



Field validation of the Water Demand Model of DRAS being conducted. (See page 3 for details)

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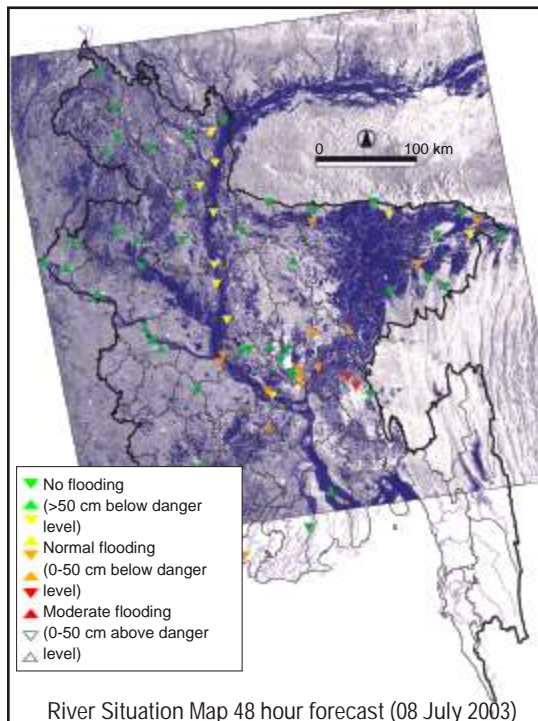
### Monitoring of the flood situation

CEGIS is monitoring the current flood situation in the country.

Continuous heavy rainfall and upstream inflow has caused flash floods in different parts of the country. Places like Bogra, Dinajpur, Comilla, Moulvi Bazar, Dhaka, Bandarban etc., have experienced more than 200% rainfall above the average year situation in the 3<sup>rd</sup> decade of June. Moreover, the Jamuna, Padma, Old Brahmaputra, Surma and Kushiara flowed above their respective danger levels for periods varying from 1 to 20 days. Numerous rivers in many parts of the country also have been experiencing moderate to severe flooding over June-July.

The image below of the flood situation up to 10 July 2003, is derived from an analysis of RADARSAT images and hydrometeorological information. RADARSAT SCW and SN2 images, covering 80% of the country, were acquired on 28 June and 05 July. Hydro meteorological data were also collected from the Flood Forecasting and Warning Centre (FFWC).

The RADARSAT images were classified to determine the open water extent. The area of open water calculated from 05 July image is about 28,94,500 hectares. The 48 hour water level forecasting data of 08 July, collected from FFWC, was analyzed and overlaid on the classified image to produce a river situation map.



### CEGIS signs new contract with RNE

CEGIS signed a new contract with the Royal Netherlands Embassy (RNE) for the period July 2002 to June 2003 for funding for the organization's core activities. RNE has been CEGIS' biggest donor since the time of its predecessors, EGIS I and II and continues to be so even today. The agreement was signed for CEGIS to work along the lines of a work plan finalized between the two parties.

The contract covers core support in four areas:

- Support to WARPO – comprising activities in Analytical Framework for IWRM, drought classification, flood and erosion monitoring and National Water Resources Database, etc.
- Public Interest Activities – comprising work on drought classification and flood level calibration, as well as CEGIS' technical support to the Joint Rivers Commission.
- Research and Development – related to integrated analysis, monitoring, database and spatial analysis, etc.
- Training – in areas such as EIA and GIS courses, Fish GIS, and ArcGIS courses, etc.
- CEGIS general activities – i.e., administrative and logistics support

Negotiations are underway for drawing up a contract for the next two years, i.e., 2004-2005.



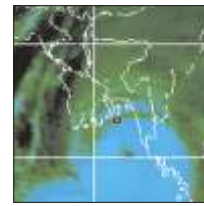
Seen in the picture Mr. Jan A. Maas, Chargé d'Affaires, a.i. RNE and Dr. Riaz Khan, Executive Director, CEGIS

### Technical workshop on validation of DRAS model

A technical workshop was recently held (15 June) at the CEGIS premises, where discussions were held on undertaking water management experiments at the BRRRI campus in Gazipur. The experiments are to be undertaken for the purpose of validating the Crop Water Demand Model of DRAS (Drought Assessment Framework). The workshop participants representing BRRRI, WARPO and CEGIS have decided that five irrigation treatments will be run for both T.Aman and Boro to validate the model.

The experiments will be undertaken jointly by BRRRI and CEGIS.

# 2



## World Environment Day observed

The World Environment Day observed every year on 05 June was celebrated this year by CEGIS along with many other organizations in the country. This year's theme was 'Water: two billion people are dying for it.' A three day long fair was organized by the Department of Environment at the Osmani Memorial Hall in Dhaka.

Various organizations, including GoB agencies, NGOs and other development organizations as well as educational institutions participated at the fair by setting up stalls and attending seminars and discussions. The seminars addressed a wide range of topics like *Water and Climate, Water Diversity, Safe Water, and Right to Use Water.*

CEGIS had its own stall at the fair where posters and publications on its activities as an organization working in the field of environment were displayed. The CEGIS newsletter was handed out to visitors at the stall. There was also a 50% discount on all CEGIS publications purchased on the occasion.

