Improving the local governance processes through exchange of good practices, pilots and training in geospatial technologies "LOCAL – SATS"

D4.2.1 Report identifying the most common problems and best practices

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LOCALSATS CONSORTIUM

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Patras Municipal Enterprise for Planning and Development S.A. GREECE	Aristotle University of Thessaloniki GREECE
Local Councils' Association MALTA	GEREDIS SPAIN
National Authority for Remote Sensing and Space Sciences (NARSS) EGYPT	Jordan University of Science and Technology JORDAN
Greater Irbid Municipality JORDAN	National Council for Scientific Research LEBANON
Union of municipalities of Hermel – planning and local development agency LEBANON	Applied Research Institute Jerusalem Association PALESTINIAN AUTHORITY

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[1] **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

[2] **PU** = Public, **PP** = Restricted to other programme participants, **RE** = Restricted to a group specified by the consortium, **CO** = Confidential, only for members of the consortium.

Contents

General

Deliverable D.4.2.1: Report identifying the most common problems and best practices is the 2nd Report in the series, following:

"D.4.1.1: Report about the cities sustainability and geo-technologies use in the Mediterranean basin".

After completing Tasks 4.1:

TASK 4.1 – SITUATION IN THE MEDITERRANEAN REGION: In this stage academic and national centres will compile all the available information about development and sustainability of cities and territories in the Mediterranean Basin and the use of geospatial applications for local management, as well as the different regional policies and relevant organizations working on this issues (European Union EU, United Nations UN, Mediterranean Commission on Sustainable Development MSCD, etc). This is necessary in order to have a general view of the situation of the Mediterranean countries and also taking into account the perspective of the other neighbouring regions. The aim is to compile all available information for the whole Mediterranean basin but if this is not possible to have a general vie by studying the nine participating countries.

The theme of the next Task is:

TASK 4.2 – IDENTIFICATION OF COMMON PROBLEMS AND BEST PRACTICES:

We are going to identify some of the detected problems in the previous study for the participating regions, and with the exchange of experiences, practices and information we will definitively identify the most important issues in local and regional administrations. This project promotes the contact among technical and local government groups, with different local development statutes and implied stakeholders from different parts of the participating regions, sharing similar problems. In the same way, with the aid of our well balanced partnership the exchange of experiences, practices and information will identify the best practices that can help local and regional administrations with their problems and extract common solutions that can be implemented in other sites after the project.

Conclusions of National Reports

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

Table 1. Part B. Identified weaknesses, critical points and gaps.

Countries/ Major themes	Cyprus	Tunisia	Greece	Malta	Spain	Egypt	Jordan	Lebanon	Palestinian Authority
1. Policies									
1.1. Spatial and Census data access									
1.1.1. Types of spatial data that are not available to the public for reasons of national security			√			√		√	
1.1.2. Improve internal coordination among agencies involved in providing spatial data			√		√				
1.1.3. Mismatch overlapping geospatial data, which are available from different organizations			√		√				√
1.2. Spatial and Census data sharing									
1.2.1. Lack of national policy for data availability							√		√
1.2.2. Existing spatial and census data is not shared between agencies				√			√	√	
1.3. Data collection funding									
1.3.1. Partial or total absence of funding	√			√			√	√	√
2. Data – Applications									
2.1. Distribution centers									
2.1.1. Ineffective method of dissemination of geospatial data	?	?	?	?	?	?	?	?	?
2.2. NSDI / metadata / format									
2.2.1. Collected data are not compatible to INSPIRE	√						√	√	√
2.2.2. Existence of national standards	?	?	?	?	?	?	?	?	?
2.2.3. Existence of outdated geospatial data						√			√
2.4. Costs									
2.4.1. Not clear pricing policy	√						√		√
2.4.2. Absence of free data						√		√	

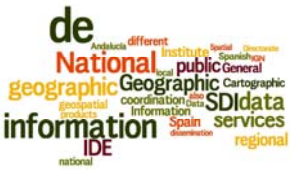
Countries/ Major themes	Cyprus	Tunisia	Greece	Malta	Spain	Egypt	Jordan	Lebanon	Palestinian Authority
2.5. Cooperation among Agencies									
2.5.1. Different pricing policies between public institutions			√	√		√		√	√
2.5.2. Absence of a single platform providing information about the collected data / lack of spatial correlation control of the data	√		√	√	√	√	√	√	√
2.6. Regional Data sets - Global Data sets									
2.6.1. Absence of free distribution of geospatial data from national institutes and public services WMS / WMTS / WMS-C	√			√		√	√		√
4. National Stakeholders/Industry									
4. A small number of National Stakeholders/Industry for geospatial data	√								

