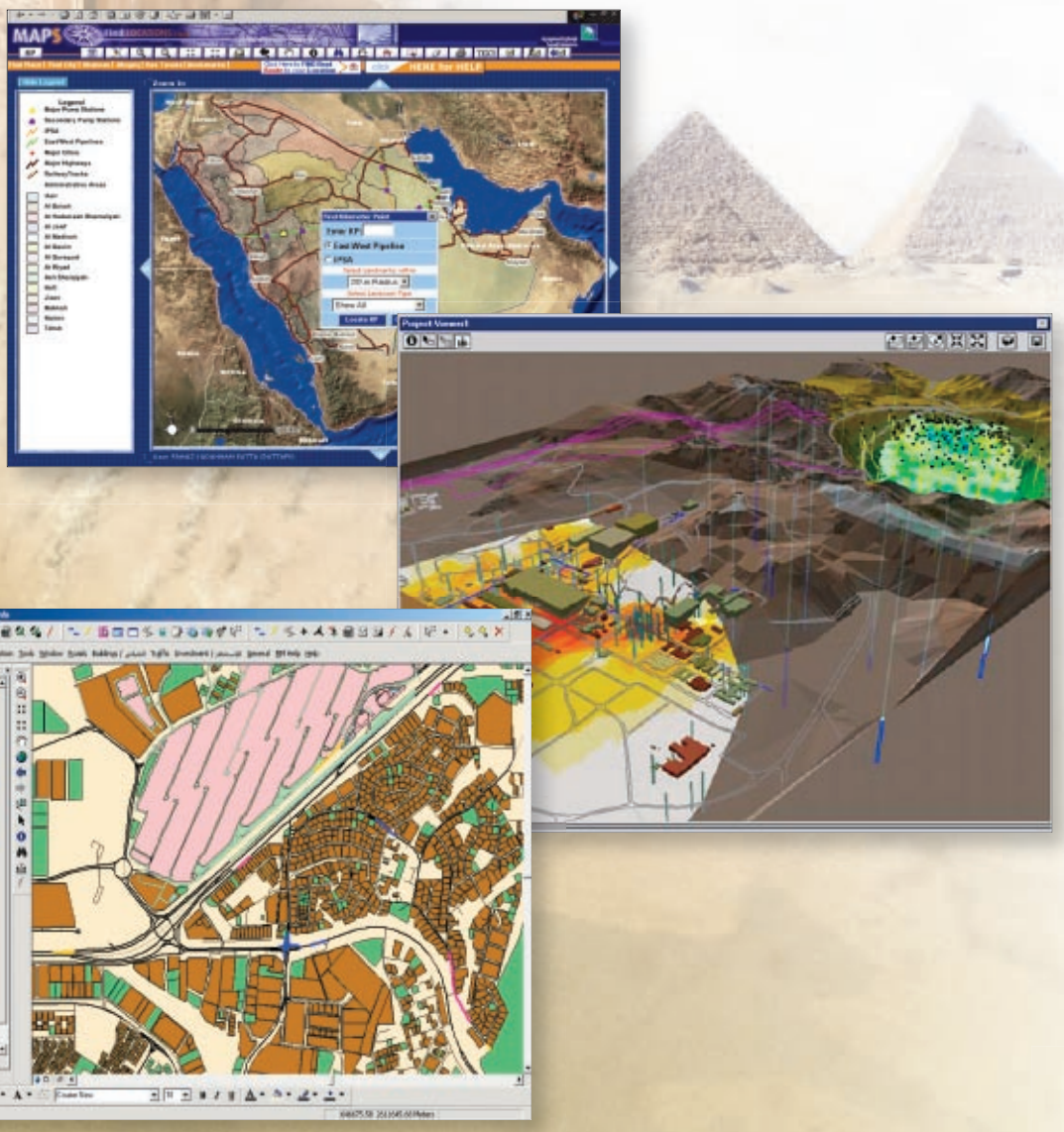
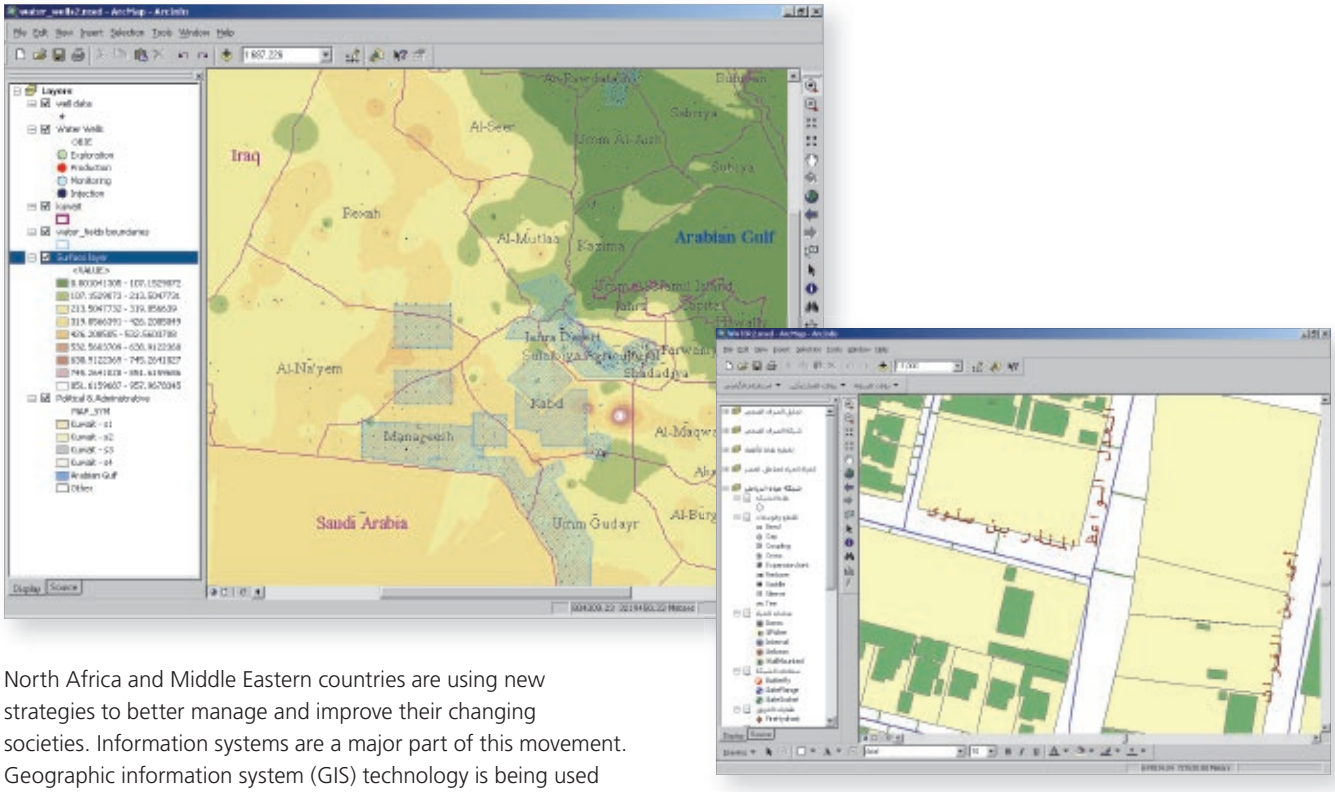
GIS for the Middle East and North Africa



ESRI

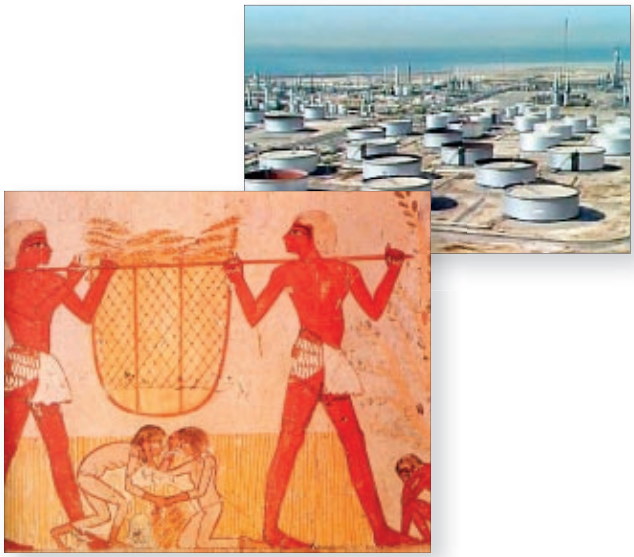
GIS for the Middle East

ESRI GIS Technology for a Better Future



North Africa and Middle Eastern countries are using new strategies to better manage and improve their changing societies. Information systems are a major part of this movement. Geographic information system (GIS) technology is being used both for industrial progress and for the sustainable development of resource management. GIS helps planners and policy makers maintain a balance of modernization and tradition as a core technology for building a better future for the Middle East and North Africa.

GIS enables its users to intelligently manage and manipulate their geographic data. Business and government analysts use GIS to review patterns and processes of projects. Administrators and managers integrate spatial information into daily routines, operations analysis, and interdepartmental work flows. Policy makers are in a position to create the foundation for ensuring the longevity of thriving communities, commerce, and government. By using GIS for spatial analysis and perspective, they are able to understand better the past, present, and future environments they may influence. Whether interdepartmental, interagency, or international, GIS enterprise solutions open a world of possibilities.



Forward thinking government agencies and private industries have found GIS essential for the management of utilities, law enforcement, health care, road services, agriculture, water resources, petroleum and pipeline facilities, mining, and much more.

ESRI and our business partners work together to bring governments and industries benefit and value from their GIS. This value comes from

- Improved service delivery and management effectiveness
- Efficient design and management of engineering projects
- Data sharing that supports decision making
- Collaborative efforts
- Decreased redundancy
- Visualization of data to create new information
- Support of daily work flow throughout the organization

Enterprise GIS

The Key to Efficient Data and Information Sharing

The concept of deploying enterprise GIS is a new way of thinking about doing business within an agency. Organizations that implement GIS enterprise solutions leverage their database investments by enabling data to be used for geospatial analysis and making it available to many people.

Bring GIS to the Heart of the Organization

GIS is considered enterprise if, by design, it is part of the overall information technology architecture of the company. This implies that GIS is integrated with standard corporate systems such as work management, marketing, and engineering.

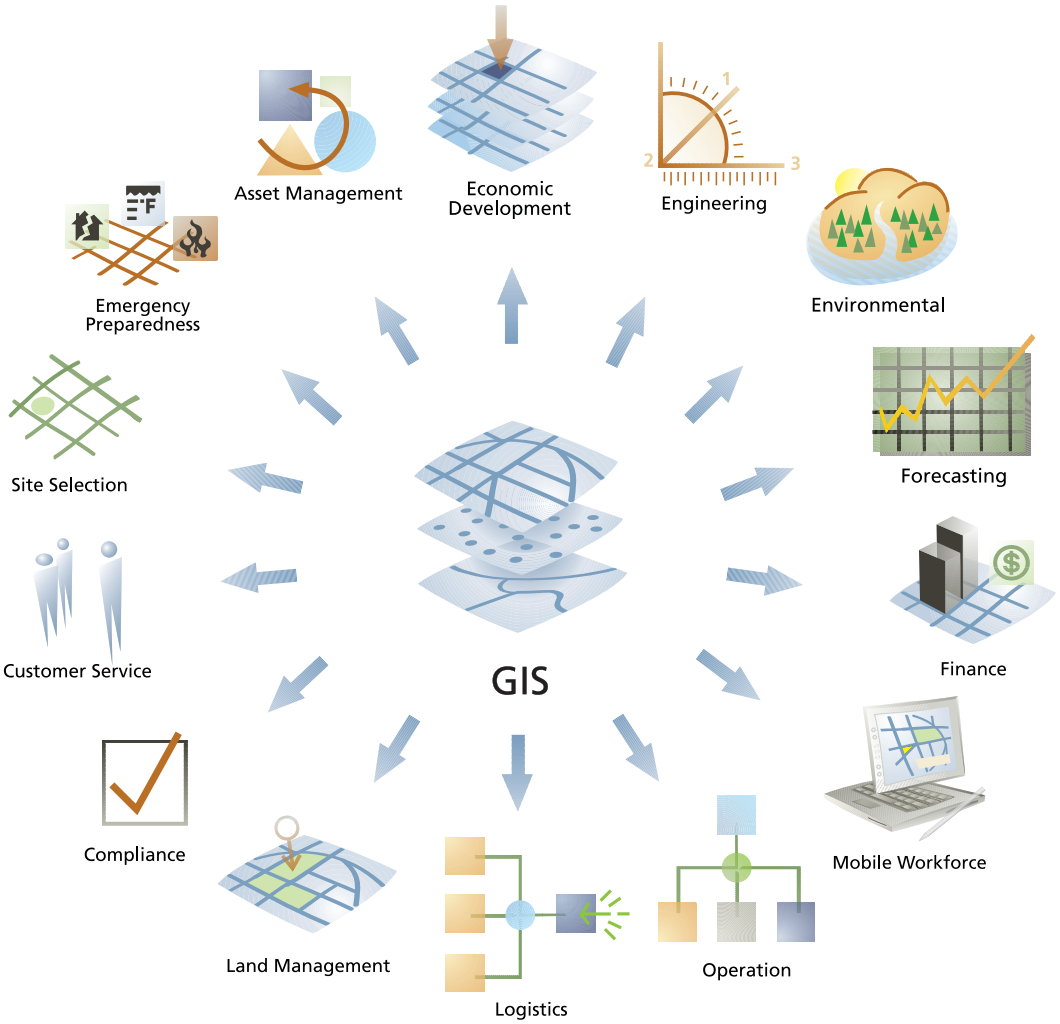
Enterprise GIS has vastly increased the efficiency of data sharing within organizations. Any organization that services multiple entities benefits from the flow of information facilitated by GIS. Different departments are able to concurrently use data to keep their functions operating at full potential.

Many organizations embed GIS functionality directly into other non-GIS corporate applications. Not only can the functions be embedded, but the data accessing ability is embedded as well. This allows users to access and leverage the investment in the GIS database but not have to integrate a GIS system with the corporate system to benefit from the data.

ESRI has given much attention to the relationship between GIS and information technology infrastructures. For our software users, this means compatibility and interoperability with major enterprise systems such as enterprise resource planning, customer relationship management, database management, work management, decision support, and others.

Integrate GIS with corporate information technology for

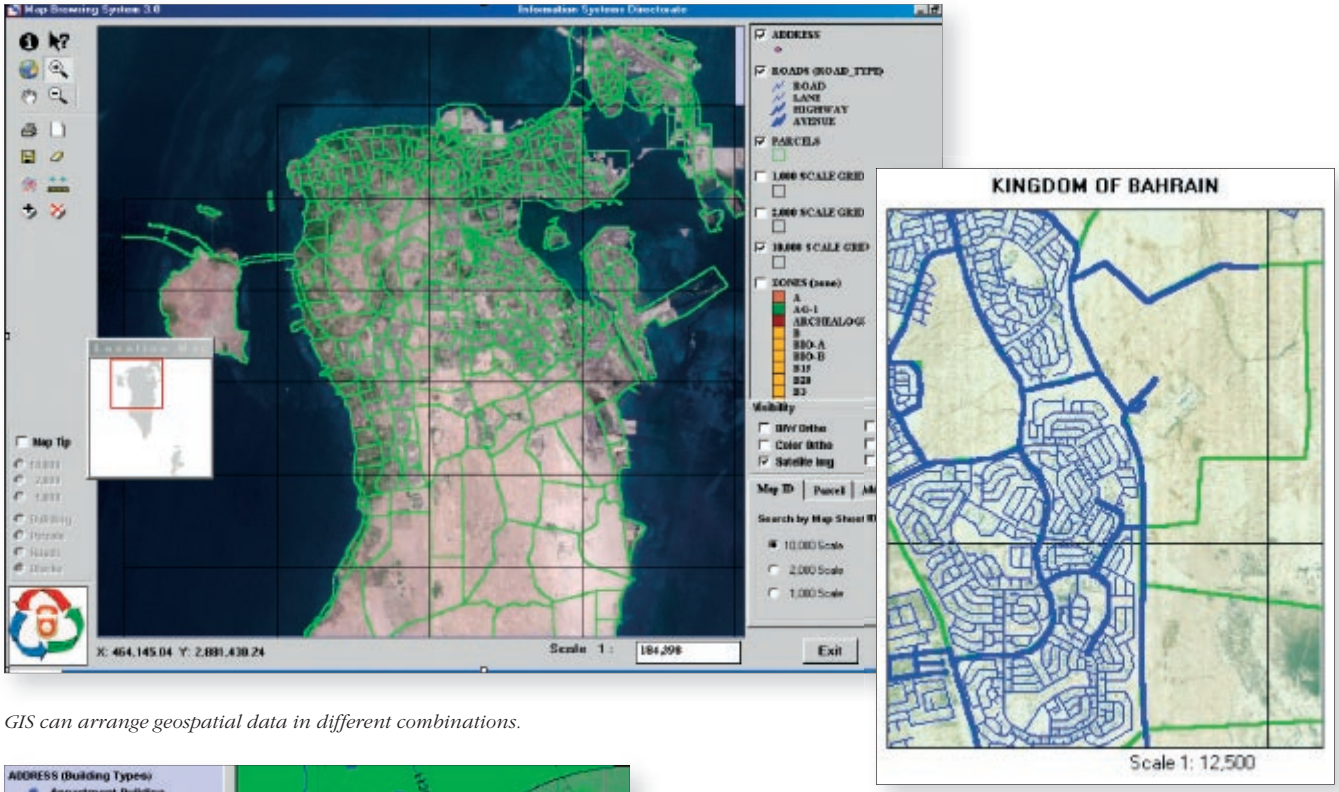
- Customer collection systems
- Customer service systems
- Financial systems
- Work management systems



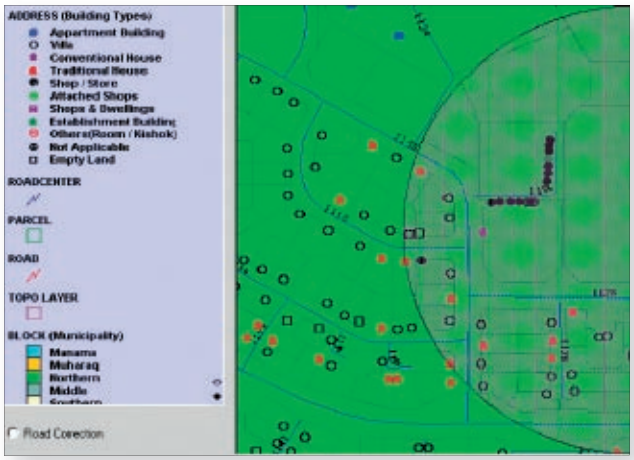
Use GIS as an organizationwide resource.