## CEGIS participates in the Conference on Braided Rivers, 2003

CEGIS participated in a Conference on Braided Rivers held at the University of Birmingham, UK between 07 to 08 April, 2003. CEGIS' Morphologist Maminul Haque Sarker presented a paper on "Morphological Evolution of the Brahmaputra-Padma-Lower Meghna Braided River System" authored by himself and Prof. Colin R. Thorne of the University of Nottingham, UK. The paper reports the morphological evolution of the system during the last 5 decades. It describes the morphological responses to the propagation of sediment waves generated by the 1950 Assam earthquake. The earthquake caused 50 billion m<sup>3</sup> of landslides most of which was destined for the Brahmaputra River through its numerous tributaries. Another paper was presented by Prof. Colin Thorne on "Bankline Shifting and Planform Evolution of the Braided Jamuna River, Bangladesh". The co-authors were Maminul Haque Sarker and Iffat Huque of CEGIS and Salam Sikder of RRI. Maminul Haque Sarker also presided over one of the technical sessions of the conference.

## CEGIS participates in ASPRS 2003 Annual Conference

CEGIS participated in the May 2003 Annual Conference of ASPRS (American Society for Photogrammetry and Remote Sensing). Ahamadul Hassan and Iffat Huque of CEGIS attended the conference. This year's conference, hosted in Alaska, had the theme 'Technology: Converging at the Top of the World'. The event included key note and educational sessions, workshops, and an expanded technical program on imaging and geospatial information. The technical program was one of the largest ever offered at an ASPRS Annual Conference with 450 technical papers and posters from over 30 nations.

CEGIS participated in one of the special sessions at the conference to present a paper on a comparative study: 'Mapping the Monsoon Landuse/ Landcover in Bangladesh using RADARSAT-1 and ERS-2 Images'. The study had been conducted under EGIS II by Dr. Khaled Hasan, Quazi Khalid Hassan, and Iffat Huque. Dr. Hasan who presented the paper at the conference is currently a visiting Asst. Research Professor at the University of Mississippi, U.S.A.



## CEGIS to carry out morphological predictions and landuse mapping for JMREMP

In May 2003, CEGIS entered into an agreement to carry out morphological predictions and landuse mapping from remotely sensed satellite images for the Jamuna Meghna River Erosion Mitigation Project (JMREMP). This ADB financed seven-year project aims to take up cost-effective bank protection measures to protect the Pabna Irrigation and Rural Development Project and the Meghna Dhonagoda Irrigation Project (MDIP) areas from erosion caused by the Jamuna and Meghna rivers, respectively. An interim phase is currently being implemented before the main project begins.

CEGIS had earlier made morphological predictions for the Jamuna River around the PIRDP area under a contract from Halcrow and Partners, Ltd. Predictions were also made for the Padma and Lower Meghna rivers upon request from a mission of the Royal Netherlands Embassy for assisting BWDB in taking up measures for protecting the Chandpur Town. Under the present contract, CEGIS will evaluate the previous predictions and make predictions for the next year. An assessment will be made of the influence of the Hurasagar River on the morphological developments of the Jamuna River around its out-fall. Satellite images will be used to prepare landuse/landcover maps for the Rabi and Boro seasons in and around the MDIP areas.

## CFAB seasonal work plan

A Steering Committee meeting held on 20 May 2003 finalized a seasonal work plan of the Climate Forecast Applications in Bangladesh (CFAB). As per the work plan, PAOS (Atmospheric and Oceanic Sciences) is to deliver forecast on a daily basis from 15 June to 10 September, 2003. A training workshop on the use of CFAB products is also proposed in the work plan. Before September, a web based interactive system would be developed to establish a forecast information dialogue between PAOS and Bangladesh partners. FFWC is to provide daily discharge and water level data to PAOS on a daily basis to validate the prediction model.

Forecast dissemination will be done in two steps. PAOS will first send it via email to FFWC and BMD who will evaluate and customize the forecast to cater to the needs of the primary users, i.e., DAE and DMB. These two will then take the appropriate measures to use the information. The forecasts will also be posted on the CFAB website as soon as they are ready.

In June, a meeting of the CFAB focal group was also held to: i) select pilot areas for the dissemination of forecast information at community level; ii) customize the flood forecast model with CFAB forecast and develop dissemination models; and iii) package the forecast data for DAE, DMB and others. The selected thanas are: Chowhali, Sirajganj (flood prone area); Tanor, Rajshahi (drought prone area); Ganges-Kobodak Project, Kushtia (drought prone area with mixed cropping); Nagorpur, Tangail (flood prone area with mixed cropping).



## The DRAS model: application in drought assessment and management

CEGIS has launched two projects, one at the upazila and another at the national level, on the application of DRAS for drought assessment and management with assistance from the Government of the Netherlands. In this connection, two workshops were held on 13 and 15 January, 2003 at the CEGIS premises with the aim of explaining the computational framework of the model to the participants along with the objectives of the projects, plan of action, and transfer of technology to various users (planners, research scientists, extension workers, and farmers). Presentations were made on comparative location specific information derived from the models on current and future crop water demand as well as water availability from both surface and ground water sources. It was also explained how the farmers at the grassroots will be benefited from the application of DRAS.

