

Newsletter of Coastal Research Unit (CRU)



Editorial

Coast is the zone of interface between land and sea. The coastal belt of Bangladesh with its diverse and dynamic morphological and ecological settings occupies near about one third of national territories and supports more than 50 million people of the country. This zone in Bangladesh is not only resourceful and fertile, but also under threat to various natural and man-made disasters. The global development trend has the tendency to move from mainland towards the coast, same also in Bangladesh. However, due to unplanned development activities the coastal ecology and environment of Bangladesh is now becoming more fragile and vulnerable. It is now the time to take proper steps for sustainable coastal zone management initiatives. CRU Newsletter is an endeavor towards that direction.

This is the first Newsletter of the series. Any comments and suggestions from any corner would be highly appreciated. We would like to include your valuable entry in our next issue.

M. Shahidul Islam



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About CRU....

Coastal Research Unit (CRU) is a research group in the Department of Geography and Environment, University of Dhaka, Bangladesh under the leadership of Professor Dr. M. Shahidul Islam. The aim of this unit is to conduct research on coast, organized seminar, arrange meeting, publish newsletter and disseminate knowledge on coastal issues.

Some enthusiastic coastal scientists of the Department of Geography and Environment mostly from the University of Dhaka as well as from Jagannath University under the guidance of Professor Dr. M. Shahidul Islam has started this research unit on 12 August, 2011. Professor Islam who is a renowned physical geographer of Bangladesh is the architect of this great initiative to meet the challenge of the coastal issues in a country like Bangladesh. CRU always welcomed or appreciated any individuals or organizations who are interested to work on coastal issues.

Though CRU has started disseminating knowledge by organizing a seminar at the very first day of its beginning it is now spreading its knowledge through half-yearly published newsletters, online publications and blog writings and weekly meeting with its active members and other interested followers. All the presenters of the seminars who are the scientists, researchers, government and non-governmental workers and senior students of the department have had great experience of working on coastal issues. The monthly organized seminar activities not only framed within its attended audience but also shared outside its space through website and CRU networks and team members.

This research unit has a dream to work as a dedicated research entity on various coastal issues both in hardcore physical as well as complex socio-economic levels. Besides, carrying out the mentioned activities CRU has a far vision to establish with the aim of making it as a focal point in Bangladesh for coastal research and coastal management challenges.

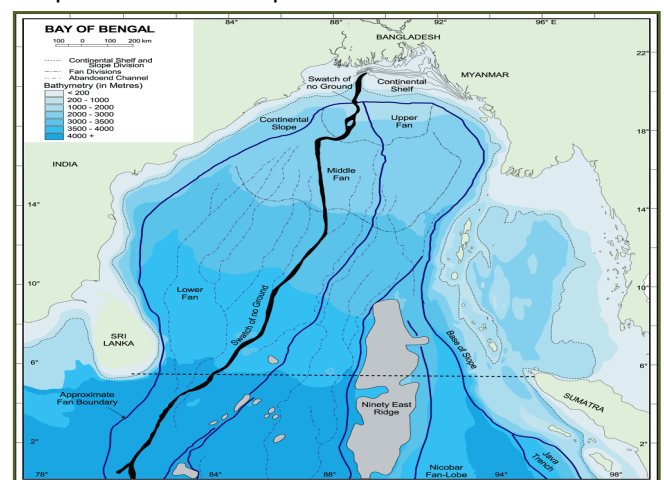
Anyone who is not currently in touch with CRU can visit our activities on the following website which introduces nearly all dimensions of coastal issues. The visitors can also contribute his/her thoughts on those issues. We are also available in facebook group.

Web Link: <http://www.pg-du.com/cru/>

Importance of Coastal Research in Bangladesh

The interface between land and water, the coast is a unique geological, ecological, and biological domain of vital importance astounding array of terrestrial and aquatic life forms- including humankind. The importance and value of the coastal zone cannot be underestimated. Coastal environments are the products of many complex interacting processes which are continually modifying coastal landforms. The coastal zone, especially in areas adjacent to major rivers and bays, has unique natural settings involving both marine and fluvial processes. In such a view the coast of Bangladesh, situated at the northern tip of the Bay of Bengal, offers access to fisheries and commerce, proximity to rich agricultural lowlands, and recreational opportunities. Before extracting the huge resources of our coastal environment it is important to understand the mutual interaction of natural processes with its ecological environment. Otherwise, it will cause serious disruption which may not be recoverable. Hence, the coast needs intense attention to do research on its various aspects.

The coastal zone of Bangladesh covers 47,201 square kilometer land area, which is 32 percent of total landmass of the country. Water line covers 370.4 km (200 nautical miles) from the coastline, estuaries and the internal river water. The Exclusive Economic zone (EEZ) is also treated as a coastal zone of its own. Various coastal environmental issues in Bangladesh give us the thinking of essentiality of coastal research such as- increased salinity during dry season, high frequency of cyclone disaster, erosion of char- land and offshore islands, changes in sea-level, flood severity, decline the fishery resources, green belt development for coastal protection etc.



Unique coastal belt of Bangladesh: The coastal geomorphological features make our coast distinguish from any other coasts of the world. The country is sloping

gently from the north to the south, meeting the Bay of Bengal at the southern end. The entire coast of Bangladesh is 710 kilometer long. The Bengal basin is one of the largest geosynclines in the world. Bangladesh portion of the basin is related with a numbers of rivers and low coastal land and bottom topography. It has a difficult coastline with many rivers and distributaries and complex ecology which is affected by natural hazards like cyclones, coastal flooding, tidal surges, salinity and the like phenomenon.

Physiographically, the coast of Bangladesh can broadly be classified into three major divisions: Ganges delta, Meghna estuary and Chittagong coastal plain belt, each with their own numerous distinct environments.

The three mighty river systems, the Ganges, the Brahmaputra, and the Meghna Rivers carry tremendous quantities of sediment; much of the sediments are entrained by waves and currents, while there is a net accumulation of sediments (delta building) at the river mouths. These sediments compensate the natural compaction and subsidence of the delta and keep its size relatively stable. The primary processes which influence, modify and diversify the coast are generated from marine, fluvial, aeolian, tectonic and ecological processes. Sometimes modify in a large scale through human intervention. The processes which are acting in the coast of Bangladesh are- sediment erosion and accretion, siltation, large volume of fresh water discharge during monsoon, continental shelf interacting with open ocean, high tidal and wind action influencing the largest compact mangrove ecosystem, afforestation and deforestation, and expansion of aquaculture industry.

Dynamic coastline of Bangladesh: The dynamic coastline is the result of continuous erosion and accretion processes which take place over a range of time scales. Short-term events like – storms, regular wave action, tides and winds are responsive, while long term events such as glaciation or orogenic cycles may significantly alter sea levels (rise/fall) and tectonic activities that cause coastal land subsidence or emergence. Wind, waves and currents are natural forces which easily move the unconsolidated sand and soils in coastal areas, resulting in rapid changes in the position of the shoreline. On the contrary, the depositional process may also act as prominent factors to change the shoreline of low deltaic plains. According to the IPCC the change in shoreline is expected to be impacted by the anticipated sea-level rise along the coast of Bangladesh due to global climate change. The shoreline change in Bangladesh has a great significance regarding coastal environment such as – coastal ecosystem, biodiversity, land use system, and socio-economic condition of the community. The people of the coastal area face the consequences of this change.

Importantly, local (or relative) changes of shoreline determine the preparation of coastal risk and vulnerability management and land use planning.

Coastal population. About one third of total population (about 50 million people) lives at the coast and island. People have always been drawn to coastal areas for food, commerce and recreation. Coastal land is intensively used for agriculture, settlements, forests, shrimp *ghers*, water bodies and fisheries, salt production, industrial and infra-structural developments and tourism. The ignorance, improper management and nature's violence of coastal zones already have created problems in coastal environment. such as-over cutting of mangrove for shrimp culture, tourism activities in the beach area, pollution load from industrial and shipping activities, natural disaster (cyclone , flood, earth quake, drought, sedimentation , erosion) etc.