Bahrain

Land Information Systems



GIS can arrange geospatial data in different combinations.



Users can create maps based on very specific features.

Cities that have land information systems with GIS components bring many databases into one integrated system. GIS-enabled land information systems streamline a city's business processes for zoning regulations, application review, approval, inspection, and work flow. Hazardous and environmental conditions can be easily assessed. GIS provides municipal views of properties, building permits, site plans, project tracking, search of records planning processes, and more. From zoning to environmental planning, GIS delivers intelligent land system management.

Bahrain's Information Systems Directorate uses GIS to improve the kingdom's method of issuing addresses. The directorate's Address Management System (ADDMS) was developed to store, analyze, query, and manipulate the address data spatially and nonspatially. GIS maintains an intelligent spatial database and a Spatial Database Engine™, called ArcSDE®, that manages data in this relational database. This GIS environment makes it possible for users in 12 municipality locations to share the geodatabase and simultaneously update the address layer from different municipalities. Users validate the data and then add new addresses. This access keeps the database up-to-date.

Workers use ADDMS, which supports both Arabic and English, to make specific queries based on specific features. For example, queries are made using a landmark list that is available in the menu. Application users create maps based on blocks, roads, areas of interest, and even the features of an individual building. GIS shows the shortest distance, creates the shortest route, and calculates distances. In addition to maps, ADDMS also produces customized charts and reports.

A logical buffer analysis tool shows polygons around points that include queried features or events. Planners and decision makers use ADDMS to visualize statistical information about buildings at a specific address and can even access building information that shows floor details.

Bahrain

Land Management

Click on a GIS map to view all projects in an area.

Property location and details can be viewed.

Professionals from planning, building and safety, public works, and engineering use ESRI® software for land management solutions. GIS software is used to perform traditional land management tasks more efficiently and more easily.

Bahrain owns and uses many government lands. Offices, commercial complexes, and markets have been developed on these lands and are rented to the public. The GIS team of Bahrain's Information Systems Directorate designed a GIS called the Land and Property Management System (LPMS). It helps the directorate administer government lands and construction projects.

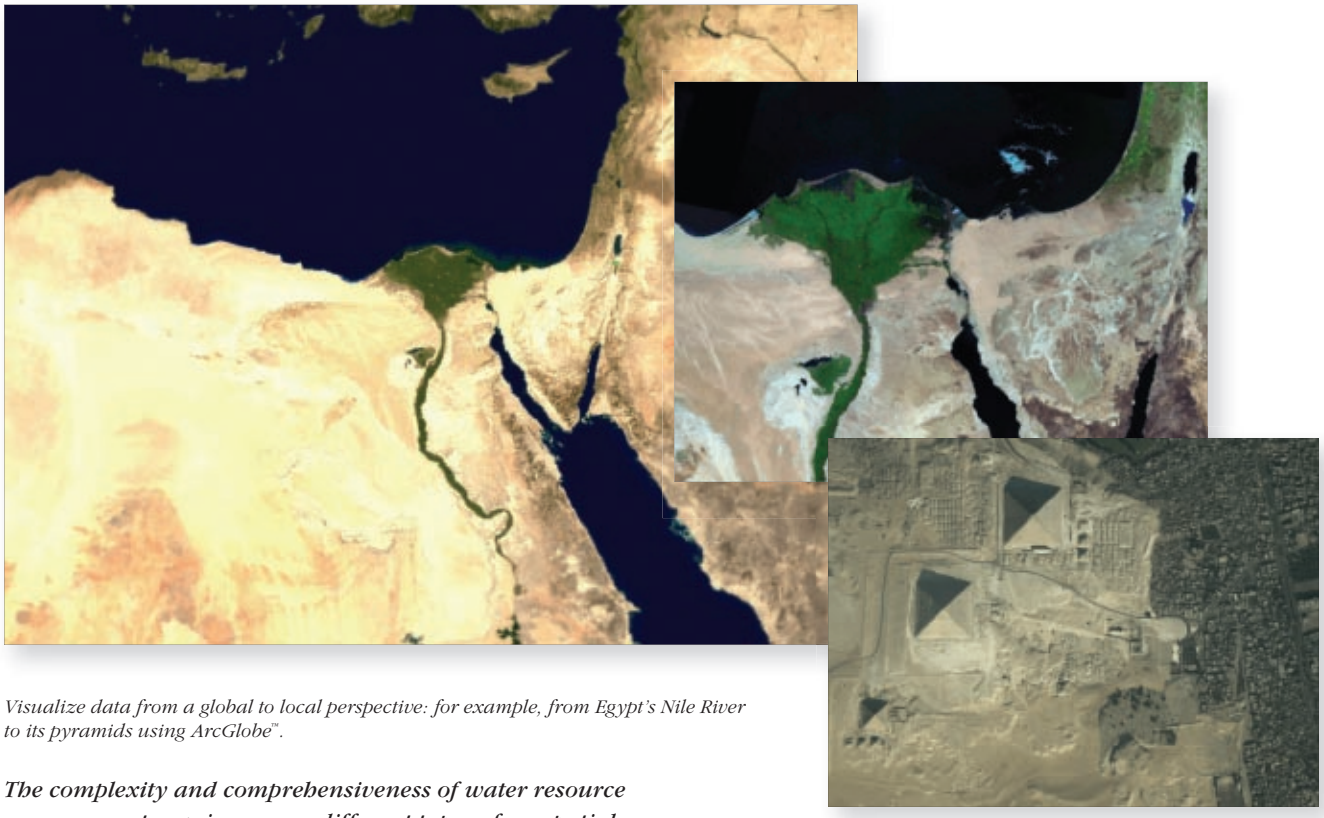
The GIS team collected land maps and checked their geographic details, such as land area, land dimensions, and locations, against government land survey data to make sure the land maps were accurate. After they made corrections, the team converted the maps to the GIS shapefile format. Then each tract of land was assigned a unique number, and the project maps and their details linked with the tract of land using this unique identification.

The information was coded under three classifications. Land information included land area, land cost, and ownership details. Project information included project name, contractor name, commissioned date, and cost. Property information included shop address, rent cost, tenant details, and agreement details. In addition, all the lands' title/deeds were scanned using Watermark software and stored in a centralized server.

GIS is important for its ability to show layers of information on a basemap. LPMS offers a selection of four base layers: block, road network, topographic, and orthographic photo. A project's maps can be layered over a land layer or other layer to create a variety of map views. All these layers are set to display at a particular scale to make the map view clearer. The availability of shops and their details are updated using an Oracle-based application in which maps are not required. The GIS and the Oracle® databases are linked together through the LPMS application, and the user can view the updates immediately. The GIS user can view all projects in a land area simply by clicking on the area of the map. With another keystroke, the property details for each project and the property's usage can be viewed. GIS analysis functions help the user identify available shops and their details immediately. Then with another keystroke, the user can view nonspatial data such as an image of the title/deed. This application helps municipality staff find property details quickly and helps management by merging both spatial and nonspatial data.

Egypt

Water Resource Management



Visualize data from a global to local perspective: for example, from Egypt's Nile River to its pyramids using ArcGlobe™.

The complexity and comprehensiveness of water resource management requires many different types of geospatial information. This data is manipulated by GIS to derive map layers that show slope, vegetation fuel loads, and drainage protection zones from buffered hydrologic features. GIS simulation models can produce vulnerability maps for ecological resources, fire hazard, slope instability, cultural resources, and water quality.

The diversified water-related challenges facing water resources management in Egypt require the efforts of a multidisciplinary research team. The National Water Research Center (NWRC) is a pioneer institution for various water research activities in Egypt. A component of this team is geospatial science.

NWRC uses GIS in its National Water Quality and Availability Management (NAWQAM) project. The main goal of the NAWQAM project is to design and implement a spatial database in the Center's Central GIS Unit. The GIS team completed a detailed design for NWRC's spatial database needs including the processes, applications, and technology required for accessing and sharing information, standards, and guidelines for spatial attributes. NAWQAM is built on ESRI's GIS software, which is used for capturing geospatial data, managing the geodatabase, creating models, and distributing GIS output.

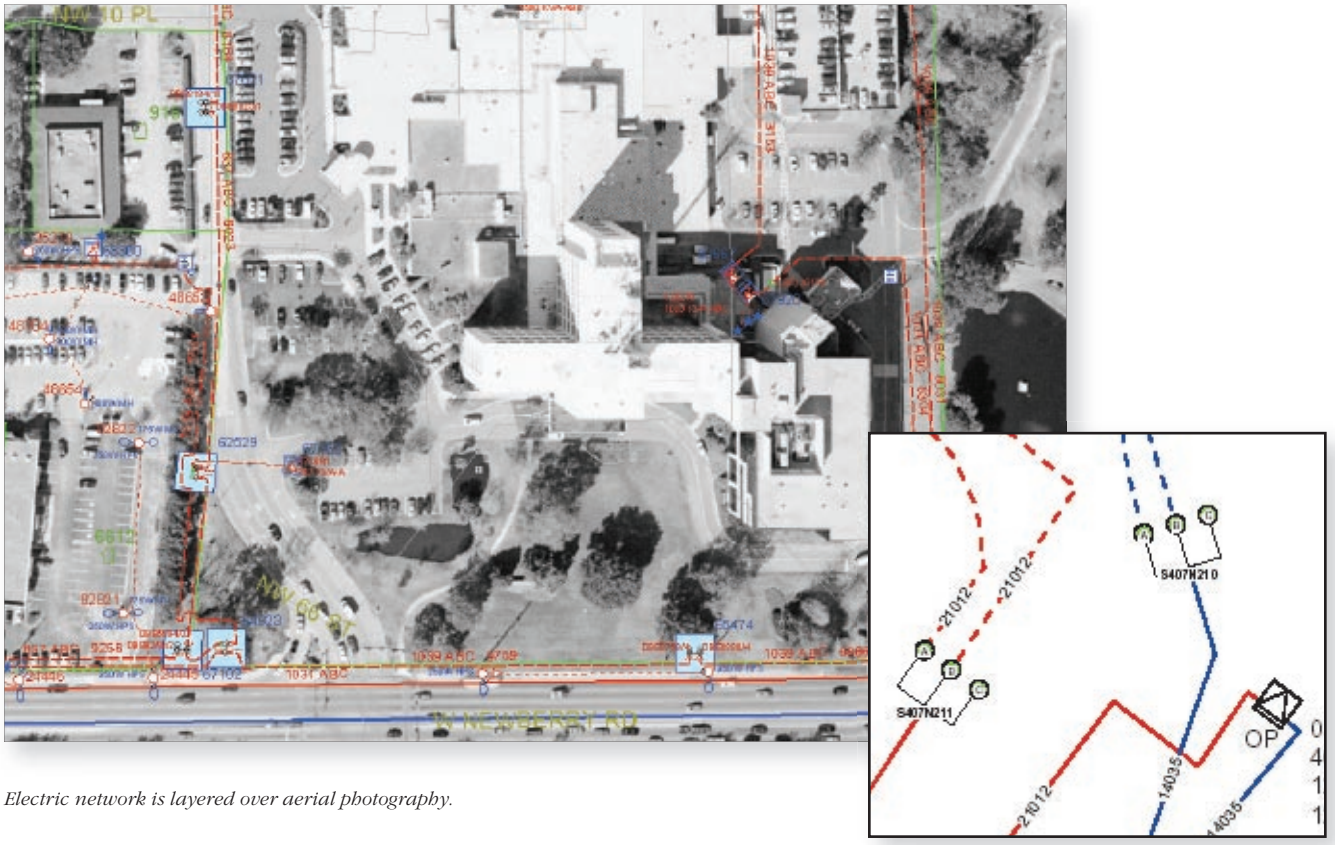
ESRI's software is used for analyzing hydrologic information. Arc Hydro, an ArcGIS® data model for water resources, opens the way for building hydrologic information systems that synthesize geospatial and temporal water resources data to support hydrologic analysis and modeling.

Exchange of water quality data is essential to the ministry's 12 research centers. Therefore, NAWQAM uses a GIS enterprise solution that includes a spatial database index to interconnect existing GIS nodes across the Internet/Intranet over secure networks to share information. ArcIMS® (Internet Map Server) software allows users to centrally build and deliver a wide range of GIS maps, data, and applications inside—as well as outside—the organization. The ArcIMS metadata server enables GIS users to manage metadata in a catalog and search for geographic information.

The benefits of this standardized and interoperable system extend beyond the ministry's central needs. The Egyptian government is employing GIS technology to create a number of useful applications in different government sectors and ministries throughout the country. This geospatial data infrastructure includes the Ministry of Education, the Egyptian Academy for Scientific Research and Technology, the Ministry of Manpower and Immigration, the Ministry of Foreign Trade, the Ministry of Information, and many other services. This government portal includes the Ministry of Water Resources and Irrigation's online database, which will also link portal visitors to the ministry's affiliated entities, projects, services, and news.

Egypt

Electric and Gas



Electric network is layered over aerial photography.

Schematic map shows devices on the network.

GIS applications integrate and spatially enable gas and electric utility services' business processes. ArcGIS is used by gas and electric utility management to model, edit, maintain, and manage facility asset data. GIS offers spatial analysis tools for predictive maintenance to show where problems may exist, support corrective maintenance by locating where poorly performing assets tend to occur, access external data sources to find out where new loads may materialize, and offer intelligent insight for load forecasting and planning. In addition to facilities management, GIS is used for trouble call and outage management, customer information service, field automation, fleet/technician management, and executive information.

North Delta Electricity Distribution Company (NDEDCO) is responsible for supplying electric energy for different purposes on both medium and low voltage networks among three North Delta Governorates (Dakahlia, Kafr Elsheik, and Damietta), which represent approximately one-sixth of the Egyptian population.

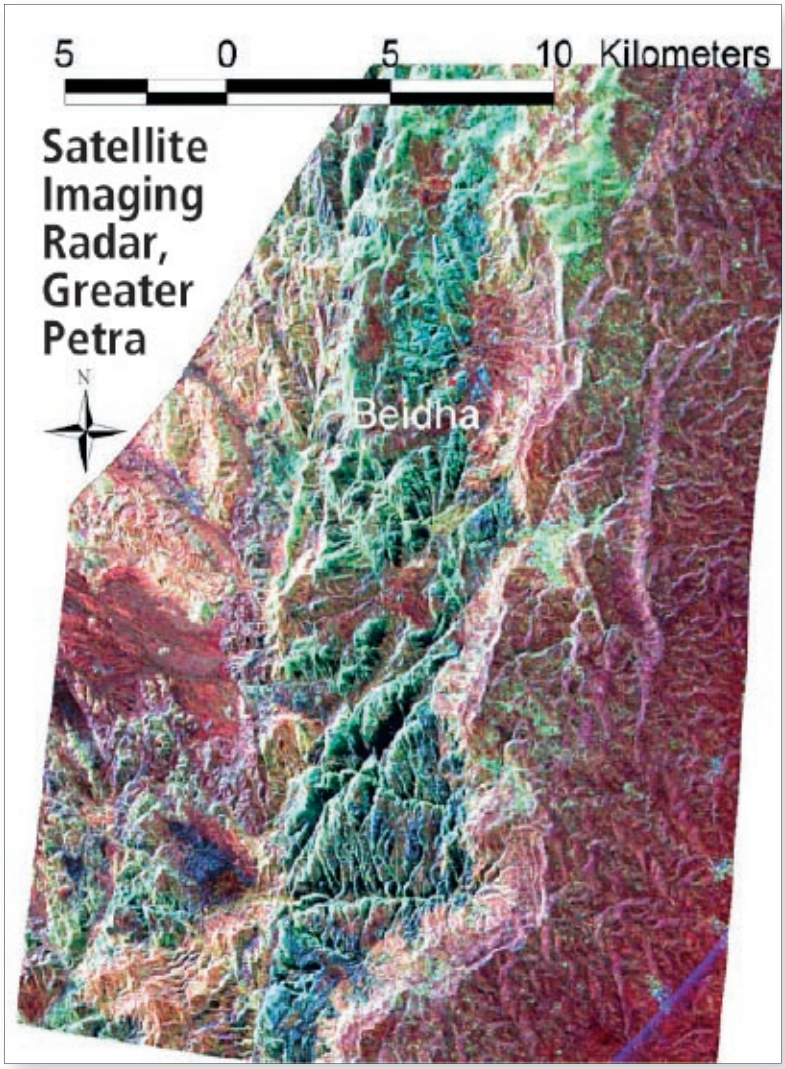
North Delta Electricity Distribution Company uses ESRI GIS software to manage its electric power facility. It digitized its facility assets. ArcSDE is used for quality assurance of geodata entry and management of the utility's geodatabase.

