



**ESRI India**

# Arc India News

**ESRI** India Magazine

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**Interview**

**Dr. C. Chandramouli, IAS**

Registrar General and Census Commissioner of India

**Technical Article**

**New Era of  
Cloud Computing and GIS**



*India's Census  
2011*  
GIS enabling the largest census  
exercise ever undertaken in the world

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Design, Preprint & Production



# From the President's Desk



Over the past several years, there has been a gradual adoption of Geo Spatial information in managing the governance, businesses and everyday lives of citizens.

As the technology keeps advancing in terms of information dissemination, the expectation from the users who seek the information keeps changing.

For example, gone are the days where people were satisfied with printed maps for locating the place where there is a need to travel. Navigation systems which are voice activated and integrated with the transport system are already very common and several new technologies are fast emerging.

GIS has, thus evolved from being a tool used in the labs of researchers to a common element in the day to day lives of common man and the decision makers in the Government and Industry.

The rapid growth in the usage of GIS can be attributed to multitude of factors. Besides the increase in awareness of this technology, the ability of GIS tools to take advantage of various technologies which make the compilation and dissemination of geo spatial information; like the web, mobile devices etc, has played a major role in the widespread usage of geo spatial information.

The fact that most of the users of Geo Spatial information need not be GIS Centric but GIS enabled, has resulted in the adoption of Geo Spatial Technology in the main stream I.T. landscape.

In India, the growth is very visible- many of the agency and government funded programs which are aimed at improving the quality of governance and increasing the transparency of operations to achieve better efficiencies across various areas, like power, urban development, land records, etc, have GIS as a key enabler.

Infact in all these programs, GIS is fully integrated into the I.T. architecture, enabling setting up enterprise wide solutions.

This trend is palpable in other domains as well, thereby, building a strong foundation for the dissemination and usage of Geo Spatial information in day to day operations of various organizations.

One of the challenges that need attention, is the availability of trained GIS professionals, who can harness the power of various GIS tools and make spatial information available to various stake holders and users. Many universities and training centres have now started offering courses and programs in GIS, and this gap is getting closed, though much more needs to be done in this area.

I am confident, that considering the current phase of growth, the vision of "GIS for All" will become a reality, sooner than later.

It is my pleasure to interact with the readers of Arc India news through these columns in my new role as the President and COO of ESRI India, and I look forward to many more interactions in the months to come.

A stylized handwritten signature in black ink, appearing to read 'S Sridhar'.

S Sridhar

President & COO



## ESRI India Welcomes its new President & COO Mr. S Sridhar

NIIT GIS Limited (ESRI India) welcomes the appointment of Mr. S Sridhar as the President and COO to operate from the Corporate Office at New Delhi. Mr. Sridhar will be an imperative part of the top management team and will be responsible for driving the business of NIIT GIS Ltd., both from technology and solutions perspective.

Welcoming the new member to the management team, Mr. Rajesh C. Mathur, Vice Chairman, NIIT GIS Ltd., said, "We are delighted to have Sridhar on board. His broad background with varied industries and his extensive experience with global operations will definitely add a significant value to our service offerings. His understanding of the marketplace and passion for GIS technology are a perfect combination to lead our vision - GIS for everyone and everywhere."

Sridhar is a Mechanical Engineer from University of Madras and has done his Post Graduate in Business Management from IIM Ahmedabad. He brings on the table, rich experience in building businesses across multiple verticals and geographies associated with high-end technologies and solutions, with over 30 years of experience in managing IT, CAD and GIS organizations. He shall supplement the business development by leveraging his extensive experience in handling global business development and delivery operations.

Sridhar most recently was a part of the executive team of Larsen & Toubro Ltd., heading the Integrated Engineering Services Business for their Chennai and Bangalore centres as well as the global operations of major vertical practices. Prior to this he has worked with major IT companies like HCL, Silicon Graphics, Autodesk & Magnasoft.

Commenting on his joining the ESRI India team, Mr. S Sridhar, President and COO, NIIT GIS Ltd. said, "I am extremely excited about the opportunity to build on our GIS capabilities and am pleased to join such a high quality customer centric and GIS Solutions focused organization".



### IN TOUCH 2010:

ESRI India hosted its annual communication get together for employees in the month of June. Popularly known as IN TOUCH program, this event is a time when all the staff members get together and are given a perspective of the future vision of the organization and the last year by the senior management. A series of meetings were organized in Delhi, Parwanoo, Mumbai & Bangalore. For all overseas locations the IN TOUCH program would be concluded in July.

Speaking on the occasion Mr. Rajesh Mathur- Vice Chairman, ESRI India, gave a perspective about the companies last years performance and the future goals set for the organization. Mr. Mathur presented the major highlights of past year. Mr. S. Sridhar presented his thoughts on the road ahead for achieving the goals set for the organization. He shared his plans for carrying the momentum forward and crossing the important milestones set for the company.

## Special course on Geo-Spatial technologies for CRPF & Para-military forces in Naxal area associated with Homeland Security

A special course in Geo-Spatial technologies for officers of para-military forces, like CRPF and BSF, was organised by ESRI India in association with GGS Indraprastha University.

The five-day course in Geospatial Technologies and Geographic Information System (GIS) was aimed at training and equipping officers of the central police forces with adequate knowledge of the technology to understand difficult terrain in the areas of their deployment and leverage power of Enterprise GIS for effective and efficient decision making.

23 officers from the CRPF, eight from BSF and two each from the Sashastra Seema Bal (SSB) and Andhra Pradesh special anti-naxal force "Greyhounds" had participated in the course which was inaugurated by Delhi's Lieutenant Governor Mr. Tejinder Khanna.

The officers -- drawn from CRPF, BSF and other forces -- were given complete exposure with Hands-on experience on ESRI GIS technologies for how to use and understand the data and images captured through satellite and analyse using GIS along with latest Technology Trends.

Officers of para-military forces said that with the aid of technology, especially in states like Chhattisgarh, Jharkhand and Orissa, they can plan and execute their operations more efficiently.



"Course on GIS found to be very informative and integral requirement of Para-Military Forces to efficiently deal with Security aspects of the Country " – Darbara Singh Bains, DIG, CRPF

# ENVI EX | Feature Extraction Workflow

Geospatial imagery is more than just a pretty picture or a backdrop to a map. Today, it is used to provide specific information about a geographic area of interest and can help you make decisions that are important in your line of work.

ENVI EX is the newest addition to the ENVI line of premier image processing and analysis software products. It provides user-friendly tools to read, explore, prepare, analyze, and share information extracted from all types of imagery. Designed specifically for GIS users and fully integrated with ESRI's ArcGIS® software, ENVI EX includes unique step-by-step workflows that walk you through previously complex image analysis tasks.



## What is Feature Extraction?

Feature extraction – the process of finding and extracting specific objects of interest from high-resolution satellite imagery based on the object's spatial, spectral, and texture characteristics – is an essential task for professionals across industries who use imagery for information. Many features can be identified and extracted from geospatial imagery such as vehicles, buildings, roads, coastlines, rivers, lakes, and fields. Once features are extracted, they can be used for many applications: in the military to find tanks or airstrips; in urban development to determine the extent of housing sprawl; or in local government to track highway assets.

## Feature Extraction in ENVI EX

Manually locating and digitizing features in an image is tedious and time-consuming, especially over large coverage areas. In addition, limited spectral content may make standard pixel-based extraction approaches inaccurate. Now, the automated workflow in ENVI EX guides you through each step of the feature extraction process with intuitive dialog boxes and preset parameters based on typical desired outcomes. And, the process works with panchromatic, hyperspectral, and multispectral imagery, allowing you to use the data that is readily available to you.

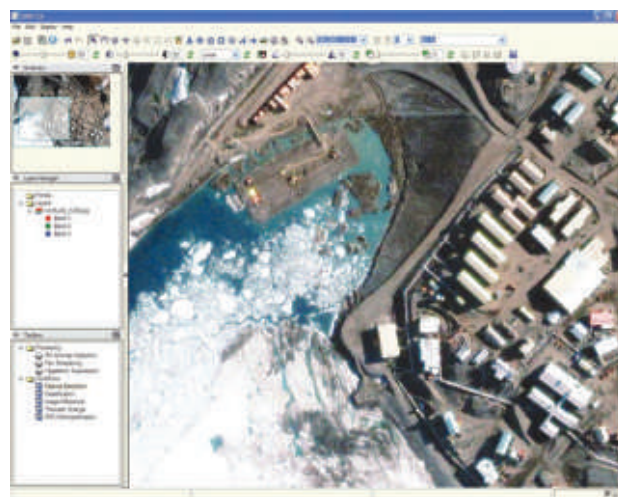
The feature extraction workflow in ENVI EX allows you to easily extract features from an image. The tool automatically segments an image into regions of pixels by computing attributes for each region to create distinct objects, and classifies the objects to extract the features you want to analyze.

The ENVI EX feature extraction workflow allows you to quickly and accurately locate, extract, and identify features of interest in imagery. And, ENVI EX is flexible so you can modify parameters and data at any stage of the process, allowing you

to get the specific information you need from your imagery and make more informed decisions.

## Select the Image You Want to Use

Select an image from web or local search results, from ArcGIS, or from Windows® Explorer and simply drag and drop it into ENVI EX. ENVI EX supports today's most popular satellite and airborne sensors, and it can extract features from panchromatic, multispectral, and hyperspectral data.

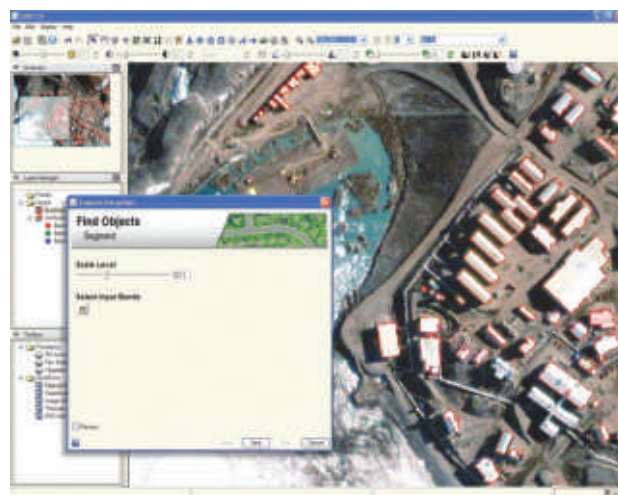


## Enhance Your Data

If you have ancillary data about your image, such as a digital elevation model (DEM), you can import it into ENVI EX to provide additional criteria when segmenting and defining features. And, you can choose to confine image processing to specific areas of interest and reduce processing time.

## Segment Your Image

ENVI EX gives you the ability to extract a variety of features, depending on your specific needs and the imagery being analyzed. The feature extraction workflow guides you through the process of segmenting the image by dividing the image into discrete, real-world, objects through the identification of edges and the grouping of pixels into regions. A preview window provides immediate feedback on your segmentation without the need to process the entire dataset. This saves you time and provides the flexibility you need when experimenting with different results.





## Classify the Segments into Features

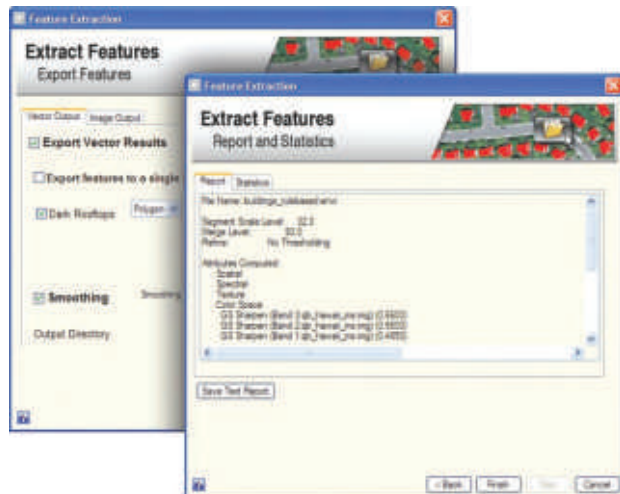
Following image segmentation, the workflow provides you with several options for defining the features that need to be extracted. You can choose example segments in the image that are representative of each feature class or create rule sets that must be met in order to assign segments to a feature class. You can also apply existing GIS or field data to supplement the classification and help ensure the most accurate parameters.

## Refine the Results

Prior to final classification and extraction, the ENVI EX preview portal window allows you to view the preliminary results, so that you can make adjustments to the analysis before processing the entire image or example data. ENVI EX also provides tools to polish and refine your extraction results, obtain statistics, and assess accuracy so you can create a realistic final outcome. You can also choose to annotate results, count individual features, edit or smooth vectors, assess classification accuracy, and generate summary statistics about extracted features.

## Share, Export, and Use Results

ENVI EX allows you to share results at all stages of the workflow, use results for further analysis or for reports, or save the results. Results can be printed, included as part of a



PowerPoint presentation, or saved to your computer, a geodatabase, or directly into an ArcGIS file. Additional analysis can also be done using ENVI EX or ArcGIS.

Unlock the information in your imagery. From reading and preparing, to exploring, analyzing, and sharing – you'll get information from imagery quickly and easily with the automated ENVI EX workflows.

## ArcGIS for iOS

Extend GIS to iPhone, iPad...

ArcGIS for iOS allows you to navigate maps, collect and report data, and perform GIS analysis. It is a part of the ArcGIS system and is a great way to

- Discover content by browsing map galleries from ArcGIS Online or leverage your existing enterprise GIS services.
- Display maps and capture information.

- Develop a custom application or brand your own iOS app specific to your business needs.
- Extend your GIS to a wider audience.

ArcGIS for iOS will extend the reach of your GIS from the office to the mobile Web. It includes an application for Apple iPhone, iPod Touch and iPad devices that you can download from the iTunes App Store for free and explore maps that are



hosted on ArcGIS.com or your corporate ArcGIS Server. Using the ArcGIS API for iOS, you can even develop focused applications for iOS devices that can be deployed within your enterprise or to the public via the Apple App Store.

Using the ArcGIS application on your Apple iPhone, iPod Touch or iPad device you can discover, open and explore maps, find places and addresses, query map layers and data that are hosted either at ArcGIS Online or your corporate ArcGIS Server.

#### Application for iOS

The following applications are available for download from the Apple App Store

- ArcGIS for iOS—Navigate maps, collect and report data, and perform GIS analysis. An API currently in public beta lets you make your own applications.
- BAO for iOS—Perform site screening in the field with demographic and market information.

It is expected that both of these apps to be available on the Google Android platform in late 2010.



#### Application Highlights

- Find and share maps from ArcGIS Online.
- Use tools to search, identify, measure, and query.
- Collect and update GIS features and attributes.
- Perform GIS analysis by accessing geoprocessing tasks.

The ArcGIS application (<http://itunes.apple.com/us/app/arcgis/id379687930?mt=8>)

is available on the App Store! Click ArcGIS (<http://itunes.com/apps/ArcGIS>) to directly open iTunes on your computer and download the application or open the App Store application on your iPhone, iPod Touch or iPad device and search for "ArcGIS".

If you plan to use the ArcGIS application with your own ArcGIS Server, please read the Maps document (<http://help.arcgis.com/en/arcgismobile/10.0/apis/iphone/ApiGuide/Maps.pdf>) to learn more about the structure of Maps

on iOS devices and how you can create and upload maps to your ArcGIS Server.