Cyprus

Tunisia

Greece

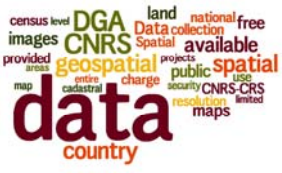
Malta



Spain

Egypt

Jordan



Lebanon

Palestinian Authority

Figure 1. High-frequency words in the national reports.

1. Policies

1.1. Spatial and Census data access

In Greece, Egypt and Lebanon control of aerial photography is required for national security reasons before selling them to individuals. In Malta partial disposal of data is available for the public.

In Greece and Spain a better internal coordination is needed, between the agencies involved to provide spatial data for their citizens. Also there are often spatial variations between overlapping geospatial data, which are available from different agencies. Finally, an increase in national and European resources is required in order to produce geospatial products. Furthermore there is a need avoid financing projects between different services that produce geospatial data for the same geographic region.

In Jordan there should be free access to geospatial data or alternatively reduce the cost of their acquisition from the citizens. The last also applies to Lebanon. In Jordan the geographic information databases should be updated, and the coverage of GPS data must be increased across the country. Finally, the SDI (Spatial Data Infrastructure) in Jordan is not part of EU INSPIRE.

In Palestine there is a lack of a national GIS source of information. Lebanon is lacking periodic census which is mainly based on surveys. Census data is limited to governorate scale. There is unidentified geo-spatial data available in several universities and academic centers, but this is neither archived nor covering wide spatial areas.

In Malta there is a gap between existing data and the data required by INPSIRE such that full compliance can be achieved.

1.2. Spatial and Census data sharing

In Greece, Spain and Lebanon many services does not make publicly available their territorial data, while those available often accompanied by a high purchase cost. The free central web application spatial data in Greece mainly retains data after 2010, while in Lebanon, the data are of low resolution. In Spain there is a need to increase the e-governance tools for advancing Geographic Information in the electronic administration service to citizens.

In Jordan and Palestine there is no clear data sharing policies and almost all public and private institutions do not have online data availability.

In Lebanon, Jordan and Malta there is no policy for sharing spatial and census data between institutes and/or public authorities.

In Malta there are barriers to sharing environmental spatial data that are generally related to the lack of appropriate skills necessary to utilize the various datasets in their native format, frequently closed coupled with underlying commercial systems. The proliferation of software solutions and the INSPIRE data specifications are contributing to the reduction of these barriers. Some datasets are currently provided for reuse subject to a fee based license. The administrative processes and revenue association with these arrangements remain as a barrier to the sharing of some data sets.

1.3. Data collection funding

In 2013, 530 million euros was made available to attract Planning, Environmental and master Cadastral projects in Greece.

In Spain the total investment for the period (2013-2016) would reach approximately 78.42 million euros in the production or renovation of cartographic products and about 5.2 million euros in implementation or maintenance of web geoservices.

In Jordan the lack of funding is a crucial challenge across all entities. In Malta there are no specific Government funds allocated for data collection. However, data collection so far has been co-financed by the EU and by the Government of Malta.
In Palestine there are rarely any programs that directly support the collection and updating of geo-spatial data at a national level.
In Lebanon the budget allocated for spatial data collection is below one million euros.

1.4. Decision making process
In Greece, Cyprus, Palestine, Egypt, Malta and Lebanon there are no national standards for the use of geospatial data in all projects.
Law 14/ 2010 on the Infrastructure and Geographic Information Services in Spain (LISIGE), through its twenty items divided into five chapters, runs from the object and its fields of application, in the General Provisions, to services organization, production and dissemination of official cartography and geographic information. It also develops coordination and the decision making processes regarding the Geographic Information Infrastructure in Spain, together with the establishment of its geoweb and its rules, the description of data, metadata and services and interoperable geographic access conditions, and the Geographic Information Infrastructure Administration General of the State with respect to the functions that correspond to its Institute National Geographic.
In Jordan there is lack of National Regulations and Standardization. The institutionalization of Spatial Data Infrastructure (SDI) within the stakeholder entities is still lagging. Finally, there is both a lack of adequate scientific staff in their respective production organization and secondly a lack of standard quality control.