For outage management NDEDCO is implementing a SCADA system. SCADA is a system for monitoring and controlling the real-time status of equipment out in the field such as substation components and certain line equipment. The NDEDCO staff displays SCADA information in its GIS. This way, it can immediately see the number of customers who are affected when a piece of equipment fails. GIS also helps engineers prioritize the recovery efforts in a storm or emergency situation. SCADA is soon to be implemented in most of Egypt's power companies. Integrating the system with GIS will provide them with spatial analysis of system efficiency.

NDEDCO is also using a GIS-produced schematic map. ArcGIS Schematics is an ESRI® software extension that allows users to obtain logical views of a utility layout. Users can create easy-to-read multilevel representations (geographic, geoschematic, and schematic) of any linear network and drill down into and manage network information. NDEDCO's schematic maps, which are delivered online, show a medium-voltage electricity network.

Jordan

Archaeology



Analysis of SIR-C/X-SAR radar data collected by the Space Shuttle Endeavor *in 1994 of the environs of Beidha in southern Jordan revealed three distinct geological zones and an important transitional area between two of them. On the right (east) is a limestone formation from the Cretaceous Era, 100 million B.P., which appears as a wide, generally smooth, deep purple band; in the middle lies the Cambrian/ Ordovician sandstone formation (ca. 450 million years old) appearing bluish green, cut through in many places by canyons of varying widths. To the far left, alluvium appears as a band of variegated purples, greens, and tans. Between the limestone and sandstone appears a thin bright line representing a disconformity between these two geologic zones. Important aspects of this geologic structure are illuminated by topographic data. Image analysis is by Douglas C. Comer, Ph.D.*

The potential of GIS to help archaeologists understand how ancient people influenced and were influenced by their environment is tremendous. GIS helps a researcher examine intersite patterns and make inquiries into how people lived.

The Madaba Plains Project (MPP) has been involved in the archaeology of Jordan since 1968, discovering hundreds of sites during surveys of the Madaba region and conducting excavations at the sites of Tell Hesban, Tell el-Umayri, and Tell Jalul. Since 1991, MPP has incorporated ArcInfo® as an integral component of the project.

In the early 1970s, a distinctive, cyclical pattern was noted in the ceramics collected by excavation and survey teams. The pattern indicated that the settlement population periodically increased and then decreased in the region. It was suspected that these cycles were in some way tied to the environment, but making a concrete connection had proved difficult. In 1991, this connection was made when MPP began using ArcInfo to build probability models for archaeological sites from the Tell el-Umayri regional survey.

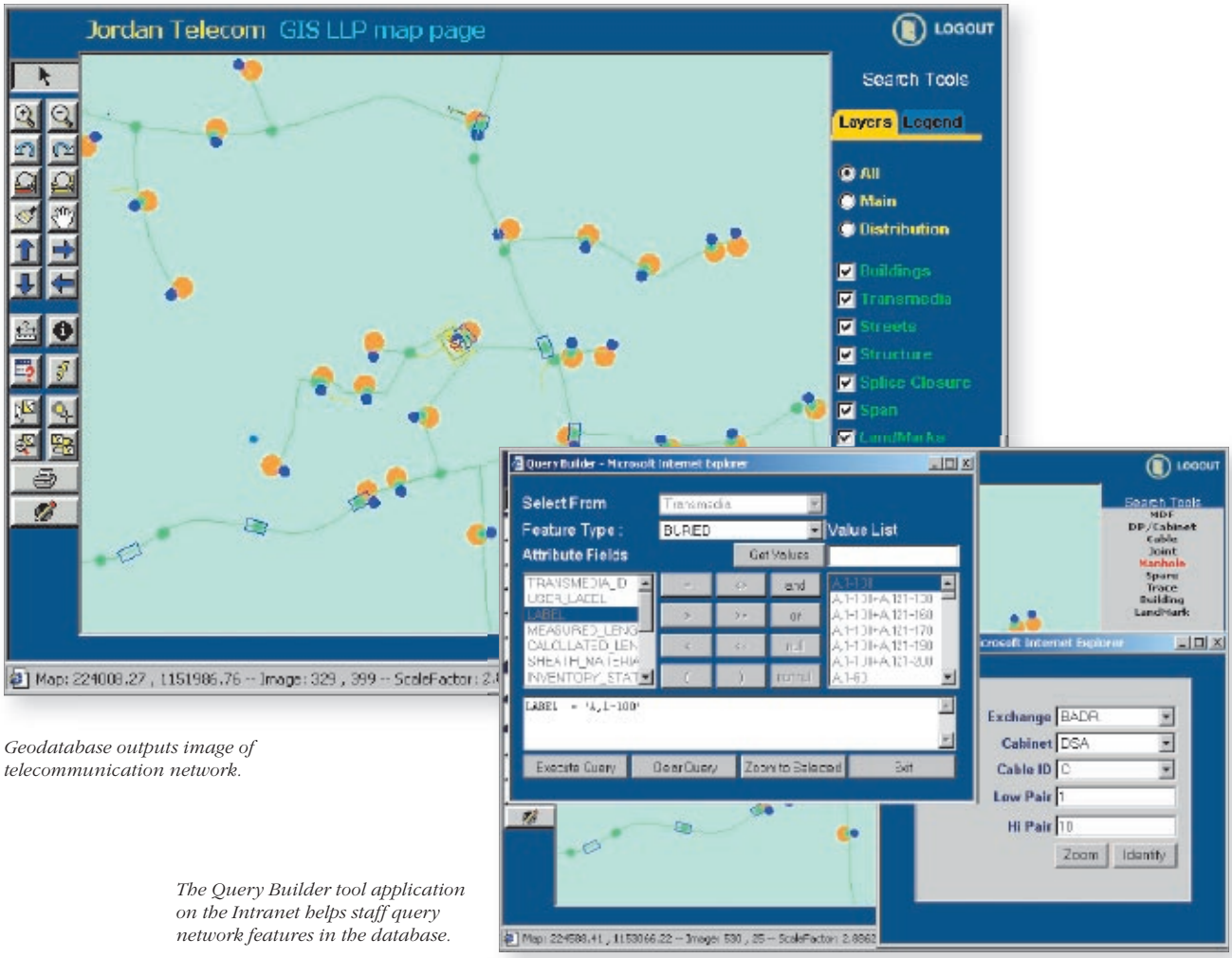
Probability models were constructed for Iron Age I (ca. 1200–900 B.C.) and Iron Age II (ca. 900–500 B.C.) sites (a transition from low to high settlement intensity). Thirteen environmental factors were analyzed along with archaeological data to determine the respective typical local environment, or environmental signature, for each age. The differences in the strengths of the environmental signatures indicate there were definite connections between the environment and locational strategies in the Umayri region.

Iron Age I sites were located in narrowly focused environmental zones. Their strong environmental signature is indicative of a population settling on prime agricultural land. On the other hand, Iron Age II sites were scattered throughout the environment, resulting in a weak signature. This suggests that population pressures were forcing people to settle in less favorable environmental zones and to adapt subsistence strategies as a result.

This study was conducted by Gary L. Christopherson, D. Phillip Guertin, and Karen A. Borstad.

Jordan

Telecom



Geodatabase outputs image of telecommunication network.

The Query Builder tool application on the Intranet helps staff query network features in the database.

GIS technology enables telecommunication professionals to integrate location-based data into analysis and management processes in network planning and operations, marketing and sales, customer care, data management, and many other planning and problem solving tasks.

Jordan Telecommunications (JTC) is the sole landline telecommunication operator in Jordan. ESRI's Jordan distributor InfoGraph offered JTC a turnkey solution for its telecommunications network management operations. The solution combines state-of-the-art technologies in computer hardware, GIS software, spatial data management systems, network engineering application programs, and Internet mapping. InfoGraph's services included network data conversion, application customization and support, and a comprehensive training program for JTC GIS staff.

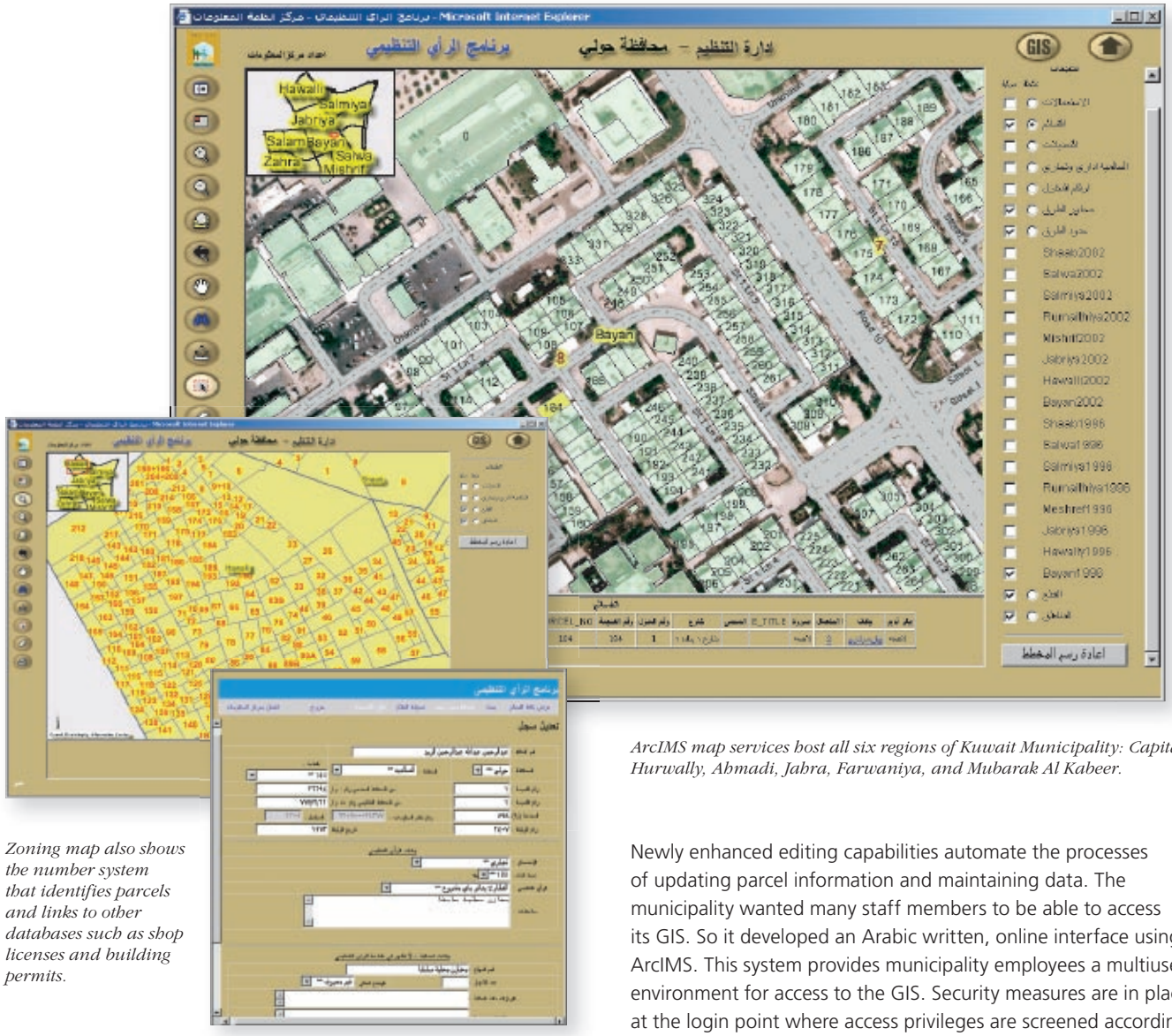
InfoGraph developed automated procedures and custom programs for the conversion of JTC's network data into ESRI's ArcSDE geodatabase structures by using ArcObjects™. The conversion process technology included an automated quality control validation program to clean source data before inputting it into the geodatabase. Telcordia's Network Engineer Geodatabase model was restructured to suit JTC's requirements.

One year later, JTC expanded its GIS to an enterprisewide system. Using ArcIMS software-based Intranet application, many other departments can now display and query the JTC GIS network data. Special tools locate customers by street address, parcel number, nearest landmarks, and building number. These applications are run from the same network database used by outside plant and design departments.

JTC management recognizes that GIS is essential for many of its operations. JTC's plans to integrate the current GIS with customer services, the billing system, and the network management center. Data gatherers will use ESRI's mobile software ArcPad® for field data collection and editing.

Kuwait

Local Governments



ArcIMS map services host all six regions of Kuwait Municipality: Capital, Hurwally, Ahmadi, Jabra, Farwaniya, and Mubarak Al Kabeer.

Zoning map also shows the number system that identifies parcels and links to other databases such as shop licenses and building permits.

GIS offers local governments numerous solutions that can be expanded and adapted for a city's individual and growing needs. Many municipalities, for example, have discovered the simplicity of distributing information over GIS Internet servers built on ESRI's ArcIMS software.

Kuwait Municipality has been using ESRI's GIS software since 1991 and has continued with upgrades as its needs have expanded and as geospatial technology has evolved. In 1999, the municipality implemented its Kuwait Parcel Information System. Since then, the GIS team has worked to collect, prepare, manipulate, and construct maps of more than 180,000 comprehensive land records and their attributes. All are now accommodated in a centralized GIS-based system.

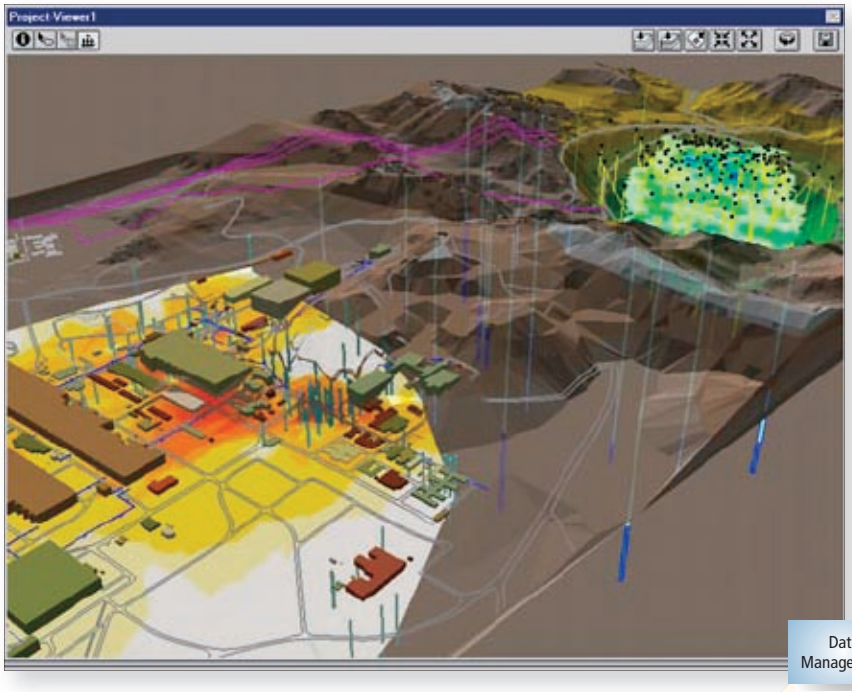
Newly enhanced editing capabilities automate the processes of updating parcel information and maintaining data. The municipality wanted many staff members to be able to access its GIS. So it developed an Arabic written, online interface using ArcIMS. This system provides municipality employees a multiuser environment for access to the GIS. Security measures are in place at the login point where access privileges are screened according to the user's authorization level.

Planning engineers log in through the Intranet from remote sites, navigate to maps, and use GIS functionality. Engineers perform complex queries to search for the required parcel; display old or recent imagery of a specific area; and retrieve a parcel's related information including area, land use, address, owner name, deed number, date, building permits, and so forth. They can add their own remarks and then automatically produce a certificate for that parcel.

The ability to gather parcel information from different departments and show it on a single screen has dramatically reduced the time taken for issuing certificates. Information that once took up to three working days to collect now takes 10 minutes.

Kuwait

Petroleum and Pipeline Industries



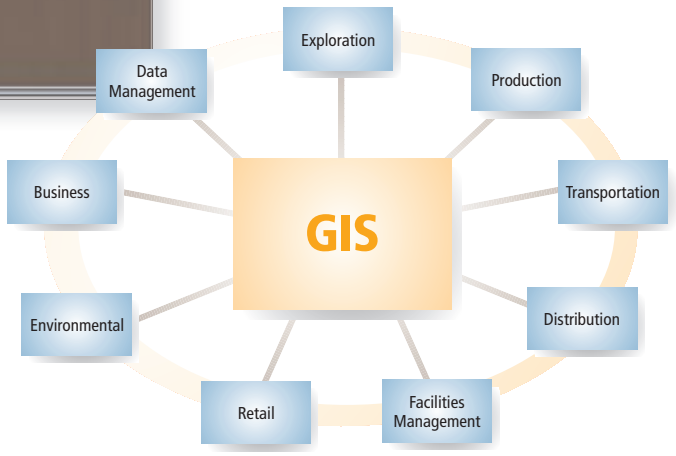
ArcGIS 3D Analyst™ is used for above ground and below ground oil facility management.

ArcGIS Data Models for Oil Companies

ArcGIS Petroleum Data Model

ArcGIS Data Pipeline Data Model

Download ArcGIS data models at **www.esri.com/arcgisdatamodels**.



GIS for petroleum on pipeline industries offer geospatial analysis, data, and solutions.

Where to drill a well, route a pipeline, build a refinery, and reclaim a site are all questions that heavily rely on an understanding of geography to make intelligent business decisions. GIS supports the managing of the spatial components of the petroleum business.

Kuwait Oil Company (KOC) is responsible for all oil exploration, drilling, and production of oil and gas within the State of Kuwait. Company activities encompass seven production onshore oil fields. KOC is also involved in the storage of crude oil and delivery to tankers for export.