#### For Developers : ArcGIS API for iOS

The ArcGIS API for iOS will enable you to build applications that utilize the powerful mapping, geocoding, geoprocessing, and custom capabilities provided by ArcGIS Server. The ArcGIS API for iOS is an Objective C SDK that you can use to embed ArcGIS maps and tasks into your line of business iPhone applications.

#### It helps to

- Use and display services from ArcGIS Online and/or ArcGIS Server.
- Execute sophisticated geoprocessing tasks and display results.
- Create applications that collect and update data.

#### What can you do with the API?

Using the iPhone API you can:

- Display and use maps that blend dynamic and cached (tiled) map services from ArcGIS Online and/or your ArcGIS Server.
- Execute sophisticated geoprocessing tasks and display their results.
- Search and identify features and create useful reports of feature found.
- Collect locations by sketching on the map or using the GPS embedded in your device

#### What does the API include?

The ArcGIS API for iOS provides the following resources for you to use in your iPhone applications:

- Maps - The API supports display of both dynamic and cached (tiled) map services from ArcGIS Server. With the ArcGIS API for iOS, you can display maps in any projection.
- Graphics - You can enhance your iPhone applications by allowing users to draw graphics or by providing informational popup windows when the user taps on a graphics feature.
- Tasks - Common GIS tasks such as query, search and identify of features, finding addresses and places, geoprocessing and collection.

#### Download

The ArcGIS API for iOS enables you to build applications that utilize the powerful mapping, geocoding, geoprocessing, and custom capabilities provided by ArcGIS Server using Objective C and deploy them to Apple iPhone, iPod Touch, and iPad devices. The API includes native Objective C libraries, templates and samples that can be used within the Xcode Integrated Development Environment (IDE).

Try the beta version of the API (<http://resources.arcgis.com/content/iphone-sdk>) from the ESRI Resource Center.

ArcGIS API for iOS is estimated to be officially released third quarter of 2010.

For more details, please visit: <http://www.esri.com/software/arcgis/ios/overview.html>

ArcGIS.com is a Web site for experiencing online ArcGIS. It includes maps, applications, communities, services, and resources. Use the site to create maps, find and use maps and Web mapping applications, and share your maps and applications with others.

What can be done with ArcGIS.com :

- Create interactive maps
- View free maps and applications from ESRI and the GIS community
- Save interactive maps
- Share your maps and applications with others
- Create public or private groups

Overview of the site

ArcGIS.com is Web site that lets us create maps, find and use maps and Web mapping applications, and share our maps and applications with others. We do not need any desktop or server software; all its capabilities are accessible with a Web browser. On the site, you'll find maps and applications published by ESRI and the ArcGIS community, a gallery of featured maps and applications, a powerful search engine, mapping tools, GIS community groups you can join and create a personal workspace for storing and organizing your content, and quick access to ArcGIS Explorer Online, an application for exploring and presenting Web maps.



Content from ESRI

ESRI has shared hundreds of its basemaps, operational layers, speciality data, and tools. These are all available to open and use in our Web browser, mobile device, Web mapping applications, or ArcGIS. To quickly find ESRI content, simply add "ESRI" to your search. For example, to see all the imagery published by ESRI, search for "ESRI imagery".



Gallery

The gallery is a place to browse featured maps, Web mapping applications, and mobile applications shared by the ArcGIS community. The editors of the site select items that show important, popular, and exciting information and cartography. All the gallery items are available for you to use in your work.



Search

ArcGIS.com has a powerful search that lets you quickly find specific maps or applications you need for your work. The search results help you determine the usefulness of each item and find related items. It also lets you open the map or application where you want—for example, in ArcGIS.com or ArcGIS Explorer Online.



Map

In ArcGIS.com, you can build interactive maps and share them with others. You choose a basemap, choose an area of interest, and add information layers. These layers can be from ArcGIS.com, the open Web, ArcGIS Servers, or groups you belong to. Once you've finished building your map, you can refine it, save it to your personal workspace, and share it with others. You can also open your maps in ArcGIS Explorer Online to create presentations, map notes, and so on.



My Content

As a signed-in member of ArcGIS.com, you can save maps, add references to applications and services and upload ArcGIS Desktop files. All these are stored in your personal workspace which you access on the My Contents page.



Groups

Groups are a way to collaborate with other ArcGIS users. You join and create groups to exchange geographic information related to a specific project or common activity. For example, you might join a utility management group to share best practices for mapping utility-related assets.



Getting Started

To get started with ArcGIS.com, simply open a Web browser to <http://www.arcgis.com>. You can browse the gallery, search and use maps and applications that have been shared with the general public, and create maps. Before you can save and add maps and applications and share them with others, you'll need to sign up for an account.



# Technical Article

The diagram illustrates a Hybrid Cloud Architecture. It consists of two main cloud environments connected by a central 'Hybrid' box:

- Private Cloud (On-Premises/Internal):** Contains components for 'Saas', 'Paas', and 'IaaS'.
- Public Cloud (Off-Premises/Internal):** Contains components for 'Saas', 'IaaS', and 'Paas'. A red circle highlights specific services: 'Bing Maps Services' and 'ArcGIS online Services'.

Below the Public Cloud, several devices (laptop, tablet, smartphone, etc.) are shown connected to the cloud services, indicating a multi-device, multi-platform environment.

- Software as a Service (SaaS) comprises end-user applications delivered as a service rather than as traditional, on-premises software. The most commonly referenced example of SaaS is Salesforce.com, which provides a customer relationship management (CRM) system accessible via the Internet.
- Platform as a Service (PaaS) provides an application platform, or middleware, as a service on which developers can build and deploy custom applications. Common solutions provided in this tier range from APIs and tools to database and business process management systems to security integration, allowing developers to build

Cloud computing provides opportunities for organizations to become more cost-effective, productive, and flexible in order to rapidly deliver new capabilities.

Lower Total Cost of Ownership	Reduced ongoing and life cycle costs
Increased Availability	Always on, always available
Faster Application Delivery	Expedites time to market; competitive advantage
Flexible Model	Scales by demand; no wasted capacity
Enables Collaboration and Community Computing	Platform for easier and faster information sharing, mobile workforce
Improved Business continuity	Inexpensive disaster recovery options
Rental Pricing Model	Pay-as-you-go; pay-in-advance; try before you buy

[illegible]

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infrastructure, driving down up-front capital spending. As monies are reallocated to be invested in core business, other initiatives could be launched to provide direct value to customers and employees, giving the organization a competitive advantage.

With outsourcing and offshoring growing, leading to creation of a global workforce, team productivity depends on the power of networks and the Internet as a common platform. As such, cloud services are available 24/7, accessible from any browser on any device regardless of time zone. This provides faster, easier access for workers to do their jobs, allowing competitive differentiation for the organization and, likewise, attracting and retaining valuable and talented staff.

### Risks in the Cloud

Despite cloud computing's many benefits, it's important to be aware of the risks and concerns when doing business in a cloud architecture.

Security and privacy are two of most IT professionals' top concerns when considering moving to the cloud, either as a vendor, broker, or consumer. The numerous known instances of security breaches should serve as reminders to be vigilant and cautious in the on-demand marketplace. Typical security and privacy examples include data storage and data transfer protection, vulnerability management and remediation, personnel and physical security, application security, data privacy, and identity management.

Depending on your industry, customer base, or public or private organization, compliance requirements exist that must be met and secured. Some compliance concerns include business continuity and disaster recovery; security standards (ISO 27001); logs and audit trails (eDiscovery); and specific standards and governmental compliance requirements, such as Sarbanes Oxley, Payment Card Industry, and the Health Insurance Portability and Accountability Act.

There are specific legal concerns when providing cloud services and, subsequently, consuming them. These revolve around liability and recourse, intellectual property issues and terms, and vendor transparency regarding location of recovery data centers. When relying on an Internet service, there is always a question of availability and the peak-load capacity that the vendor can carry. For example, current and prospective customers can scrutinize the uptime (and downtime) of Amazon Web Services and Google App Engine through CloudStatus.com to determine how healthy the services have been, monitoring their track record of service failures, latency, and throughput.

And finally, as of yet, there are no standards to ensure interoperability or free movement between cloud providers. As such, cloud consumers should also be aware of vendor lock in when moving forward in the cloud ecosystem.

When consuming cloud services, clearly, it's important to recognize the potential hazards and risks ahead, as with any new or existing IT investment. Concerns about security, inquiries around the provider's maturation in an incubating industry, reliability, and regulatory issues are all topics for discussion and clarification in a vendor service-level agreement (SLA). Although not a guarantee, to better ensure delivery of best practices in the cloud, SLAs with the cloud vendor are recommended when consuming cloud services. Realistically, these concerns are not too different from those that one would have choosing any third-party provider or service. As barriers to entry into cloud computing continue to fall away, confidence in cloud vendors will be established through repeated successful experiences, testimonials, and proven reliability with respect to operating procedures and performance.

## Cloud Computing Deployment Models

There are several types of cloud computing deployment scenarios. The National Institute of Standards and Technology (NIST) is emerging as the preferred provider of the de facto definition of cloud computing and the distribution models.

### Public Cloud

The public cloud is the most commonly referenced regarding the topic of cloud computing, where the infrastructure and applications are owned by the organization selling cloud services.

### Private Cloud

Since many traditional vendors and users are not quite ready to jump into public cloud computing or are restricted from doing so, the cloud service tiers are replicated within a private cloud environment, behind the firewall, and maintained within the parameters of the host organization.

### Hybrid Cloud

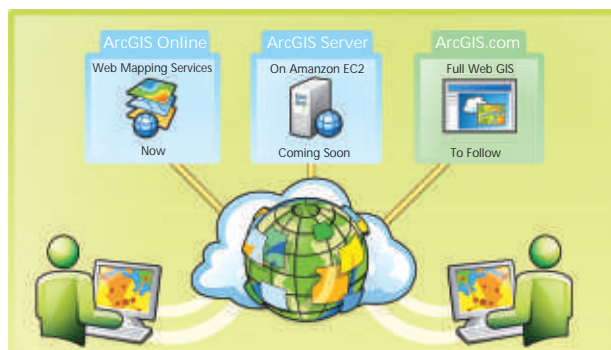
Many believe that the sweet spot for cost optimization in an organization will rely on a delicate balance of public, or community, and private clouds. However, since this hybrid cloud solution is commonly bound together by proprietary technology, it will only be embraced by enterprise computing in the future as standards are developed.

### ArcGIS in the Cloud

Cloud computing is viewed as the next evolution that will impact businesses and how they manage their IT infrastructures. Cloud computing has a direct impact on GIS and GIS users. ESRI has already been leveraging cloud computing resources for a number of years and, in the coming months, will offer additional products for direct use in the cloud. ESRI's emerging cloud-ready strategy is to provide customers with a range of opportunities for choosing the most efficient, cost-effective, and secure mix of on- and off-premises GIS applications and services to meet their business needs.

ArcGIS in the cloud makes it possible to take advantage of the benefits of cloud computing, including deployment of Web 2.0 applications that require flexible scalability. ArcGIS Server and ArcGIS Online provide new, cost-effective, and flexible opportunities for organizations to deliver and consume GIS content and services in the cloud. Using ArcGIS in the cloud shifts the duty of maintaining on-premises resources to the cloud vendor, alleviating the customer's responsibility for maintenance and support.

ESRI has been leveraging cloud computing resources for a number of years and will continue to offer additional products and services for direct use in the cloud.



In 2010, ArcGIS will deliver a growing selection of online services and software.

### ArcGIS Server on Amazon EC2

ESRI provides preconfigured ArcGIS Server Machine Images (AMI) for use in the Amazon Cloud infrastructure. Running

ArcGIS Server on Amazon EC2 allows organizations to take advantage of multiple cloud services and features. These include the ability to deploy ArcGIS Server across more than one data center and access to Amazon's elastic computing infrastructure which makes it possible for organizations to quickly adjust the capacity of ArcGIS Server services and applications to user demand. For more information or to get started with ArcGIS Server on Amazon EC2, visit ArcGIS for Amazon EC2.

### A Complete Online GIS

The road map for ESRI's cloud-based GIS offerings includes access to full GIS capabilities in a cloud environment. This will include authoring, analysis, geodata management, hosting Web services, and applications. ESRI sees cloud-based GIS as a key aspect of any GIS system moving forward. Some aspects of this are available now, and more will be available over time. Over the next year, ESRI will systematically release capabilities and components in a fully integrated system that make up an online cloud-based GIS system.

### Users Take Advantage of the Cloud with ArcGIS Online

Many ArcGIS users are already interacting with on-demand cloud services as part of their normal GIS workflow. These services are built into ArcGIS software with ready-to-use high-quality imagery and topographic and street basemaps, as well as routing and geocoding services for North America and Europe. This system allows users to access and apply these maps and the most current available data and functions without the expense and labor of developing and maintaining this information in-house.

Example of recent Haiti Earthquake interactive Web map shared via ArcGIS Online.

ArcGIS Online also allows users to share their maps and data and collaborate with others who have a common interest. Users can create and join groups and upload items to share. They can control access to their own data, either making it available only to certain groups or sharing it publicly. This system allows GIS users to collaborate on joint projects and quickly share their GIS work within specific communities. ArcGIS Online includes content published by ESRI, other GIS



Example of recent Haiti Earthquake interactive Web map shared via ArcGIS Online.

users, and commercial data vendors. It also includes a Web map application for visualizing shared services and creating mashups without any programming. Developers can also access ArcGIS Web Mapping APIs through ArcGIS Online.

### On-Demand GIS and Mapping: ESRI and the Cloud

ESRI considers cloud computing and technology important in the development and vision of the ArcGIS platform. Access to online cloud-based services is built into ArcGIS software so that users can directly tap into ready-to-use content from ArcGIS Online. This includes high-quality imagery, topographic maps, and street basemaps, as well as routing and geocoding services for North America and Europe. As a result, end users can be assured that they are always using the best cartography and the most current available data and functions without the expense and labor of developing and maintaining this information in-house.

Several options are available for companies that want to improve productivity and efficiency while reducing expenses and freeing up valuable IT resources to concentrate on newer business initiatives. As cloud computing continues to move farther into mainstream IT to become a convention in business, ESRI will continue to offer solutions to allow customers and prospects success in the cloud.