2. Data – Applications

2.1. Distribution centers
Greece has not yet completed the National Cadastre (will be completed in 2020). The NCMA SA in late 2013 and early 2014 announced two international calls in order to support the National Cadastre. Other basic activities that are under development are the creation of protected areas maps and the compilation of forest maps, in an accurate, transparent and definitive way.
Identical in Lebanon the DGA (Directorate of Geographic Affairs) has not yet completed the recent airborne photo acquisition of the country which can be used to complete cadastral mapping (60% of the municipalities in Lebanon have cadastral maps) and create a high resolution DTM (Digital Terrain Model). Despite the updated land cover and land use map from CNRS (National Council for Scientific Research), soil maps and flood hazard maps, the update of this information is not done periodically and depends on project requirements. The CAS (Central Administration of Statistics) is implementing projects based on current needs and available funding and also provides free access at governorate level and upon authorization at local level.
Spain has a very complex public sector, being both a producer and user of Geographic information. The Central Government exercises both facets by numerous bodies and agencies of various government departments. The national referent of Spain is the National Geographical Institute (IGN) of the Ministry of Development. Apart from the IGN other major producers of geographic information also exist in Spain. Moreover, the regions also need to produce and use specific information of their geographic areas to meet their government competences or to provide specific services.
In Jordan the insufficient budget impedes efforts to enhance and expand the center‘s services as well as limit its ability to update existing maps of various scales.

In Palestine the only official distribution center is The Palestinian Central Bureau of Statistics (PCBS). Nonetheless, PCBS does not share geospatial data with the public.
In Cyprus the Geospatial information for the end users will be done through the National Geoportal and through the corresponding European Geoportal. The operation of the National Geoportal will be compatible and consistent with the Geoportal of the Department of Lands and Surveys, the design of which is in progress.
In Malta the National Mapping Agency within MEPA (Malta Environment and Planning Authority) provides both large and small scale topographic maps of Malta, maintains an archive of aerial photography and produces the national Ortho photo map. The transport in Malta is regulated by Transport Malta. It provides a geoportal to the general public which allows access to geospatial information related to transport. The general public can buy Land Registry Plans from the Land Registry Department. The Agricultural Paying Agency makes use of the Land Parcel Identification System (LPIS) which is a key component of the Integrated Admiration and Control System (IACS) with regards to area based subsidies. The Enemalta Corporation is the main entity responsible for the provision of energy generation and distribution to the Maltese Islands. The corporation has a number of data sets on a geoportal however these cannot be accessed by the public. The Malta International Airport (MIA) Met Office offers a broad and reliable spectrum of meteorological products and services including georeferenced weather forecasting, satellite and radar images all of which can be accessed through the MIA website. Physical Oceanography Unit, IO-Malta Operational Centre, University of Malta offers a compilation of physical oceanographic data and information with links to internationally renowned websites, and also provides a gateway to public information. Heritage Malta is the national agency for museums, conservation practice and cultural heritage. The datasets available on the Heritage Malta's geoportal are museums and sites.

2.2. NSDI / metadata / format

In Greece, Spain and Malta all data is compatible and in accordance to the EU INSPIRE Directive.
In Jordan, Palestine, Cyprus and Lebanon the data is not compatible and not in accordance to EU INSPIRE Directive. Data is not available for Egypt.

2.3. Coverage – Revision cycle

In general there are maps of various scales covering the whole territory of every county. In Greece the basic topographic map scale is 1:5,000 provided by NCMA S.A., followed by 1: 50,000 provided by HMGS. While the general maps at 1:250,000 and 1:1,000,000 scale are provided by ELSTAT (Greek Statistical Authority). Regular aerial survey of the entire territory of the country is being realized by the Hellenic Military Geographical Service (HMGS) and the NCMA SA. From 2007 NCMA SA has initialized the mapping of the entire Greek country with a GSD of 20 (urban areas) and 50 (rural areas) cm to produce true ortho images in RGB spectral channels. Since April 2010 NCMA is operating a remote sensing monitoring system for the detection of illegal building constructions in the region of Attica, which was affected by the destructive fires of 2009.
In Spain the coverage and revision cycle depends nowadays from the PCN (National Cartographic Plan, 2013-2016) and the PNOT (National Plan of Land Observation). So according to the approved budget every year geographic areas are designated for updating information. Some examples are the update of Agriculture plots registry by the Spanish Agricultural and Guarantee Fund (FEGA) for the Common Agricultural Policy of the European Union, the update of the Integrated Water Information System (AIS) and the National Information System Flood Zone (SNCZI), the update of the Urban Information

System (UIS) by the Directorate General of Architecture, Housing and Land, the revision of the geographic positioning service and land navigation from Real-time Permanent Stations by the Directorate General of IGN, conducting topographic mapping, and official thematic statistics Administration General like the National Plan of Orthophotography (PNOA) and LIDAR coverage reinforcement.