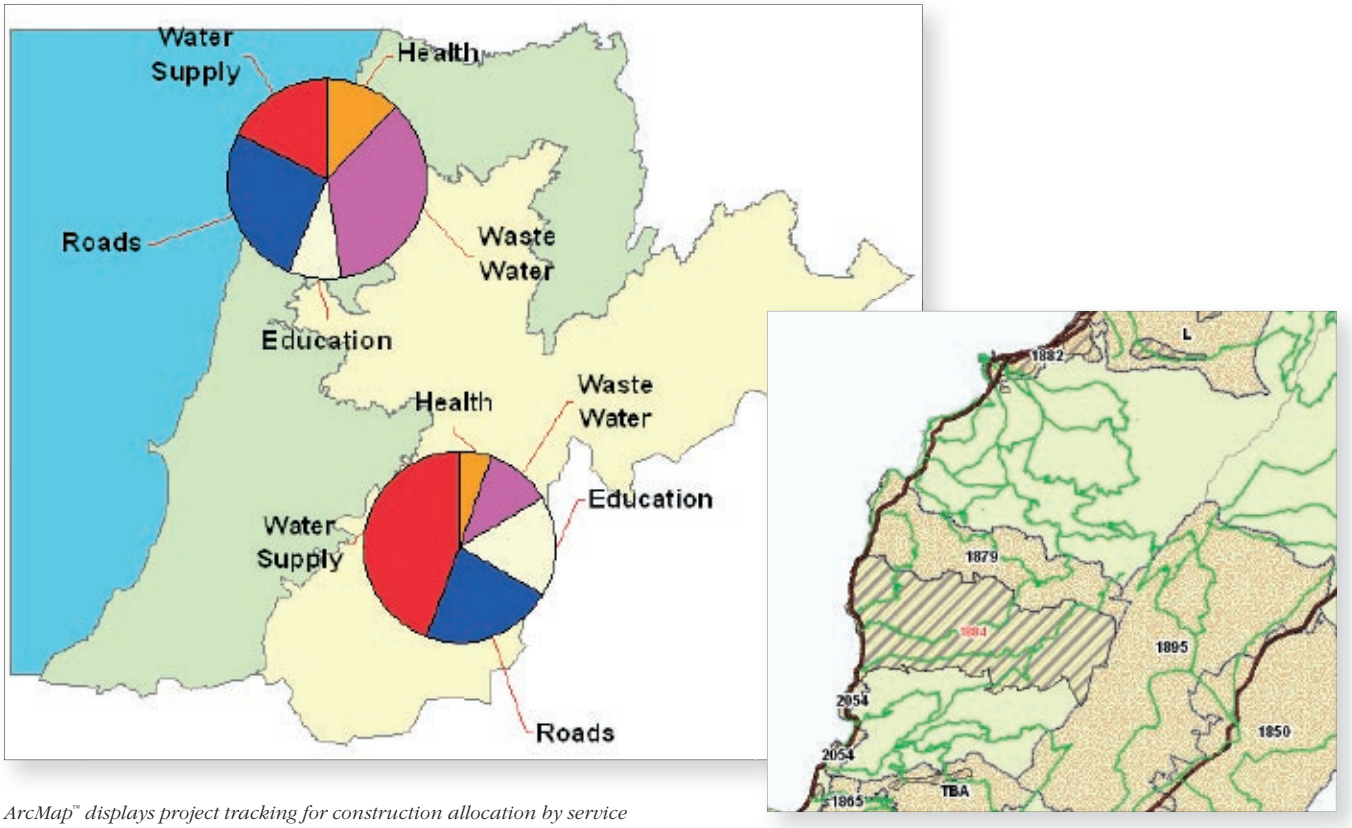
KOC implemented enterprisewide information solutions using Schlumberger Information Solutions (SIS) for its core business system. To aid facility analysis, SIS created a GIS application, GeoQuest, built on ESRI software. KOC staff uses the application to monitor the entire oil and gas life cycle from reservoir characterization and economic modeling to reservoir management. With access to multiple data repositories and collaboration tools, users can immediately obtain pertinent work process information and tools to efficiently manage information. This combination of easy access to a wealth of information streamlines exploration and production work flows and knowledge sharing and leads to improved business decisions.

The enterprise GIS interacts with KOC's multiple business operations to organize, analyze, and distribute data for day-to-day operations as well as to perform research, engineering, and facility management. KOC identified more than 100 functions for using GIS applications. For example, GIS provides day-to-day operation and maintenance of KOC oil field equipment. Asset site maps provide a reference for accessing databases that include assets, equipment maintenance history, repair work order management, spare part inventory, and so forth.

KOC will use various GIS applications to access data sources and manipulate them for geospatial analysis. One such application is GeoQuest's Finder for oil and gas exploration and production. It is useful for storing and retrieving geological, geographical, geophysical, reservoir engineering, and other types of exploration and production data. Openworks, a GIS application from Landmark, allows the company's geophysicists to use subsurface geological and geophysical data including water tables, fault locations, and reservoir sites.

Lebanon

Projects Tracking



ArcMap™ displays project tracking for construction allocation by service type and region.

Project assignment codes match locations, and regional allocation levels are shown by choropleth symbology.

From construction projects to conservation projects, administrators use GIS to stay updated on the progress of planning and development operations. Combine GIS with project tracking systems to show the stage of completion by site location. ArcSDE for database management helps administrators follow the progress and multiple complexities of projects at even high-volume levels.

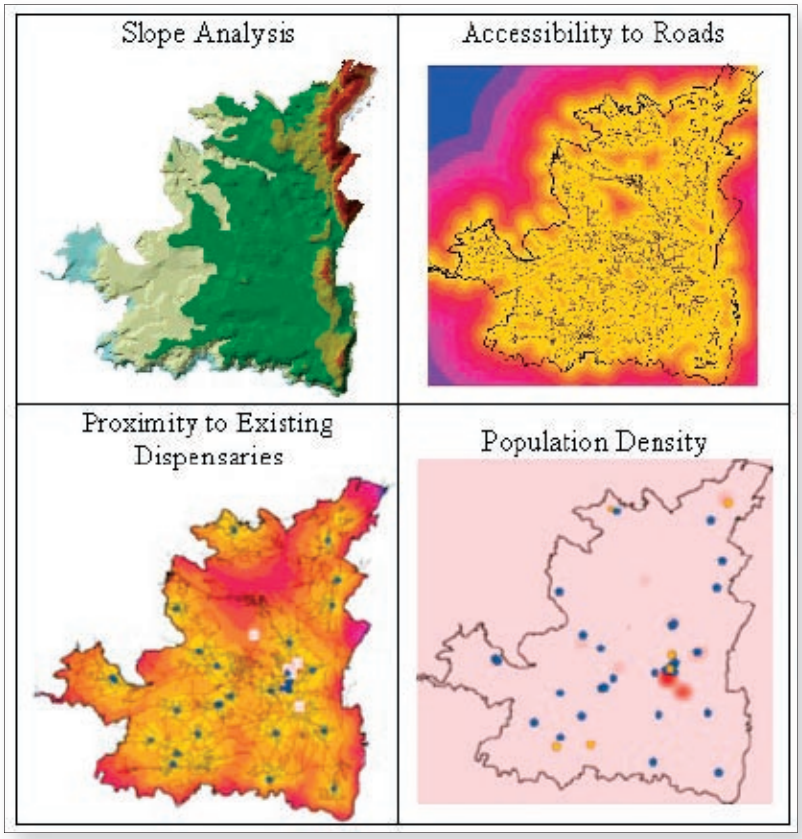
The Council for Development and Reconstruction (CDR) in Lebanon oversees planning, investment, and implementation programs for the country's reconstruction and development projects. CDR manages funding provided by Horizon 2000, which is designated for reconstruction and development projects in basic infrastructure and social and productive sectors. These projects include power, health, education, water and wastewater, solid waste, agriculture, telecommunications, transportation, environment, and roads and highways. CDR uses GIS to track its projects and make sure that future plans for development are effectively prioritized and distributed to address the country's most immediate needs.

CDR commissioned Khatib & Alami, Consolidated Engineering Company, to develop a GIS-based project tracking system aimed at combining GIS within the day-to-day project management and decision making of CDR. The GIS project tracking system links CDR's project database with basemaps of Lebanon and includes attributes of towns, population data, cadastral information, road centerlines, contours, lakes, rivers, land use, railways, sewers, and watersheds. ArcSDE (Spatial Database Engine) software is used to manage the relational database for serving spatial and attribute data to all connected users. An advantage of this GIS-based solution is that it uses a complete and central up-to-date database accessible to many people for a wide variety of applications. This helps coordinate the sharing of data and supports interdepartmental work flows.

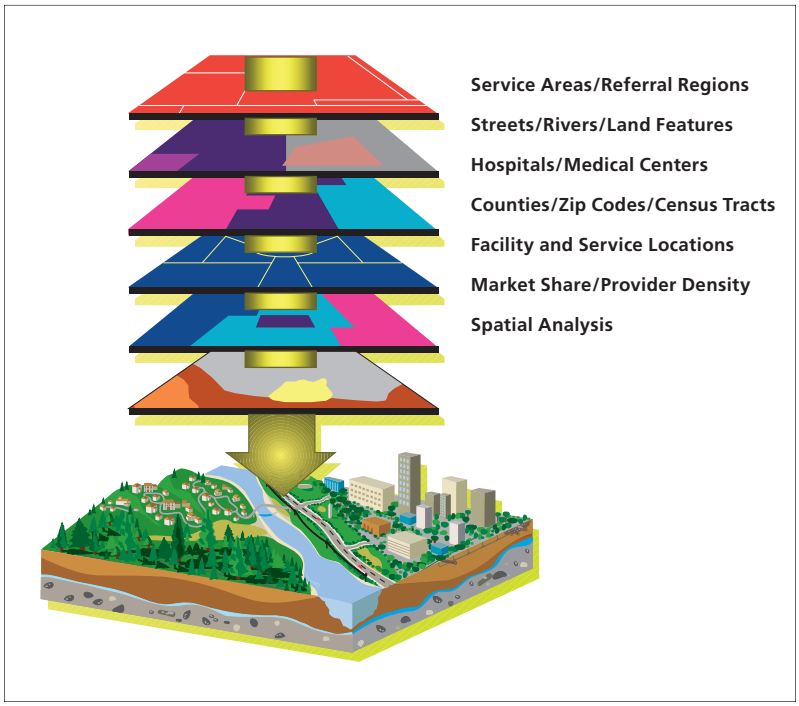
The system displays spatial project locations and their characteristics and generates reports about recent plans and projects that include their location and status. It allows a wide range of queries serving the daily business processes of CDR. The system provides CDR's decision makers with spatial or tabular reports and spatially displays percentages of the investment or monetary amounts spent by period, sector, area, work status, work type, funds source, operator, appropriation, and project size. The GIS project tracking system automates report and chart generation. These periodical analysis reports and charts are indispensable, especially for presentations to Lebanon's Council of Ministers and the CDR board.

Lebanon

Public Health



Maps that show accessibility to health services are important assessment tools.



GIS provides a common analytical framework in which public health authorities can understand problems and formulate a response, improving incident management and health planning. GIS offers insight into issues ranging from medical epidemiology to health care access.

Because of recent developments in the field of prevention, cure, and care, Lebanon's Ministry of Public Health (MOPH) has experienced a significant increase in demand for the administration of public health services. Moreover, changes in laws and regulations have redefined the role for the ministry's intervention in public health care. To efficiently meet the needs of the country, MOPH has turned to GIS to help it secure a cost-effective quality service for Lebanese citizens.

MOPH worked with GIS consultants Khatib & Alami to develop a planning tool for locating health care sites. GIS was used for spatial analysis to define health sectors and assess current and potential health care site locations. Medical professionals and the GIS team created the Inventory Carte Sanitaire, which characterizes the attributes of Lebanon's health infrastructure. The inventory includes characteristics ascribed to primary health care centers, secondary and tertiary care hospitals, specialized clinics, pharmacies, laboratories, private clinics, and dispensaries.

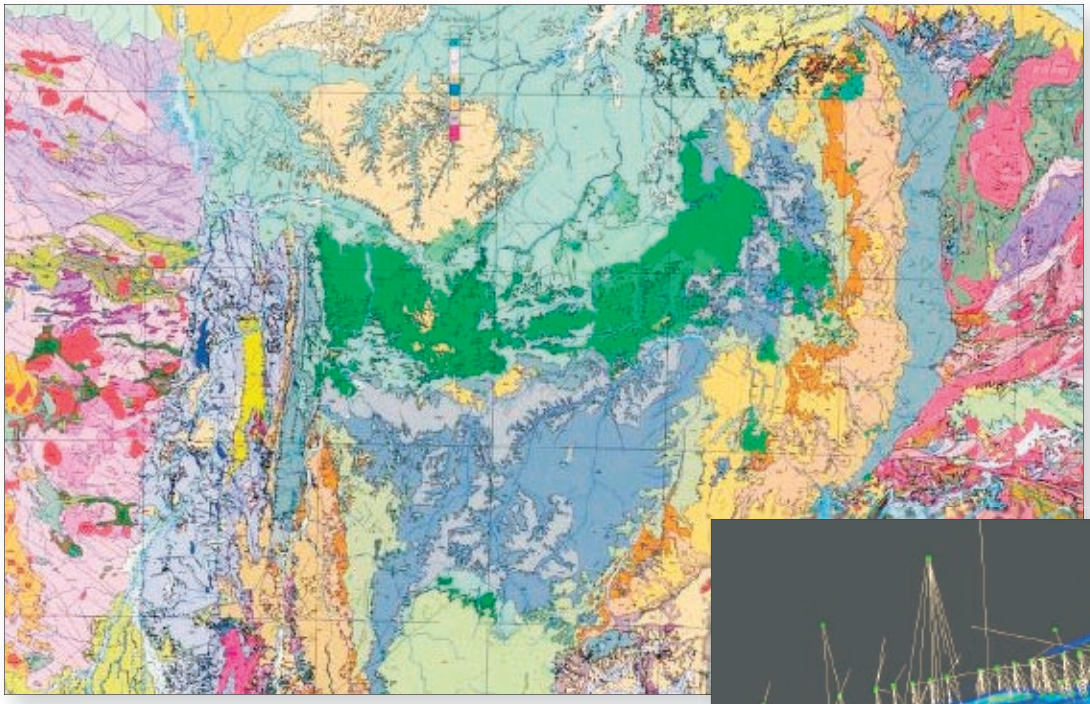
The team defined health facility need indicators to assess service efficiency. These indicators include clients' access to health services, quality of service provided, and the equitable distribution of facilities to population. Public health risks such as water sources, bakeries, and butcheries were included as potential health risks in area assessments. The factor of cost of medical technologies at health care sites was also included in the analysis.

ArcGIS Spatial Analyst provided spatial modeling and analysis features that helped the team of GIS and health experts perform site suitability modeling. The results of the study included spatial analysis and depiction that were used to prioritize areas with health facility needs inside administrative boundaries. The study also gave insight into the feasibility of local health referral systems.

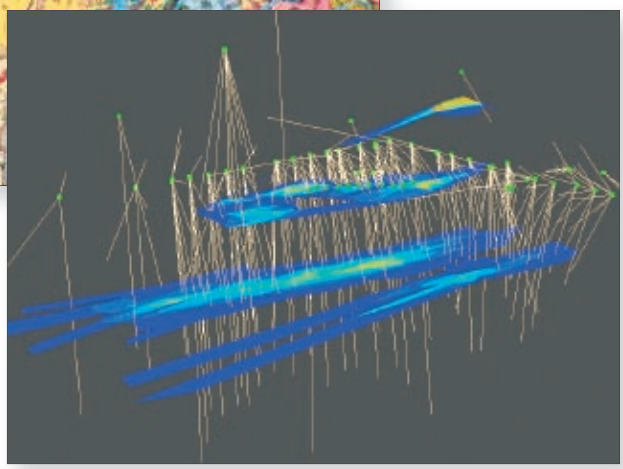
Visit Khatib & Alami at www.khatibalami.com.

Morocco

Mining



Tectonic map created from database tables



Items positioned along linear features such as pipelines and boreholes are referenced by station numbers or measured lengths, and are used for mining operations management.

Mining operations staff use GIS for a facility planning application such as keeping track of an existing infrastructure and integrating it with the mine plan and block models. GIS can display various types of geologic data sets that are useful for mining such as geophysical images, geochemistry tables, geologic maps, radiometric data, borehole locations, and mineral deposits.

Morocco is the world's second largest producer of phosphate rock. It also mines a wide range of minerals that include barite, coal, cobalt, copper, fluorspar, gold, iron ore, lead, manganese, salt, silver, and zinc. The Bureau de Recherches et de Participations Minières (BRPM) is responsible for the development of most mineral resources.

BRPM is setting up its GIS to support the management, processing, and analysis of all its geological and mining data. GIS will also be used for performing routine tasks in the office and in the field. The ministry is building a mining database that will be accessible for reference at national and international levels.

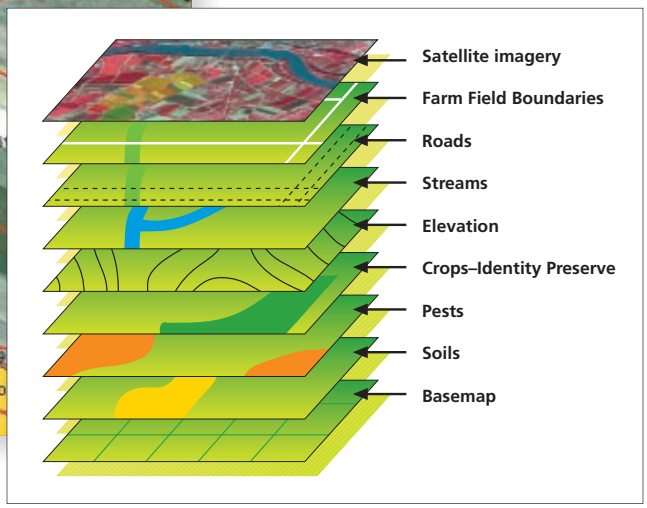
To begin this process, Abdelkrim Rhziza, chief of BRPM, brought together a multidisciplinary commission of data processing specialists, GIS specialists, and geologists to create a lexicon for data gathering, decide the types of attributes to be collected, and agree on database standards. Once the commission devised a plan, geodata gatherers went to work using mobile field devices such as GPS receivers and handheld devices loaded with ArcPad software. ArcPad expands GIS capabilities to the field. Digital forms can be specifically developed for easily recording required data. Other information for the database comes from remote sensing data such as satellite photo data.