Compiled from Esri website, for more information visit : <http://www.esri.com>

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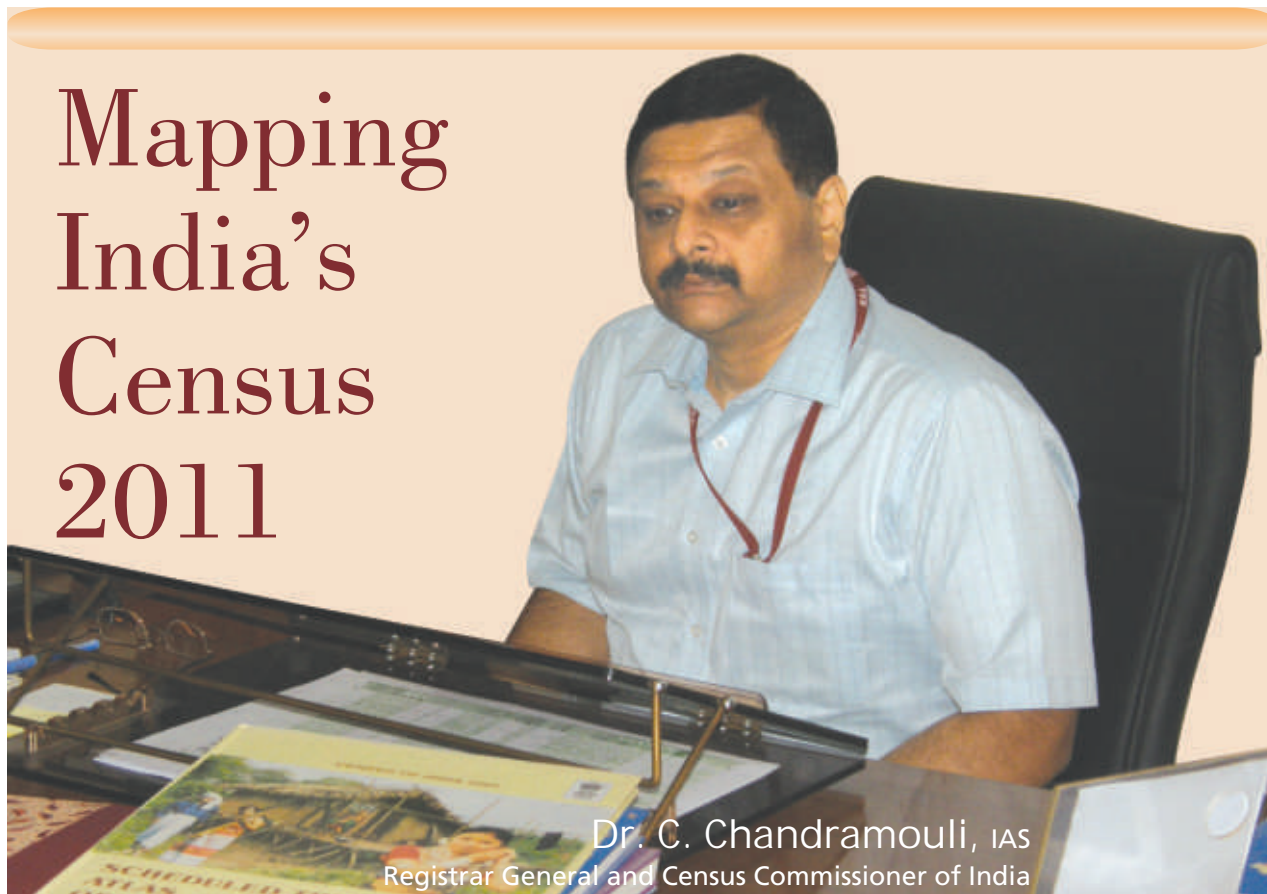
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# Mapping India's Census 2011



Dr. C. Chandramouli, IAS  
Registrar General and Census Commissioner of India

India embarked its journey on the largest census exercise ever undertaken in the world with Census 2011 on 01 April 2010. Mapping back to time, the first Census was held in India in 1872 and since then Census had been conducted uninterruptedly.

The current census of India 2011 is the 15th Census and 7th after Independence. Census 2011 will mark a milestone as the National Population Register (NPR) will also be subsequently prepared. The Census has been described as the largest administrative exercise in the country. With the added task of preparing the NPR, its scope and magnitude has grown manifold. The responsibility of conducting the decennial Census rests with the Office of the Registrar General and Census Commissioner, India under Ministry of Home Affairs, Government of India.

The Indian Census is the most credible source of information on Demography (Population characteristics), Economic Activity, Literacy & Education, Housing & Household Amenities, Urbanization, Fertility and Mortality, Scheduled Castes and Scheduled Tribes, Language, Religion, Migration, Disability and many other socio-cultural and demographic data since 1872. Census 2011 is the only source of primary data at village, town and ward level. It provides valuable information for planning and formulation of policies for Central & State Governments and is widely used by National & International agencies, scholars, business people, industrialists, and many more. The delimitation/reservation of Constituencies - Parliamentary/Assembly/Panchayats and other Local Bodies is also done on the basis of the demographic data thrown up by the Census. Census is the basis for reviewing the country's progress in the past decade, monitoring the on-going schemes of the

Government and most importantly, plan for the future.

The Census is a statutory exercise conducted under the provisions of the Census Act 1948 and Rules made there under. The NPR is being created under the provisions of the Citizenship Act and Rules. Census 2011 is being conducted in two phases:

The first phase is called the Houselisting and Housing Census. This is to be conducted between April and July, depending on the convenience of different States/UTs and over a period of 45 days in each State/UT. The Census process involves visiting each and every household and gathering particulars by asking questions and filling up Census Forms. The information collected about individuals is kept absolutely confidential. In fact this information is not accessible even to Courts of law. This provision is there to encourage people to give correct information in Census without any fear.

The entire population of the country, around 1.2 billion, will be enumerated during the second phase which will be conducted simultaneously across the country between 9 - 28 February 2011. Enumerating the country's population and classifying usual residents according to their gender, religion, occupation and education. This massive exercise, is spread over period of 11 months, that will mark a milestone as the first-ever National Population Register (NPR) will also be prepared in which all persons aged over 15 years will be photographed and fingerprinted to create a biometric national database. With this India will probably

become the first democratic nation in the world which would have got its population fingerprinted in a year from now. De-duplication of the data and issue of unique identity numbers will be done by UID Authority of India. The NPR would then be finalised and maintained by the Office of RGI

#### Census & GIS

This Census 2011 has collected data from Metros to the smallest hamlets with data at ward levels being collected in towns.. All these valuable information data for planning and formulation of policies for Central & State Governments; National & International agencies, scholars, business people, industrialists; Delimitation/Reservation of Constituencies - Parliamentary/Assembly/Panchayats and other Local Bodies are available in the form of large Thematic Maps. The Census organization is the one of the largest producer of GIS based Thematic Maps in the country for all kinds of Valuable information on Demography (Population characteristics), Economic Activity, Literacy & Education, Housing & Household Amenities, Urbanization, Fertility and Mortality, Scheduled Castes and Scheduled Tribes, Language, Religion, Migration, Disability and many other socio-cultural



Houselisting and Housing Census is completely based on ESRI GIS technology. All the cities are being provided with GIS based Houselisting layout maps. These GIS based maps will be used as reference and guideline on boundaries, landmarks, building numbers, etc which will help the enumerators to draw the blank layout map for restoring the information and in turn is used to updated as per actual situation prevailing in the field during the Houselisting Operations. The second copy of the layout map will be drawn afresh. Photocopy of any census material is completely prohibited. The enumerator are advised to update the GIS map as well and submit the copy of GIS based map (or village map, in case of villages / ward map in case of other town areas where GIS based map is not provided) along with the duplicate copy of layout map. Both the maps should be kept together (one after other) in the Charge register docket which will be preserved at the DCO.

These thematic maps on Houselisting and Housing has canvassed information relating to Buildings- Use, Quantity and Quality ; Amenities available to the Households ; Assets possessed by the Households; 35 Columns relating to Building material, Use of Houses, Drinking water, Availability and type of latrines, Electricity, possession of assets. The Census organization is also working on producing digital maps of all 33 capital cities in the country using satellite imagery. Ground truthing is also being carried out and the digital maps would be by March 2011.

Note: Source - Information Compiled from Census Website <http://www.censusindia.gov.in>

On the occasion of the ongoing Census 2011 , our marketing team got the opportunity to have a conversation with Dr. C. Chandramouli, IAS, Registrar General and Census Commissioner of India.

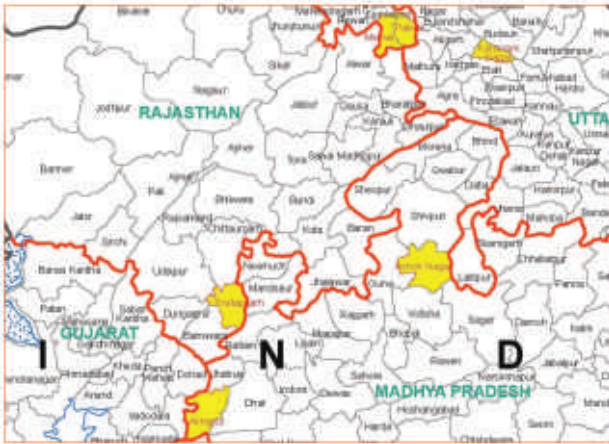
Q.How do you think the geospatial technology today would help in understanding the heterogeneity and complexity of the census data of such a highly populated nation ?

Ans.India is a vast country comprising 35 States/UTs, 640 Districts, 5767 Sub-districts (Tahsil/Taluka/CD block etc.), 7742 Towns and 638588 Revenue Villages. Unless we have clearly defined boundaries of administrative units at all levels, it is difficult to ensure complete coverage without omission or duplication. Geo-spatial technologies provide an effective tool for complete coverage.





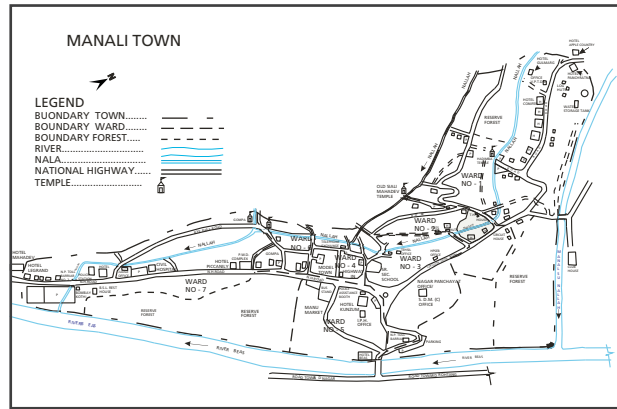
## ADMINISTRATIVE DIVISIONS & CHANGES



Q. What are the challenges being faced by the department in conducting India Census 2011 and how the department dealt with some of them by using GIS and Remote Sensing.

Ans. The Census 2011 and the creation of the National Population Register have been described as the largest administrative exercise in the world. The geographical spread, different climatic zones and extremely diverse terrain add to the challenge. To make it even more daunting, the Census Schedule is to be canvassed in 16 languages. Add to this the fact that the instruction manuals to train 2.5 million Census functionaries have to be translated in 18 languages! Not in the least an easy task you will agree.

You might be aware that the Census organization is one of the largest producers of thematic maps in India. We have a digital database of all the 600,000 Villages and by the end of this year we would also have digital maps of all Towns showing Ward boundaries. Apart from this, in 33 Capital Cities we also have digital Maps based on satellite imagery which show details upto the individual buildings.



TOWN MAP

Q. Census Commissioner's office has decided to adopt GIS to capture the socio-economic profile of the population in order to have error free Census Operations. Please elaborate.

Ans. As mentioned earlier, Maps are being used to ensure an error free Census, by ensuring complete coverage without any omission or duplication. In addition, after the Census is over, the socio-cultural, demographic and economic profile will be disseminated by way of data products such as individual theme based maps, data sheets, Atlases etc. National and State Level Atlases like Migration Atlas of India, Linguistic Atlas, Individual thematic maps on amenities, education, health facilities and other parameters like sex ratio, population density etc would be brought out.

ENUMERATION MAP



Q. What are your views on National Population Register and its future plans of using/ promoting spatial data?

Ans. Along with Houselisting operations, information for the preparation of National Population Register (NPR) has been collected. The NPR will contain details of all the 'usual residents' of the country regardless of whether they are citizens or non-citizens.

The initial stage of preparation for NPR will involve biographic data collection of all residents of the country including newborns. To this, biometric data of people like 10 finger prints, photographs and Iris will be added and sent to the Unique ID Authority. De-duplication of the data will be ensured by the UIDAI before identity numbers are generated. Identity (smart) Cards would then be issued by this office to each usual resident. A system of continuous updating and maintenance is also being worked out. This again an extremely daunting task.



# Multi Criteria Decision Making System for Sustainable Shrimp Culture Development using Remote Sensing and GIS techniques



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## Abstract:

Land suitability analysis using MCDM involves a complex array of critical factors involving technical, economic, social, and environmental issues. It is the process of finding locations that meet desired conditions set by the selection criteria. In such a process, manipulation of spatial data and satisfaction of multiple criteria are essential to the success of decision-making. Because of the complexity of the problems a number of tools must be deployed to arrive at the proper solution. Geographic information systems and Multi-criteria decision making techniques are integrated systematically in solving land suitability problems. This Paper describes comprehensive discussion of the site selection process for sustainable shrimp culture development, its characteristics and tools.

**Key words:** MCDM, Sustainable shrimp Culture, RS, GIS.

## Introduction:

Aquaculture has been attracting heavy investment due to the availability of sound technologies and limitless potential for export especially shrimp. It has been transformed from a traditional activity to commercial farming of high profit sector in the early nineties, and the area increased. This rapid expansion of aquaculture in India has led to a growing concern about its impact on the environment. There are several positive and negative impacts of shrimp culture development. It has a major role in the rural employment and economic development of coastal villages. The ecological and social impacts of shrimp aquaculture include large-scale degradation of coastal wetlands (especially mangroves), land subsidence, acidification, Salinisation of ground water, pollution of agricultural land and coastal waters by pond effluents, introduction of exotic species or pathogens into coastal waters, loss of wild larvae and subsequent loss of goods and services generated by natural resource system. Given the lack of guidance available on environment impact assessment for shrimp farming, it is not surprising that projects often proceed without adequate environmental and site surveys. This problems needs to create a Multi criteria Decision Making system for Sustainable shrimp culture development using proper guidelines.

## Shrimp Culture:

Shrimps are aquatic organisms inhabiting the seas, estuaries and brackish waters. In the seas around India, 90 species of penaeid shrimps are known to occur of which 10 species are considered for culture. Based on the level of scientific management measures and use of inputs, shrimp culture can be broadly classified as traditional, extensive, semi-intensive and intensive. Based on water exchange adopted during farming certain of the farming systems are referred as Zero water exchange system. However, there is no universally accepted classification for types of shrimp farming.

Remote sensing (RS) and Geographical Information System (GIS)

Remote sensing is the technique of deriving information about objects on the surface of the earth without physically coming into contact with them. Geographical Information System (GIS) is a powerful tool for collecting, storing, organizing, retrieving, transforming and displaying data from the real world for a set of particular purpose (Burrough, 1986). It is a decision support system, which involves the integration of spatially referenced data in a problem-solving environment.

With the addition of GIS based models and other analytical tools, decision makers can begin to manipulate data in a true planning environment (Faber, et al., 1997; Thomas 1994; Thomas and Roller, 1993). To be effective, a land use decision support system must provide access to data, the tools or mechanisms to transform data into useful information, and the context from which understanding is derived (Worrest, et al., 1994). For geographic information systems have been readily adopted by users seeking to learn more about the physical world through the ability of computers to transform huge databases into thematic maps. The DSS is a software platform with diversity and expandability. It contains intelligent and visualization functions.

## Site selection for Sustainable Aquaculture Development using remote sensing and GIS

Site selection for Sustainable Aquaculture is a key factor in any aquaculture operation for both success and sustainability. Moreover, it can solve conflicts between different coastal activities, making a rational use of the coastal space. The criteria for the selection of a brackish water farm site for shrimp culture have been discussed by Hora and Pillay (1962), Muthu et.al (1988), Lee and Winkins (1992), Verghese et.al (1996), Purushan (1996), Lawson (1997) and Chandrakant and Singh et., al., (2001). Field (2001) explained how the combination of 'fuzzy logic' methods applied to scientifically exact GIS helps to inventories areas suitable for aquaculture in Australia. Site selection for aquaculture planning is a complex task involving the identification of areas that are economically, socially and environmentally suitable, available to aquaculture and commercially practicable (McLeod et al., 2002).