In Jordan the RJGC has produced maps for the entire country at a wide range of scales. A few of the main cities are available in a scale of 1:1,250, while the majority of cities and villages have been produced at both 1:2,500 and 1:5,000. Maps of the main cities and their surrounding areas have also been produced at 1:10,000, and the most heavily populated areas of the country have been mapped at the scale of 1:25,000. There are also maps of the entire country at 1:50,000 and 1:100,000 and archaeological maps at 1:250,000, showing all the main cites of antiquity, as well as tourist maps at 1:5,000 and 1:1,500.

The Palestinian Ministry of Agriculture has land- use and land -cover layers that cover all the Palestinian Territory. The Applied Research Institute Jerusalem (ARIJ) has up to date aerial photos and satellite images covering all the Palestinian Territory. ARIJ has also topographic maps, road networks, water networks, and points of interest (POI). The Palestinian Ministry of planning has national spatial plan for that covers the West-Bank Area.

In Cyprus the Cartographic Branch of the Department is currently working on several hardcopy and digital cartographic products. A number of digital maps in both vector and raster formats have been completed based on scales from 1:7,500-1:500,000.

The Military Survey Authority and Egyptian General Surveying authority have full coverage at national level. The basic national topographic map scale is 1:5,000.

In Lebanon the basic topographic map scale is 1:20,000, followed by 1:50,000, 1:100,000 and 1:200,000 and are produced and provided by DGA. Regular aerial survey of the entire territory of the country is being realized by the DGA since 1962. From 2007 the DGA has initialized the air borne coverage of the entire country with a GSD of 20 cm (urban areas) and 50 cm (rural areas) to produce true orthoimages. Only 70% of the mapping campaign has been completed for security reasons. The land cover land use maps are periodically updated and revised at CNRS.

In Malta a LIDAR survey was carried out as part of the SEIS project. It was conducted by Terraimaging and consists of maps for terrestrial and bathymetric zones including high resolution three dimensional terrestrial coverage of the Maltese Islands applying both oblique aerial imagery and Light Detection and Ranging (LIDAR) data. The coastal bathymetric survey within one nautical mile off the coast of Malta was realized by using bathymetric LIDAR data, acoustic scans and physical grab sampling.

2.4. Costs

In Greece the national data are free of charge for non-commercial purposes (from NCMA SA). There are also available hardcopies and digital files from other state and military services for commercial use. The price list is available online.

In Spain the IGN/CNIG generates and maintains a significant amount of geographic information. These data, in digital format, constitute the bulk of the continuous and comprehensive Geographic information reference for all Spain. The National Center for Geographic Information (CNIG) is the organization responsible for producing, developing and distributing the work and publications of geospatial nature. Public dissemination of geographic information generated by the Directorate General of the National Geographic Institute is governed by the order FOM/956/2008. This order establishes the policy of disseminating digital geographic information, establishing the free nature of the non-commercial use of such information and how to define the economic consideration in the general use of it. For products and services whose rights are owned by the National

Geographic Institute or CNIG, not included in the FOM 956/2008 order, public prices are set by a resolution establishing public prices for the geodata, publications and services. In the case of products owned by other government agencies, the CNIG sells under agreements established with these agencies. The prices are set by agreement between them.
In Jordan, Palestine and Cyprus no clear policies are defined for pricing.
In Egypt and Lebanon the national data are not free of charge.
In Malta most of the National Data can be viewed online free of charge. However some datasets are not free of charge. Both hardcopies and digital copies can be bought from various entities.