Participants at the workshops included professors, scientists, and officials of WARPO, BWDB, BARC, DAE, BRRI, BARI, SRDI and Dhaka University, who presented technical papers on their own initiatives for drought management. CEGIS will be considering these initiatives in the implementation of the DRAS model.

Several recommendations emerged from the workshops that were mostly related with model validation and improvement with updated data on soils, crops, and water. To validate the model results in the field a joint research team from CEGIS, BRRI, BARI and other organizations was also recommended.

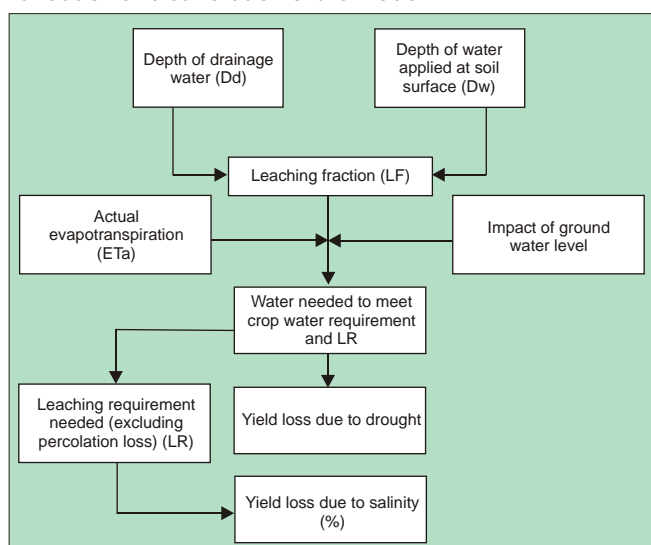


Validation of the Crop Water Demand Model being carried out in the field

### Salt Model Development

CEGIS has started computational procedures of salt model development with data on soil and water salinity, and crop and hydrology in Batiaghata and Sudhampur thanas, which are located in salt affected coastal areas.

The model can be used to calculate the leaching requirements and yield loss due to salinity and drought. The main computational processes are the same as in the crop water demand and yield reduction model of DRAS; only the computed leaching requirement has been incorporated into the water balance equation. Soil and water salinity and crop data are being regularly collected from these pilot study areas for validation and calibration of the model.



Structure of the salt model for drought assessment in the coastal areas

This exercise of developing a salt model is important as a vast area in southern Bangladesh is salt affected, adding to the country's vulnerability to drought. Unless a separate module for salt affected soils is incorporated into the DRAS, the degree of drought vulnerability cannot be assessed for the coastal areas.

## Analytical instruments at CEGIS

Analytical instruments are required to evaluate the effects of alternative water management, land use, climate change, population growth, economic development, etc. The tools that are available at CEGIS for supporting the planning process in Bangladesh are:

- ❖ *The Oracle Database*: A well developed database, with approximately 300 layers of information in GIS and a large collection of hydrometric data.
- ❖ *ArcView*: Used to perform most data processing at CEGIS to support various model applications.
- ❖ *Stream-GBM*: The Ganges-Brahmaputra-Meghna (GBM) catchments model is based upon a simplified description of hydrology in large river basins.
- ❖ *Stream-Spial*: The SPatial Integration of Hydrological monitoring and Remote sensing Applications is a framework for water resources planning focusing on the use of remote sensing techniques.
- ❖ *Water Balance Model*: Consists of a lumped description of the processes of rainfall, evapo-transpiration, surface storage and run-off, infiltration, soil storage, deep percolation and base flow.
- ❖ *River bank erosion model*: A rule based tool which predicts the behavior of river bank erosion as a result of interventions.
- ❖ *Drought Assessment Model*: Consists of two components: the Water Availability Assessment Model and the Crop Water Demand and Yield Reduction Model, both focusing on natural drought conditions and conditions under supplementary irrigation.
- ❖ *Shrimp crop DSS*: An Excel based tool that uses GIS and salinity information to produce economic and social decision support indicators for land use management strategies.
- ❖ *Nijhum Dwip integrated development project. DSS*: An Excel based model that uses GIS information as well as description of physical measures and socio-economic assumptions and scenarios to transform these into benefits and costs.

# 4



## CEGIS in Third World Water Forum

CEGIS participated in the Third World Water Forum held in Kyoto, Japan in March this year. More than 24,000 participants from 182 countries attended the event. CEGIS was one of the 27 members in a team of 'Government delegates' headed by Engineer L.K. Siddiqi, Hon'ble Minister of Water Resources, Government of Bangladesh, representing both Government and non-governmental organizations from Bangladesh.

The Bangladesh session 'Bangladesh towards Integrated Water Resources Management (IWRM) and Basin Management' jointly organized by WARPO and BWDB was held on 21 March, 2003. Altogether eight papers were presented in the session describing the approach, strategy and plan that Bangladesh has come up with for the development of water resources.