Geographical information system (GIS) in site selection for coastal aquaculture using a salmonid cage culture development in Camas Bruaich Ruaidhe bay of Scotland assessed based on bathymetry, current, and shelter and water quality variations to determine the suitability of the site Ross et al. (1993)

Spot imagery has been used to satisfy the site selection criteria for shrimp ponds (Loubersac and Populus, 1986) such as location, bathymetry, possible pond shape and pattern, site areas potential for expansion, access routes, practicalities of pumping seawater and the identification of possible sources of pollution. This type of information has been central to the development of shrimp farming in New Caledonia (Ifremer,

1987). SPOT XS sensor was the most widely used sensor (67%) for aquaculture.

A case study for south Gujarat and West Bengal was undertaken to show the better sites for brackish water aquaculture development using remote Sensing and GIS using various thematic layers like engineering, ecological, meteorological, infrastructural and socio economic data. Gupta (1995).

Identification and inventory areas of Franklin Parish, Louisiana, suitable for catfish (*Ictalurus punctatus*) farming based on soil characteristics and susceptibility to flooding. As a test of approach, the locations of existing catfish farms were compared with suitable location as determined by GIS Kapetsky et al. (1988) and it was further developed by Cheney and Rabanat 1984; Meaden 2004 ;Ross, 1998; Nath et al., 2000). Coastal aquaculture site selection and digital soil map using remote sensing data and GIS for West coast of India developed by Sudarshana et al. (1993) and Nair et al. (1996).

A study on optimizing site selection for the development of shrimp and mud crab culture in southwestern Bangladesh using remote sensing and GIS. Satellite image of 1996 of southwestern Bangladesh was used as primary data source. A GIS database was built up while incorporating environmental layers such as water bodies, rivers, soils, land use, water temperature, rainfall, salinity and pH. A series of biological models were developed based on biological databases for key species, current farming systems and practice. The most suitable sites for shrimp culture and crab farming in the area were identified. They found out that GIS modeling associated with remote sensing have great potential for informed decision-making in aquatic production systems. In these study implications for use of these systems to reduce land use conflicts were used Salam and Ross (2000).

Suitable site selection methodology developed for shrimp farming in the coastal areas of Bangladesh using remote sensing techniques comprises of: (i) construction of GIS based fisheries environmental database (GISFED); (ii) selection, adaptation and test of GIS based Suitable Shrimp farming Site Selection model (shortly 4s model); (iii) practical implementation of 4s model; (vi) application of shrimp suitability model and analysis of model generated output; (v) socio-economic characterization of the study sites and analysis of the trend of shrimp culture development; (vi) analysis of environmental impacts of shrimp culture expansion and risk due to climatic events. The study concluded that tropical countries can use this model for allocating suitable site for shrimp farming by their government for allocating shrimp farms in the coastal areas Quader et al. (2004)

Site Selection technique, using GIS, for aquaculture planning in Margarita Island in Venezuela. Reveals that identify of optimum sites for mangrove oyster raft culture based on multi-criteria evaluation (MCE) using GIS. Twenty variables were grouped in criteria based on the way they influence the project. Thirty-five experts were asked to evaluate the factors and to score each according to their suitability weight. The study concluded that higher scores were reached in 13 areas covering 4.1 km<sup>2</sup>, those places having the optimum conditions for oyster raft culture in the region. Buitrago et al. (2005)

A study was conducted to identify the potential area for the commencement of sustainable shrimp farming with the help of RS and GIS. Current land use pattern of the study area (coastal area of Palghar Taluk, Thane district, Maharashtra, India) was extracted from the satellite image (IRS 1D LISS III FCC Print) with the help of GPS data. Intertidal areas (mudflats) were evaluated for the development of brackish water aquaculture (shrimp farming) and the data on 37 parameters under six major categories namely, engineering

parameters, water quality parameters, soil quality parameters, infrastructure facility, meteorological parameters, and social restriction were collected for different mudflat areas. The weighted overlay method was adopted in GIS to delineate the potential area into four major categories as highly suitable, suitable, moderately suitable, and unsuitable. This study revealed that of the total study area of 20431.034 ha, 0.377% is highly suitable, 9.873% is suitable, 1.772% is moderately suitable, 85.027% is unsuitable, and 2.951% is already under aqua farms (Karthic et.al, 2006).

One of the fundamental problems in planning for the expansion of aquaculture is to accurately assess the land, water, economic and human resources available for development. Comprehensive planning for the aquaculture is still uncommon. One of the reasons that such planning is not routine is because the means to synoptically integrate and analyze diverse kinds of resource, environmental, design and economic data have been lacking. Therefore, there is a need for approach, which can be used to rapidly identify areas of a country suitable for various kinds of aquaculture as an aid to development or planning (FAO-2001). Status of shrimp culture development in India, its ecological and socio-economic impacts and recommends measures to achieve long term sustainability using advanced tools like RS and GIS leads to the sustainable aquaculture development Rajithae.al, (2007).

#### Multi Criteria Decision Making System (MCDM):

Multi-criteria decision-making (MCDM) systems were designed to analyze decision problems, generate useful alternative solutions, and to evaluate the alternatives based on a decision maker's values and preferences. The general objective of these methods is to assist the decision-maker in selecting the best alternative from the number of feasible alternatives under the presence of multiple choice criteria and diverse criterion priorities (Mollaghasemi and Pet-Edwards 1997, Jankowski 1995). MCDM techniques have been used to solve various site selection problems (Badri 1999, Korpela and Tuominen 1996). These techniques, however, assume homogeneity within the study area, which is unrealistic in many spatial decision making situations such as site selection problems.

Malczewski (1999) suggested that there is a need for an explicit representation of geographical dimension in MCDM techniques. The combination of GIS and MCDM capabilities could effectively solve this problem As discussed above, ES, MCDM and GIS are useful tools but independently not sufficient to solve complex spatial decision making problems such as industrial site selection. Integration of these tools is needed so that the weakness of any one tool is offset by the others. Such integration has been attempted with varying success (Vlachopoulou et al 2001, Thomas 2001, Kao et al 1996, Siddiqui et al 1996, Jankowski and Richard 1994, Carver 1991, Janssen and Rietveld 1990). However, these studies concentrated only on the technical aspects of the integration procedures and overlooked the modeling process that guides the users in their choices during the screening and evaluation phases.

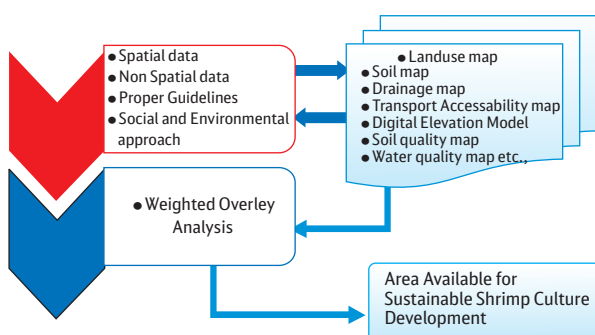
#### Sustainable Shrimp Culture Development using MCDM

Spatial decision-making problems, such as site selection, require appropriate means for handling multiple socioeconomic factors while considering physical suitability. Radditional decision support techniques lack the ability to simultaneously take into account these factors and conditions. Carver (1991) forwarded the integration of multi-criteria evaluation (MCE) techniques with GIS as providing the user with the means to evaluate various alternatives on the basis of multiple and confliction criteria and objectives. He

used Arc / Info GIS with the addition of MCE techniques to identify feasible sites for disposing radioactive waste in U.K. Pereira and Duckstein (1993) proposed a new technique, based on multiple-criteria decision-making (MCDM), to combine factors in suitability analysis of land with respect to potential use. It was applied in conjunction with GIS to a case study of habitat evaluation for endangered Mount Grehan red squirrel. Similarly MCDM was integrated in GIS by Jankowski (1995) and Malczewski (1996).

Nyoman Radiarta et.al (2008) identified the most suitable sites for hanging culture of Japanese scallop using geographic information system (GIS)-based multi-criteria evaluation models. Remote sensing data (Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Moderate Resolution Imaging Spectroradiometer (MODIS) and Advanced Land Observing Satellite (ALOS)) were used to extract most of the parameters. Seven thematic layers were grouped into two basic requisite for scallop aquaculture, namely biophysical (sea temperature, chlorophyll, suspended sediment and bathymetry) and social-infrastructure (distance to town, pier and land-based facilities). A constraint layer was used to exclude the areas from suitability maps that cannot be allowed to develop scallop aquaculture, including harbor, area near town/industrial and river mouth. A series of GIS models was developed to identify the most suitable areas for scallop culture using multi-criteria evaluation known as weighted linear combination. Suitability scores were ranked on a scale from 1 (least suitable) to 8 (most suitable), and about 56% of the total potential area with bottom depths less than 60 m had the higher scores (scores 7 and 8). These areas were shown to have the optimum condition for scallop culture in this region. The final suitability model outputs were compared with field.

MCDM for Sustainable Shrimp Culture development:



Site Screening Process:

The above table describes the work flow of the study and the below discussions explains the methodology followed for the study.

Digital Image Processing

Digital image processing may involve numerous procedures including formatting and correcting of the data, digital enhancement to facilitate better visual interpretation or even automated classification of targets and features entirely by computer. In order to process remote sensing image digitally, the data must be recorded and available in a digital form suitable for storage on a computer tape or disk. Obviously, the other requirement for digital image processing is a computer system, sometimes referred to as an image analysis system with the appropriate hardware and software to process the data. Several commercially available software systems have been developed specifically for remote sensing image processing and analysis. For discussion purposes, most of the common image processing functions available in image analysis systems can be categorized into the following four categories: Preprocessing, Image Enhancement, Image Transformation and Image Classification and Analysis

GIS Analysis (Using Arc GIS 9.1):

Digitization and Editing

The interpreted themes were entered into Arc Info Gis 9.1 by digitization technique. The digitization converts the spatial features on a map into digital format using various steps and commands. Point, line and area features that compose a map were converted into x, y coordinates. After the digitization, to have a correct spatial data, the digitizing errors, dangles, label errors, node, polygons that are not built, or user ids that are not unique were corrected based on clean and built command. The final topology creation labelling was carried out. The vector layer was viewed into Arc Map and layout was created for analysis and output generation.

Ground truth verification

Ground truth verification is one of the important components in the field of remote sensing applications. The validation of the information derived from remote sensing data was checked by ground truth information using the GPS (GS 5+). Field checks were made in doubtful areas and the necessary corrections were made in the interpreted maps. Based on the field verification the changes of landuse categories and potential site for further aquaculture development were verified and it was directly imported using the Arc Pad7 GPS software.

Accuracy Assessment:

For the accuracy assessment for kappa correlation method was used. Kappa can be used as a measure of agreement between model predictions and reality (Congalton 1991) or to determine if the values contained in an error matrix represent a result significantly better than random (Jensen 1996).

$$k = \frac{N \sum_{i=1}^r x_{ii} - \sum_{i=1}^r (x_{i+} \times x_{+i})}{N^2 - \sum_{i=1}^r (x_{i+} \times x_{+i})}$$

The agreement criteria for Kappa statistic was defined by Landis and Koch 1987. The agreement is poor when  $K < 0.4$ , good when  $0.4 < K < 0.7$  and excellent when  $K > 0.75$ . As per the study kappa correlation is Alternatively, Monserud-1990 suggested the use of subjective Kappa value as <40 percent as poor, 40-55 percent fair, 55-70 percent good, 70-85 percent very good and >85 percent as excellent.

Site Evaluation and Model Generation:

The Coastal Aquaculture Authority guidelines, social and environmental law aspects should be followed for the sustainable shrimp culture development. Based on the above things the suitable weightage should be assigned for the each layer for sustainable shrimp culture development. The following weightage analysis process followed for the study.

Weightage

All the Thematic layers (Each parameter) was scored based on its limitation category according to the scheme: Low-3; Moderate-2; Good-1. For most of the parameters, weights were assigned subjectively as discussed by Nath et al. (2000). This score of each parameter changes as the parametric values deviate from their optimum values for brackish water aquaculture (Gupta, 1995; Treece, 2000).

The limitations were categorized into three, for all the parameters as given below:

1. Good - If the properties are generally favourable and limitations can be easily overcome. No unusual planning or maintenance will be required for the designated use.
2. Moderate - If the properties are not favourable and special planning or maintenance is required to overcome or minimize the limitation.



3. Low - If the properties are so unfavourable or more cost and effort are required to compensate for a low limitation. Sometimes, it may not be economically feasible to use a site with one or more severe limitations.
4. Unsuitable-The properties of this category is not fit for future development

Weightage parameters for the Different classes for the study:

Assignment of score to the limitation categories

No	Limitation category	Score
1	Good	4
2	Moderate	3
3	Low	2
4	Unsuitable	1

Relative weightage for the study:

Assignment of weightage as per relative importance of parameter

No	Relative Importance	Weightage
1	Very Important	70
2	Important	15
3	Moderately important	5

The total relative weightage of polygon varied from 0 to 280, which was calculated out of 300 and it was regrouped as highly suitable (Good), moderately suitable (moderate), suitable (Low), unsuitable through the range regroup command in raster analysis module as:

No	Score (Total)	Class	Range
	< 210	Unsuitable	
	210-240	Moderately Suitable	
	240-270	Suitable	
	>270	Highly suitable	

Conclusion:

The land suitability analysis process has become increasingly complex because of the coastal zone regulations as well as the environmental issues. GIS and MCDM are very vital efficient tools for solving sitting problem. However, each of these tools has its own limitations and drawbacks in solving such problem. For this study This MCDM approach consists of two phases: screening and evaluation phase. For the screening phase CAA guidelines, Buffer analysis should be used for the different site suitability criteria and a GIS is used to determine the alternative sites that best satisfy these values. For the evaluation phase Overlay and Weightage Analysis Process is used to determine the optimum site among all possible sites. In Arc GIS-Visual Basic technique is also used to facilitate the interoperability and communication of the different software components to the single platform.

## Letters to Editors

Dear Sir,

Many thanks for providing the opportunity for sharing views and feedback regarding Arc India news. The contents published in the magazine for ARCGIS updates, case studies, applications, technology updates etc appears informative. Some of the case study/applications published are helpful to us in getting an idea of solutions to our problems as well.

Also, apart from what we are doing in ARCGIS, we remain updated with the latest and new happenings in the world of GIS through this magazine and can explore this technology more. In the last issue of Arc India news, I really liked tips and tricks & Arc scripts section, it was really interesting & informative.

Vidhi Sammaria  
Deputy Manager  
NDDDB, Anand (Gujarat)

Dear Editorial Team



Arc India news, Arc News and Arc User from ESRI India is a very useful magazine for all GIS users and researchers. As a agriculture scientist I can say that the magazine helps me a lot in various aspect of my research project. One article in Vol-4 entitled "GIS: Designing Our future" and "Using Information from Imagery in GIS by Jack Dangermond is a very informative article. Research articles are very high quality published in this magazine. My request to the Editor is please put more research article in this magazine.