Coast as a buffer zone: The coast provides some unique geomorphological features which provide safety for people living near the ocean. Beaches, dunes, barrier islands, mangrove forests all act as buffers against the high winds and waves associated with coastal storms. Vulnerabilities in the coastal zone of Bangladesh are increasing with accentuations of natural hazards and sea-level rise caused by various factors. Various indigenous techniques and adaptive measures have been followed by the intrepid people of the coastal zone from a very long time to minimize the effect with their daily life style.

Coast as a unique habitat: The coastal zone provides a unique habitat for thousands of plant and animal species that cannot be duplicated elsewhere. The estuaries provide a nursery for numerous species of fish, whereas the coastal wetlands are home to variety of birds, plants and other biota, and also serve the important role of filtering impurities in the water coursing through them.

Research activity has to be introduced in an intensive scale for the requirements of sustainable coastal zone management. The research need to be done for understanding the natural processes, proper implementation of environmental policies, laws and regulations, conservation of vulnerable aquatic species, development of eco-friendly industries in the coastal zone, tourism activities in selected areas, coastal zoning and resource management, socioeconomic development of coastal peoples and awareness creation among coastal community. In this regards National Coastal Research Institute need to be established.

From CRU Desk, Department of Geography & Environment, University of Dhaka

MONTHLY SEMINARS: Organizing seminar is one of the regular activities of CRU. The followings are the eleven seminars arranged by CRU on coastal and various related issues of Bangladesh. Most of the topics of the seminars were the outcome of studies of CRU team.

Title of 1st Seminar: Generic Characteristics of Coastal Dunes at Kuakata

This was the first seminar which was organized at the very first day of CRU's inauguration which was at 12 August, 2011. Coastal researchers from various backgrounds have participated in that seminar which includes young researchers from various universities and also the founder of CRU. The presenter reported that the topic what she had chosen was very fundamental work on coastal dunes at the central coast of Bangladesh (at Kuakata) primarily very challenging. According to her that research has revolved many opportunities and creates a ground for further coastal research works which would narrate more deep interpretation of the physical processes relate with coastal dune formation. The topic of the seminar has given the audience a new perception of coastal dune study through which various complex issues like: climate change, sea-level change or even frequency or intensity of cyclones or storm surges can be investigated. Any chronological study related to natural processes can be interpreted through dunes generic characteristics. So as a very prominent and dynamic morphological feature, dune can be significant research tool for coastal study.

Presenter: Nazla Bushra, Lecturer, Department of Geography & Environment, University of Dhaka.
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Title of 2nd Seminar: Holocene Geomorphic Evolution of Arial Beel: A Palaeo-environmental Reconstruction.

The 2nd seminar which was held on 31 January, 2012. is an original work on Geomorphic Evolution of Arial beel, which is located in between Dhaka and Munshigonj districts of Bangladesh. Arial beel encloses the signature of dynamic nature of the upper Ganges floodplain along with the tale of the evolution of Bengal basin in addition to the Pleistocene or early Holocene sea-level movements. In the seminar, the presenter has tried to accomplish the aim of investigation of Holocene Geomorphic Evolution of the Arial beel. The study reveals that this beel area was under marine influence ca. 3000 year BP, which had later been changed into a mangrove ecosystem in between ca 2000 BP to ca 1000 BP. The area turns into a fresh-water ecosystem since ca 1000 BP and takes the shape of a great depression having back swamp in the core, surrounded by natural levee. This palaeo-environmental reconstruction is also supported by the distinctive sedimentary layers of alternative minerogenic and biogenic origin.

Presenter: Mahmuda Islam, Postgraduate Research Student, Department of Geography and Environment, University of Dhaka.
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Title of 3rd Seminar: Measurement of Accuracy Level of Tidal Data of Bangladesh for Sea-Level Research

This seminar was arranged at the 23rd of February, 2012. In the seminar a comprehensive delineation on tide and the system of tide measurement, sea-level trend of Bangladesh coast, and the causes and sources of errors in these tidal records have been widely discussed, which is very important for Bangladesh in respect to climate change issues. In Bangladesh tidal records are accumulated by different government organizations installing tidal stations within its tidal zone, which are primarily being used for navigation, but can also be used for sea-level studies. Measurement of the current trend of sea-level change largely depends on the quality of tidal records for at least 60 years. Questions remain regarding the use of such data for sea level calculation due to their erroneous characteristics. The aim of the study was to measure the possible sources and causes of errors in connection with this tidal data.

Presenter: B. M. Avi Nahmias, Postgraduate Research Student, Department of Geography and Environment, University of Dhaka
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Title of 4th Seminar: Morpho-ecological Characteristics of Sand Dune along the Coastal Belt of Bangladesh

On March 24, 2012 the 4th monthly seminar of CRU was organized. According to speaker the aim of the research was to discover the morphological and ecological characteristics of Sand Dune along the Coast of Bangladesh. Through that presentation it has been known how the study was carried on using a cheap technique (e.g. punt pole-nylon thread technique) for beach profile measuring during the field work in addition to implement available technology like Google Earth Image interpretation and GPS use. The findings from the laboratory analysis of sediment samples collected from beach-dune complexes of study areas had been interpreted to the audience of the seminar. As a part of ecological study the major vegetation coverage (e.g. *Ipomoea pescaprae*) of foredunes was unveiled. The presentation was followed by a question-answer session with the interactive participation of CRU members and young, enthusiastic learners on coastal environment. The queries were mainly focused on the points - dissimilarities of dune morphology, dune-shoreline distance relationship, appropriate techniques in dune study, role of wind in dune formations etc.

Presenter: Md. Tariqul Islam, Postgraduate Research Student, Department of Geography and Environment, University of Dhaka.
e-mail: rana_075_du@yahoo.co.in

Title of 5th Seminar: Salinity Intrusion and Changes in Fisheries and Agricultural Environment in South-western Coast of Bangladesh

In the 5th seminar, which was held at 28 April 2012, one of the most contemporary coastal issues of the southwestern coast of Bangladesh was discussed. According to the discussant, the study was undertaken to assess and identify the spatial and temporal changes of salinity with upstream river discharge, mean tide level and local rainfall. The main focus was to identify the environmental changes with salinity regarding fisheries and agriculture. Two different zones viz. High saline zone and Moderate saline zone, namely Paikgacha and Rampal, were selected for the study. Information was collected from two categories viz. fishermen and agriculture farmers through semi-structured questionnaire regarding the changes of environmental parameters due to salinity over the 30 years period from 1975-2005. Some indices of species structure in communities and conventional statistical techniques were used to find out.

Presenter: Rubayet Bin Mostafiz, Assistant GIS Specialist, Data Experts (Pvt) Limited (datEx), Dhaka.
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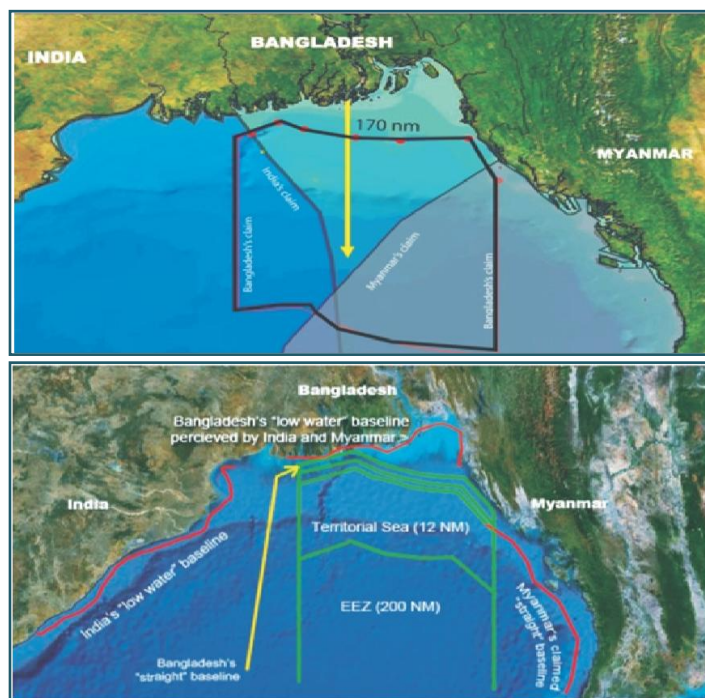
Title of 6th Seminar: Managing Flood Flows For Crop Production Risk Management with Hydraulic and GIS Modeling: Case Study of Agricultural Areas in Shariatpur

The 6th seminar was held on 26 May, 2012. According to the presenter, the study provides a method for food management to help with crop production risk management. In this study, inundation maps have been produced using hydrodynamic model HEC-RAS and HEC-GeoRAS extension of ArcGIS 9.2. Then calculation of optimal flood depth for crop production risk management has been done using some sophisticated statistical analysis. Finally, volume of water above the optimal flood depth has been calculating using GIS model with ArcGIS 9.2 and based on this, proposed some ways of flood flows management which ensure the crop production risk management. The study findings show that, the optimal flood depth is 1.85m (msl) in where Boro production would be safe and Aman production would face about 200 t on/yr loss.