The papers were, 'Bangladesh: Road to Integrated Water Resources Management (IWRM)' describing the key issues and challenges the country now faces; 'Community Participation in Water Management in Bangladesh' presenting how the 600 flood control and irrigation projects in Bangladesh have changed its land use pattern; 'State of Water Resources in Bangladesh' describing the present status of the country's water resources including floods, water availability, flood forecasting system etc.; 'Bangladesh and the Transboundary Water Issues' discussing the transboundary problems and conflicts related to water; 'Case Study of Impact of Climate Change in a Selected Coastal Area of Bangladesh Estuary Area of Noakhali: Char Elahi (Companiganj Thana)'; 'Water and Climate' stressing upon the various issues for the adaptation of climate change to global water resources management and social livelihood; 'Urban Water Supply and Sanitation Services in Bangladesh'; 'Rural Water Supply: Bangladesh Context' projecting the water supply situation and the challenges of arsenic in the ground water based water supply system in Bangladesh; and 'Arsenic Contamination of Ground water in Bangladesh'.

## Activity Update

**Surface and ground water interaction:** During the last six months, the CEGIS team has significantly improved the Concept Paper on surface and ground water interaction on salinity. The Concept Paper has been shared with local experts from universities and consulting firms. An informal consultation session was organized where the CEGIS team made a presentation. The main objective of the session was to critically review the project concept and determine achievable objectives with a limited time frame. The Concept Paper is now being finalized based on the feedback and suggestions from the consultation session. An inception report is to be brought out before embarking upon project implementation.

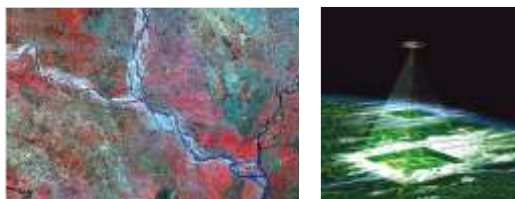
**National Drought Vulnerability and Damage Assessment:** Work on validating the Crop Water Demand Model of DRAS (Drought Assessment framework) has been continued during this period. The RRA approach was used to validate the model in four thanas. Monitoring activities have been carried out to validate the model for the Boro crop in Jessore and Manda thanas. An interim report on field and model results is currently being prepared. Collection of field data continues for the development of the salt model in three salt affected coastal areas, and a database on soils, climate, crops, irrigated areas and surface and ground water has been developed for four thanas in the south west region. So far the database contains information on 50 thanas.

**Establishment of Ground Control Points (GCP) Data Bank:** The GCP Databank has been designed to establish a well-organized national-level archive based on 6m resolution IRS images, and to develop a software for efficient use of GCPs (query, extraction, accuracy, etc.) for georeferencing satellite images and GIS data layers. A base information map is being prepared since 2000 in the form of an IRS image mosaic. About 70% of the images has already been procured and around 30% of data collection has been completed. A framework for the software has also been developed and 50% of its design has been completed. The software will have the following options: a) Spatial Query; b) Attribute Query; c) Frame-wise Query; and d) Image-wise Query.

Sample output of GCP

GCP ID	X	Y	UTM Zone	Date
000001	481000	165000	48Q	11/01/2003
000002	482000	165000	48Q	11/01/2003
000003	483000	165000	48Q	11/01/2003
000004	484000	165000	48Q	11/01/2003
000005	485000	165000	48Q	11/01/2003
000006	486000	165000	48Q	11/01/2003
000007	487000	165000	48Q	11/01/2003
000008	488000	165000	48Q	11/01/2003
000009	489000	165000	48Q	11/01/2003
000010	490000	165000	48Q	11/01/2003

Interface and output of the GCP Databank software

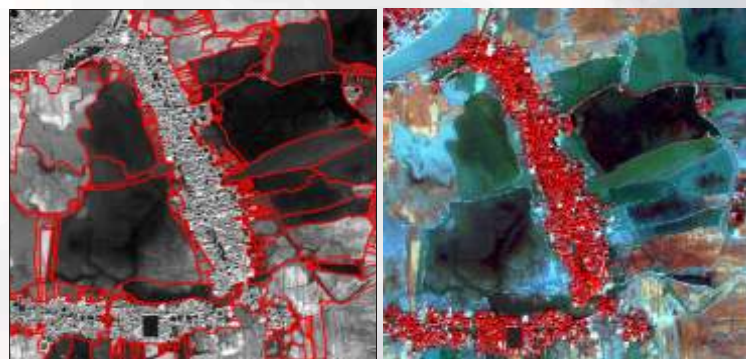


## Training course schedule (July-December 2003)

CEGIS offers courses on environment impact assessment, spatial analysis and special skills development (see table for schedule). Four new courses currently being developed are IWRM, Arc-GIS, Geo-spatial and Image Processing. CEGIS plans to develop joint and accredited courses with national and international academic and training institutes on its areas of specialization.