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# NeerUrja - Geospatial Gateway for Potential Hydropower Sites in the State of Uttarakhand

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## Introduction

Hydroelectric power (HEP) schemes provide environment friendly option for sustainable utilization of readily available natural resources; the surface water. Development of hydropower in the country is important to attain the optimal ratio of power generated from hydro-thermal sources, which at present is underdeveloped in comparison to the assessed available potential. Uttarakhand with its abundant surface water resources have large hydropower potential and the Government has ambitious plan to harness the available potential to meet the growing demand for power. In addition to the large or mega power projects, there are a large number of identified small hydro-projects (SHP), in the state. RRSC-North, Dehradun has carried out the present study for UIPC (JV between Govt. of Uttarakhand and IL&FS, New Delhi), wherein Cartosat-1 stereo data and Geospatial techniques have been used for identifying and characterizing potential HEP sites at prefeasibility level in nine river valleys falling in the upper catchments of Alaknanda and Bhagirathi rivers of Uttarakhand.

A potential HEP site is identified based on the favourable contribution from various parameters like elevation difference between the diversion and the power house (topographic 'Head'), dependable stream discharge, stable geological disposition in terms of lithology, structure and valley slope, and also in terms of socio-economic and environmental aspects. The hydropower potential of such a site is a function of the discharge at that location and the available 'Head' generated due to the diversion/storage structure and/ or due to the transportation of the water from this site to an economically and technically feasible destination where the powerhouse is located. Geospatial technologies comprising Remote Sensing, Global Positioning System (GPS) and Geographic Information System (GIS) provide a very useful set of tools for locating potential HEP sites, calculating some of the parameters relevant to the power generating potential of the identified HEP scheme and also for interpreting the characteristics of the sites with reference to the geological and environmental point of view.

In the present study, the potential HEP sites have been identified and finalized through iterative analysis and interpretation of multiple data sources like Digital Elevation Model (DEM) and multispectral remote sensing data (IRS-P6 LISS-IV, LISS-III and AWiFS), coupled with inputs collected from reconnaissance field survey and ancillary data. The study involves DEM generation from Cartosat-1 stereo data for identification of potential HEP sites and determination of their 'head'; site characterization using remote sensing derived information (land use/ land cover, lithology, structure, existing landslides and topography) and estimation of probable discharge, power potential and water conduction path of the

identified potential schemes. Cartosat-1 satellite stereo-pairs (12 scenes) have been triangulated in Digital Photogrammetry (DP) environment using 101 Ground Control Points (GCPs), collected using Differential Global Positioning System (DGPS) survey, to generate DEM which has been refined with the help of break-lines and additional mass points. The elevations at the diversion points and powerhouse locations have been measured using 3-D visualization under the digital stereo model. Discharge assessment at the prospective hydropower sites have been carried out using observed discharge data processed for 50% and 90% dependable year and upstream catchment characteristics derived from remote sensing data in geo-spatial environment. The site characteristics evaluation has been done using IRS-P6 LISS-IV multi-spectral data (13 scenes) and ancillary data to generate information on land use/ land cover, lithology and structure. The valley cross sections at the diversion points, longitudinal profiles along head race tunnels and the head race channel contours for water conduction have been derived from the digital elevation model. Existing landslide locations have also been mapped from the multispectral satellite data.

68 prospective hydropower sites have been identified in the 9 river valleys of Alaknanda and Bhagirathi rivers, in the present study. The gross power potential capacity estimated for 68 sites is 408 MW approximately for 50% dependable year. The Head computed for these sites varies from 66m to 1242m and the power potential computed varies from 0.29 MW to 34.33 MW for 50% dependable year. The sites fall on geological formations belonging to the Lesser, Higher and Tethys Himalaya. Granitic Gneisses, Schists, Migmatites, Phyllites, Quartzites and Limestones are the dominant lithological units in the study area. The major geological structures are the Main Central Thrust, the Vaikrita Thrust, Baijnath Thrust, Niti Fault and Bhilangana Thrust. The various land use/ land cover categories are dense forest, open forest, scrub forest, alpine pasture and scrub, snow and glaciers. Sample sites verification was jointly carried out by RRSC-N; IL&FS, New Delhi and UIPC, Dehradun officials during the field visit. Various options between diversion and powerhouse locations have been worked out which may be useful during detailed investigation of prospective sites. Further detailed investigation of the identified sites is essential to understand the geotechnical characteristics, site-specific discharge measurements as well as socio-economic viability and environmental feasibility.

Now at this prefeasibility level, there is a need to depict the identified potential HEP sites along with other Geospatial data. This paper portrays representing hydropower schemes in a spatial domain along with its key spatial attributes (storage/ diversion and powerhouse location, HRC/HRT and penstock) in 3D perspective using ArcGIS Explorer. ArcGIS Explorer, a free GIS viewer from ESRI provides an easy way to view, present, and share GIS data. It connects directly to a variety of ready-to-use ArcGIS Online basemaps and layers and enables users to connect to their own map services or add local data. It can also be extended with a user's own tools to deliver geoprocessing and other capabilities to people who do not necessarily know anything about GIS. It is ideal for delivering GIS to everyone, not just GIS professionals.

ArcGIS Explorer includes intuitive, high-performance visualization and presentation tools that let users make information visually compelling. It is engineered to work directly with maps and layers authored using ArcGIS Desktop and published via ArcGIS Server, or shared as layer packages, and makes integration of other data easy.

This paper portrays customization in ArcGIS Explorer 900 using SDK in .net framework in order to create an intuitive interface for 3D visualization of identified potential hydropower sites in Alaknanda and Bhagirathi river valleys of Uttarakhand, India.

## Study Area

Uttarakhand falls between latitudes 28°43'45" N to 31°08'10" N and longitudes 77°03'5" E to 81°02'25" E. Alaknanda and Bhagirathi are turbulent Himalayan Rivers and are the two major tributaries of River Ganga. The present study has been carried out in Alaknanda and Bhagirathi River catchments. The Alaknanda emerges at the foot of the Satopanth and Bhagirathi Kharak glaciers whereas the headwaters of the Bhagirathi are formed in the region of the Gangotri and Khatling glaciers in the Garhwal Himalaya in Uttarakhand. The Alaknanda River flows for approximately 230 km and the Bhagirathi River flows for about 700 km till their confluence point, Devprayag. The present study has been carried out in the valleys of Birahiganga, upper catchment of Nandakini (above Ghat), left and right bank of Dhauliganga (from Vishnu Prayag to Rishiganga confluence), upper catchment of Dhauliganga (above Rishiganga confluence), Kagbhusand, Khirganga, Kalpganga, Mena and upper catchment of Bhilangana (Ghuttu and above).

Table 1. Longitudes and Latitude of Study Areas

S.No	Study Area	Longitude	Latitude
1.	Upper Catchment of Dhauliganga	79° 30' - 79° 45'	30° 25' -30° 36'
2.	Lower catchment of Dhauliganga	79° 45' - 80° 00'	30° 30' -30° 43'
3.	Nandakini Above Ghat	79° 36' - 79° 45'	30° 10' -30° 19'
4.	Birahiganga Above Gohna Tal	79° 31' - 79° 41'	30° 19' -30° 26'
5.	Khirganga	79° 25' - 79° 31'	30° 38' -30° 42'
6.	Kagbhusand	79° 34' - 79° 41'	30° 35' -30° 39'
7.	Kalpganga	79° 24' - 79° 31'	30° 31' -30° 36'
8.	Mena	79° 20' - 79° 27'	30° 26' -30° 36'
9.	Bhagirathi/Bhilangana	78° 47' - 78° 56'	30° 31' -30° 47'

The first eight watersheds lie in the Northern part of Chamoli District of Uttarakhand and form major tributaries of the Alakananda river, whereas the Bhilangana watershed lies in the North Eastern part of the Tehri Garwal district and it falls in the Bhagirathi catchment. The confluence points of all the eight valleys of Alakananda catchment to main Alakananda river are approachable from the Rishikesh-Mana National Highway. Further accessibility in the valleys is mostly through foot paths, except to a few kilometers by motorable road. The Kagbhusand valley is un-inhabited and unapproachable whereas Khirganga and Mena valleys are partially approachable through footpaths. The Dhauliganga valley is approachable to a large extent with national highway passing along its main river.

## Methodology

Prospective hydropower sites identification has been carried out using multidisciplinary information on drainage and watershed, terrain characteristics, geology (lithology and structure), land use/land cover (LULC), etc. Probable yield at identified sites has been assessed based on hydrological analysis of historical data coupled with ancillary information on catchment characteristics. Through data integration techniques, prospective hydropower sites have been identified and their potential assessed.

The identification of potential sites for hydropower development requires integration of various parameters. The most critical factor in hydropower site suitability is scope for sufficient topographic head, which in combination with discharge can provide desirable (depending upon the requirements of the specific project and specific situations) power potential. Various spatial decision criteria were used to identify the site suitability and beyond the scope of this paper.

The identified sites have to be studied in detail for economic feasibility and site-specific characteristics based on priority assigned. The overall methodology used in identifying the schemes is beyond the scope of this paper as this concentrates on customization of ArcGIS Explorer to depict the identified schemes in 3D domain. The potential HEP sites in the nine valleys have been identified based on integrated analysis of multiple data sources and field data. The sites are identified based on topographical, hydrological, geological and environmental suitability. The topographic profiles drawn from Cartosat-1 DEM in transverse directions have been used to zero-in stable, ideal valley portions as diversion points and the DEM has also been used to trace the water conductor path from these sites providing optimum head in the shortest distance to locate suitable sites for the power house. In certain cases (wherever HRTs have been feasible), the longitudinal profiles have also been used for such optimization. The present study has utilized the 3D Photogrammetry model for estimating 'head' at identified potential schemes for hydropower generation. The geological appreciation of the selected sites has been done with the help of regional geological maps. The identified sites have also been validated during joint field expedition. 68 potential HEP sites have been identified in 9 valleys of Alaknanda and Bhagirathi River.

Spatial depiction of identified potential hydropower schemes in ArcGIS Explorer

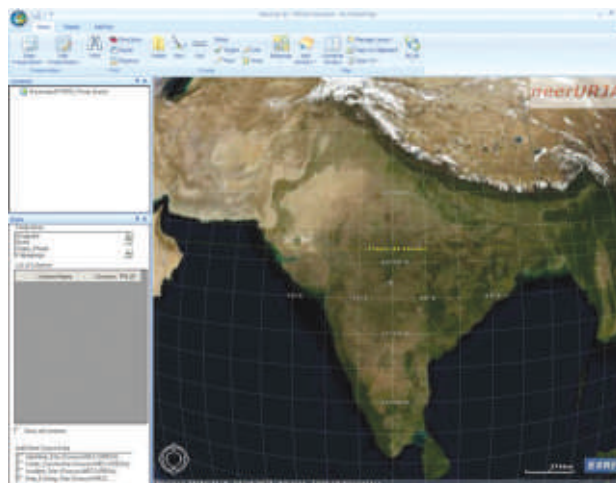


Figure 1: ArcGIS Explorer customized interface and basemap of neerURJA

ArcGIS Explorer's basemap gallery includes ready-to-use basemaps from ESRI and other sources, but can also add user created one. The basemap provides context or reference for the content that we add to the map. ESRI supplies several basemaps that we can change without affecting the map's additional content. Provisions exist to change the basemap by clicking Basemap in the Map group of the Home tab and selecting a basemap from the Basemap gallery. While the basemaps that ESRI supplies in the gallery may be appropriate for most of our work, in this study we require a basemap that's more specifically tailored to projects objective.

There are two approaches to consider when creating own basemaps. One is that to use one of the existing basemaps and add own specific layers on top. The other approach is to build a completely new basemap from scratch. In this study



we use the later approach to create the basemap. The same high resolution DEM that used to identify the hydropower schemes was used as elevation source and natural color composite obtained after fusing LISS IV MX and Orthoimage derived from Cartosat-1 data was used for texture data. Bluemarble data has been used in the basemap to cover remaining area that is not in the study area.

ArcGIS Explorer includes a Software Developer Kit (SDK). The aim of the SDK is to support developers in using the ArcGIS Explorer Application Programming Interface (API) to build add-ins which plug into the ArcGIS Explorer application. An add-in can be used to add a wide variety of functions to the standard ArcGIS Explorer interface, as it can execute any custom code. We could use an add-in to retrieve data or images from the Internet or local system, query a remote database, perform a geoprocessing task on a remote server and extract information from the results, and so on. We can also use an add-in in order to interact with the other classes in the object model of ArcGIS Explorer; for example we can find out information about the existing layers and results, run other add-ins, add content to the map and search the features in local vector layers.

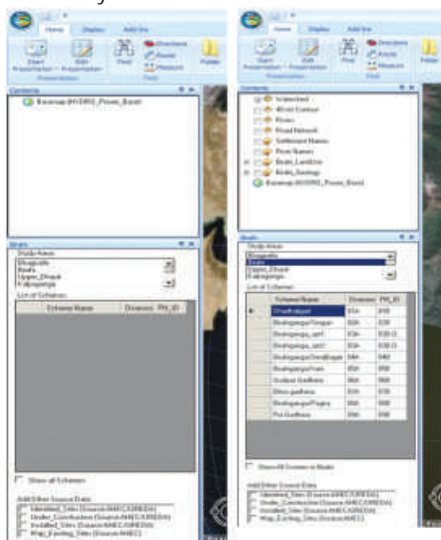


Figure 2: Customized DockWindow in ArcGIS Explorer

Figure 3: populating the grid with schemes

study area the table will be populated with the identified potential hydropower schemes as shown in figure 3. An "on click event" based approach has been implemented to visualize the 3d perspective of the selected scheme on the tabular grid. Hence on clicking any scheme in the tabular grid, the image canvas in the ArcGIS Explorer will zoom to the extent of selected scheme as shown in figure 4.

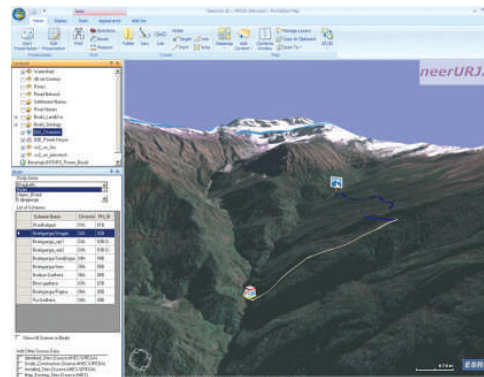


Figure 4: 3D perspective view of selected scheme

The customization further contains showing attribute information as shown in figure 5. Other vector layers like watershed boundary, contours, road network, Landuse map and Geological map can be visualized by clicking the checkbox adjacent to the concerned layer in the contents panel.

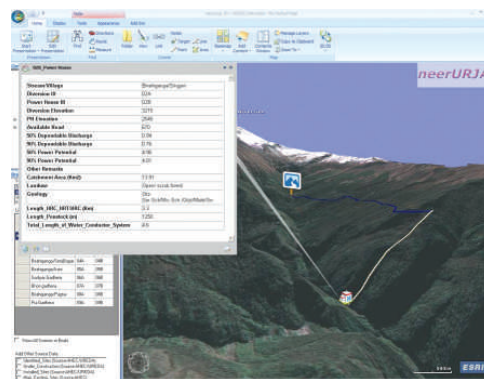


Figure 5: Hyperlinked attribute data of clicked scheme

ArcGIS Explorer 900 API provides four types of 'Add-Ins' as a means to extend the application: Buttons, DockWindows, Extensions, and Galleries. Each type of add-in class is implemented in .NET by deriving from an abstract class in the ESRI.ArcGISExplorer.Application namespace. The ArcGIS Explorer API relies upon the Microsoft .NET 2.0 Framework. The .NET Framework is integral to successful development and deployment of add-ins; Microsoft Visual Studio 2008 (a .NET development environment) is required to develop add-ins, and the .NET Framework must be installed on machines to which add-ins are deployed. The ArcGIS Explorer API supports all current editions of Microsoft Visual Studio 2008 (Express through to Enterprise), and two .NET languages (C# and VB.NET) are supported for add-in development. Using Microsoft Visual Studio 2008, and the ArcGIS Explorer API, add-ins can be developed. Once you have authored an add-in in Visual Studio, the add-in is compiled as a Dynamic Link Library (DLL) file and packaged into an Add-in file (.eaz). When you point ArcGIS Explorer at the add-in file, it recognizes the file as an add-in, and the add-in is available for use in ArcGIS Explorer using the ArcGIS Explorer Add-Ins dialog.