Presenter: Md. Abdullah Al Baky, Lecturer, Department of Geography and Environment, Jagannath University
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Title of 7th Seminar: Maritime Boundary Delineation with Myanmar: Recent Verdict of ITLOS

On June 30, 2012 the 7th monthly seminar on a very significant issue about the maritime boundary of Bangladesh was held. According to speaker,



Bangladesh's "low-water" baseline perceived by India and Myanmar.

Bangladesh started dealing with these issues since 1974 declaring "Territorial Waters and Maritime Zones Acts". From then Bangladesh tried to resolve the issue bilaterally. For this, Bangladesh had to go to "International Tribunal for the Laws of the Sea" in short ITLOS, to resolve the disputed issue. Basing on the submission of claim by both the parties, on 14 March 2012 the historical 151 pages verdict was given by the tribunal. Bangladesh has consistently argued since 1974 that the principle based on "equity" would be applicable, while India and Myanmar favoured "equidistance" method. The "equidistance" method, could cut-off Bangladesh sea boundary from both east and west, making the EEZ not extending beyond 130 nm and would deny Bangladesh, not only to claim an additional 260 nm of continental shelf, but also access to the open ocean, and thereby turning Bangladesh into a "sea-locked country".

Presenter: Kazi Nadir Hossain, M.S. student in Disaster Management, Department of Geography and Environment, University of Dhaka
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Title of 8th Seminar: Coastal Zone Management: Status of Bangladesh

The CRU's 8th seminar was held on 28 July, 2012. According to the presenter, Bangladesh has a difficult coastline with many rivers and distributaries and complex ecology which is affected by natural hazards like cyclones, coastal flooding, tidal surges, salinity and the like phenomenon. The coastline is of 710 km involving coastal and island communities of about 50 million people, nearly about one-third of the total population of Bangladesh. The coast of Bangladesh is known as a zone of vulnerabilities as well as opportunities. It has a great importance since pre-

historic times for its abundance in natural resources. Coastal zone management is very necessary for the country. Through integrated coastal zone management a sustainable development of coastal region can take place. For this reason various coastal management program has been taken for sustainable development and conservation of biodiversity and natural resources in Bangladesh.

Presenter: Mishkat Marziya, Postgraduate student, Department of Geography and Environment, University of Dhaka)
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Title of 9th Seminar: Diatom as an Indicator of Palaeoenvironment

On September 29, 2012 the 9th monthly seminar of CRU was organized. According to the presenter, Diatom is a mobile plant of microscopic single cell or colonial algae, and is one of the most common types of phytoplankton. The study of diatom species, and particularly their ecologies, can provide useful information for the interpretation of palaeoenvironmental conditions. The Diatom cell ranges in size from 5-2000 μm , although most species encountered are in the size 20-200 μm . Diatom photosynthesis in the ocean yields as much as 40% of the organic carbon produced each year in the sea. Increasing research into deep-sea history has also encouraged their use as biostratigraphic zone fossils. The ratio between the oxygen isotopes ^{18}O and ^{16}O in the silica of fossil diatom frustules can also be used to indicate absolute temperature in Quaternary deposits. Freshwater diatoms have been used to study the developmental history of lakes since the glaciation, revealing the effects of changing acidity and climate and the effects of human pollution. Diatoms are an effective proxy for climate change due to their sensitivity to a variety of ecological conditions. Diatoms are highly sensitive to pH and can illustrate differences of as little as 0.1 pH units. Diatoms are a well-suited, and widely used, biological indicator because of their abundance in both freshwater and marine ecosystems, their well-preserved siliceous cell walls, and the fact that many taxa have well defined optima for a wide range of environmental variables, including salinity. Structural materials such as heat and fire resistant products, sound proofing materials, polishes such as 'Tripoli Powder', porcelain, drain pipes, tiles, non-conducting materials and artificial stone can be generated from diatom.

Presenter: Md. Selim Jaman, Postgraduate Research Student, Department of Geography and Environment, University of Dhaka)
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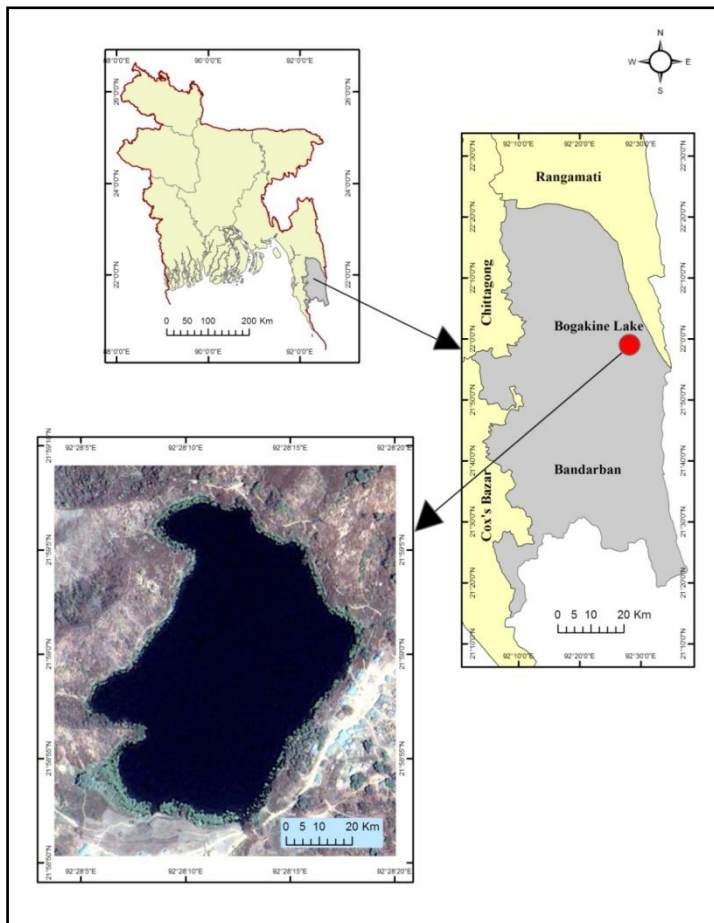
Title of 10th Seminar: Sediment Dispersion and Siltation Characteristics in the Bay of Bengal

The CRU's 10th seminar was held on December 08, 2012. According to the presenter, coastal erosion and deposition are currently considered as critical problem for coastal zone management. Suspended sediment is one of significant factors related to cause of erosion and deposition on coastal zone. Hence, monitoring and understanding the suspended sediments dynamics are vital components to handle coastal problems. Worldwide numerous studies have been conducted on the Suspended Sediment Dispersion and Concentration. In the continental shelf of Bangladesh region, a very few studies were conducted. This study is an attempt in the coastal belt of the Bay of Bengal. For better understanding the pattern of suspended sediment distribution and its movement, three types of experiment were done. Firstly, the in-situ data was collected from two study area and these were analyzed in the laboratory. As satellite imagery has been found that can be useful for providing information on coastal study such as offshore circulation and suspended sediments concentration, the second experiment was done to calibrate the in-situ information to the satellite imagery for getting out the spatial distribution of suspended sediment concentration over the whole coastal zone of northern part of the continental shelf. The third experiment was done for understanding the depositional rate of suspended sediment over the continental shelf. It was also included the bottom topography change of the shelf over the last twenty seven years (1982-2007 AD) and projected to the future forty three years (2007-2050 AD) which involved the mapping out of the areas of deposition and scouring. Maximum suspended sediment is found near the Meghna estuary, about 1.9gm/l and minimum found in front of the head of Swatch of No Ground, about 0.24 gm/l.