2.5. Cooperation among Agencies

In Greece, Palestine and Malta some ministries and organizations have high degree of cooperation. In Greece, Palestine, Malta, Egypt and Lebanon there are different pricing policies among the public agencies/providers of geospatial data. Many agencies sell geospatial data even to other public agencies. Furthermore there is not a single database of all available geospatial data managed by a governmental body. As a result, spatial correlation of data cannot be checked.
In Spain the production and dissemination of geographical information is much decentralized in two aspects: geographically, as both regional and local administrations took care of it, and thematically, as it was produced by different thematic departments at national or regional level. The regions have hierarchical centers or horizontal institutions to meet their geographic and mapping information needs. Some have their own cartographic plans. Meanwhile, there are communities which have their own mapping records with different regulation levels. Because of this a Central Cartographic Registry is needed in order to connect all cartographic records of the regional administrations. The insufficient coordination in the generation of this information is a source of problems in different fields. On the other hand most of the regions have their own geodetic networks GNSS.
In Jordan and Cyprus the lack of coordination is noticeable among the different stakeholders in this domain. Ownership of data layers is not defined, and multiple entities claim ownership of common layers and update them independently.

2.6. Regional Data sets - Global Data sets

For Greece, Spain and Malta there is free distribution of geospatial data from national Institutes and official WMS/WMTS/WMS-C services. Also, for all partners there is free distribution of geospatial data from international websites.

3. Capacities

3.1. National and Regional Spatial Information collection and processing

In Greece, Malta, Jordan, Lebanon, and Palestine there are a lot of organizations that are involved in Geospatial data collection-delivery. In Cyprus and Spain a common access point to the geographic information exists.
In Greece the Ministry of Defence, the Ministry of Environment, Energy and Climate Change and the Greek Statistical Authority (ELSTAT) are involved in Geospatial data collection-delivery.
The national and regional Spatial Data Infrastructure (SDI) of Spain (IDEE) is the common access point to the geographic information collected and processed by the Spanish government provided through their catalog services (CSW).
In Jordan the Royal Jordanian Geographic Center (RJGC), the Department of Lands and Survey (DLS), the Greater Amman Municipality (GAM), the Natural Resource Authority

(NRA), the Ministry of Municipal Affairs (MoMA) and the Department of Statistics (DOS) coordinate or are the core spatial data provider institutions.
In Palestine the Ministry of Planning (MoP), the Ministry of Agriculture (MoA), the Ministry of Local Government (MoLG), the Ministry of Environmental Affairs (MEnA), the Palestinian Water Authority (PWA), the Palestinian Land Authority (PLA), the Ministry of Public Work and Housing (MoPW), the Applied Research Institute Jerusalem (ARIJ) and the Land Research Center (LRC) coordinate or are the core spatial data provider institutions.
In Cyprus the Ministry of the Interior, through the Department of Lands and Surveys of Cyprus, is the body responsible for the development and operation of the infrastructure for geospatial information.
For Egypt there is no available information.
In Lebanon the CNRS-CRS is downloading and processing available open source satellite data. The DGA, the CNRS-CRS, the Ministry of Energy and Water (MoEW), the Ministry of Agriculture (MoA), the Ministry of Environment (MoE), the MoEconomy, the MoInterior, the Litani Authority and the Lebanese Agricultural Research Institute (LARI) coordinate or are the core spatial data provider institutions.
In Malta the MEPA, the Transport Malta, the Malta Resources Authority, the Malta International Airport Met Office, the Physical Oceanography Unit (IO-Malta Operational Centre, University of Malta), the Malta Tourism Authority, the Heritage Malta and the SEIS Malta coordinate or are the core spatial data provider institutions.

4. National Stakeholders/Industry

For all partners, except Cyprus, there is a big number of National Stakeholders/Industry involved in geospatial data issues.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

CYPRUS

1. Policies

1.1 Spatial and Census data access

Geospatial data are accessible through a GIS with online link to the Land Information System of the Department of Lands and Surveys. Additionally, the Department of Lands and Surveys provides direct access to basic levels of LIS data through controlled web applications. Those procedures are still in limited use because of the old technology used. It is expected that, based on current efforts to upgrade the LIS, a modern system will be created, in which direct access will be more easily provided to a large variety of geospatial and other data to all interested parties.

Additionally, digital geospatial data are provided on a regular basis, both to government departments and agencies, and to individuals through digital means (CD's, DVD's, etc.), as well as through email. Static digital geospatial data are provided free of charge through the website of the Department of Lands and Surveys in various formats (PDF, KML, KMZ, jpg, etc.).