Users can use GIS to simultaneously query, display, and analyze data. They can create coverages for map features to show, for example, plans of mine levels and locations of pit shafts. Integrating this information with surface topography and terrain models creates a complete picture of mining opportunities. In addition, ArcGIS gives BRPM the ability to create spatial views of metamorphism and deposit systems over geology and tectonic maps. Three-dimensional views can show thematic layers of mineral deposits, pit shafts, horizontal mine levels, and underground barriers. GIS can also be used to integrate recent survey data with block models or mine design data from other mining software packages.

Morocco

Agriculture

Precision farming crop management map



GIS can show agriculture maps in multiple layers, which makes attribute relationships obvious.

Agronomists use GIS to analyze agriculture variables that influence crop production such as relationships between soil types, fertilizer, and water. GIS is used to record the past history of land management, analyze current growing conditions, and predict future outcomes. Informed decision making based on GIS increases the probability of higher crop yields.

Morocco's Ministry of Agriculture states that the country's average annual rainfall varies from more than 450 millimeters in the north, making rain-fed agriculture possible, to less than 150 millimeters toward the southeast, making irrigation absolutely necessary. More than 50 percent of the precipitation is concentrated on only 15 percent of the country's area.

Because these rain-fed lands are fragile, the government established regulations for managing these areas called Rain-fed Agricultural Development Perimeters (RADP). Moroccan geographic researchers used GIS to analyze geographic attributes impacting rain-fed agrarian areas. This information will be used to improve managing, monitoring, and decision making for RADP classified areas.

The research team chose the Tanant perimeter in the Province d'Azilal as its study area. Tanant is a mountainous region consisting of alternate hills and flat areas. The climate is semiarid, rainy and cold in winter and dry and warm in summer. Researchers captured data and built an agricultural georeferenced database that includes relevant attributes such as soils, slopes, geology, and vegetation.

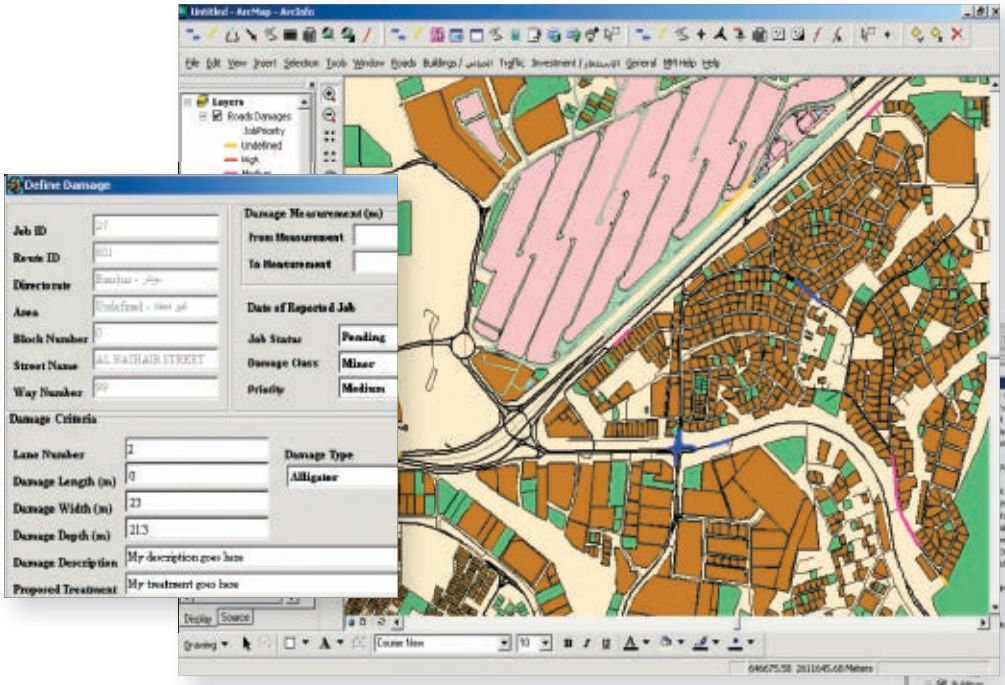
A digital terrain model was used to derive slope data to produce a classified slope map. A simplified lithologic (rock formation) map was also generated from geologic data by interpretation and merging of geologic classes. ArcGIS, ArcIMS, ArcSDE, ArcGIS Spatial Analyst, and ArcGIS 3D Analyst comprised the GIS used to complete this project.

By using slopes, lithology, and land cover data, a map portraying homogeneous units showed correlative relationships. Based on this map and field data, a pedologic map (soils map) was created. Then, by employing geographic constraints of slope, erosion, land cover, and so forth, researchers produced an agro-pedologic map. This map can be used to generate or update the area's land management map.

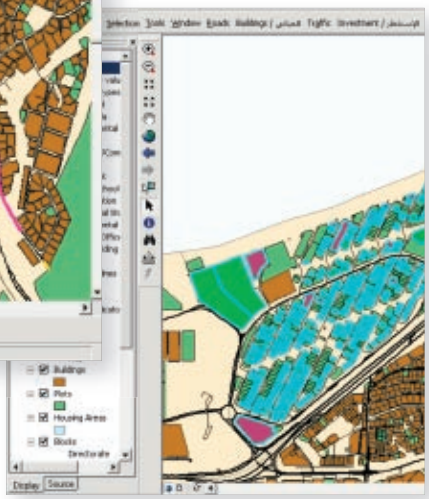
A GIS-enabled Internet Web site will soon make this information more useful to public sectors. Visitors to the site will be able to access RADP maps for analyzing geographic and water factors affecting crop production. RADP is the first phase of a larger program to improve living conditions among smallholder farmers and herders in rain-fed areas by promoting agricultural development and upgrading rural infrastructure such as roads and irrigation.

Oman

Municipal Governance



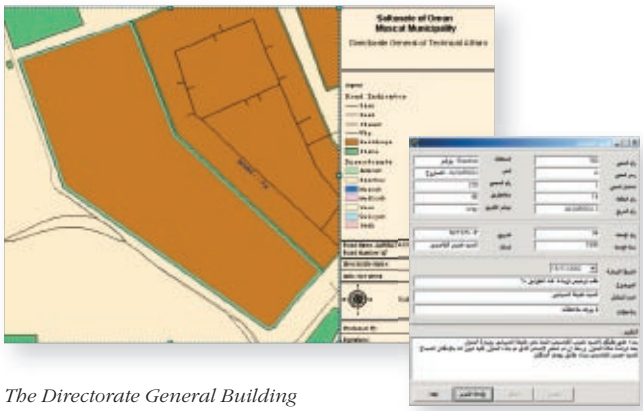
The Asphalt Road Maintenance System (Directorate of Roads) gives users a global view of the road network status to help them plan the maintenance jobs needed for each road. In addition, it tracks all maintenance jobs and work orders issued to the contractor.



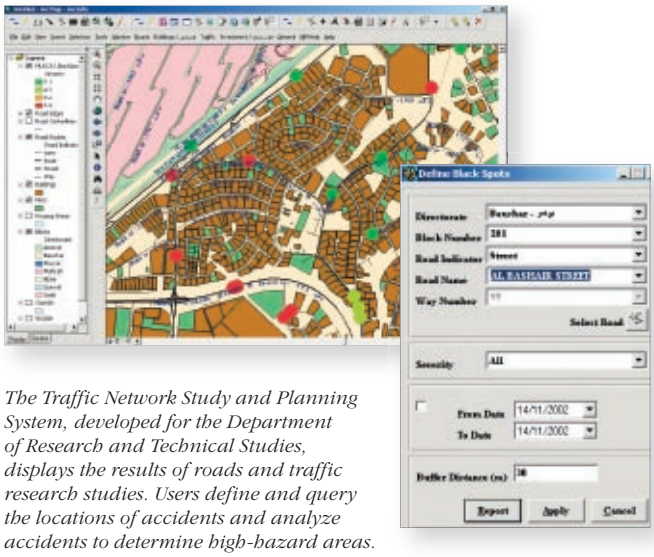
The Building Permits Management System (BPMS) application gives the user the editing tools needed to generate plot outlines and building footprints in addition to display and query functions. The BPMS application was developed for the Building Permits Directorate and interfaces with the Major Permits database.

An enterprise approach to GIS provides a framework for departments of the municipal government to collect data, share information, collaborate, and conduct cross departmental analysis in order to become more efficient and informed about the population, resources, infrastructure, and the activities affecting them. The better the information the municipality has about the public's diverse needs, the better it can manage and direct its own resources.

Oman's Muscat Municipality has many GIS applications that operate on top of a centralized GIS database that interfaces with the existing municipality's databases. Here are just a few.



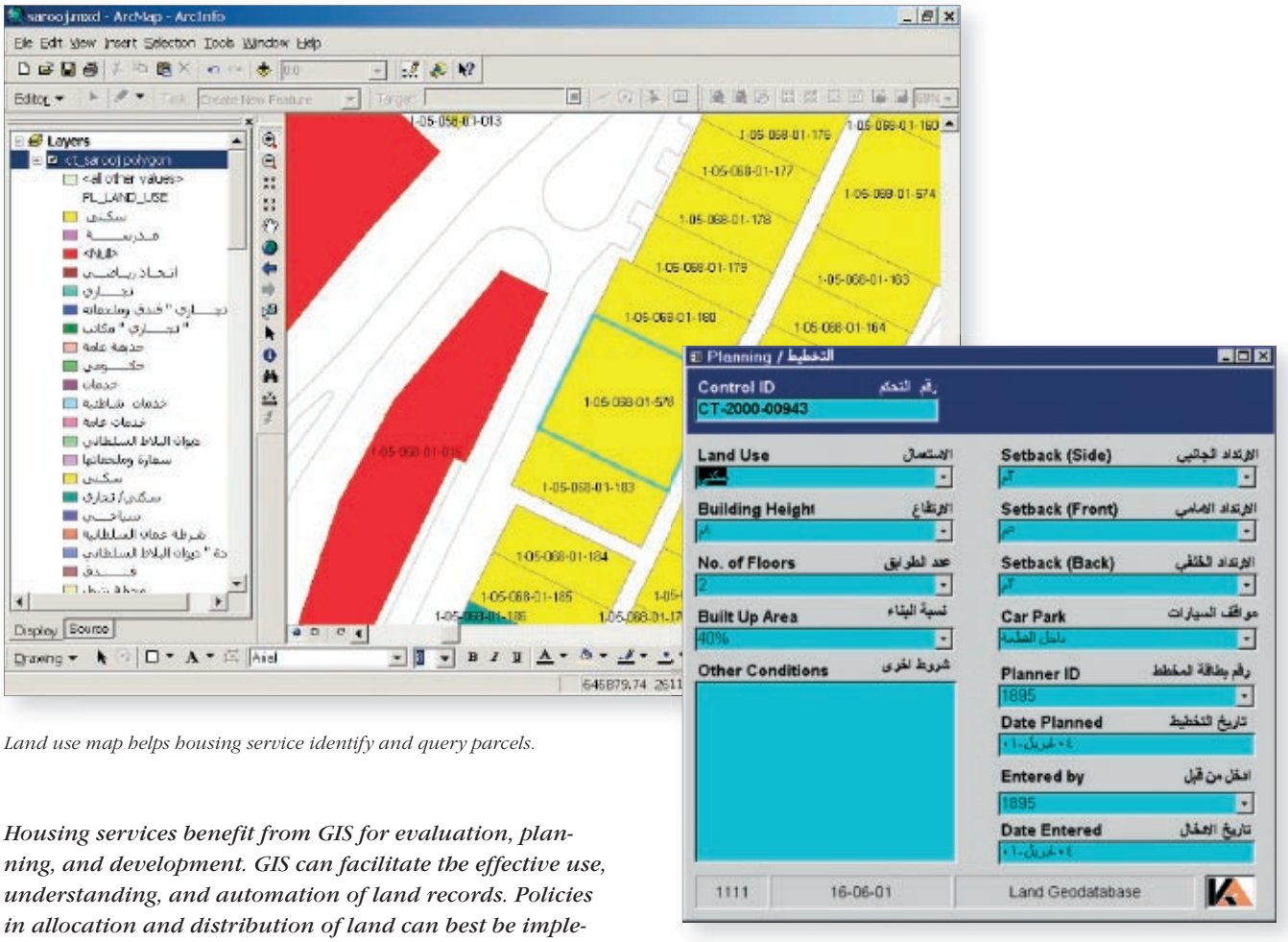
The Directorate General Building Management System, developed for the Department of Technical Affairs, allows users to provide information and track the status of major and minor building permits as well as construction violations. The system interfaces with the Major and Minor Permits databases.



The Traffic Network Study and Planning System, developed for the Department of Research and Technical Studies, displays the results of roads and traffic research studies. Users define and query the locations of accidents and analyze accidents to determine high-hazard areas.

Oman

Housing



Land use map helps housing service identify and query parcels.

Housing data capture

Housing services benefit from GIS for evaluation, planning, and development. GIS can facilitate the effective use, understanding, and automation of land records. Policies in allocation and distribution of land can best be implemented by managing cadastral information effectively through GIS.

Muscat is the most densely populated and developed part of Oman. The Ministry of Housing's Electricity and Water Department rates suitable housing for everyone a high priority. It manages its development activities using GIS.

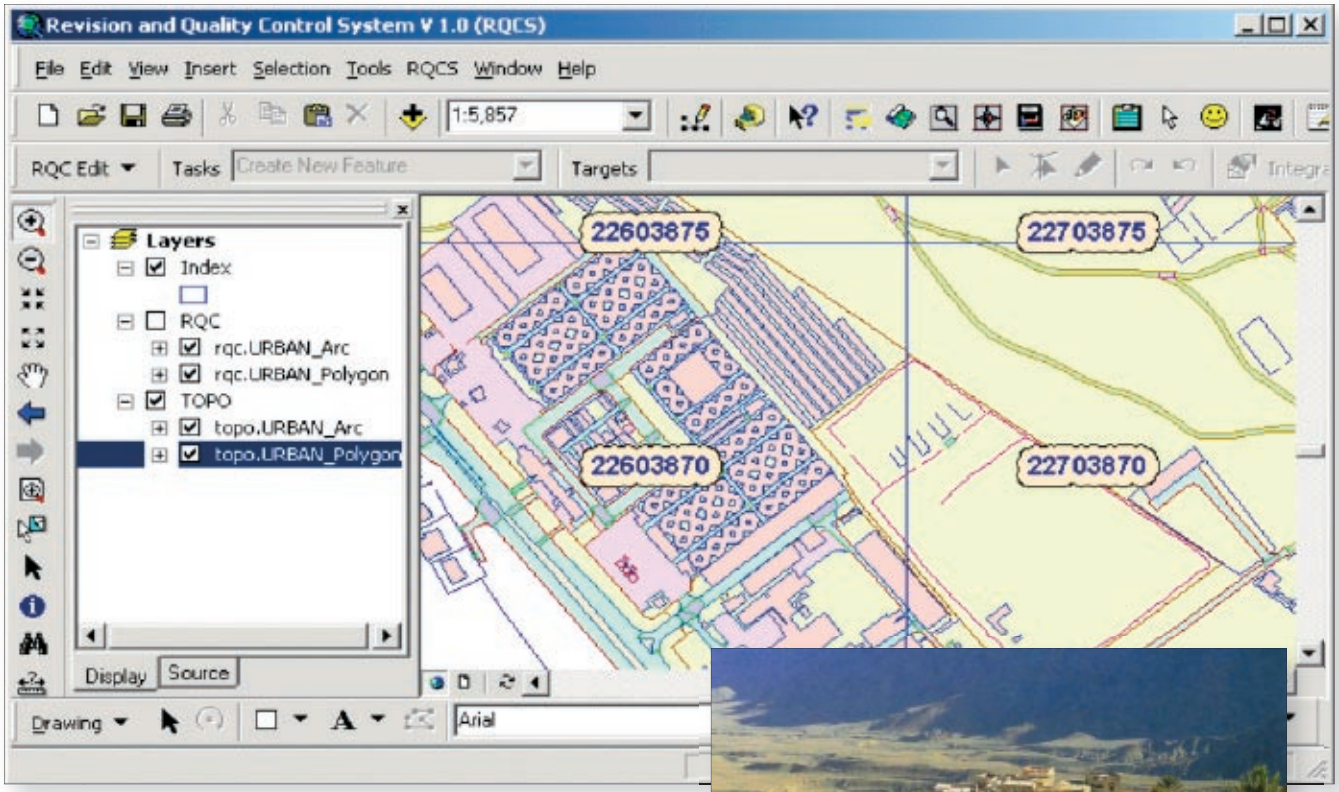
The ministry's Survey and Planning Department sought to migrate its geospatial technology from a common computer-aided drafting (CAD) system to GIS. The basic difference between the two is in how each technology stores geographic data in the computer. CAD is rooted in drafting—it is used to create and represent geographic features as drawings in a computer. ESRI GIS is rooted in data management—it has a great facility for processing geographic features and their related attributes in a computer database. CAD is suited for design drawings, but it is not an information system. The ministry's new GIS is database-oriented and, thus, handles data in a single seamless database. GIS includes many tools for map projection and handling large data volumes. GIS employs the concept of layering and segregating different kinds of features into more easily managed layers, typically one layer per feature type. Layers can have different data requirements and behaviors that are well expressed in a GIS.