Presenter: Sanjoy Roy, Postgraduate Research Student, Department of Geography and Environment, University of Dhaka)
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Title of 11th Seminar: Reconstruction of Palaeo-Monsoon of Bangladesh Based on Lake Sediment Signatures: A Study of the Bogakine Lake

On January 19, 2013 the 11th monthly seminar of CRU was organized. In the seminar the presenter focused on the characteristics of the palaeo-monsoon of



Bogakine Lake in Bangladesh

Bangladesh through the study of the lake sediment. To achieve this goal presenter analyzed the sediment of Bogakine Lake situated in Bandarban District, Bangladesh. Total six cores were collected by using a local made lake sampler designed by the CRU team. Data on Lake Bathometry was also collected. Laboratory analysis of diatom, pollen, including measuring the percentage of organic matter and particle size analysis have been done. Through the study it appears that seven sequences of stronger asian monsoon approached in Indian Sub-continental region and among those four were stronger and three are relatively weaker than today. It is hard to measure the time of such sequences due to lack of C14 dates of Boga Lake sediment. The presentation was followed by a question-answer session with the interactive participation of CRU members and young, enthusiastic learners on coastal environment. The queries were mainly focused on the points of diatom analysis and key indicator through which the climatic dynamics is reconstructed, the core collection procedure and the relation of the morphological characteristics of the lake and climatic dynamics indicated by the study.

Presenter: Ripan Kumar Das, Postgraduate research student, Department of Geography and Environment, University of Dhaka) e-mail: dhrubotosh@yahoo.com

Institutional Profile: BIWTA



Bangladesh Inland Water Transport Authority (BIWTA) is the authority who controls the inland water transport and responsible for managing development and maintenance of inland water transport system of Bangladesh. The department was first established in October 31, 1958 by the former East Pakistan government as East Pakistan Inland Water Transport Authority (EPIWTA). After independence of Bangladesh this department was named as Bangladesh Inland Water Transport Authority.

For the development, maintenance and control of inland water transport and navigable waterways BIWTA disseminate navigational and meteorological information, execute hydrographic survey and dredging activities; develop, maintain and operate inland river ports, landing/ferry ghats and terminal, conduct research in matters relating to Inland Water Transport etc.

Bangladesh has about 24,000 km of rivers, streams and canals that together cover about 7% of the country's surface. Most part of the country is linked by a complex network of waterways, which reaches its extensive size in the monsoon period. Out of 24,000 km of rivers, streams and canals only about 5,968 km is navigable by mechanized vessels during monsoon period which shrinks to about 3,865km during dry period. The BIWTA sector carries over 50% of all arterial freight traffic and one quarter of all passenger traffic.

For Detail information: <http://www.biwta.gov.bd/>
Compiled by: B. M. Avi Nahmias

COASTAL LANDMARK:

Norbert P. Psuty

Dr. Norbert P. Psuty is Professor Emeritus at Rutgers University. He is a coastal geomorphologist whose research encompasses the dynamics of the coastal zone, incorporating process-response studies of beaches, coastal dune processes and morphology, sediment budget studies, barrier island dynamics, estuarine sedimentation, and sea-level rise. His research has been conducted primarily in various portions of coastal New Jersey and it has both a basic science component as well as an applied side. He has been doing research at Sandy Hook since around 1970 and is regarded to have the best long-term data set on



the geomorphological evolution of Sandy Hook. He has been and continues to be consultant to the National Park Service on shoreline dynamics and change in the coastal parks. He has been Vice-Chair and Chair of the Coastal Commission of the International Geographical Union, President of The Coastal Society, and President of the New Jersey Academy of Sciences.

His research focuses on the dynamics of the coastal zone, incorporating process-response modeling of the beach and dunes, beach erosion and deposition, and barrier island dynamics and the ecological system that it represents including barrier island displacement and the spatial shifts of the ecological systems with sediment loss and sea level rise. His interests extend to estuarine sedimentation and geomorphology. He has served as Project Leader of the Coastal Hazard Management Project to the New Jersey Department of Environmental Protection, the report from this project serves as the input to the revised State Shore Master Plan. He is currently Project Leader of the shoreline monitoring effort for the Northeast Coastal Barrier Network of the National Park Service, a program to establish a regional and then nationwide methodology to track, measure, and understand coastal change in the National Parks. He is the project leader for coastal geomorphological monitoring in Gateway National Recreation area. This program has been extended to the coastal refuges in the US Fish & Wildlife Service. He has been working on the topic of regional shoreline and foredune change since about 1976 and has very long data sets of shoreline and dune displacement under a variety of energetics. Some of the effort is directed toward the instrumentation that is used to build the data bases, whereas some of the effort is directed to understanding the scale of changes in annual and decadal time frames.

He also applies his expertise to the evolution of present day coastal features under the drivers of global climate change (sea-level rise and storms). He serves as scientific advisor to two major coastal National Parks in the US National Park Service and two refuges in the Fish & Wildlife Service. He has input to the development of their General Management Plan and to their decision-making related to sediment transfers and beach-dune restoration. He is very interested in the coastal changes taking place under the influence of global climate change and sea-level rise. This inquiry requires an investigation into the scales of sea-level encroachment and the generation of models to describe the impacts of various magnitudes of sea-level rise and imposed storms. He tries to have input to decisions regarding land-use in coastal areas exposed to the impacts of sea-level rise.

Lead Article: The Sand Dunes of Kuakata

The interface between land and water, the coast is a unique geologic, ecological, and biological domain of vital importance astounding array of terrestrial and aquatic life forms- including humankind. The coastal zone, especially in areas adjacent to major rivers and bays, has unique natural settings involving both marine and fluvial processes. In such a view the coast of Kuakata, situated at the northern tip of the Bay of Bengal, offers access to fisheries and commerce, proximity to rich agricultural lowlands, and recreational opportunities.