1.2 Spatial and Census data sharing

A licensing framework has been established regarding the sharing of geospatial data and services among the Public Authorities. The licenses used at this stage to make the data of the Department of Lands and Surveys available are the following:

- License to use for internal needs within an organization,
- License to use for specific publications (e.g. books, journals, etc.) with a fixed duration and number of copies,
- License to use on the internet,
- License for limited use in students' studies,
- License for limited use for a specific purpose (e.g. an environmental study),
- License for commercial use.

1.3 Data collection funding

Data collection funding information is not available.

1.4 Decision making process

Currently there are no standards for the usage of geospatial data in the projects.

2. Data - Applications

2.1 Distribution centers

Geospatial information for the end users will be done through the National Geoportal and through the corresponding European Geoportal. The operation of the National Geoportal will be compatible and consistent with the Geoportal of the Department of Lands and Surveys, the design of which is in progress. To make better use of modern web technologies, the services will have standardized interfaces, will be self-descriptive and searchable, so that they can be retrieved and used by other applications and web services.

2.2 NSDI / metadata / format

Once this process is complete, all data will be compatible and in accordance to EU INSPIRE Directive.

2.3 Coverage – Revision cycle

The Cartographic Branch of the Department is currently working on several hardcopy and digital cartographic products. A number of digital maps in both vector and raster formats have been completed based on scales from 1:7,500-1:50,000.

2.4 Costs

The costs required for the development of the National Infrastructure for Geospatial Information can be divided into three categories:

- Development cost: The cost relates to the development of infrastructure and web services and applications as well as to the preparation of specifications and rules on common use and sharing of the system and the data.
- Cost of production of basic geospatial reference data: The cost relates to the homogenisation of existing geospatial data in order to produce the background to be used for the presentation and dissemination of geospatial data through the information system.
- Compliance costs for data producers: The cost relates to the transformation of geospatial data and the development and maintenance of appropriate services, from PAs which produce geospatial data and are obliged to participate.

2.5 Cooperation among Agencies

The involvement and participation of other government departments and agencies in the creation of an integrated geospatial data infrastructure was quite difficult and much more time consuming than initially estimated. Gradually, other peripheral systems were created and a large volume of digital information was collected. Much of the data generated were based on the infrastructure for geographical data of the Department of Lands and Surveys and the same projection system and coordinates were adopted. Other systems have followed their own specifications, in order to meet quickly specific internal needs, with the result that there is no compatibility.

2.6 Regional Data sets - Global Data sets

A web application (http://parcel.dls.moi.gov.cy/) has been created, which is accessible in the website of the Department of Lands and Surveys (www.moi.gov.cy/dls).
The application has been created to enable navigation and geographic projection of parcels in space. More specifically, it can be used as a "tool" to locate a parcel by navigating to satellite images of "Google Maps" or through the "Google Earth" software, which are provided by "Google" and are governed by its own Terms of Use and Conditions. This application is free software and all rights with respect to the contents and the source code belong to the Department of Lands and Surveys.

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The Ministry of the Interior, through the Department of Lands and Surveys of Cyprus, is the body responsible for the development and operation of the infrastructure for geospatial

information for the parties involved and for providing tools, guidelines and technologies that will facilitate participation and interoperability.

4. National Stakeholders/Industry

- Geomatic Technologies Ltd is one of the biggest cartographic companies in Cyprus that exclusively deals with Geographical Information Systems (G.I.S.). Since 2002, T.C. Geomatic Ltd has developed and continuously updates its own digital-spatial database of Cyprus.
- SELAS provides GIS Services to both the public and private sector. It has created a rich digital geographical database for Cyprus "Map CyprusTM" and can offer GIS data of Cyprus of large scale and high resolution. All data is fully compatible with the most widespread GIS software and are offered in any projection system

PART C. BEST PRACTICE VIGNETTES

CYPRUS 

1. Introduction

The Department of Lands and Surveys has already implemented an integrated Land Information System which serves its needs and the needs of other organizations and departments which use land related data. The implementation phases included a series of projects such as: the strategic planning and system design, the release of tenders for hardware and software, the tender evaluation, followed by an agreement which was signed between DLS and an International Consortium for the system development.

The system development started officially in September 1995, and it was followed by the system design phase. The next phase, which was the system development phase, lasted approximately 2 years. After the delivery of the customized system, a series of testing scenarios followed, which enabled the improvement of the applications.