In this customization of neerURJA, DockWindows 'Add-Ins' class has been selected to extent the interface. This interface consists list box to select the preferred study area (1 out of 9 valleys) as shown in the figure 2. On clicking the required

## Conclusion

This study shows how well ESRI's free, downloadable software application lives up to that motto. The application includes a sleek new ribbon interface that lets you easily add content and basemaps, create presentations, and toggle between 2D and 3D map modes. These new tools and features made displaying, visualizing, analyzing, and sharing geographic content and capabilities easier than ever. By design, ArcGIS Explorer 900 is easy to use. It is intended for not just GIS professionals, but also for "GIS information users." Although GIS professionals who are used to doing more complex mapping tasks find innovative ways to use this application, ArcGIS Explorer increasingly fills a niche for these geographic information users.

The current release of ArcGIS Explorer includes a host of enhancements to the API, creating new opportunities for custom task developers. The custom task framework genuinely differentiates ArcGIS Explorer from other virtual globes, allowing users to plug in custom functionality directly into the main application.

## References:

1. [www.esri.com](http://www.esri.com)
2. <http://blogs.esri.com/Info/blogs/arcgisexplorerblog/>

# GIS Facilities @ Department of Geology Presidency College, University of Kolkata, Kolkata

Presidency College, Kolkata has become the new destination for Remote Sensing and GIS scientists. A state of the art Remote Sensing and GIS laboratory has been established in the Department of Geology with the sponsorship from Coal India Limited under an R & D project, the main aim of which is to detect and demarcate underground and surface coal mine fire in Jharia coal field through satellite thermal remote sensing data analysis where Arc GIS 9.3.1 software is being profusely utilized.

This spacious laboratory is well equipped with high-end hardwares along with the updated versions of image processing and GIS softwares like Arc GIS 9.3.1, ENVI RT 4.3, ERDAS Imagine 2010 etc. Voluminous digital and hard copy satellite image data library covering the entire India have been archived in this laboratory, which adds another dimension to the College. Besides satellite images in visible

ranges, this data library also possesses remote sensing thermal digital image data of ASTER, Landsat TM and ETM+ for selected areas. Those data sets are processed for overlaying operations using Arc GIS 9.3.1 software.

A number of R & D projects is now going on in this laboratory under the guidance of Dr Alokesh Chatterjee, Reader and Dr Asis Bhattacharya, Emeritus Scientist of this department. Dr Bhattacharya, who was formerly associated with ISRO, DOS, Hyderabad provided a direction and guidance with his vast knowledge in RS and GIS to set up this laboratory. A number of RS and GIS applications studies are being carried out in this laboratory, using Arc GIS 9.3.1 software. Details of the projects are mentioned below in a tabular format:-

Other than these above-mentioned ongoing projects, a number of new R & D projects are expected to come very soon.

SI No.	Name of the R & D Project	Sponsoring Departments	Duration (in yrs)	Fund (in Lakh)
1	Inventory and Monitoring of Underground and Surface Coal Mine Fire for Modeling Fire Dynamics and Rate of Fire Movements, Jharia Coal-Field, Jharkhand using Satellite Thermal Remote Sensing Data	Coal India Limited (CIL), Kolkata	3	138
2	Ground water prospect mapping on 1:50,000 scale for Maldah district in West Bengal	North Eastern Space Applications Centre (NESAC), Umiam, Shillong	0.5	1
3	Geological investigation of Kachchh mainland fault and associated features, Western India: Implication for fault development and seismicity	Ministry of Earth Sciences (MoES), CGO Complex, New Delhi	3	25.788
4	National geomorphological and lineament mapping on 1:50,000 scale for Sikkim, Meghalaya, Tripura and Mizoram	National Remote Sensing Centre (NRSC), Balanagar, Hyderabad	3	27.864
5	Application of Remote Sensing and GIS technique in groundwater potential study around Ramchandrapur, Purulia District, West Bengal	Department of Geology, Presidency College, Kolkata	2	M Sc Research work
6	Grain boundary detection using GIS technique	Department of Geology, Presidency College, Kolkata	2	M Sc Research work

Many scientists from the field of RS and GIS from various prestigious organizations have delivered valuable lectures in this laboratory to enlighten the students. To mention a few, Dr Prasun Gangyopadhyay, ITC, Netherlands, Dr C S S Reddy, Australian Geological Survey, Dr P S Roy, Dr A Perumal and Dr S K Subramanian from NRSC, Hyderabad, Dr T J Majumder, Space Application Centre, Ahmedabad, Mr Arvind Kumar Malvya and Mrs Saswati Chatterjee from GSI, Kolkata, Prof Soumitra Mukherjee, JNU, Delhi, Mr Mridul Pathak, New York, USA and Mr Bhaskar Bose, Toronto, Canada had put forwarded their valuable suggestions to the scientists working in this laboratory. Programme Co-ordinators of this laboratory visited all the ISRO centers and exchanged their opinion with other ISRO scientists for carrying out advance research work in the field of RS and GIS.

## Activities Taken:

- Ph D programs using GIS enrolled under University of Calcutta are taken under supervisions of Dr Alokesh Chatterjee and Dr Asis Bhattacharya.
- M.Sc dissertations Programmes on various themes of RS and GIS, using Arc GIS 9.3.1 software.
- Students from other institutions use to visit and utilize the GIS

facilities available in this laboratory for their summer training programmes regularly.

- Applied Geology syllabus for M Sc degree in Presidency College has a Full Subject paper on RS and GIS including theory and practical.
- Envisaging a GIS training programme for college lecturers under NNRMS sponsorship in collaboration with EOS, ISRO, Bengaluru.

Coal fire mapping in Jharia coal field, Jharkhand, using Arc GIS 9.3.1 software for overlay operation

Sitting (Left to right): Project Co-ordinators

Dr Asis Bhattacharya, Dr Alokesh Chatterjee

Standing (Left to right): Research Associates

Mr Tanmoy Pramanik, Mr Amitava Mukherjee,

Ms Lopamudra Dasgupta

Programme Co-ordinators:

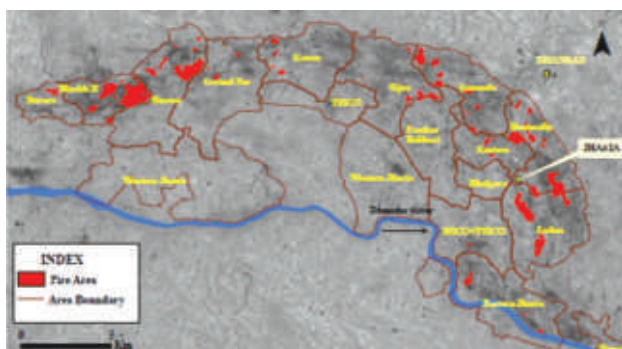
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# 11th ESRI India User Conference



A unique opportunity for the GIS user community to interact and disseminate information was the 11th ESRI India User Conference that was held during 21-22 April 2010 at Radisson MBD Hotel, Noida, in the National Capital Region, Delhi, India. The User Conference offered a wealth of information regarding software and technology from ESRI Inc (USA), ESRI India, exhibitors and business partners. The User Conference kicked off with the remarkable response this year along with the presence of Jack Dangermond, ESRI President at the User Conference. Two days (28-29 April 2009) of user conference was inaugurated by lighting of lamp with august gathering of eminent Users

The two day conference drew a diverse audience of several hundred attendees across the country with a fascinating mix of delegates and bureaucrats from the government agencies and the private sector one that is hopefully representative of the GIS designing our Future the theme of the conference. Designing our future, a vision that combines the wealth of data available about our world with sophisticated analysis and management tools is the prescription for understanding and shaping the future of our planet—an anthropogenic future where advances in human society, technology, etc., are designed in close collaboration with nature, resulting in the best of possible future worlds. Today with GeoDesign, GIS becomes a tool for designers; they can move rapidly through an iterative design process while leveraging the full analytical power of the geodatabase

The inaugural session started off with the address by Mr. Rajesh Mathur, Vice Chairman NIIT GIS Ltd. Addressing the gathering he spoke about the Government's plan for including Geospatial technology in sustainable development. GIS will be one of the key enablers in most of the government led projects be it in power, water, infrastructure, transportation and utilities or the flagship programs such as NREGA, NRLMP etc. Mr. Mathur also gave highlight of the past year at ESRI India, right from improving technical support to putting a help desk in place so that the users get assistance as soon as possible, alert systems to

remind users of their annual maintenance contracts, relationship with ITT Visual information solutions for ENVI Image Processing and Analysis software, establishment of new unit at Parwanoo in Himachal Pradesh and expansion of ESRI India business partner network. He also highlighted that ESRI Technology has been an GIS enabler in all the 12 projects of R-APDRP program announced till now and Water Resource Information system by RRSSC Jodhpur, CGWB and Municipal corporation of Mumbai, Karnataka State Disaster Management Portal by KSNDMC are path breaking as far as ESRI technology is concerned.



Delivering his address Mr. P. Rajendran, COO NIIT Limited, emphasized that e-governance projects and public private partnership are the key drivers of geospatial technology. He also said that the Government is spending millions in areas like literacy, Education, potable water, vocational training and all this has GIS as the key driver to drive the projects. He looked ahead at GIS by drawing the audience's attention to the mega issues such as basic infrastructure that has huge challenge and opportunity where in India would need to adopt such technologies changing the current situation. He also drew the conference attention towards the huge potential for research and development using the satellite imageries which will be soon out of the labs and be a part of the potential common masses.

ESRI President Jack Dangermond, delivered his Plenary address with a simple and yet a powerful statement calling all the professionals to integrate geographic knowledge and design, leading to Geodesign – a new way of organizing, collaborating and communicating in geospatial language. He talked about the convergence of GIS and design and the possibilities of bringing GIS into the design process.

Explaining how GIS has an important role to play in the design



# : Marching Ahead



space, Dangermond said " Taking full advantage of geography during the design process results in designs that emulate the best features and functions of natural systems, benefitting both humans and nature through a more peaceful and synergistic coexistence". Emphasising the need to move beyond the concept of simple maps he opined that geospatial technology application can go even further enabling data analysis, sharing and comparison. He also said that fast accelerating improvements in geospatial technologies will consequently, hasten advances in Geodesign.

Highlighting the features of new design friendly capabilities in the upcoming release of ArcGIS 10 will help professionals apply GeoDesign methodologies to problems and challenges related to anything from climate change to pandemic diseases, environmental protection to food production and resource conservation to infrastructure improvements.



This year during the 11th ESRI India User Conference launched a new platform of recognizing some of eminent user organizations which have done a commendable work using ESRI GIS technology. ESRI India took this opportunity to announce the Special Achievement in GIS India Awards (SAG awards) till now these awards were given only at ESRI International Conference. On the first day, immediately after Mr. Jack Dangermond's Plenary Address these awards were announced by Mr. Rajesh C Mathur, Vice Chairman, NIIT GIS Ltd. National Informatics Centre (NIC) received the awards for its outstanding work in creating multilayer planning system. Registrar General of India (RGI) received the award for consistent innovative work using geospatial technology for Census India. Karnataka State Natural Disaster Monitoring Centre (KSNDMC) was awarded for creating portal on ArcGIS server for disaster management where all the stakeholders can visit and share data relating to disasters.

This was followed by the Technology Exposition session that was indeed awe inspiring and informative. Representative from ITT Visual Informatics Ms. Susan Parks focused on the Road Map of Image processing Suite integrated within ArcGIS system and showing a detailing on the technical exposition of ENVI image Processing suite for the GIS Professionals. Accentuating on the facility management Ricardo Ferreyros from Telvent spoke about what smart grids can do, how they can improve reliability, enhance financial performance, improve customer service and enable sustainability. They can provide seamless interoperability between applications, broaden functions and simplify user experience. Subrata Mitra from IBM India took the audience through the IBM and ESRI alliance and virtual association of various applications where GIS has an immense potential to tackle the issue in different disciplines such as crime management, agriculture, property taxation, retail supply chain management / fleet management / banking or tower management.

Dean Angelides along with ESRI India Technical team presented the potential capabilities of ArcGIS 10 which would be released soon. It is packed with great features, it is easier, fast and more productive. Dean also said we want ArcGIS 10 to be everywhere. Python scripting integrates with GIS and extends the power of analysis and layers can be made time aware. It also highlighted the latest trend of moving ArcGIS to the Cloud. ESRI ArcGIS 10 will transform the way people use and apply GIS. This release will help users be more productive work and provide them with more powerful spatial analysis capabilities while significantly improving performance.



ESRI India always believed in the vision of moving ahead the geospatial technology for the development of the mankind. Keeping this vision alive we had IBM as Platinum Sponsors, Trimble as Gold Sponsors, ITT Visual Information Systems, Telvent and Red Hat as Silver Sponsors who participated

along with ESRI India, Registrar General of India, NIC, CRRI, North South GIS, GeoEye showcasing the cutting edge development in the geospatial domain. Stating the art of exhibition as a large single family of GIS users, exhibitors had an opportunity to display their hardware, software, datasets, data services, application products and GIS information to the user community. The user conference witnessed an attendance of 500 + delegates from 70 + organizations.

Along with the plenary session User Conference also had the technical sessions on the technology, GIS applications and poster session. These technical sessions featured ESRI GIS technology being used by the varied communities in the Indian subcontinent focusing on the major GIS applications. 35 technical papers and 22 posters were presented during the conference along with the display of GIS technology at the exhibition. The Best Paper and Poster Awards were honored to the GIS professionals using ESRI GIS technology.

The first Best Paper was given to D. Giri Babu from RRSC – North, ISRO for NeerUrja – Geospatial Gateway for Potential Hydropower Sites 3D Visualization; second Best Paper award – A. Mohan Rao from CRRI Delhi for Application of GIS for infrastructure projects in Road and Transport Sector; third Best

Paper award went to P. C. Rao, Infotech Enterprises Ltd. Hyderabad for Data Append Tool. The Best Poster Award was given to Mr. G Areendran from World Wildlife Fund, New Delhi.

Two Special Student awards were also awarded - Asheesh Sharma from NEERI Nagpur for NutriL-GIS : A Tool for Assessment of Agricultural Runoff and Nutrient Pollution in a Watershed and N. Shivani Agarwal from Indraprasth Guru Govind Singh University for Forest Change Analysis of Jim Corbett National Park, Uttarakhand - A Remote Sensing & GIS Approach.

As always, the User Conference was a hotbed of new ideas with conversations about trends that are occurring in the GIS world. The Panel Discussion was conducted on second day on "GIS Designing our Future", the panelists were, Maj. Gen. Siva Kumar, Head NSDI; Mr. Uday Kale, Reliance Energy Ltd; Mrs Seema Parihar, Delhi University, Mr. Dean Rogers, ESRI USA and Mr. Rajesh C Mathur, Vice Chairman, NIIT GIS Ltd. who was the moderator of the discussion forum. The forum discussed the various aspects geographical domains such as how GIS is designing the new future relevance to the National Database storage, Infrastructure segment, Manpower resources in the field of GIS and new technological and futuristic approach designing the future of all the disciplines.