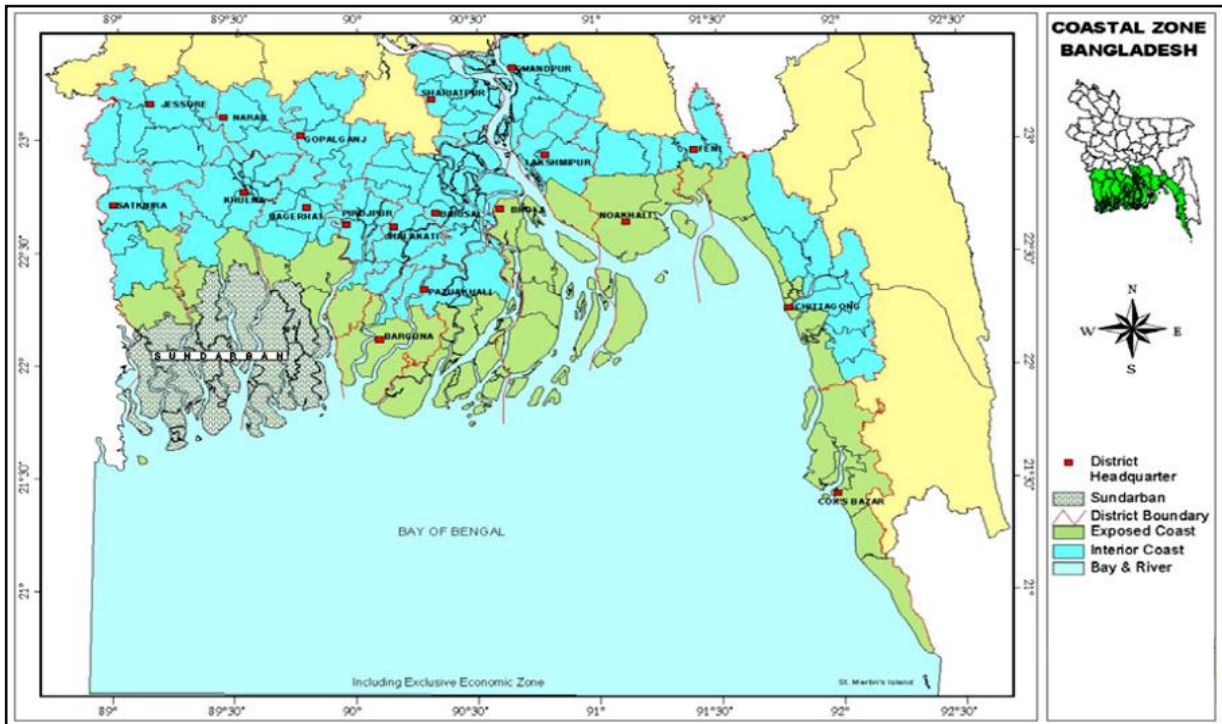


Fig 1 Coastal zone of Bangladesh
(Source: Coastal Development Strategy, WRPO, 2006)

Coasts have variety of natural features – beaches, dunes, cliffs, barrier islands and mangrove forests. Coastal sand dunes (CSD) of Kuakata are sensitive and fragile reflecting the domination of wave, tide, and wind actions along the flat topography of Bangladesh. Deep synthesize of the genesis, evolution and migration of the CSD has interpreted its diverse surrounding ecosystems within a chronological time frame. This study investigates the chronological development of different types of sand dune along the coastal belt of Kuakata in relation to its hydro-metrological condition and geo-ecological environment. This work is a comprehensive introduction to investigate the formation, dynamics, maintenance and perpetuation of coastal sand dune systems along the coast of Kuakata.

Study Area: Kuakata is a panoramic sea beach on the southernmost tip of Bangladesh, located in Kalapara upazila of Patuakhali district and along the western side of the Meghna estuary. It is an isolated beach at the southern tip of the delta locally known as Shagor Khan-Ya (Daughter of the Sea) (Banglapedia, 2010). This area is in Latachapli union under Kalapara Police Station of Patuakhali district. This beautiful sandy beach of Bangladesh is situated within 21°47" N to 21°52" N latitude and 90°05" E to 90°16" E longitude.

Background and Purpose: Coastal zones contain some of the world’s most diverse and productive resources. Significant research work on coastal geomorphological environment can give us potential thoughts and direction for proper coastal management considering economic, livelihood, habitation, more even disaster management issues. To understand the diversity of processes and nature of land forming agents, CSD can be a unique geomorphologic feature as well as potential landmark for understanding the coastal mechanism. The central coast (from the west bank of the Tentulia river to the mouth of the Feni river) of Bangladesh is more dynamic in nature (Rasheed, 2008); The study of the generic characteristics of CSDs at Kuakata thus helps us to sketch up the dynamism in this coastal zone.

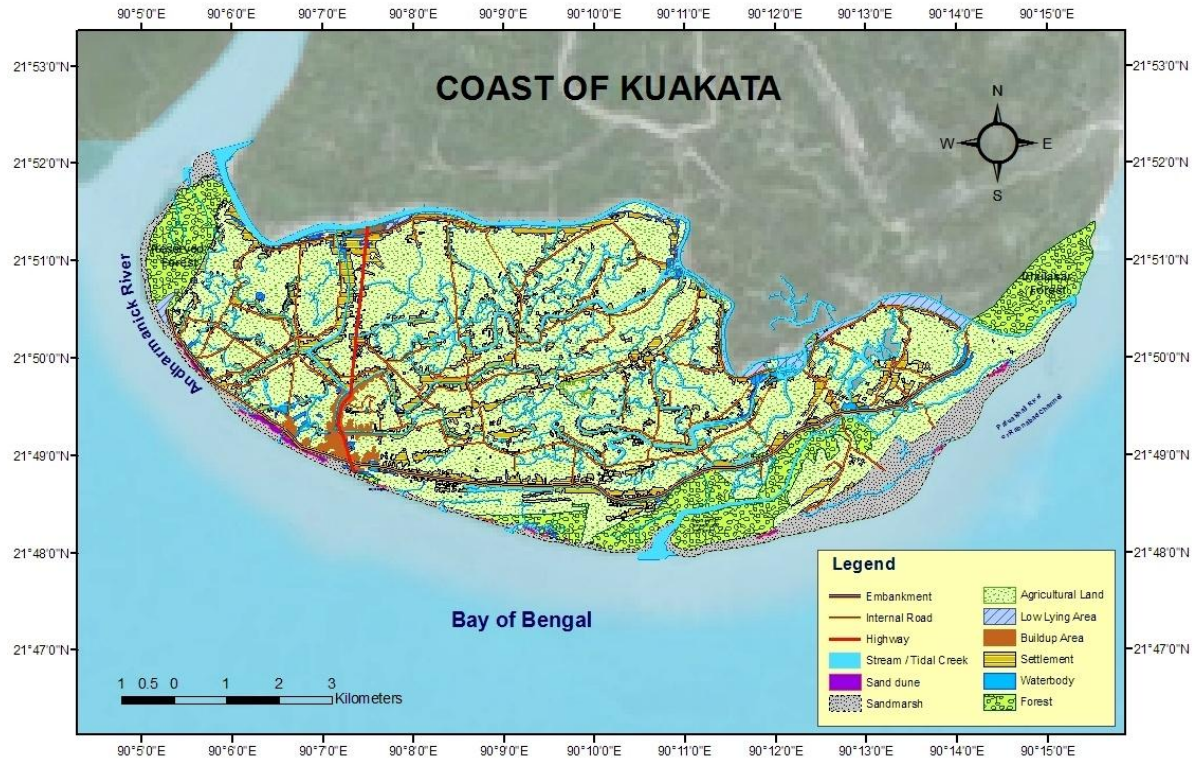


Fig 2 Kuakata – the study area
(Source: Adopted from Google 2010 & digitized in ArcGIS 9.3)

Objectives of the Study: The aim of this study is to analyze the present dominant environment in dune formation and the impact of human activity on this balance. Both spatial and chronological analysis have been done for future interpretation. The study includes an estimation of the dune forming processes, the impact of the anthropogenic parameters on these processes, and, finally, the status of dunes in this coastal belt.



Fig 3 Dune locations in Kuakata. In addition to natural processes the formation of dune's highly influenced by the crescent shape land figure, embankment along the coast and forest location.

The objective of this study is mainly analyze the generic characteristics of the Kuakata's CSDs which are eventually related with the natural process of that local coastal environment, which will ultimately give us the clue about the mechanism and processes through with various agents like – wind, wave, tide, current and stream flow run.

The focus of the study were-

- Investigate the involvement of the processes (aeolian, fluvial & marine) in dune morphology.
- Investigate dune's chronological evolution and sources of sand.

Methodology: The development of coastal dune fields in the area from east bank of Andarmanick River to west bank of Radnabad Channel has been studied here from the maps, aerial photographs, satellite images and vegetation transect analyses.

Within Kuakata Char Chapali (Latachapli), Gangamati are the smallest southern deltas of Kuakata having significant number of sand dune systems. Among a series of coastal dune system four sites were surveyed. They are selected according to their unique characteristics as –

- site one is for massive erosion at the windward side of the dune (a)
- site two is for profuse human interventions (b)
- site three is for dune afforestation (c) and
- site four is for identical stratified vegetation succession (d).