The system was officially accepted in 1999, and it is currently used in a production environment. At the same time, many projects have been initiated for collecting and preparing the data that populate the LIS databases. These projects include the re-survey of the whole island, the digitization of current cadastral plans, and the data entry of legal and fiscal data.

The progress of the LIS data collection and database population is shown in the following figures:

- Legal data 814.000 registrations (62.6%), out of 1,300,000.
- Fiscal data 190.000 sub-properties (9.0%), out of 2,106,000
- DCDB 850.000 (78.0%) land parcels digitized, out of 1,089,480, 696,900 in database (64,0%).
- SDB 50.000 land parcels in database (5,0%).

It is estimated that in 1-2 years the Digital Cadastral Database (DCDB) and the Legal Database data input and processing will be completed for the free areas, whereas the Fiscal database will be completed within the next 2-3 years. The Survey Database (SDB) is scheduled to be fully populated after the completion of the resurvey program.

Σχόλιο [P1]: Should we include it as such?

Further developments have been done on the LIS, during 2005, towards the creation of a planning zones database. The data model has been designed along with the required conversion routines. The digitization of a total of 4,500 plans started in January 2005 and it will finish in December 2005. All vector data will be converted and accommodated in the Land Information System. Mass updating will be carried out for the population of all zoning characteristics and attributes of each property.

Σχόλιο [H2]: Is it completed?

In addition to the above, extra themes were created in the LIS, providing access to ortho-photo maps and satellite images, which cover Cyprus at large scale. A new server computer has been installed, which accommodates both ortho photos and satellite images. These sets of data along with all the rest GIS/LIS information and datasets can be accessed by all users in an interactive environment.

2. The project

The URBANGUARD project aimed to facilitate the incorporation of urban sustainability indicators into the spatial planning process in Cyprus through a custom made GIS tool. These indicators were mainly used by planners and authorities responsible for preparing and reviewing Development Plans, by local administrators, stakeholder organizations and other special interest groups participating in the plan review process, as well as by the wider public when filing objections against published Development Plans. This will in turn improve procedures that enable a more productive form of public participation and a higher level of governance, through which decision-makers can be held responsible for their choices. The process also involved the creation of the necessary capabilities and system tools for the monitoring and reporting of these indicators, as well as their application within the urban policy decision-making process.

The beneficiary was the Department of Town Planning and Housing (DTPH) and the project was implemented in Cyprus, with the help of partners from Greece (EAPAX SA) and Belgium (ADD asbl), as well as local partners from the private sector (Atlantis Consulting Cyprus Ltd; and ALA Planning Partnership).

The URBANGUARD project has been financially supported by the European Commission, as provided for by Regulation (EC) No 1655/2000 in the field of the environment (LIFE Third Countries).

3. The indicators

The URBANGUARD system consists of a list of sustainability indicators developed by cross-breeding the objectives of the Cyprus national urban policy with a pool of European and international indicators identified through research. The selection was carried out with the participation of stakeholders in the urban development process and the final list was prepared after consultation with competent government services, local authorities and special interest organisations.

The indicators have been specifically chosen to address a wide range of urban development issues, incorporating environmental, economic, social, and spatial planning parameters. The 100 indicators selected examine the sustainability of residential, commercial, tourist and industrial development; conservation and transport policies; as well as the areas of heritage and culture, environment and landscape, sport and recreation, and health, education and community services. Out of all the URBANGUARD indicators, a core set of key spatial development indicators directly relates to the national spatial planning policy and will be used in monitoring and assessing spatial and urban policy sustainability.

The final list of indicators tested in the pilot phase is the result of the review of all lists drafted using international, EU and national pools of indicators. It is based on consultations

carried out with the local stakeholders, as well as urban policy areas over which Planning Authorities have competency through Development Plans. These thematic policy areas are:

- Residential development
- Commercial and office development
- Industrial and workshop development
- Tourism development
- Transport and utility infrastructure
- Health, education and community services
- Sport and recreation
- Heritage and culture
- Environment and landscape

Indicators were therefore grouped in compatible policy areas. The main goals, as expressed in statutory Development Plans, on which the formulation of these policies is based are:

- Viable and efficient distribution of land uses
- Sustainable use of natural resources and improvement in the quality of the environment
- Urban containment, compact development, action against sprawl
- Sustainable mobility and accessibility, adequate provision of amenities and infrastructure
- Protection and sustainable management of cultural heritage and historic neighborhoods
- Revitalization of urban centres and reinforcement of their role as focal points of urban agglomerations
- Social integration and cohesion
- Economic viability of urban development
- Urban cohesion
- Mixed use development (integration of compatible uses)
- Protection of the quality of life
- Sustainable tourism development

The above goals played a key role in the selection of the final list of the URBANGUARD indicators and the elaboration of each indicator's methodology sheet.