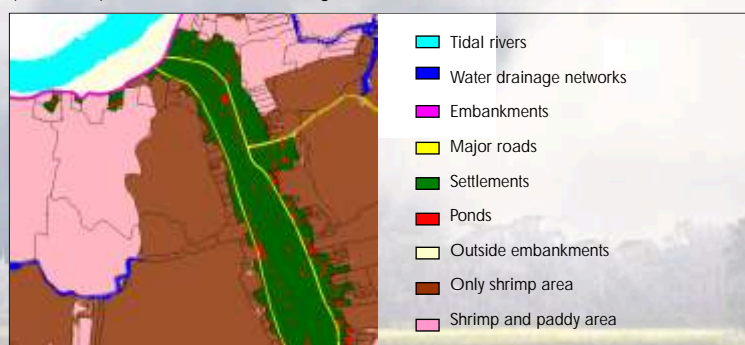
Course title	Schedule
<b>Natural Resources Management:</b>	
EIA Reviewers' course	October 2003
Integrated Water Resources Management (IWRM) course	December 2003
Environmental Awareness Program	August, October 2003
<b>Spatial Analysis and Database Management:</b>	
ArcView GIS course	August, December 2003
ArcView Spatial Analyst course	September 2003
<b>Special Skills Development:</b>	
Advanced presentation course using Microsoft Powerpoint	August 2003
Computer Graphics	December 2003
Web Page Development	July 2003

## Application of High Resolution Satellite Images over the Coastal Zone



**Figure 1:** Extracted shrimp farm boundaries (red colour) shown over IKONOS image

**Figure 2:** IKONOS multi-spectral image



**Figure 3:** Sample land use map over a part of the study area

CEGIS has recently conducted a pilot research study on the development of a spatial database for Polder # 23 at Paikgachha in Khulna. Over the past years, many studies have been conducted in the coastal areas of the country for better understanding, planning and management of aquatic resources. Since 1980, shrimp cultivation has been popular along the 500 km of the country's coast line. The impact of shrimp farming on the environmental condition of the region is a major concern and needs extensive research. In order to address the problem, the 'Aquatic Resources Development, Management and Conservation Studies' one of the on-going projects funded by the Global Environmental Funding Agency, was initiated. The pilot research study fell under the scope of this project.

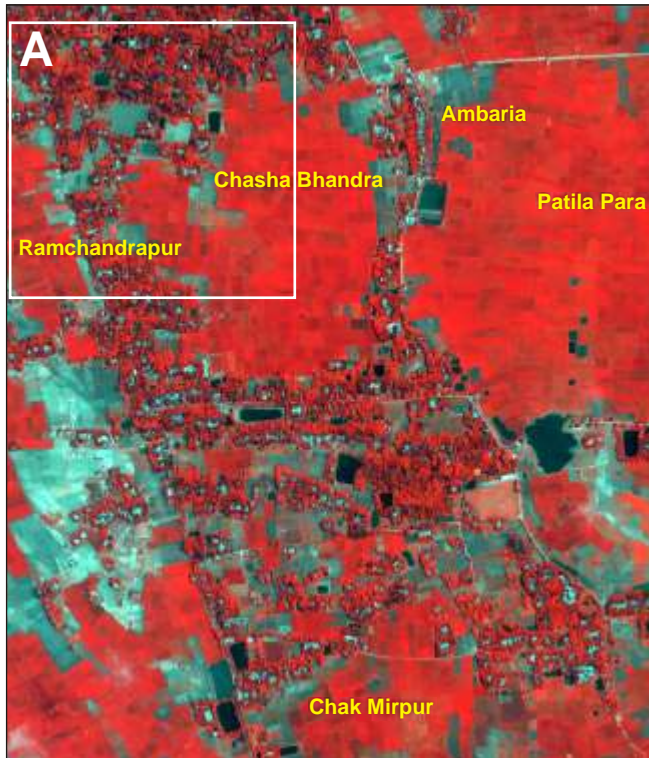
The study focused on the use of high resolution satellite images to generate information on shrimp farming and cropping practices. It had two components: one was the delineation of shrimp farm boundaries, and the other was the generation of land use maps. The IKONOS panchromatic and multi-spectral images of spatial resolutions of 1 meter and 4 meters, respectively, were used here. These satellite images were georectified using ground control points (GCP) surveyed by a Differential Global Positioning System (DGPS). The images served as a base map and were used for extracting shrimp farm boundaries and generating the land use maps.

Digital image processing techniques were used to extract the shrimp farm boundaries and land use maps. GIS techniques were also used for the extraction of the shrimp farm boundaries. *Figure 1* presents the extracted shrimp farm boundaries over an IKONOS panchromatic image. *Figure 2* presents the IKONOS multi-spectral image, which was used for land use mapping in conjunction with the IKONOS panchromatic image. For land use mapping, the targeted classes were: tidal rivers, water drainage networks, only shrimp areas, shrimp and paddy areas, homesteads, ponds, major roads, embankment-cum-roads, etc. *Figure 3* presents a sample land use map over a part of the study area.