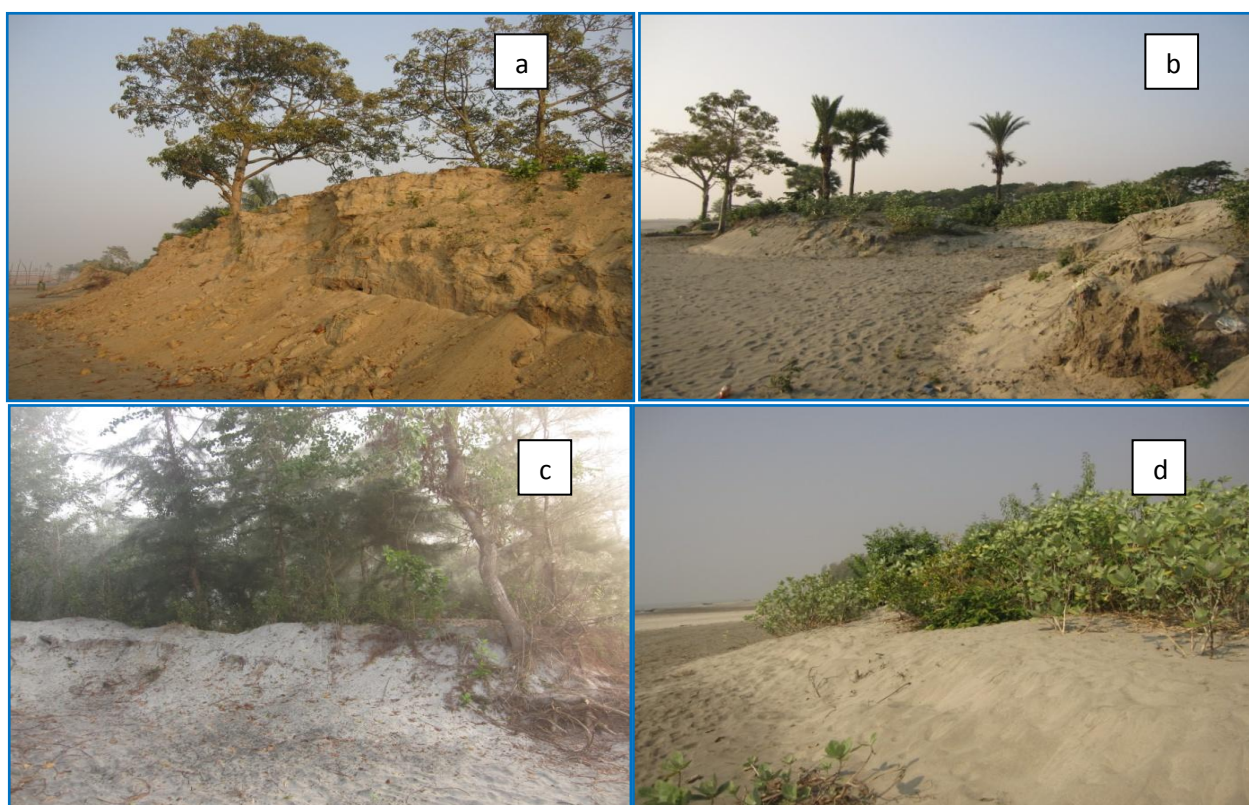


Fig 4 Four characteristic sites which have takes as sample for investigation

To study the grain-size distribution, composition, sources of sand and vegetation succession on dunes – both sediment samples and vegetation samples have been collected.

For the analysis of continental shelf and slope, which determine the deflection of wave and the current that cause coastal erosion along the coastal beach of Kuakata, bathymetry along the shoreline of Kuakata have been examined for about 32 nautical miles (60 kilometers). Station wise secondary data for wind velocity, wind direction, tidal flow, current and wave have also been collected in addition to field measurement.

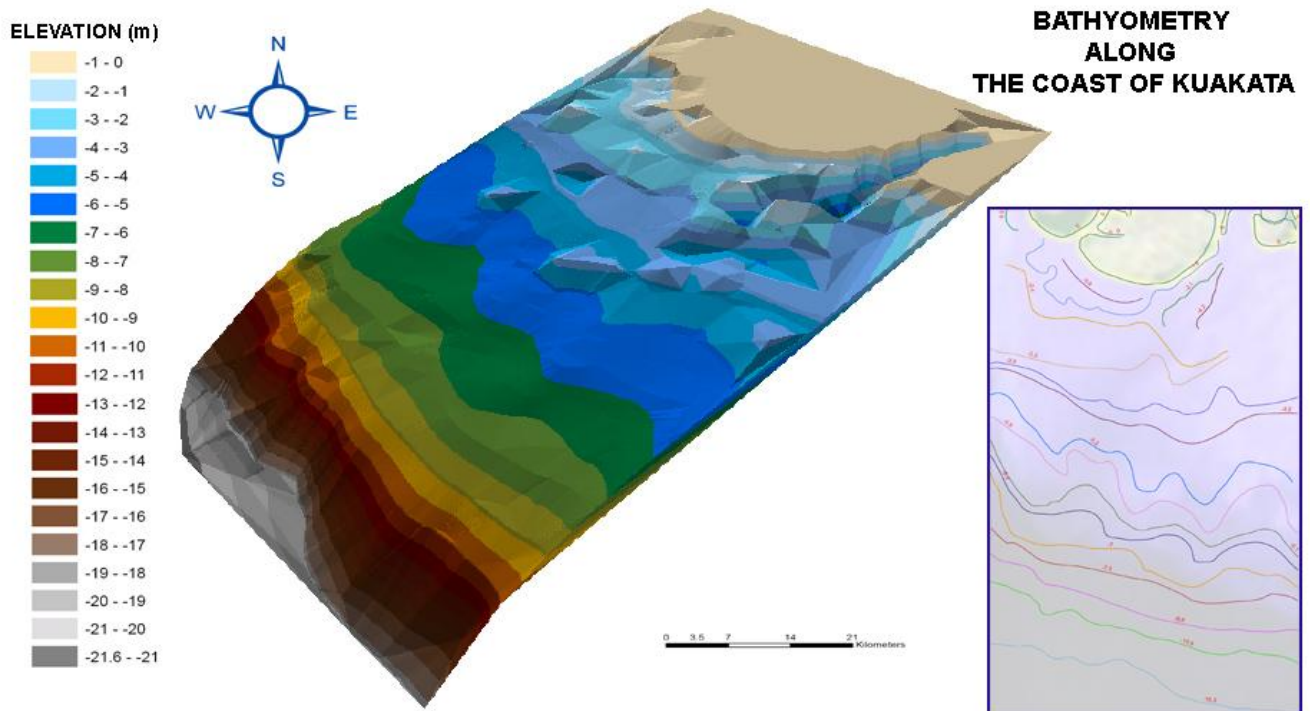


Fig 5 The surface bathymetry of the Bay of Bengal along the coast of Kuakata (3D surface formulation using DEM).
(Source: Bathymetry data from admiralty charts, 1999)

Topographic Survey and Mapping

This study conducts topographic survey to update land level and land use pattern, infrastructure development including drainage and communication networks. The data is collected through state-of-the-art equipment like DGPS. The data is processed through professional software. The result is presented in the form of topographic as well as landuse maps for further investigation.

Output: The diversification in sand dune size, shape and position expresses the multiplicity of nature in that small region. But at the same time their identical composition expresses the generality of natural processes. The migration of the dune narrates the power of processes which takes place within that ecological system. Seasonal variability of climatic effect plays a major role in chronological change of the whole sand dune system in that locality. With variety of floral species dominating by *Ipomoea Prescraprae*, *Croton Bonplundianum*, *Calotropis Gigentea* (zoophyte plant), *Datura Metal* and *Glycosmis Pentaphyla*, sand dunes have different ecological settings.

Aeolian transport of sand is most pronounced during pre monsoon. Dry condition at late winter loosen sand grains on the dune crests for wind transport, and the sand blowing down lee side slopes forms secondary sand mounds often with flat crest. The median grain-size varies between 0.125 and 0.5 mm have the dominance in dune creation.