The Ministry of Housing's Electricity and Water Department is migrating all of its cadastral data from CAD into a GIS. To do so, the ministry developed a database design for storing all coordinate planning data in Oracle. It then developed data conversion procedures for moving existing spatial data into ArcInfo coverages.

The consultants Khatib & Alami (K&A) provided planning, design, and support expertise for the GIS implementation. K&A trained ministry employees, including surveyors, planners, cartographers, and CAD operators, to use GIS. Even entry-level users could use GIS by accessing forms in both English and Arabic to input data into an Oracle database. K&A also published a manual for GIS users to reference. Housing, survey, and planning data is now managed and stored in an efficient and user-friendly GIS.

Qatar

Mapping Agencies



Quality control application ensures data accuracy.

Cartography and map production have always been an integral part of GIS. ESRI's GIS tools provide powerful database driven cartography that enables mapping agencies to produce their maps and map series from large, multipurpose, geographic databases. ESRI's mapping solutions are used for digital map publication, digital data publication, geographic analysis, maps on demand, geographic reports, and enterprise integration.

The Centre for GIS (CGIS)—State of Qatar is the country's official mapping agency. Using ESRI's GIS software, CGIS is systematically implementing GIS for all agencies, government organizations, and the general public of Qatar. This simplifies data transfer between agencies and minimizes data redundancy.

CGIS works to develop national standards, specifications, and procedures for the orderly collection, storage, and retrieval of GIS data. It encourages interagency cooperation. CGIS maintains the high-speed fiber-optic network called GISnet that links all of Qatar's GIS databases and ensures it is secure and operational at all times. It also provides an accurate spatial reference database. In addition, CGIS offers technical support and advice; develops special products; hosts training programs, seminars, and conferences; and publishes periodicals.

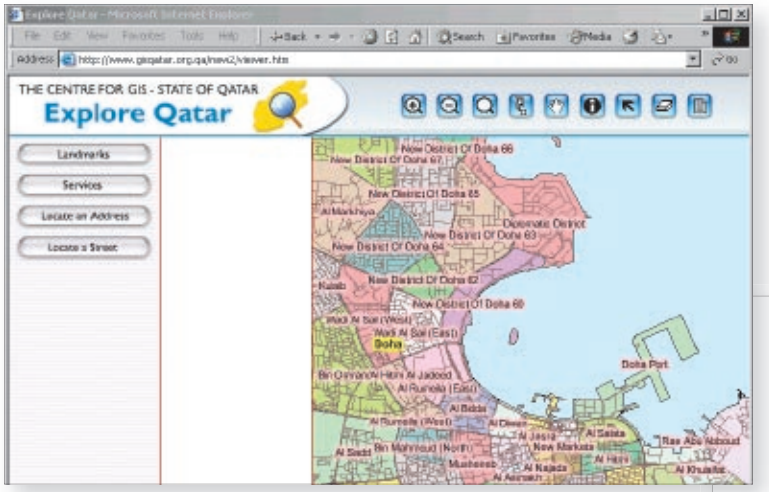
Quality Control

CGIS' objective is to assure the integrity of its geospatial data. Using ArcGIS with its user-friendly interface, staff members perform quality checks of new data submitted by external agencies or taken from Qatar's Survey Department database. A quality assurance application performs plotting, verification, initial quality control, editing, final quality control, and updating of the topographic database.

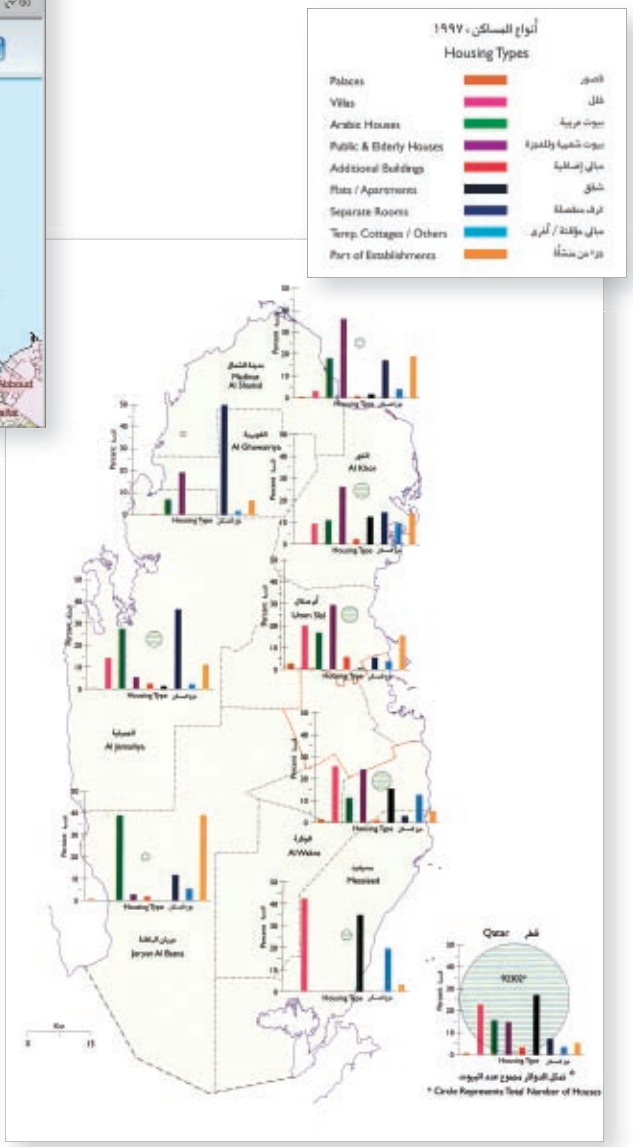
The Revision Quality and Control (RQ&C) section of CGIS is solely responsible for additions, deletions, or any modifications to topographic databases. Using GIS, RQ&C performs content completeness checks and system routine examinations of topological relationships. RQ&C also performs data enhancement using GIS functionality for edgematching. The edgematching tool provides mathematical continuity from one sheet to the next, thus allowing any two sheets to be appended without any resultant polygon misclosures or linear discontinuity.

Qatar

Mapping Agencies



Qatar Map Server is a live map service.



Maps Published on the Web

Explore Qatar is a GIS Internet application developed by CGIS for public use. This application can be accessed at the CGIS Map Server Web site (www.gisqatar.org.qa). The visitor types in an address, selects a landmark, and locates it on the map. Users can find the nearest school, clinic, or pharmacy or highlight physical features on the live map.

This application provides three locator tools.

- The Landmarks tool can be used to locate prominent landmarks in Qatar.
- The Services tool can be used to locate a service feature from a category list.
- The Locate an Address tool can be used to find a specific address by zone/locality name/number, street name/number, and plot number.

After locating a feature on the map, the visitor can use these tools to perform a nearby feature search for finding service features within a specified distance of the original located feature or landmark.

Maps Published in an Atlas

Once Qatar's national census was completed, the country's planning council decided to present the findings on maps and, therefore, called on CGIS. Working with other government agencies, CGIS created the Qatar Socio-Economic Atlas.

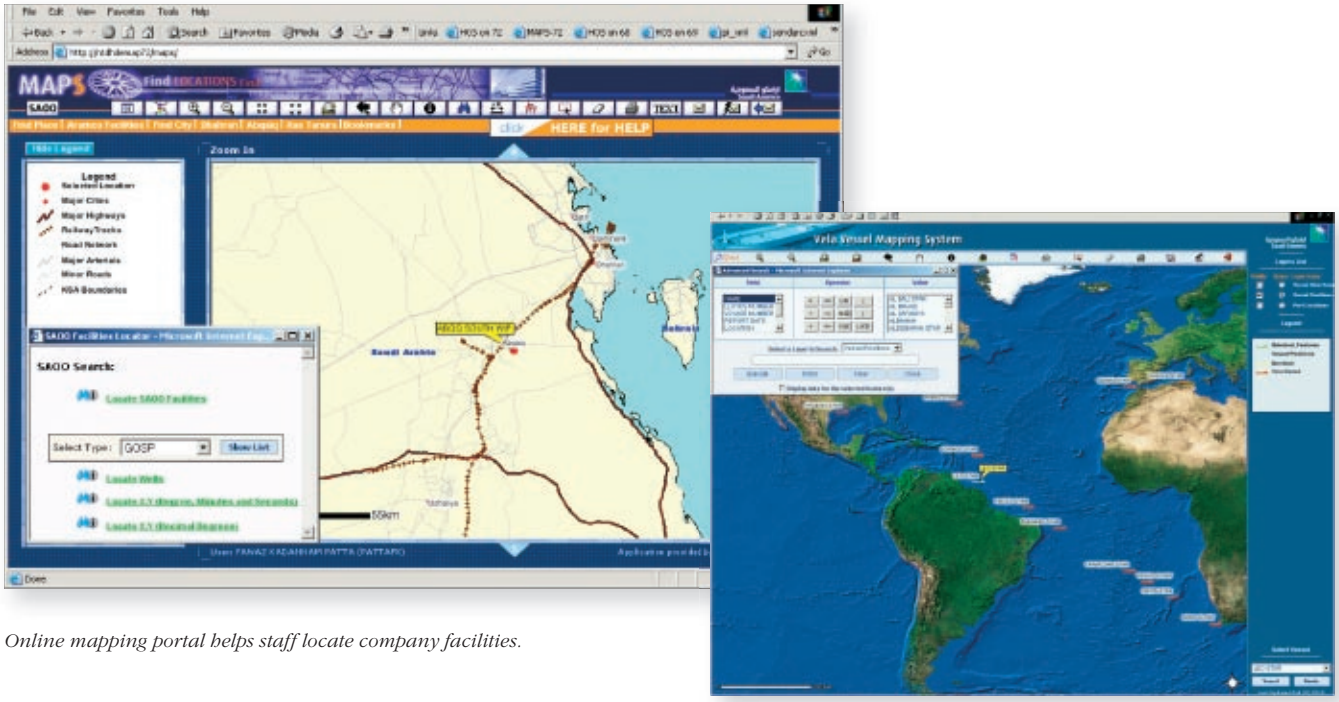
The atlas contains 110 map plates that are based on the Qatar National Grid and presented in a Transverse Mercator projection. The maps show diverse information such as archaeological sites, births and deaths, clay loam soils, data users, electricity networks, population growth, maritime boundaries, mosques, population density by zone, mean monthly rainfall, tourism, and well fields.

Because of the comprehensive nature of the atlas, it has become the standard reference book for planning professionals who seek detailed information about potential benefits and drawbacks for developing a particular tract of land. Scholars and other professionals refer to the atlas for up-to-date economic and sociological information.

A hardcover printed atlas is already being distributed to citizens, and an online version will soon be available that has GIS capabilities including statistical analysis. Qatar is currently involved in collecting building and population statistics and will soon be publishing a second edition of the *Qatar Socio-Economic Atlas*.

Saudi Arabia

Enterprise Solutions



Online mapping portal helps staff locate company facilities.

Logistics map shows precise location of tankers.

Enterprise GIS integrates GIS with the corporation's other business and information systems. This expands the value of the GIS investment and the database investment.

Saudi Aramco is the world's largest supplier of hydrocarbon energy products, producing approximately eight million barrels of oil per day to fuel the global industry. The company manages a colossal network of assets, which includes wells, pipelines, plants and buildings, roads, utility networks, jet aircraft, and supertankers.

More than 50,000 staff members perform jobs ranging from exploration geologists and geophysicists to engineers, project managers, environmental scientists, and deep desert surveyors. All of these jobs rely on geographically-based information. Virtually all of Saudi Aramco's activities on land, in the air, and on the sea can be mapped to a physical location and analyzed in GIS. Recognizing this, Saudi Aramco has been developing innovative ESRI-based GIS solutions for the following purposes:

Surveying and Exploration—ArcGIS is used to plan seismic surveying missions, monitor the performance of contractor crews, and analyze geophysical data collected during surveys.

Engineering—Customized ArcGIS applications are used to support well site planning, wellhead maintenance, and other engineering functions.

Logistics—The company's existing telecommunications infrastructure is being leveraged to dispatch and track the movement of company cars, heavy trucks, and oceangoing supertankers.

Planning—ArcEditor™ is used to digitize the location of all new facilities. Planners and engineers review the resulting information on dynamic online maps. ArcIMS, integrated with a Web-based document management system, reduces the project review time frame.

Transportation—ArcGIS has been integrated with a third party road and pavement maintenance system. Transport engineers use the system to assess road conditions over a large geographic area and forecast road works based on local traffic volumes.

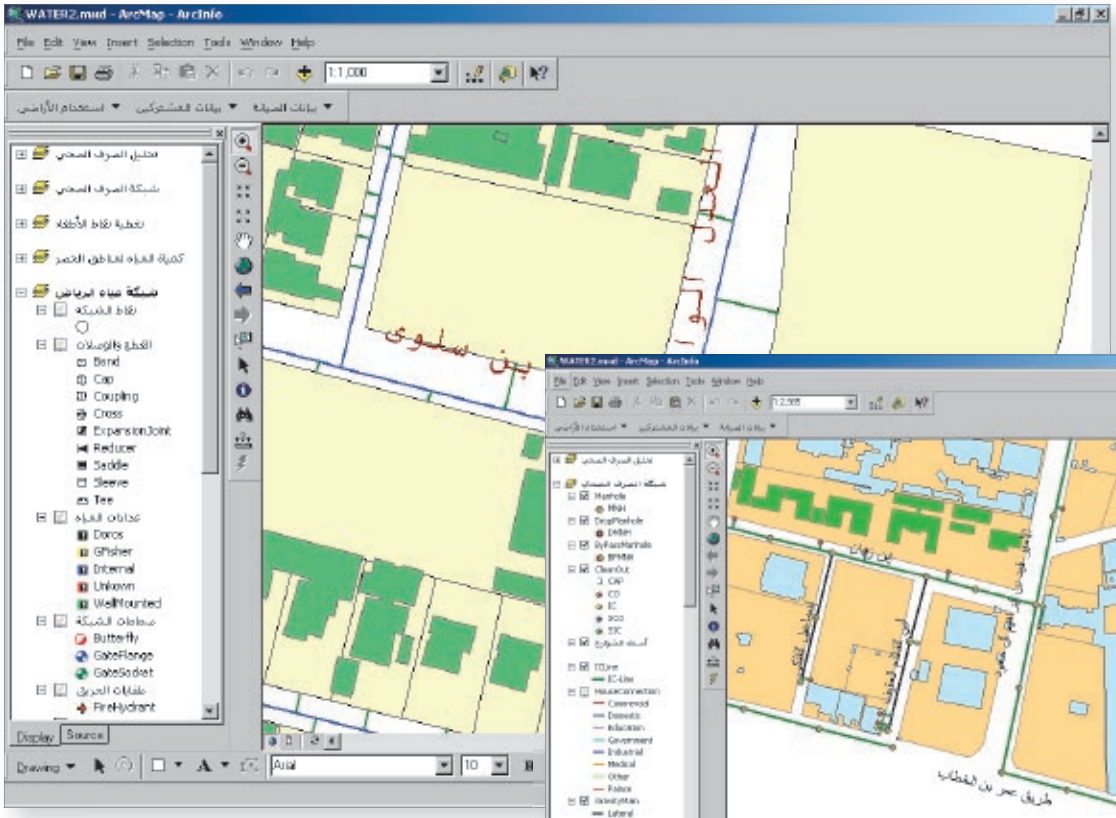
Safety and Emergency Response—A Web-based gas leak emergency response system brings together live gas sensor readings, real-time weather information, and the corporate network database. To mitigate and respond to problems, GIS is used to graphically overlay this information with feature layers of buildings, roads, hospitals, airports, and rescue facilities.

Knowledge Sharing—An online mapping portal has been released on the company's Intranet. Developed in Java, the ArcIMS site enables staff to easily locate company facilities, dynamically generate routes and driving instructions, and share annotated maps with colleagues via e-mail.

Land Management—GIS is used to manage land use permitting processes, research land claims, and monitor illegal encroachment within the company's thousands of square kilometers of concession area.

Saudi Arabia

Water and Sewer Services



Facility assets for water are displayed.

ArcMap shows sewage network features.

Water and wastewater utility services use GIS to manage different types of information for facilities management. Water mains, valves, hydrants, meters, storage facilities, sewer mains, and condition ratings are among the features that can be entered into a geodatabase and shown on a map. GIS for water and wastewater services is used for facility management such as operation and maintenance, network tracing and reporting, network pressure and flow analysis, surface flow analysis, and facility inventories.

Riyadh Water & Sewerage Authority (RWSA) has developed extensive digital maps and a database depicting the city's entire water and sewer facility network. The water and sewer network is approximately 9,500 and 2,300 km, respectively. The authority is improving its day-to-day operations by using ESRI's GIS software. GIS uses RWSA's facility graphics and tabular database, which defines the characteristics of each element including valves, pipe segments, services, and other system appurtenances. A comprehensive data server provides many departments with access to this information and expands the capabilities and usefulness of the existing digital mapping system.

To implement the GIS for water and sewer networks with the latest technology available in the market, RWSA decided on a solution based on ESRI products with its new object-oriented GIS model. The solution consists of Miner & Miner's ArcFM™ for water, sewer, and storm water as the base model for the geodatabase design; ESRI's ArcInfo as the GIS software; and Oracle's database to host the geodatabase.