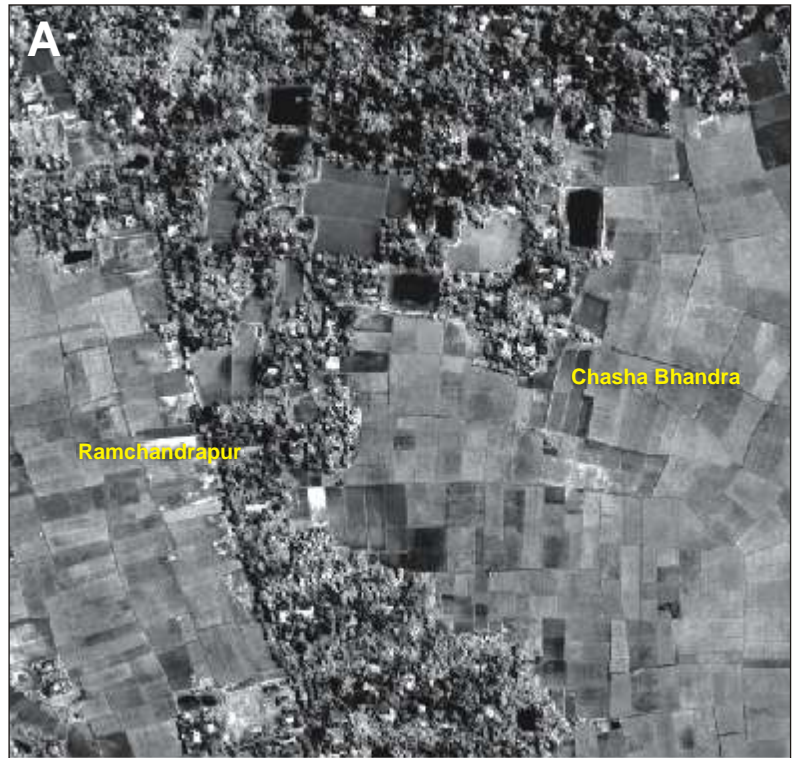
The findings of the research shows promising results with regard to extracting various features from high-resolution images at local level and could be implemented in other areas for generating and/or updating spatial databases.