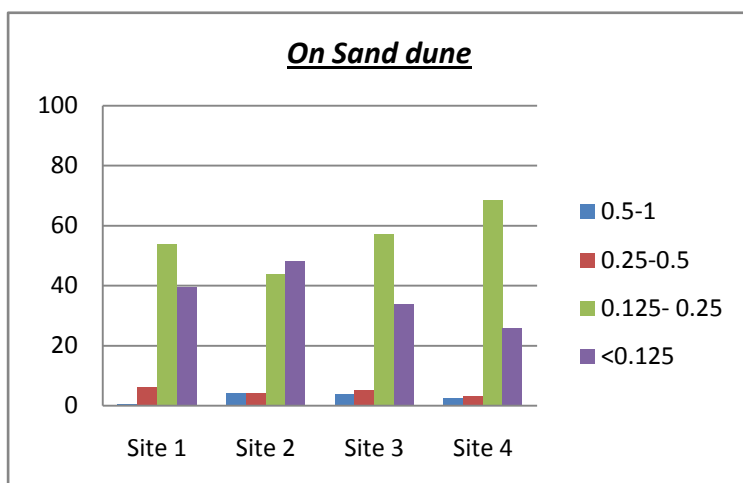
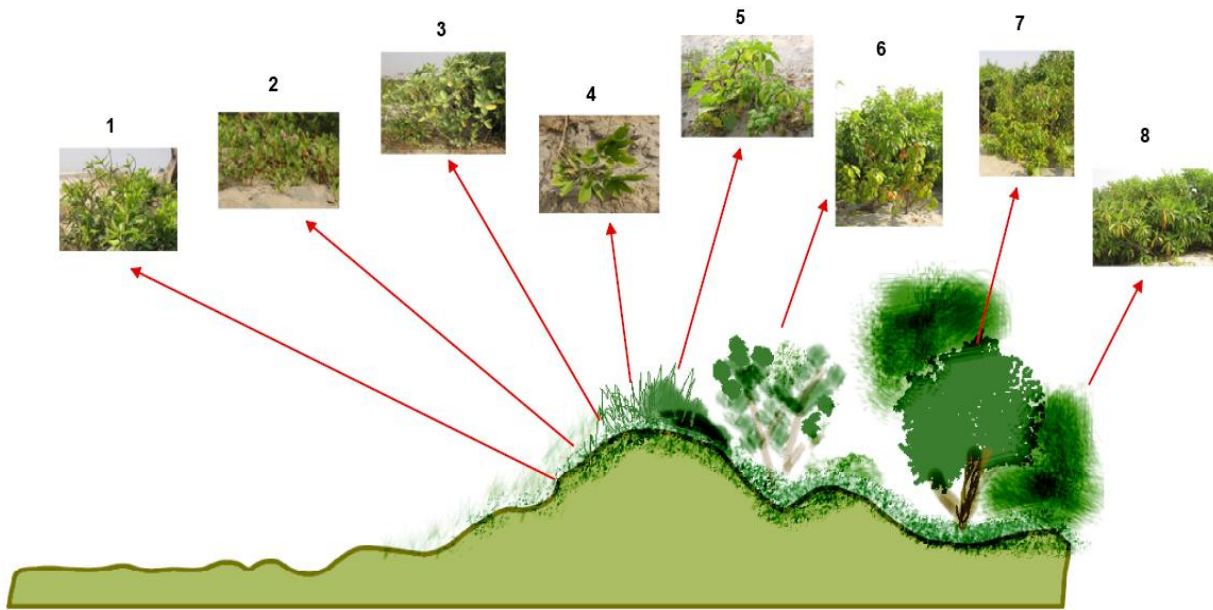


Fig 7 The diagram shows the percentage of sand particles on sand dune of different size (according to USDA classification) at four sites.



1 = *Croton Bonplundianum*
 2 = *Ipomoea Prescraprae*
 3 = *Calotropis Gigantea*
 4 = *Glycosmis Pentaphylla*

5 = *Datura Metal*
 6 = *Exocaria sp.*
 7 = *Syzgium sp.*
 8 = *Alstonia Schoralis*

Fig 6 Bio-geographic profile of Kuakata sand dune. This profile is the general slope analysis for vegetational zonation in dune system.

The irregular shaped particles i.e. angular and sub-angular aeolian materials were mostly found in the dunes as these have deflation surfaces more responsive to wind action. The finest-grained material was found in the parallel dune ridges of the very gently sloping beaches.

The foredunes forming on the coasts of Kuakata are typical transverse coastal dunes, varying in height between 0.5 to 6 m, but usually about 2 m high, and occurring either alone or in swarms, in parallel or partly overlapping. The windward slopes of the foredunes (5°–45°) are usually more gentle than the leeward slopes (15°–35°), but may also be steepened into bluffs by wave or wind erosion. Small embryo or lee dunes may occur on the beach. Active slip faces have been formed leeward of the most trampled blow-outs. Broad deflation flats are dotted with separate hummock dunes.

The most important factor affecting beach development regionally is the grain-size of the source material, which controls the steepness of the beach. The beach profile in turn affects the characteristics of the approaching waves, which may be either eroding or accumulating. The beach slope affects the breadth of the sandy flats that are left above the water level at times of low water, and thereby the supply of sand for aeolian transport. The beach slope also affects the moisture content of the soil, which in turn regulates the development of the vegetation.

Conclusion: In sand dune formation, function of the processes (marine, fluvial and aeolian) have been appraised from secondary data of tide, wave, wind, and rainfall and soil condition. The role of the surface topography and eco-environment on sand dune formation have been investigated from bathymetry chart of the Bay of Bengal, detail coastal topological map (FINNMAP), Google image and Landsat and Modis satellite image interpretation. In addition to field investigation and laboratory work, model analysis has been implemented for projecting dune system development.

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Some Common Books on Coasts

1. Pethick, J. 1986, An Introduction to Coastal Geomorphology. Edward Arnold (Australia) Pty Limited. Pages 256, Chapters 12.			
Includes:	Introduction, Waves, Wave-induced currents, The tides, Coastal sediments. Beaches, Coastal sand dunes, Tidal land forms: mud flats and salt marshes, Estuaries, Cliffs and shore platforms, Coast geomorphology and sea-level, Applied coastal geomorphology	Comment:	A very good fundamental book Recommended for students
2. Boaden, P.J.S. and Seed, R. 1993, An Introduction to Coastal Ecology. Chapman & Hall, London, UK. Pages 213, Chapters 11.			
Includes:	The coastal environment, The neritic province, Life on rocky coasts, Life in sediments, Brakish-water environment Coral reefs, Marshes and mangroves, Other coastal habitats, The Inshore harvest, Coastal birds, Coastal management.	Comment:	A very good book on coastal ecology
3. French, P.W. 1997, Coastal and estuarine management, Routledge, London. Pages 248, Chapters 7.			
Includes:	Introduction to estuarine and coastal systems, The physical regime of coasts and estuaries, Land claim and coastal defense, The industrial use of coasts and estuaries, Coastal development for tourism, Causes of indirect impacts on the coast, Management frameworks for coastal and estuarine systems.	Comment:	Very good book, Recommended for coastal manager
4. Rafaelli, D. and Hawkins, S. 1997, Intertidal Ecology. Chapman & Hall, London. Pages 335, Chapters 8.			
Includes:	The shore, Environment: major gradients, Patterns of distribution, Causes of Zonation, Community dynamics, Coping with the physical and biological environment, The shore as a system, Human impact on the shore, Studying shore.	Comment:	Very good book on intertidal ecology.
5. Islam, M.S. 2001, Sea-Level Changes in Bangladesh: The Last Ten Thousand Years. Asiatic Society of Bangladesh. Dhaka, Bangladesh. Pages 183, Chapters 10.			
Includes:	Introduction, The coastal environment of Bangladesh, The bay of Bengal, Sea-level changes: A review, Method of reconstruction, Palaeo-environmental records of Bangladesh: site one, Palaeo-environmental records of Bangladesh: site two, Reconstruction of Holocene sea level changes, Implication of the Holocene sea level changes: a discussion, Summary and Conclusion.	Comment:	Research book on Holocene sea-level changes Recommended for Sea-level researchers
6. Dean, R.G. and Dalrymple, R.A. 2002, Coastal Processes with Engineering Applications, Cambridge University Press, South Africa, Pages 471, Parts 4, Chapters 6.			
Includes:	Overview, Sediment characteristics, Long-term processes, Tides and storm surges, waves and wave-induced hydrodynamics, Field measurement techniques and analysis, Equilibrium beach profiles, Sediment transport, Miscellaneous coastal features, Modeling of beaches and shorelines, Beach fill and soft engineering structures, Hard engineering structures, Tidal inlets, Shoreline management.	Comment:	Recommended for coastal engineers

7. Haslett, S.K. 2003, Coastal Systems. Routledge, USA and Canada, Pages 215, Chapters 6.

Includes:	Coastal systems: definitions, energy and classification, Wave-dominated coastal systems, Tidally-dominated coastal systems, River-dominated coastal systems, Sea level and the changing land-sea interface, Coastal management issues.	Comment:	Excellent book to understand various coastal systems.
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8. Kay, R. and Alder, J. 2003, Coastal Planning and Management, Spon Press, London, Pages 371, Chapters 6.