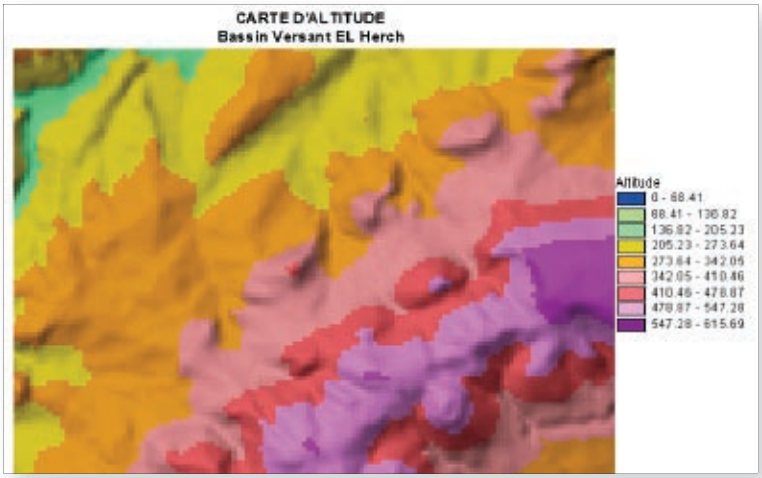
Implementation of the GIS project includes a comprehensive solution for all water and sewerage networks that integrate hydraulic modeling, maintenance system, call center, and billing system with GIS by building different user interfaces.

Al-Moammar Information Systems promotes and deploys the ESRI-based solutions that ensured the success of those Saudi Arabia projects.

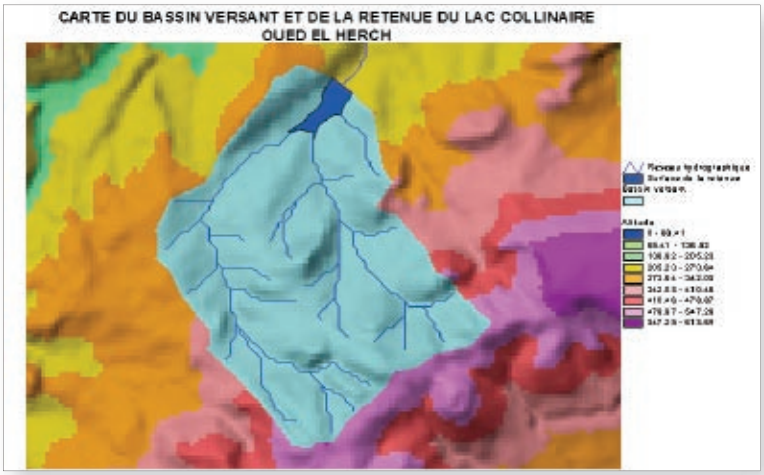
Visit them on the Web at www.mis.com.sa/.

Tunisia

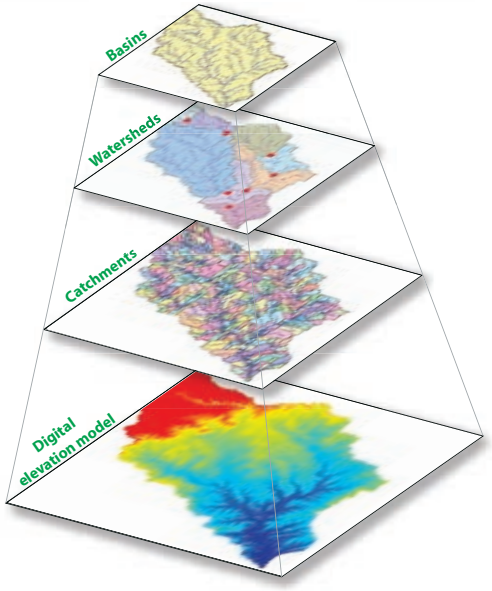
Hydrology



Elevation map of El Herch Basin



Map of Watershed and Retained Water Surface of Reservoir



Surface water location, depth, and flow data is collected and used for many purposes by local and national agencies. National agencies have traditionally compiled hydrographic data for basemaps. The scope and scale of water resources problems make GIS software a powerful tool for developing solutions.

The Welaya of Bizerte, in northern Tunisia, is a region known for its fertility. The Tunisian government commissioned a study of the Welaya region to locate the most efficient sites for reservoirs created by dams that could be situated between hills. Using an agricultural sector database, researchers incorporated stream, watershed, urban area, and topographic data into ArcView®.

A model was created to estimate a dam's potential capacity related to its expected rainwater volume. Criteria defined minimum surface, minimal slopes, and maximum and minimum water levels. The expectations of necessary engineering work were also factored into the equation. By optimizing all these parameters, automated geospatial analysis prioritized best efficiencies and indicated the best proposed dam sites.

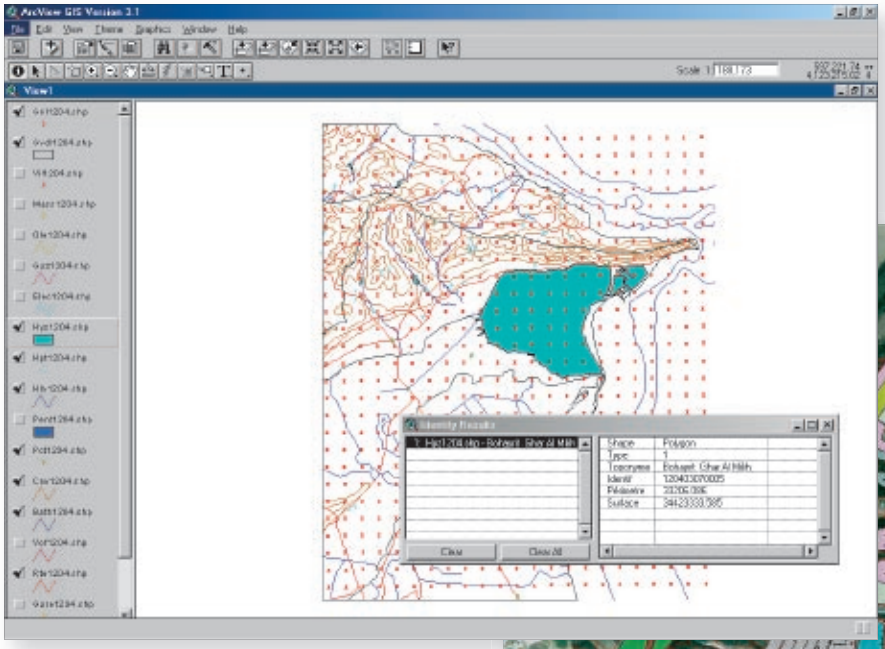
Next, engineers visited the locations listed in the study's findings and completed geological examinations of the grounds and the validity of sites. Researchers and engineers used a GIS hydrologic model to study the environmental factors as well as the economic and social impacts that would result from building a reservoir.

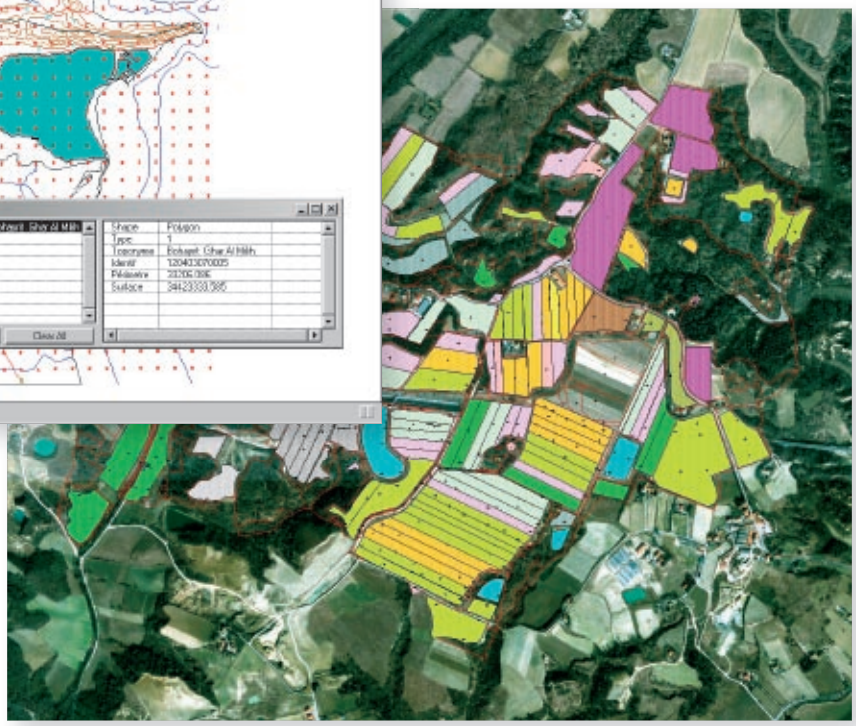
These studies, performed by Tunisia's Regional Commission for Agricultural Development, have been proven to be accurate and efficient. Therefore, Tunisia has standardized this approach to hydrographic analysis for future planning projects.

ESRI's ArcGIS Data Model Arc Hydro opens the way to building hydrologic information systems that synthesize geospatial and temporal water resources data to support hydrologic analysis and modeling.

Tunisia

Remote Sensing





Remote sensing, combined with ArcView, produces a cartographic tile for altimetry images using isolines.

Aerial photography makes a compelling background for GIS.

Remote sensing imagery is acquired from satellites and aircraft. Aerial photographs make compelling backgrounds for other GIS data. The increased availability of GIS and remote sensing technologies has led to significant advances in spatial assessment. For example, on-site GIS and rapid delivery of remote sensing products enable a fast response to natural disasters and can be used for fire management. GIS, combined with remote sensing, saves time and increases accuracy, leading to faster analyses and better recommendations.

The National Centre for Remote Sensing (NCRS) is Tunisia's principal earth resource satellite ground station and data processing facility. Since 1988, NCRS has provided Tunisia with ready-to-use cartographic documents. NCRS now combines GIS and remote sensing technology to create a large-scale institutional project named SPATIO 2000. This includes an exhaustive coverage of the whole Tunisian territory by a set of thematic digital maps cut into cartographic tiles.

SPATIO 2000's emerging product is Carthage 21. This product offers thematic cartography for space management and development. Carthage 21 allows end users to create a personalized geographic database for decision making. It can be used for both map generation and cross-reference analysis.

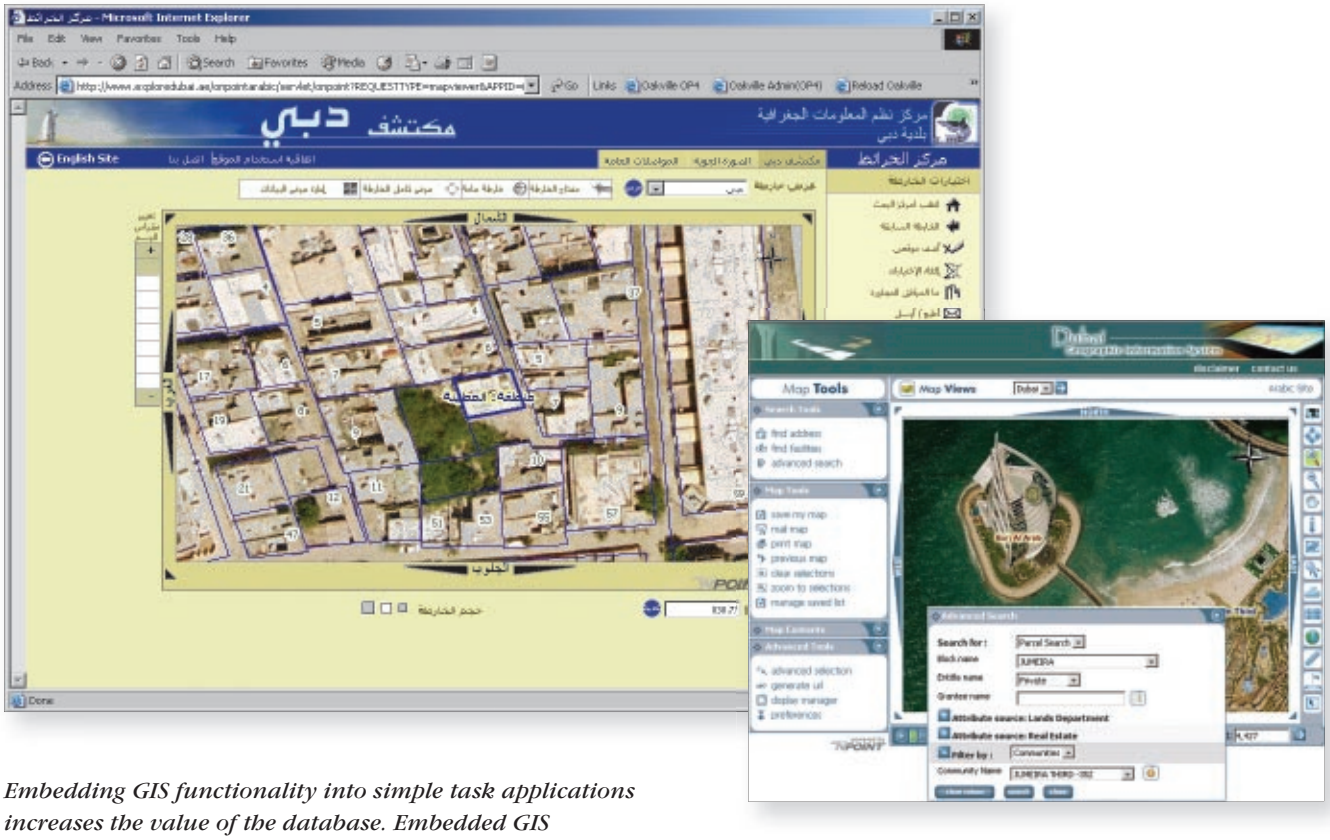
Carthage 21 is a geographic reference for decision and policy making. It can be put to work for environment analysis and management and natural hazard prevention. It is also useful for territory management and urbanization monitoring.

Carthage 21 contains 21 layers and covers the following 10 themes.

1. Image (orthoimage)
2. Transport infrastructure (road network, railway network, and train stations)
3. Hydrography (linear, punctual, and surface)
4. Altimetry (DEM, isolines, geodesic points, bathymetry, and slope)
5. Energy (pipeline, gas conduits, and electric network)
6. Administrative entities
7. Land cover
8. Toponymy (town and city names, mountain and hill names)
9. National boundaries
10. Grid

United Arab Emirates

Embedded GIS Services



Embedding GIS functionality into simple task applications increases the value of the database. Embedded GIS functionality allows organizations to leverage their investments in the GIS database without having to integrate GIS into their own information systems. This leads to efficiently streamlining job functions.

Dubai, an emirate of the United Arab Emirates, provides a spatial data service for individuals and organizations to embed interactive mapping and basic GIS functions into their own applications and on their own Web sites. Because the service delivers embedded GIS capabilities across the Web and directly into non-GIS corporate applications, employees can make GIS part of their everyday tasks.

The Dubai GIS Center is the sole source of Dubai's government mapping services, so the demand for service is enormous. The GIS handles numerous transactions daily and automatically updates its spatial databases each evening. System specifications required reliability at up to 10,000 transactions per minute. Therefore, the center installed 10 servers, all running GIS software from ESRI including ArcSDE for managing spatial data; ArcIMS for distributing spatial data on the Internet; and ArcMap Server for providing extensive display, query, and analytical capabilities.

Dubai's embedded GIS brings a wealth of information to Web users to help them find public transportation; locate community facilities such as emergency services, schools, hotels, and hospitals; and visit points of interest such as tourist attractions. Companies use embedded GIS in applications on their Web sites.

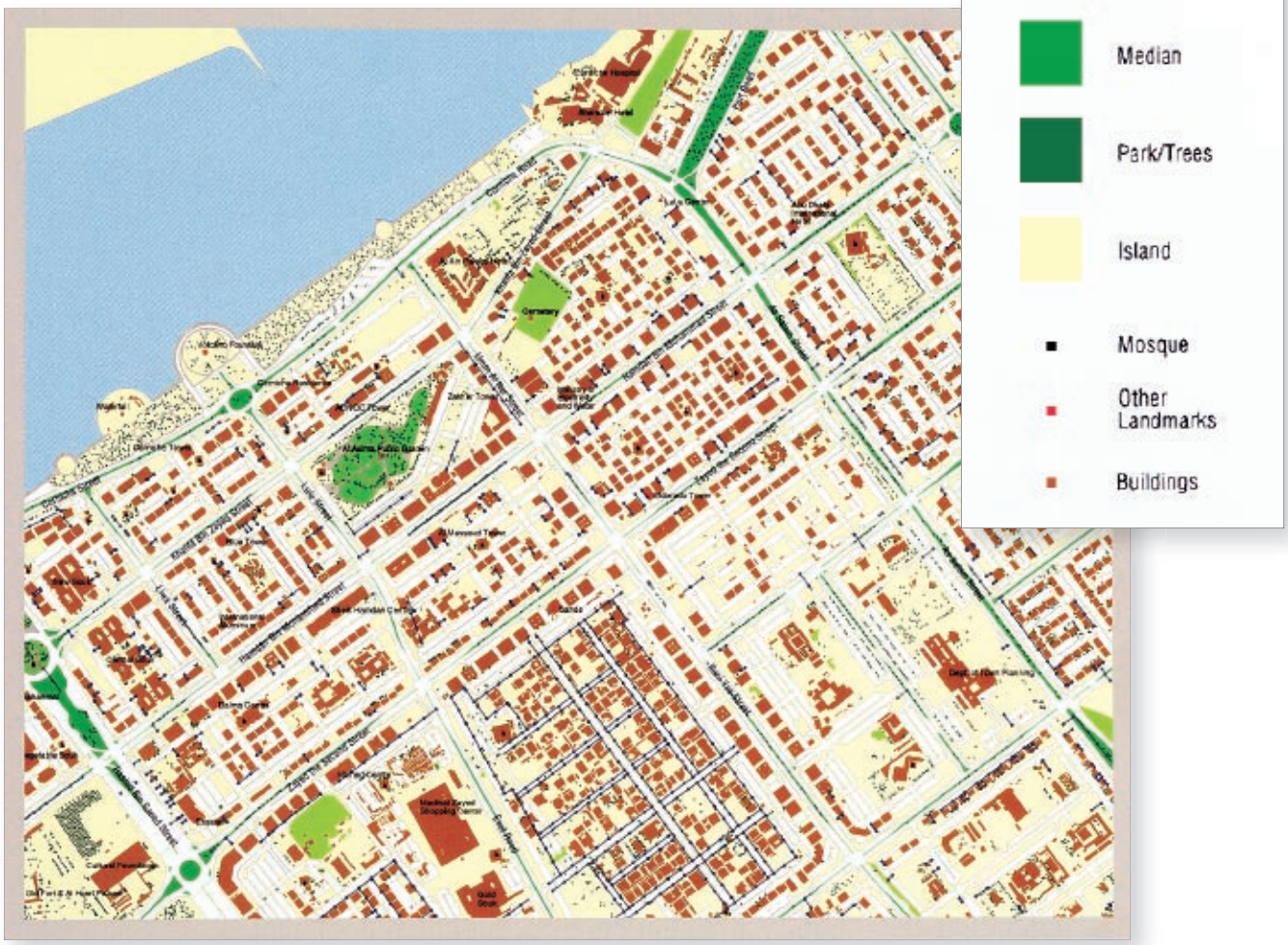
Dubai's Civil Defense Department has a GIS component in its automatic fire surveillance system. If a fire occurs in one of the city's major buildings, the surveillance system receives the alarm. By automatically accessing the Dubai GIS, the surveillance system queries a database to extract the building's location and the locations of other nearby threatened facilities. It can even store information about volatile chemicals housed in nearby buildings. GIS can also store aerial photographs of the endangered area. Within seconds GIS automatically prepares a map of the burning building's location and displays it in a window of the monitoring system at the Civil Defense Department.