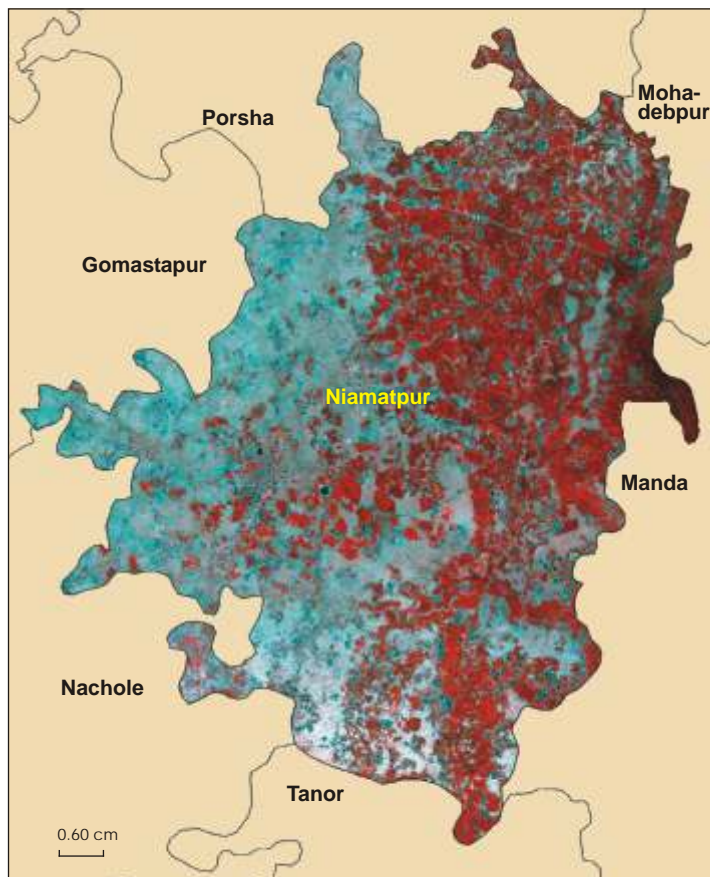
## Satellite Images processed by CEGIS



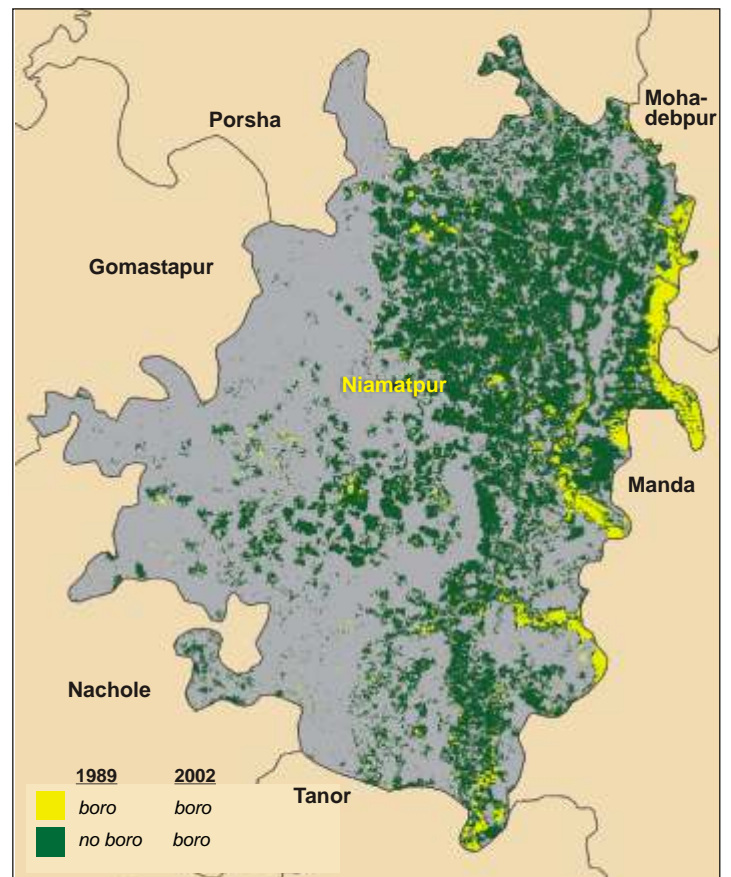
Quickbird multispectral image, Date: 03 April 2003, Resolution: 2.4 m  
Location: Daulatpur Thana, Manikganj District



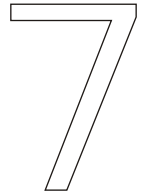
Quickbird panchromatic image, Date: 03 April 2003, Resolution: 60 cm.



Landsat ETM+ image of 13 April 2002 of Niamatpur Upazila of Naogaon District



Map showing change in area under Boro crop between 1989 - 2002 derived by digital image processing of Landsat TM and ETM+ images of 1989 and 2002 respectively



## Tidal River Management: A sustainable solution to drainage congestion in the coastal region of Bangladesh

The *Khulna-Jessore Drainage Rehabilitation Project (KJDRP)* is one of the various on-going efforts to relieve the problem of drainage congestion in the coastal region of Bangladesh. The project aims to solve the problem of water logging and drainage congestion in about 100,000 ha of the region covering a population of approximately one million. The KJDRP area became water logged in the 1980's due to a gradual siltation of the rivers, which started after the construction of a number of BWDB polders in the early 1960s.

Under KJDRP, studies and reviews (covering technical, social, institutional and environmental aspects) were initiated to define programs and strategies for interventions in order to relieve the project area from drainage congestion. To name a few: an engineering study was done by Haskoning and Associates in 1993; a sociological study was undertaken by the Bangladesh Institute of Development Studies - BIDS in 1994; and an Environmental and Social Impact Assessment (EIA/SIA) was executed by EGIS in 1998. Based on this accumulated knowledge, SMEC drafted an "Overall Drainage Plan" in April 1998. In this plan, a range of activities and interventions were identified and assessed in technical and financial terms. Implementation of the plan began in 1998 and was completed by the end of 2002. Since then CEGIS has been entrusted with the responsibility of monitoring the consequent environmental, socio-economic and institutional developments.

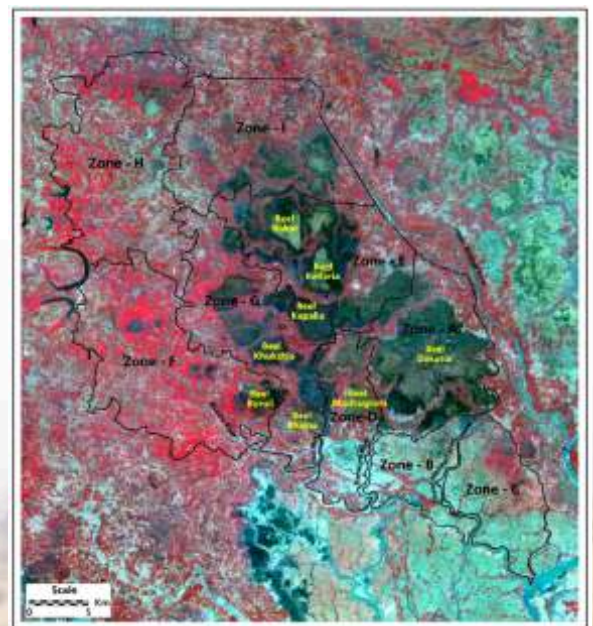
**The Drainage Plan:** One of the important concepts adopted in the plan is tidal river management which allows rivers to remain free from sedimentation through re-establishment of natural tidal processes. The concept was advocated by the local people as a sustainable solution to the drainage problem and was accepted by the project authorities. The execution of the drainage plan has brought relief to the project area from water logging and drainage congestion. The water area now stands at only 7% compared to 26% in 1997 during the critical months of the dry season. Livelihood opportunities related to agriculture and fisheries have increased and have had a positive influence on the poverty situation. Important components of the drainage plan are regulators, cross-dam, river dredging and a Tidal River Management (TRM) concept.