## ESRI Participates @ Geointelligence Asia 2010



The Annual Asian Conference on National Security Geointelligence Asia 2010 was held from June 2-3, 2010 at Hotel Taj Palace. The conference was organized by GIS Development. ESRI participated as the Platinum Sponsors of the event along with ESRI Defence team, NIIT GIS Ltd. (ESRI India) and ITT Visual Information Systems.

India's Chief of Army Staff General VK Singh PVSM, AVSM, YSM, ADC inaugurated Geointelligence Asia 2010. In his inaugural address, the Indian Army Chief observed that India's boundary includes high altitude mountains, deserts and coastal zones and geospatial intelligence has a significant role to play in tackling security threats from the porous boundary. According to the General, it creates situational awareness and helps in precision operation. Geointelligence enables forces to work in network-centric environment. Such innovative visual tools multiply forces, said Indian army Chief.

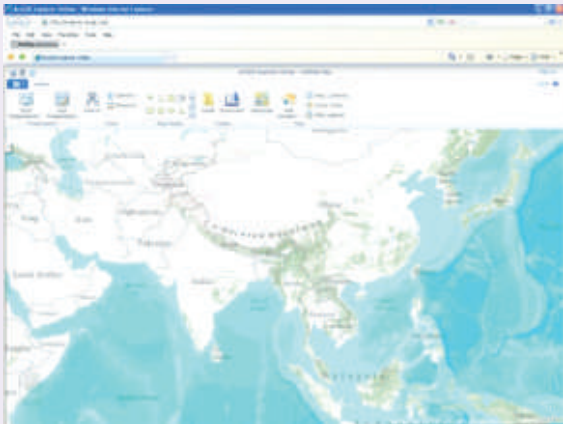
The inaugural session witnessed the release of bi-monthly magazine GeoIntelligence, a publication of GIS Development. The General also opened the exhibition for the public where ESRI exhibited and showcased its state of art solutions for Defence and Security.

Mr. Lawrie Jordan, Director – Imagery, Enterprise Solution, ESRI Inc. US, in his plenary address demonstrated how one can maximise the value of imagery and how it can be further used in various walks of life. He also emphasised on the shift from need to know to need to share and collaborate. Mr. Rajesh C Mathur, Vice Chairman, NIIT GIS Ltd chaired the Plenary Session that discussed about the lawful interception project, battle space awareness and crime statistics analysis, cyber security threats associated with the data and Art of War by Sun Tzu and Clausewitz.



## Explore the world of maps

**A**rcGIS Explorer Online lets you open a map, add other content to it, navigate around it, ask questions the map can answer, and present and share the map.

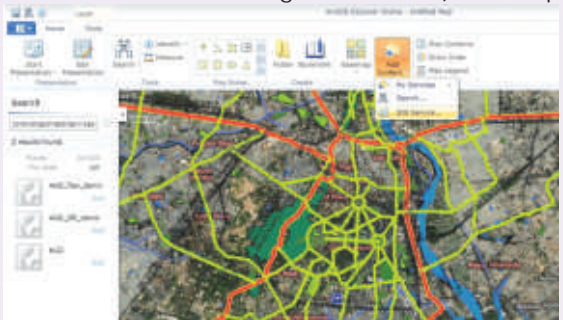


### Creating a presentation of your map

Many a times, we need to prepare and share our maps with our teams. ArcGIS Explorer Online helps us in uploading our Maps, overlay with other Basemaps like Microsoft Virtual Earth etc. and allow us to use other available Webservices. Here we can add Annotations & Texts and finally prepare Layouts. These Layouts can be shared with other team members in the form of presentations using simple steps as follows :

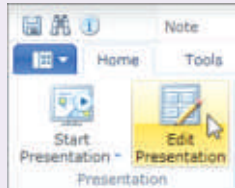
Step 1: Open the URL <http://explorer.arcgis.com/> in a web browser.

Step 2: Add your own content (<http://<your own hosted ArcGIS Server>/arcgis/rest/services>) to the map

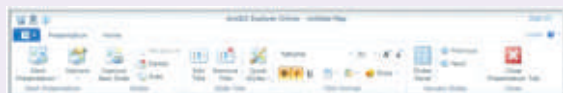


### Step 2: Open the presentation tab

On the Home tab, in the Presentation group, click Edit Presentation:



You'll see the Presentation tab with the Slides panel below it to the left:

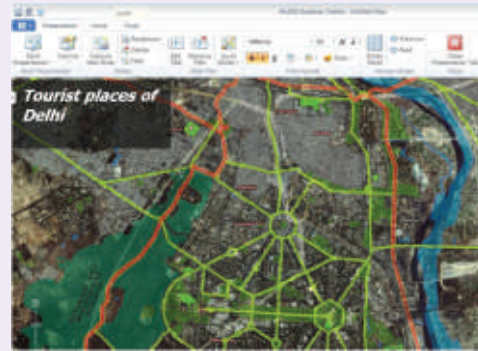


Step 3: Arrange and prepare the map to display the content you want

You can adjust the viewpoint, turn items in the Map Contents panel on or off, add notes, etc.

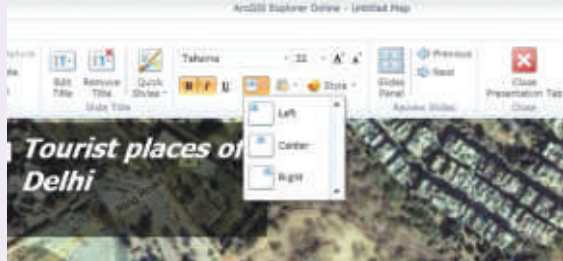
Step 4: Create a slide title

On the Presentation tab, in the Slides group, click Edit Title:



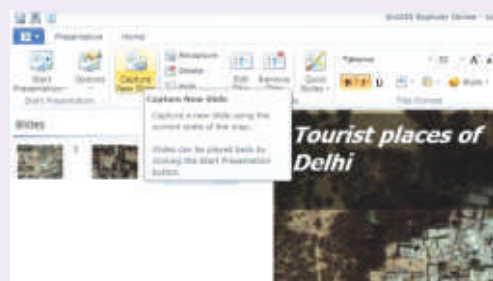
### Step 5: Adjust the title

Using the Quick Styles gallery and/or the various controls in the Presentation tab's Title Format group, you can modify the format of the slide to be captured:



### Step 6: Capture the slide

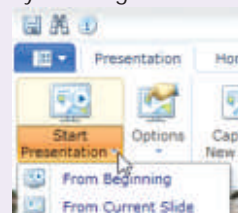
On the Presentation tab, in the Slides group, click Capture New Slide. ArcGIS Explorer Online adds the slide to the Slides panel, positioned after the selected slide, if one exists:



### Step 7: Start a presentation

To start a presentation do one of the following:

- On the Home tab, in the Presentation group, click Start Presentation. You can choose which slide to start with by selecting from the dropdown options:



- On the Presentation tab, in the Start Presentation group, click either From Beginning or From Current Slide.

### My First iPhone Application

The following tutorial will walk you through the process of creating your first iPhone application.

#### Creating the Project

To make it easier to create ArcGIS applications for the iPhone, we've provided a number of ArcGIS templates. The templates import all of the necessary ArcGIS header files and set the required build parameters and library dependencies.



Start by opening Xcode and creating a new project. In the New Project Window, you will be asked to choose from a list of User Templates. On the left panel of the dialog you will see that templates are organized into categories and one of the categories is titled "User Templates". Select ArcGIS from the list of User Templates and you will see a number of ArcGIS templates appear.



Select the View-based ArcGIS Mapping Application template and then click the Choose... button.

Once you have chosen a template, you will be prompted to save the project. Title the project "MyFirstMapApp" and click Save.

Note:

In addition to the required files, the view-based template also provides a view controller to manage the view and a nib file that contains the map view. In Xcode under Groups and Files expand the classes folder and you will notice that the template creates the application delegate and view controller files. The resources folder is where the nib file resides and the required libraries are referenced from within the project.

Test the Application

At this point we should be able to build and run the application successfully. It won't do much other than display an empty view inside of the iPhone simulator. However building and deploying the application at this time ensures that the ArcGIS library is installed in the default directory and can be accessed from an Xcode project.

Note:

If you are unable to successfully run the application, check the location of the libArcGIS.a library. It should be located in the proper directories as outlined in the Creating a New Xcode Project topic.

Developing the Application

To get started writing code into your first project, first open the MyFirstAppViewController.h file and add the following bold lines of code:

```
#import <UIKit/UIKit.h>
#import "ArcGIS.h"
#define kTiledMapServiceURL
@"http://server.arcgisonline.com/ArcGIS/rest/services/
ESRI_StreetMap_World_2D/MapServer"
@interface MyFirstMapAppViewController :
UIViewController{
    AGSMapView *_mapView;
}
@property (nonatomic, retain) IBOutlet AGSMapView
*mapView;
@end
```

In the code above you are creating a constant that represents a URL to a map service hosted on ArcGIS Online. This will represent the layer in our map.

The @class directive is used to specify that we want to declare an AGSMapView object while the @property directive uses the IBOutlet keyword so that we can connect a UIView component to it in Interface Builder.

In the MyFirstAppViewController.m file add the following bold lines of code. Note the viewDidLoad method is already there and you will need to uncomment it:

```
#import "MyFirstMapAppViewController.h"
@implementation MyFirstMapAppViewController

@synthesize mapView = _mapView;
// Implement viewDidLoad to do additional setup after
loading
// view, typically from a nib.
- (void)viewDidLoad {
    [super viewDidLoad];
    AGSTiledMapServiceLayer *tiledLayer =
    [[AGSTiledMapServiceLayer alloc] initWithURL:[NSURL
    URLWithString:kTiledMapServiceURL]];
    [self.mapView addMapLayer:tiledLayer
    withName:@"Tiled Layer"];
    [tiledLayer release];
}
- (void)dealloc {
    self.mapView = nil;
    [super dealloc];
}
@end
```

The code above uses @synthesize directive so the system will create getters and setters for the AGSMapView object. In the dealloc method we perform some memory management by setting the AGSMapView object to nil.

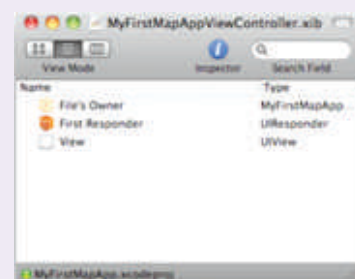
The viewDidLoad method is where we create a service layer and add it to our map view. Notice the service layer is created from the constant you declared earlier. Be sure to release the instance of AGSTiledMapServiceLayer to avoid memory leaks.

What we've done thus far is create an instance of a tiled map service layer and added it to our map View. However, we have not created the visual container that will hold our map. Let's do that now.

Implement the visual component of the map

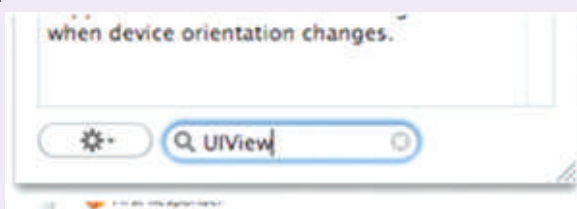
In Xcode double click on the MyFirstMapAppViewController.xib file in the resources directory. This will open Interface Builder.

If it's not already displayed open the main window by clicking Window -> MyFirstMapAppViewController.xib.



Notice the UIView object that's already part of the application. This is provided for us by the template. Now, we will add a subview that will display our map data.

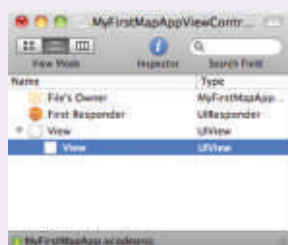
Open the Library window by clicking tools -> Library. The library window contains all of the visual components you can use when developing iPhone applications. We are looking for a UIView component that will display our map data. In the Search bar on the Library window type "UIView".



Notice that the components are filtered by what you type.



Click and drag the UIView object from the library window to the main window and drop it on top of the UIView that already exists. If you are successful in doing this your main window should look like:

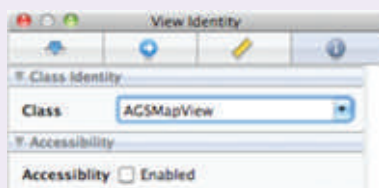


Now, we need to tell the UIView what type of view it is. In this case it is an instance of AGSMapView.

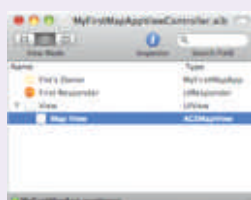
To do this ensure the UIView object you just put in to the main window is highlighted.

Bring up the Identity Inspector by clicking Tools -> Identity Inspector.

In the class drop down type "AGSMapView" and hit enter. It should look like this:



Your main window will look like this. Notice the type of view has changed to AGSMapView.

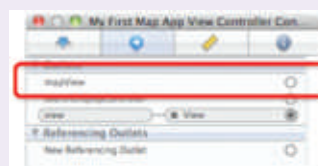


The last step is to hook our AGSMapView up with the object we instantiated in Xcode (mapView).

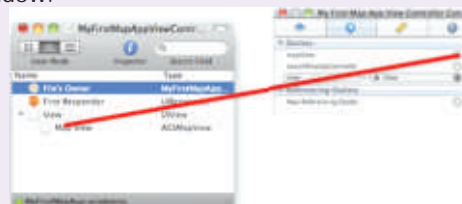
In the main window click on the File's Owner and bring

up the Connections Inspector window (Tools -> Connections Inspector)

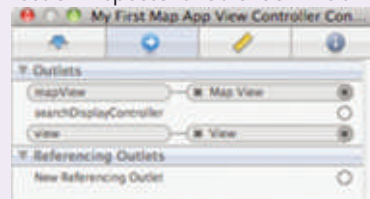
Notice in the inspector there is an object called mapView. This corresponds to the outlet we created in Xcode.



In the Connections Inspector window click and drag the empty circle (far left) to the AGSMapView in the main Window.



The Connection Inspector should look like this:



Save your project in Interface Builder and return to Xcode. Then build and run your application.

Experiment with some of the navigation functionality that's included with the template.

To zoom in:

- Double-click
- Use pinch navigation within the simulator by holding the option key, clicking your mouse and dragging away from the center of the map

To Zoom out:

- Use pinch navigation within the simulator by holding the option key, clicking your mouse and dragging towards the center of the map

Notice that more detail in the map is visible as you zoom in:



Rotate the Map

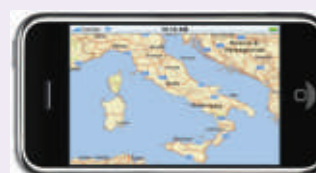
To allow the map to rotate uncomment the shouldAutorotateToInterfaceOrientation method in the MyFirstApp ViewController.m file and add the following code:

```
-(BOOL)shouldAutorotateToInterfaceOrientation:(UIInterfaceOrientation)interfaceOrientation {
    // Return YES for supported orientations
    return (interfaceOrientation != UIInterfaceOrientationPortrait);
}
```

Build and run the application.

To rotate the map click Hardware -> Rotate Left (or the command-Left Arrow buttons).