The emirate's Parking Authority also employs an embedded GIS application in its parking management system. Kiosks located throughout the city of Dubai provide automated parking permit services to metropolitan drivers. Even though the Parking Authority has not implemented GIS software, by using Dubai's GIS Center's embedding services, employees can easily view kiosk data displayed on real-time, interactive maps that integrate their real-time data. Across the Web, interactive maps display locations of the parking ticket stations and their current status.

Visit the Explore Dubai Web site at www.exploredubai.ae.

United Arab Emirates

Transportation and Roads



GIS facilitates the essential maintenance of detailed, spatially accurate geodatabases by specifying common roadway features such as pavements, bridges, signs, signals, surveillance cameras, curbs, guardrails, and roadway shoulders. Accident locations can also be included in the database for safety analysis and road improvements. Planning engineers can model future traffic demand based on population changes and land use policy and present their findings to legislative officials and citizens. Traffic operations and construction project managers can better understand and manage traffic capacity when faced with changing conditions. ArcGIS allows the easy visualization of transportation infrastructure and system performance.

GIS is the ideal information management and analysis tool for many aspects of the transportation industry. Diverse areas of transportation, including highway and railway infrastructure management, international shipping, airport management, fleet logistics, traffic management and intelligent transportation systems, transit bus and rail service planning, transportation modeling, supply chain modeling, and others, are applying GIS to their work.

Abu Dhabi uses GIS for its transportation and roads inventory program. Abu Dhabi, the capital of the United Arab Emirates, has undergone considerable growth due to the development of its oil reserves. Transformed from small communities to a modern metropolis of high-rise towers in just 30 years, Abu Dhabi is an urban planning challenge. Abu Dhabi set up the Transportation and Roads Improvement Project (TRIP) for the purpose of developing a comprehensive transportation plan for the city.

GIS has enabled large amounts of data to be displayed and analyzed. For modeling, the outputs from ArcInfo are put into traffic modeling software, and the results are input back into ArcInfo. Census data is being collected by door-to-door surveys, and those results are entered into the GIS database.

Currently the TRIP GIS contains a huge library of data, which enables planners to design roads, intersections, and buildings for the future Abu Dhabi emirate.

Integrating Resources

GIS must produce useful information products that can be shared among multiple users and, at the same time, provide a consistent infrastructure to ensure data integrity. Interoperability enables the integration of data between organizations and across applications and industries, resulting in the generation and sharing of more useful information.

ESRI's GIS technology provides the framework for a shared spatial data infrastructure and a distributed architecture. ESRI has developed its products based on open standards to ensure a high level of interoperability across platforms, databases, development languages, and applications. The value of an open GIS is that it allows for the sharing of geographic data, integration among different GIS technologies, and integration with other non-GIS applications.

ESRI has given great attention to the relationship between GIS and the rest of the information technology (IT) infrastructure. For our users, this means compatibility and interoperability with major enterprise systems such as enterprise resource planning (ERP), customer resource management (CRM), enterprise application integration (EAI), work management systems, decision support systems, and others.

The Open GIS Consortium, Inc., (OGC), an international industry consortium of private companies, government agencies, and universities, published an open spatial standard called the Simple Features Specification. ESRI actively participated in the definition of the OpenGIS Simple Features Specification and was the first vendor with products to successfully complete OGC's conformance testing. In fact, ESRI is the only vendor with both client and server products that conform to the OpenGIS Simple Features Specification for SQL.

This compliance has been the catalyst for the design of interoperable Web services that allow GIS vendors to manage their own data using the best methods and formats for their tools in whatever database environment they choose. In addition, Web services allow server-to-server sharing of data and services. Web services facilitate a network of distributed computing nodes, which can include servers, workstations, desktop clients, and lightweight clients. Web services standards provide the glue by which these computers and devices interact to form a greater computing whole, accessed from any other devices on the network. With the introduction of Web services, distributed multivendor GIS services can be dynamically integrated into applications using the interoperable standards of XML and SOAP.

ESRI's ArcGIS Desktop products (ArcView, ArcEditor, and ArcInfo) can fuse multiple ArcIMS services. ArcIMS 9 supports integration of these GIS services on a Web service tier. ESRI's products can dynamically integrate distributed GIS services from different GIS vendors that support Web services standards.

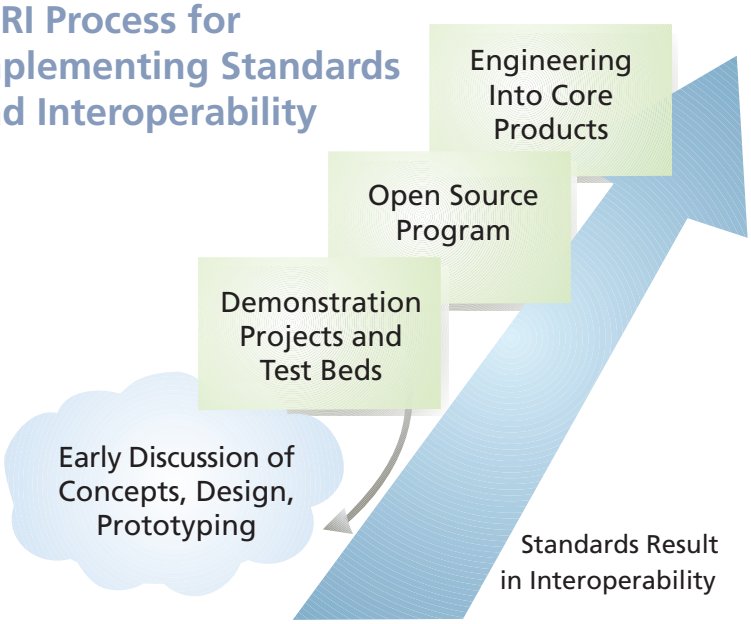
An example of our commitment to making these services available and useful, ESRI has designed OGC-supported add-ons and extensions to ArcGIS desktop products, ArcIMS, and ArcExplorer™.

The Open GIS Consortium Interoperability Add-Ons deliver support for Open GIS Consortium, Inc., Web Map Services (WMS) and Web Feature Services (WFS) to the ArcGIS Desktop products (ArcView, ArcEditor, and ArcInfo). Using the OGC Interoperability add-on, ArcView, ArcEditor, and ArcInfo can write out any feature layer as a Geography Markup Language (GML) document, which is compliant with a specific profile. It can add these GML documents to any map view.

The ArcGIS Data Interoperability extension provides state-of-the-art direct data access to more than 65 spatial data formats, data translation with 120 specialized transformers, and export capabilities to more than 50 spatial data formats.

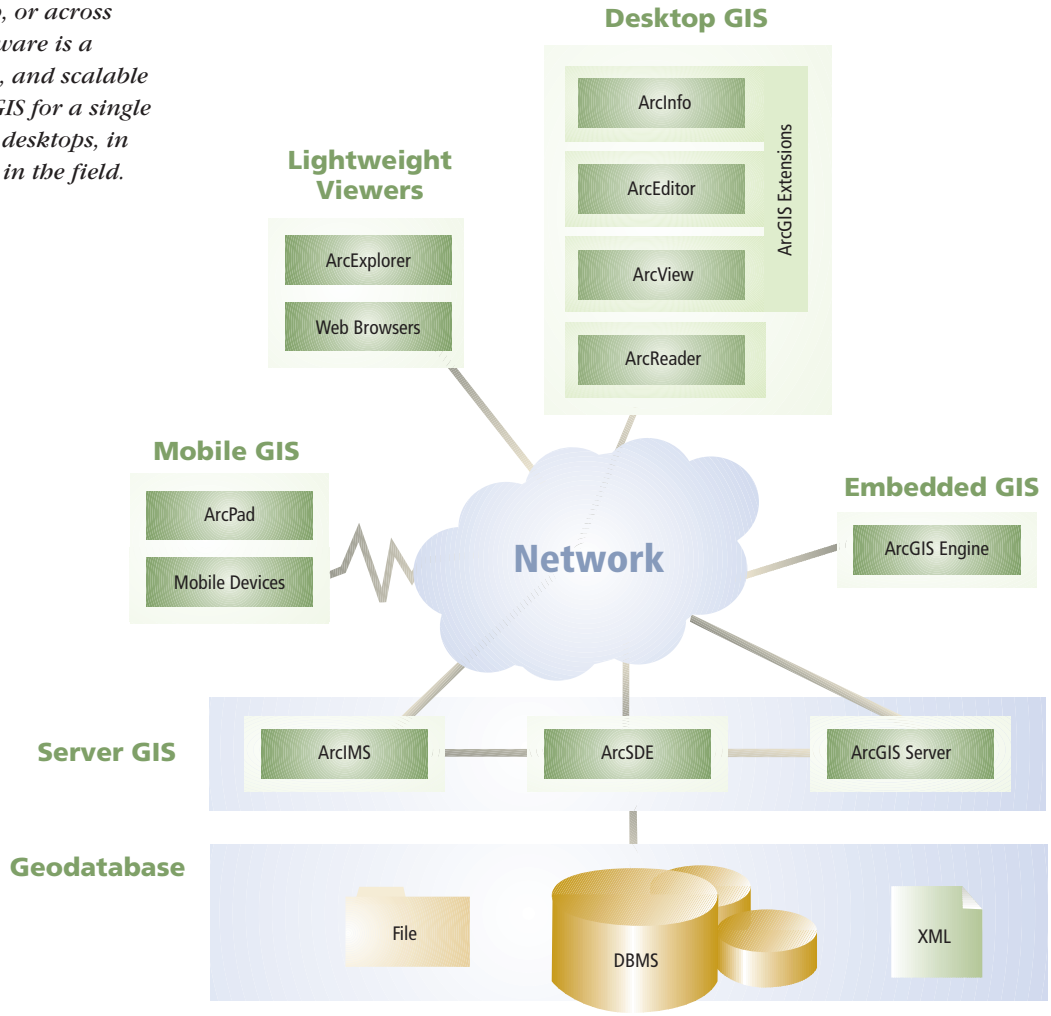
The ArcIMS Data Delivery extension enables users to easily select, export, and deliver data in multiple formats and projections from a centralized Internet Map Server. This extension gives users and administrators the ability to publish data in all standard spatial formats used within the industry.

ESRI Process for Implementing Standards and Interoperability



The ESRI Family of GIS Solutions

ESRI has solutions that can be deployed on the desktop, on the Web, or across the enterprise. ArcGIS software is a comprehensive, integrated, and scalable system for implementing GIS for a single user or for many users on desktops, in servers, over the Web, and in the field.



Desktop GIS

ArcGIS Desktop is scalable to meet the needs of many types of users. It is available at three functional levels.

- ArcView focuses on comprehensive data use, mapping, and analysis.
- ArcEditor adds advanced geographic editing and data creation
- ArcInfo is a complete, professional GIS desktop, containing comprehensive GIS functionality.

Embedded GIS

- ArcGIS Engine is a comprehensive library of embeddable GIS components for developers to build custom applications. Using ArcGIS Engine, developers can incorporate ArcGIS functions into applications such as Microsoft® Word and Excel as well as into custom applications that deliver focused GIS solutions to many users. Embedded GIS is useful for delivering focused GIS functions to many users not familiar with GIS.

Lightweight Viewers

- ArcExplorer is a GIS data viewer software that offers an easy way to perform a variety of basic GIS functions. It can be used on its own with local data sets or as a client to Internet data and map servers.
- Web browsers allow end users to connect to Web applications running in the Web server.

Mobile GIS

- ArcPad is a mobile mapping and GIS technology for mobile Windows devices. ArcPad provides database access, mapping, GIS, and GPS integration to field users via handheld and mobile devices.

Server GIS

- ArcSDE is an advanced spatial data server, providing gateway for storing, managing, and using spatial data in a DBMS for any client application (for example, ArcIMS or ArcGIS Desktop).
- ArcIMS is a scalable Internet map server. It is widely used for GIS Web publishing to deliver maps, data, and metadata to many users on the Web.
- ArcGIS Server is a comprehensive GIS toolkit for enterprise and Web application developers. It is used to build distributed and multitier enterprise information system configurations.

For more than 30 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

ESRI
380 New York Street
Redlands, California
92373-8100, USA
Telephone: +1-909-793-2853
Fax: +1-909-793-5953

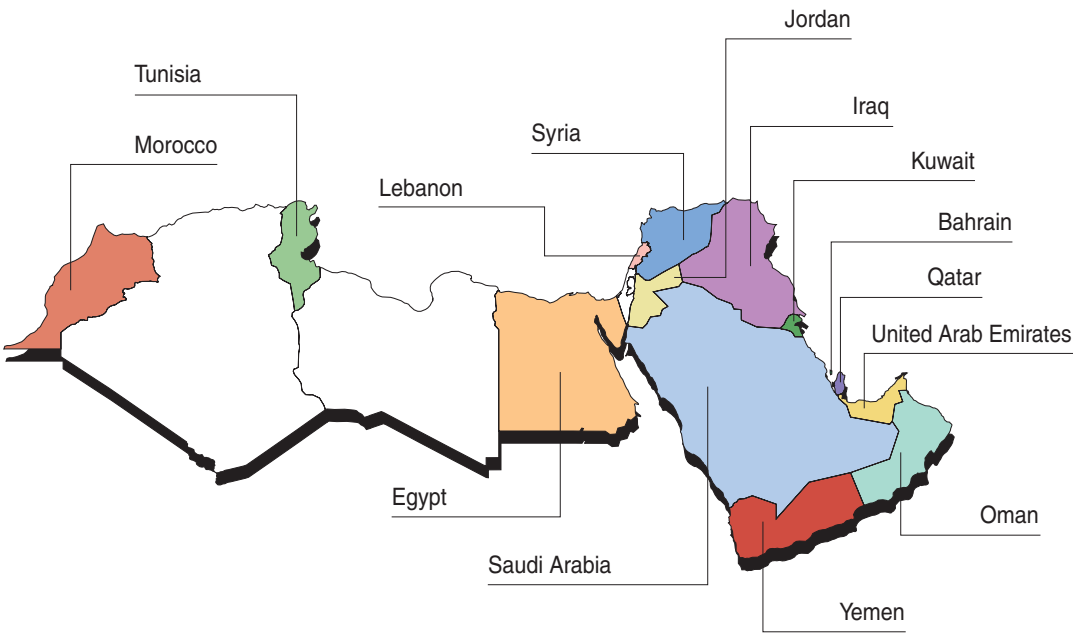
For more information on ESRI

send e-mail inquiries to

info@esri.com

Visit ESRI's Web page at

www.esri.com



Distributors

Bahrain
Micro Center
www.microcentergulf.com
+973-262-535

Egypt
Quality Standards Information Technology
www.qs4it.com
+20-2-761-2344

Jordan
InfoGraph
+962-6-560-3546

Kuwait
OpenWare
www.duc.com.kw
+965-434-0560

Lebanon
Khatib & Alami
www.khatibalami.com
+961-1-843843

Morocco
Geomatic
www.geomatic.ma
+212-22-20-01-63

Oman
Khatib & Alami and Partners
www.khatibalami.com
+968-602-016

Qatar
Mannai
www.gisqatar.org.qa
+974-4-412-555

Saudi Arabia
Moammar Information Systems
www.mis.com.sa
+966-1-463-1270

Syria
Hi-Tech House
+963-11-472-2222

Tunisia
Graphtech
+216-71-729-404

United Arab Emirates
GISTEC
www.gistec.com
+971-6-555-7675

Yemen
NATCO
+967-1-441-500

Contact your local ESRI distributor
or call ESRI at +1-909-793-2853, ext. 1-1235,
or visit our Web site at **www.esri.com/international**

Place ESRI business partner or distributor address here.

96872
UBS3M07/04tk

Printed in USA