Includes:	Introduction, Coastal Management issues, Concepts of coastal planning and management, Major coastal management and planning techniques, Conclusions and future directions.	Comment:	Very good
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9. Woodroffe, C.D. 2003, Coasts: form, process and evolution. Cambridge University Press, New York, USA. Pages 617, Chapters 10.

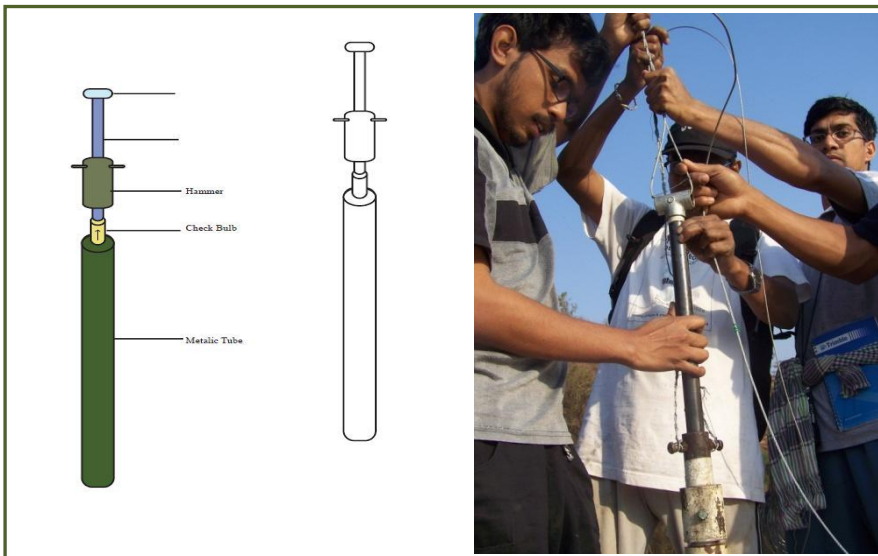
Includes:	Introduction, Geological setting and materials, Coastal processes, Rocky coasts, Reef coasts, Beach and barrier coasts, Deltas and estuaries, Muddy coasts, Morphodynamics of coastal systems, Human activities and future coasts.	Comment:	Excellent book on coast.
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Compiled by: Mahmuda Islam

PEARL OF THE SHELL

CRU Innovation: Low Cost New Boring Device for Lake Sediments

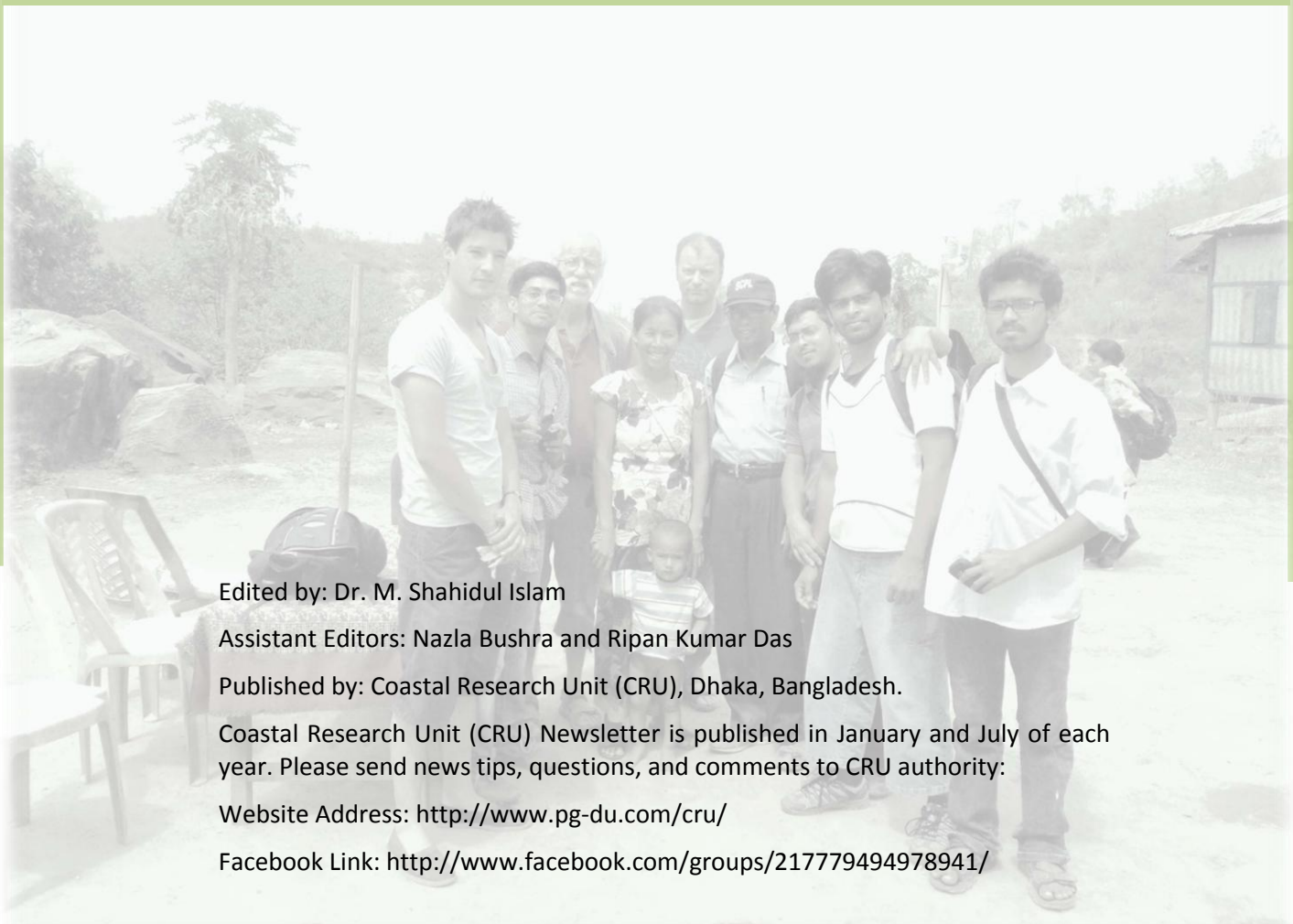
Sediment collection from deep lake floor requires special coring device. Such device was not available to CRU team. Considering this limitation, CRU team started to design a device using locally available technology. The device includes a rod (handle) fitted with a moveable hammer to operate from a floating platform. At the lower end of the rod, a metal tube of 5 cm diameter and 1 m long can be fitted, which is kept airtight by a check-bulb during its pulling stage. The making coat of the device is less than TK 7000.



Boga Lake



Bogalake at Bandarban in Bangladesh is the highest hill-enclaved lake of Bangladesh at 1216 ft above the sea level. Neither any stream falls in it, nor any stream goes out, but it never dries up. The Bogalake is located in the west of the Keokradang peak, the highest peak of the country. It is parallelogram in shape and quite deep. The lake is surrounded by hill on its three sites. In 2004 Dr. M. Shahidul Islam and his team for the first time surveyed the depth of this lake. According to that survey the maximum depth of this lake is 35 m. Recently, he and his team has completed a research on Palaeo-monsoon Reconstruction based on sediment collected from the Bokalake.



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