tech. Asst. (Draftsman)
Ms. Najumunniza	Tech. Asst. (Draftsman)

12.10 Library

Sri. A. Abdunnasar	Scientist-B (Librarian)
Ms. Preetha Sathyan	Professional Assistant
Ms. P. Girija	Office Assistant (Gr. I)
Sri. P. M. Gopakumar	Helper (Gr. II)

12.11 Camp Office, Kochi

Dr. P. V. S. S. K. Vinayak	Scientist-E2 & S I C
Sri. K. R. Unnikrishnan	Scientist-E2
Ms. Sreekumari Kesavan	Scientist-B
Sri. K. K. Varghese	Tech. Asst. (Gr. V)
Sri. D. Raju	Tech. Asst. (Draftsman)
Sri. K. P. Bhaskaran	Stenographer (Gr. I)
Ms. M. K. Radha	Typist (Gr. I)
Sri. Asokan Andy	Helper (Gr. II)

12.12 Administration

Sri. P. Sudeep	Registrar
Sri. R. Renganathaswamy	Internal Audit Officer
Sri. M. P. Sivakrishnan	Deputy Registrar (Accts)
Sri. K. Ravikumar	Deputy Registrar (Stores)
Ms. S. Kalpana Devi	Asst. Registrar (Purchase)
Sri. K. Sreedharan	Asst. Registrar (Admn.)
Sri. P. Gopakumar	Asst. Controller, Finance
Sri. A. Gopinathan	Section Officer
Sri. M. A. K. Haroon Rasheed	Section Officer
Ms. K. V. Padmaja Kumari	Section Officer
Sri. N. Sukumara Pillai	Engg. Supervisor (Grd. I)
Sri. P. Ramachandran Nair	Driver (Gr. I)
Sri. S. Krishnakumar	Office Asst. (Gr. II)
Sri. R. Haridas	Office Asst. (Gr. II)
Ms. K. Viswabharathy	Office Asst. (Gr. II)



Staff Details

Sri. C. M. Yousuf	Office Asst. (Gr. II)
Ms. G. Sarojini Amma	Office Asst. (Gr. II)
Sri. M. Madhu Madhavan	Office Asst. (Gr. IV)
Ms. R. Jaya	Office Asst. (Gr. IV)
Ms. G. Lavanya	Office Asst. (Gr. IV)
Ms. Femi R. Sreenivasan	Office Asst. (Gr. IV)
Sri. Rajesh P	Office Asst. (Gr. IV)
Ms. Rasi P. C	Office Asst. (Gr. IV)
Mr. Shensha C	Office Asst. (Gr. IV)
Mr. Siju V	Office Asst. (Gr. IV)
Sri. T. D. Besherdeen	Stenographer (Gr. I)
Sri. C. N. Gopalakrishnan Nair	Stenographer (Gr. II)
Ms. N. J. Saramma	Typist (Gr. I)
Ms. C. Thulasi	Typist (Gr II)
Ms. K. Nirmala	Clerical Asst. (Gr. II)
Sri. N. Jayapal	Clerical Assistant
Sri. K. R. Satheesan	Clerical Assistant
Sri. G. Chandukutty	Clerical Assistant
Sri. M. Parameswaran Nair	Skilled Assistant
Sri. G. Balakrishnan	Skilled Assistant
Sri. K. P. Thulaseedharan	Skilled Assistant
Sri. C. Surendran	Skilled Assistant
Sri. K. Gopi	Skilled Assistant
Sri. R. Karthikeyan Nair	Helper (Gr. I)
Ms. S. Vimala Kumari	Helper (Gr. I)
Sri. R. Sudhakaran	Helper (Gr. I)
Sri. P. Devan	Helper (Gr. I)
Sri. B. Rajendran Nair	Helper (Gr. II)
Sri. P. Saseendran Nair	Helper (Gr. II)
Sri P. Rajendra Babu	Helper (Last Grade)

12.13 Retirements

Smt. Prtretha Sathyan	Professional Assistant
Smt. G. Sarojini Amma	Office Assistant (Gr. II)
Sri. K. K. Varghese	Technical Assistant (Gr. V)
Smt. C. Thulasi	Typist (Gr. II)
Smt. S. Lyla Beevi	Typist (Gr. II)
Smt. S. Kalpana Devi	Assistant Registrar
Sri. P. Devan	Helper (Gr. I)
Sri. S. Devadas	Technical Officer (Photography)
Sri. N. Sukumara Pillai	Engineering Supervisor (Gr. I)
Sri. C. N. Gopalakrishnan Nair	Stenographer (Gr. II)
Sri. G. Chandukutty	Clerical Assistant
Sri. G. Balakrishnan	Skilled Assistant
Dr. S. Sampath	Scientist F & Head ASD
Sri. R. Sudhakaran	Helper (Gr. I)
Dr. V. Sasikumar	Scientist E2
Dr. K. N. Kusala Rajendran	Scientist E2

12.14 Recruitments

Sri. P. Rajesh	Office Asst. (Gr. I)
Smt. P. C. Rasi	Office Asst. (Gr. I)
Sri. K. Eldhose	Technical Asst. (Gr. I)
Sri. C. Shensha	Office Asst. (Gr. I)
Sri. V. Siju	Office Asst. (Gr. I)
Sri. N. Nishanth	Technical Officer (Gr. I)
Smt. T. M. Liji	Technical Officer (Gr. I)
Smt. Femi R. Srinivasan	Office Asst. (Gr. I)
Sri. P. S. Anoop	Helper (Gr. I)



Balance Sheet

CENTRE FOR EARTH SCIENCE STUDIES

(An Institution of Kerala State Council for Science, Technology and Environment)

Balance Sheet as at 31st March 2008 (without excluding inter-unit balances of CESS and External Projects)

Liabilities	SCH	31.03.2008	31.03.2007	Assets	SCH	31.03.2008	31.03.2007
		Rs. Ps.	Rs. Ps.			Rs. Ps.	Rs. Ps.
General Fund	I	40781328.07	34389435.07	Fixed Assets	VI	53715647.00	47323754.00
Current Liabilities and Provisions	II	24727862.00	17858208.00	Current Assets	VII	5764582.85	16666390.85
Unspent balance of Grant from GOK		6165416.78	25615997.78	Loans & Advances	VIII	12194377.00	13873496.00
Unspent balances of External Projects	III	15874547.71	24193970.21	External Projects:			
Advance received for Consultancy Projects pending adjustment	IV	53691045.00	45048252.00	Current Assets	IX	15889273.71	22996874.21
Corpus Fund	V	17787698.50	14383015.50	Loans & Advances	X	(14726.00)	1197096.00
				Consultancy Projects:			
				Current Assets	XI	28840276.00	29413702.00
				Loans & Advances	XII	24850769.00	15634550.00
				Corpus Fund:			
				Balance with SBT		187698.50	806998.50
				Term Deposits		17600000.00	13576017.00
Total		159027898.06	161488878.56	Total		159027898.06	161488878.56

Significant Accounting Policies and Notes on Accounts forming part of Accounts - Schedule-XIV

Sd/-
Dy. Registrar
Sd/-
Registrar
Sd/-
Director

AUDITORS' REPORT
As per our report of even date attached

Thiruvananthapuram
Date: 26.11.2008

For Jayakumar George & Associates
Chartered Accountants
Sd/-
U. Jayakumar, B.Com., FCA
Membership No. 208958