**The Tidal River Management (TRM) concept:** Intensive consultation with local people and NGOs yielded the concept of a tidal basin as an alternative to a regulator approach. The concept is that beels are to act as tidal storage basins which allow natural tidal flows up and down in the river system. During high tide, a large volume of water flows into the beels and huge sedimentation occurs in the beel area. The sedimentation occurs in the riverbed if the beels are not utilized for storage. This tidal storage basin keeps rivers alive by maintaining tidal flow characteristics in the downstream river system and thereby preventing silt deposition in the river bed. This is in fact a natural water management process with very little human intervention. However, it needs strong participation and consensus along with a great deal of efforts by the stakeholders for a specific period (3 to 5 years or even more depending on the tidal volume and the area of the beel).

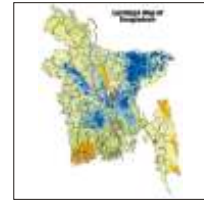
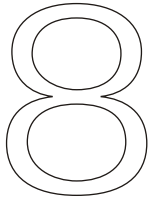
Since the operation of the BBtb and the Beel Kedaria tidal basin (BKtb), the TRM concept has proven to be applicable in the coastal areas. The high tidal volume generated by the BBtb increases the flow area of the Hari River in the downstream of the basin. The riverbed deepens about 10 m more than the design level, and the river widens as well by eroding both its banks. A comparison of the long profiles of the Hari and Upper Bhadra rivers before and after the BBtb shows the existing bed levels and design levels to be 1 to 3 m deeper than before the BBtb.

**Sedimentation in the tidal basin:** Both sedimentation and sediment distribution in the tidal basin are important aspects in the TRM. Sedimentation determines the life span as well as the rate of rise of the land topography of the basin. The recent operation of the BKtb has allowed the tidal volume and sediment to enter into the basin. Sedimentation in the riverbed may cause drainage problem for the upstream basin. It is therefore strongly suggested to exclude the riverbed from the tidal basin and to use the concept of compartmentalization for sediment management and for preventing drainage congestion.

**Changes in land use and poverty level:** Changes in land use are being monitored by CEGIS through analyses of satellite images. There has been considerable improvement in the drainage situation since 1997. The area under agricultural crops has increased with potential for further improvement in the situation. Improvement in livelihood opportunities including agriculture and fisheries have influenced the poverty situation positively. The poverty ratio stood at 53% in 2002 compared to 75% in the pre-project condition.



Satellite image of the KJDRP area, of March 1997



## CEGIS' services in Spatial Database Systems

CEGIS provides the following services in the area of database design and management:

**Systems design:** Services in the area of systems design for database management include applications and user needs assessment; software, hardware and platform identification; and network, software and hardware installation and configuration.

**Data capturing:** CEGIS has experience with capturing data, one of the most important aspects of building a GIS database, from available data sources including digital and hardcopy satellite images, aerial photos, hardcopy maps, and field surveys.

**GPS survey:** The Global Positioning System (GPS) is one of the primary methods to accurately capture positional data. CEGIS uses GPS surveys to geo-reference existing hardcopy maps, satellite images and aerial photos. It also provides consultancies in identifying optimal survey methods.

**Database development:** CEGIS has extensive experience in database structure design and implementation; quality assessment and refinement of existing data for satisfying organizational need; and development of data standards (accuracy, unit, format).

**Application tool development:** CEGIS has been instrumental in the development of such application tools as decision support systems (DSS); monitoring systems and MIS. It also has extensive experience in the customization of various software products as ArcInfo, ArcView and ERDAS for specialized applications; development of tools for data analysis; development of software by integrating common development environments (Visual BASIC, Visual C++) with GIS software like ArcView, MapObjects and database management systems using Visual Basic and SQL Server.

**Metadata:** CEGIS provides support for archiving, documenting and publishing data. Services in this area include assistance in developing data archiving policies; assessing metadata requirements for various types of data; customizing metadata standards for individual organizations; and implementing metadata information systems with specialized software (GeoKey).

**Image processing:** CEGIS provides a wide range of image processing services from optical and RADAR images. These include image mapping; feature extraction, e.g., for roads, rivers and settlements; classification of images for special needs, e.g., for land use and cover; flood mapping and damage assessment; morphological analysis of rivers with time series images.

**Training:** CEGIS conducts specialized GIS and RS software training alone and in collaboration with ESRI South Asia. It is the only authorized PC/ArcInfo training center in Bangladesh. Training is provided on ArcInfo for NT (Core, GRID, TIN, AML), ArcView Avenue, ERDAS Imagine, Visual BASIC with MapObjects, and Internet Map Server.

## Recent arrivals at the CEGIS Library

- ❖ Project Report on SPIHRAL, May 2000
- ❖ Developing and Updating Empirical Methods for Predicting Morphological Changes of the Jamuna River, March 2002 (EGIS Technical Note 29)
- ❖ EGIS Metadata: A pilot study to set guidelines for EGIS Metadata, May 2002 (EGIS Technical Note 26)
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