Notice when the device is rotated the map also rotates.



Source : [www.esri.com](http://www.esri.com)

# “Implementing Route Solver: simplified”

**Web Method Name:** RouteSolver

**Input Parameters to web method:** SourceID, Stops, Type

**Output:** XML Document

**Environment:** Windows

**Version:** ASP.NET 3.5, C#, ArcGIS Server 9.3.1 with Network Analyst extension

## Description:

This webservice demonstrates how to generate a route starting from one source to multiple destinations. The web method accepts the source and destination and generates the shortest route starting from the Source ID. A sequentially arranged list of stops as a XML Document and a link to the map image with the shortest route is returned.

```
using System;
using System.Collections;
using System.Web;
using System.Web.Services;
using System.Web.Services.Protocols;
using ESRI.ArcGIS.Server;
using ESRI.ArcGIS.NetworkAnalyst;
using ESRI.ArcGIS.ADF.ArcGISServer;
using ESRI.ArcGIS.Geodatabase;
using ESRI.ArcGIS.Carto;
using System.Xml;
```

Code Snippet:

```
[WebMethod]
public XmlDocument RouteSolver(string
sourceID, string Stops, string Type)
{
    IServerContext serverContext = null;
    try {
        // Get ServerContext
        serverContext = GetMapServerContext();
        return AddStop(serverContext, sourceID,
Stops, Type);
    } catch (Exception exception) {
        String ex;
        ex = exception.Message.ToString();
        return null;
    }
    private XmlDocument AddStop(IServerContext
serverContext, string dtcID, string csString,
string displayType)
    {
        NAServerProxy naServer = null;
        IMapServer mapServer = null;
        IMapServerObjects mapServerObjects = null;
        IMap map = null;
        IFeatureClass featureClass = null;
        DbInteraction dbInteraction = new
DbInteraction();
        IQueryFilter queryFilter = null;
        XmlDocument xmlDoc = new XmlDocument();
        string sourcefieldName = "";
        string stopfieldName = "";
        string sourceLayer = "";
        try
        {
            mapServer = serverContext.ServerObject as
IMapServer;
            mapServerObjects = mapServer as
IMapServerObjects;
            map =
            mapServerObjects.get_Map(mapServer.DefaultMap
Name);
            queryFilter =
            serverContext.CreateObject("esriGeodatabase.Q
```

```
ueryFilter") as IQueryFilter;
if (displayType.ToLower().Trim() == "ccb")
{
    sourceLayer =
    dbInteraction.GetStringFomXML("CCBDTCLayer").
Trim();
    sourcefieldName =
    dbInteraction.GetStringFomXML("CCBSourceField
Name");
    stopfieldName =
    dbInteraction.GetStringFomXML("CCBStopFieldNa
me");
}
else if (displayType.ToLower().Trim() ==
"wams")
{
    sourceLayer =
    dbInteraction.GetStringFomXML("WAMSDTCLayer")
.Trim();
    sourcefieldName =
    dbInteraction.GetStringFomXML("WAMSSourceFiel
dName");
    stopfieldName =
    dbInteraction.GetStringFomXML("WAMSStopFieldN
ame");
}
featureClass = GetLayer(sourceLayer, map);
if (featureClass == null)
    throw (new Exception("Could not find the DTC
source layer "));
queryFilter.SubFields = "*";
queryFilter.WhereClause = sourcefieldName +
"=" + dtcID;//"FID IN (100,200)";
IFeatureCursor featureCursor =
featureClass.Search(queryFilter, true);
IFeature feature =
featureCursor.NextFeature();
ArrayList ptAryList = new ArrayList();
ArrayList stopsArray = new ArrayList();
while (feature != null) {
    ptAryList.Add(feature);
    feature = featureCursor.NextFeature();
    break;
}
naServer =
NAServerProxy.Create(dbInteraction.GetStringF
omXML("NAServerName"),
dbInteraction.GetStringFomXML("NAServiceName"
), null);
string[] naLayers =
naServer.GetNALayerNames(ESRI.ArcGIS.ADF.ArcG
ISServer.esriNAServerLayerType.esriNAServerRo
uteLayer);
NAServerSolverParams solverParams =
naServer.GetSolverParameters(naLayers[0]) as
NAServerSolverParams;
ESRI.ArcGIS.ADF.ArcGISServer.NAServerRoutePar
ams routeParams = solverParams as
ESRI.ArcGIS.ADF.ArcGISServer.NAServerRoutePar
ams;
solverParams.ReturnMap = true;
solverParams.SnapTolerance =
Convert.ToDouble(dbInteraction.GetStringFomXM
L("SearchTolerance"));
solverParams.MaxSnapTolerance =
Convert.ToDouble(dbInteraction.GetStringFomXM
L("MaxSearchTolerance"));
solverParams.SnapToleranceUnits=
ESRI.ArcGIS.ADF.ArcGISServer.esriUnits.esriMe
ters;
ESRI.ArcGIS.ADF.ArcGISServer.ImageDisplay
imgdisp = new
ESRI.ArcGIS.ADF.ArcGISServer.ImageDisplay();
imgdisp.ImageHeight =
```



```

Convert.ToInt32(dbInteraction.GetStringFomXML
("ImageHeight"));
imgdisp.ImageWidth =
Convert.ToInt32(dbInteraction.GetStringFomXML
("ImageWidth"));
imgdisp.ImageDPI =
Convert.ToDouble(dbInteraction.GetStringFomXML
("DPI"));
solverParams.ImageDescription.ImageDisplay =
imgdisp;
if (routeParams != null) {
routeParams.PreserveFirstStop = true;
routeParams.FindBestSequence = true;
routeParams.ReturnRouteGeometries = false;
routeParams.ReturnRoutes = true;
routeParams.ReturnStops = true;
routeParams.ReturnBarriers = false;
routeParams.ReturnDirections = true;
routeParams.DirectionsLengthUnits =
ESRI.ArcGIS.ADF.ArcGISServer.esriNetworkAttri
buteUnits.esriNAUMeters;//GetStringToesriUnit
s("meters"); }
string[] csStringSplit =
csString.Split(',');
ESRI.ArcGIS.ADF.ArcGISServer.PropertySet[]
propSets = new
ESRI.ArcGIS.ADF.ArcGISServer.PropertySet[csSt
ringSplit.Length + 1];
//Preserve first stop
ESRI.ArcGIS.ADF.ArcGISServer.PropertySet
propSet1 = new
ESRI.ArcGIS.ADF.ArcGISServer.PropertySet();
propSet1.PropertyArray =
CreateLocationPropertyArray(dtcID,
((ESRI.ArcGIS.Geometry.IPoint)((ESRI.ArcGIS.G
eodatabase.IFeature)ptAryList[0]).Shape).X.To
String(),
((ESRI.ArcGIS.Geometry.IPoint)((ESRI.ArcGIS.G
eodatabase.IFeature)ptAryList[0]).Shape).Y.To
String(), null);
propSets[0] = propSet1;
string stopLayer="";
if (displayType.ToLower() == "CCB".ToLower())
stopLayer =
dbInteraction.GetStringFomXML("CustomerLayer"
);
else if(displayType.ToLower() ==
"WAMS".ToLower())
stopLayer =
dbInteraction.GetStringFomXML("PoleLayer");
featureClass = GetLayer(stopLayer, map);
queryFilter.WhereClause = "";
bool isNum = false;
int num;
System.Collections.Specialized.NameValueColle
ction workOrderCollection = new
System.Collections.Specialized.NameValueColle
ction();
for (int fids = 0; fids <
csStringSplit.Length; fids++)
{
workOrderCollection.Add(csStringSplit[fids].S
plit('|')[0].ToLower().Trim(),
csStringSplit[fids].Split('|')[1]);
isNum =
Int32.TryParse(csStringSplit[fids].Split('|')
[0], out num);
if (fids == 0)
if(isNum) queryFilter.WhereClause =
stopfieldName + "=" +
csStringSplit[fids].Split('|')[0];
else queryFilter.WhereClause = stopfieldName
+ "=" + csStringSplit[fids].Split('|')[0] +
""; else
if(isNum) queryFilter.WhereClause += " OR "
+ stopfieldName + "=" +

```

```

csStringSplit[fids].Split('|')[0];
else queryFilter.WhereClause += " OR " +
stopfieldName + "=" +
csStringSplit[fids].Split('|')[0] + "";
}
featureCursor =
featureClass.Search(queryFilter, false);
feature = featureCursor.NextFeature();
ArrayList ptAryList1 = new ArrayList();
while (feature != null) {
ptAryList1.Add(feature);
feature = featureCursor.NextFeature(); }
for (int len = 0; len < ptAryList1.Count;
len++)
{
//Get all the subsequent stops
propSet1 = new
ESRI.ArcGIS.ADF.ArcGISServer.PropertySet();
IFeature loopFeature =
(ESRI.ArcGIS.Geodatabase.IFeature)ptAryList1[
len];
string nameVal =
loopFeature.get_Value(loopFeature.Fields.Find
Field(stopfieldName)).ToString();
propSet1.PropertyArray =
CreateLocationPropertyArray(nameVal + " - "
workOrderCollection[nameVal.ToLower().Trim()]
((ESRI.ArcGIS.Geometry.IPoint)((ESRI.ArcGIS.G
eodatabase.IFeature)ptAryList1[len]).Shape).X
.ToString(),
((ESRI.ArcGIS.Geometry.IPoint)((ESRI.ArcGIS.G
eodatabase.IFeature)ptAryList1[len]).Shape).Y
.ToString(), null);
propSets[len + 1] = propSet1;
}
ESRI.ArcGIS.ADF.ArcGISServer.NAServerProperty
Sets StopsPropSets = new
ESRI.ArcGIS.ADF.ArcGISServer.NAServerProperty
Sets();
StopsPropSets.PropertySets = propSets;
routeParams.Stops = StopsPropSets;
//Solve the Route
NAServerSolverResults solverResults = null;
solverResults =
naServer.Solve(solverParams);
if (displayType.ToLower().Trim() == "wams"){
System.IO.MemoryStream imageStream = new
System.IO.MemoryStream(solverResults.MapImage
.ImageData);
System.Drawing.Bitmap rawBitmap = new
System.Drawing.Bitmap(imageStream, false);
imageName = "Route_" +
System.DateTime.Now.ToString("yyyy-MM-dd hh-
mm-ss") + ".jpeg";
rawBitmap.Save(dbInteraction.GetStringFomXML
("ImagePath") + imageName);
XmlElement root =
xmlDoc.CreateElement("MapPath");
xmlDoc.AppendChild(root);
XmlElement strURL =
xmlDoc.CreateElement("URL");
strURL.InnerText =
dbInteraction.GetStringFomXML("VirtualPath")
+ imageName;
root.AppendChild(strURL);}
else if (displayType.ToLower().Trim() ==
"ccb"){
xmlDoc = OutputDirections(solverResults);}
return xmlDoc; }
catch (Exception exception)
{
string ex;
ex = exception.Message.ToString();
return xmlDoc; } } }

```



## ESRI Application Lets Anyone Build and Share Economic Impact Maps of the Gulf Oil Spill

### People Can Create Custom Maps or Embed Mapping Capability into Their Web Sites

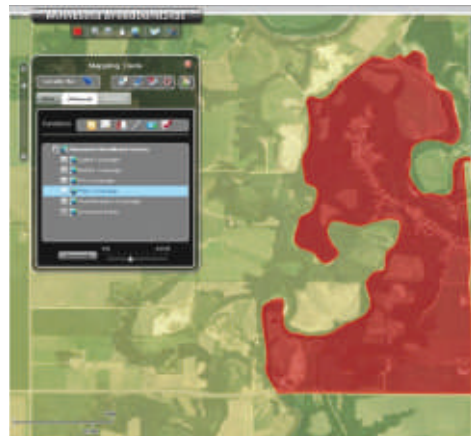
A new ESRI-powered mapping application allows anyone to freely create and share dynamic oil spill economic impact maps. The application allows individuals to visualize and understand the spill's economic effects related to fishing, boating, tourism, and employment in the vicinity of the Gulf of Mexico. They can quickly create a precise economic impact map of the area of interest using ZIP Codes or other location data, then share it using Facebook, Twitter, or e-mail.

"ESRI developed this application to provide a better understanding of what's happening in the Gulf beyond the spill footprint," says Russ Johnson, public safety manager, ESRI. "There is a lot of good data available from different government sources. Maps are a way to bring complex information together and quickly make sense of it. Our Web service is easy to use and provides location-specific information for areas throughout the Gulf states."

The ESRI-developed application provides an interactive map of the Gulf Coast, along with data overlays illustrating the current size and location of the oil plume. Data updates provided by the National Oceanic and Atmospheric Administration (NOAA) include beached oil and oil spill concentrations and areas of uncertainty. People can visualize the oil spill data on top of economic data to gain a better understanding of the disaster's impact. They can then create their own specific maps based on their area of interest and the available business data they want to view.

In addition, the application gives anyone the tools to easily embed the economic impact mapping functionality into their own Web pages.

For more Information Visit - <http://mapapps.esri.com/disasters/create-map/oil-spill-econ/index.html>



## ESRI's BroadbandStat Puts Interactive Maps Online

### Four States Inaugurate Maps Showing Detailed Broadband Coverage

The states of Michigan, Minnesota, Nevada, and South Carolina are now providing easy-to-use maps that show in detail each state's broadband coverage. The interactive, online maps are made possible by BroadbandStat, an application based on ESRI geographic information system (GIS) technology, and will help the states plan and improve high-speed Internet access for their residents and businesses. The BroadbandStat maps were funded by grants from the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA) and contribute to the comprehensive national broadband map that NTIA is required by the American Recovery and Reinvestment Act to create and make publicly available by February 2011.

"A complete, interactive broadband map is now available for customers, Internet service providers, and policy makers," said Orjiakor Isiogu, chairman of the Michigan Public Service Commission (MPSC), about the new map hosted on the Connect Michigan Web site. "This is an important first step as the state seeks to target resources to those areas of the state without high-speed Internet service."

Interactive tools include the ability to identify the population density and unserved households in a selected area, link to news about broadband-related projects, and create reports and charts.

MPSC received a \$1.8 million NTIA grant to launch its broadband mapping and planning initiative. Over the next 18 months, Michigan's initial BroadbandStat map will be updated and refined as additional data becomes available. Connect Michigan, Connect Minnesota, Connect Nevada, and Connect South Carolina are the entities tasked with collecting the data and producing their states' online maps. All are affiliated with the nonprofit Connected Nation organization, which partnered with ESRI to create BroadbandStat.

Connect Nevada was awarded \$1.4 million in stimulus funds through the NTIA for broadband mapping and planning. Nevada's broadband map includes data collected on the availability, speed, location, and type of broadband services from more than 35 state broadband service providers.

During the inauguration of his state's BroadbandStat map, Nevada governor Jim Gibbons said, "Nevadans will now have a map that not only puts information about available broadband services at their fingertips but also defines where the state and the private sector need to focus their attention to bring high-speed Internet to every part of our state."

Connect Minnesota and Connect South Carolina worked with their state broadband service providers to accurately pinpoint remaining gaps in broadband availability across the state. They also collected data from community anchor institutions such as schools, universities, libraries, hospitals, and public safety facilities, which are potential sites for providing community access to broadband services.

For links to each state's interactive maps and more information on BroadbandStat, visit [www.esri.com/bbstat](http://www.esri.com/bbstat).