The indicators can be further categorized into two sets. The first one comprises basic indicators whose main role is to provide information utilized in evaluating other indicators; for example, indicator 1 (GDP) is used to evaluate indicator 77 (heritage restoration expenditure per capita). The second one is a core set comprising indicators related directly to the national spatial planning policy, such as those concerning housing, transportation, natural and cultural heritage conservation as well as the various development types. Covering the spectrum of areas over which the final users are legally competent, these key spatial development indicators will constitute the main set to be used in monitoring and assessing policy sustainability.

In order to assess each indicator, corresponding data collection and processing guidelines have been prepared and elaborated in methodology sheets. Each sheet includes information on the indicator's code number, full title, policy area addressed, sustainability principles covered, definition, data collection methodology, units of measurement, collection level, frequency of measurement, sources of information etc. The data collection process and its results were recorded in metadata forms, which aim to provide information for current and future users regarding the sources, accuracy, credibility, validity and value of the selected data. The metadata stored in these forms also serves as a record in the database search system, which has also been developed as part of the GIS tool so that users can locate data sets of interest.

4. The planning tools

The selected indicators provide information through a custom-built GIS-based planning analysis tool, partly derived through paradigms from Belgium and the ESPON Community Initiative Programme and partly developed with local innovation and know-how. It is hoped that the URBANGUARD tool will help put the monitoring of spatial plans in Cyprus on a new track, providing a more holistic analysis of sustainability parameters, more transparent and accountable planning practices, and as a result, better governance and more effective stakeholder participation in the planning process.

The URBANGUARD tool is a complete tool based on a customized ACCESS database coupled with ArcGIS, a Geographic Information Systems software package, which can simultaneously calculate the value and spatial distribution of all indicators included in the system. The tool includes a series of basic data to which indicator-specific data are overlaid in order to provide spatially distributed information concerning the selected indicators.

To test the URBANGUARD system, a study area within the Municipality of Strovolos was defined for its pilot run, in order to assess monitoring and reporting capabilities as well as to properly evaluate the indicators and tools chosen.

5. Preparation of a GIS Based Monitoring Tool Based on ArcGIS

To facilitate the monitoring and assessment of these indicators, a GIS-based tool has been developed. This tool is based on a customized Microsoft Access database tool designed in accordance with the calculation methods specified in the methodology sheets. The database is coupled with ArcGIS, a Geographic Information Systems software package by ESRI.

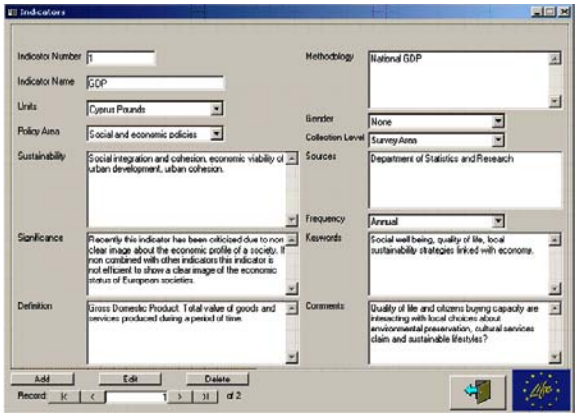


Figure 1. Digitized Methodology Sheet.

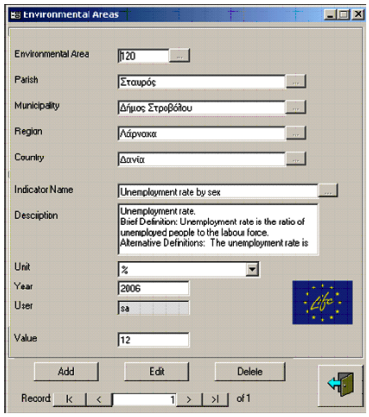


Figure 2. Access Database sample.

The main functions of the GIS tool include:

- Importing geospatial data via the ArcGIS interface
- Importing indicator values, methodology sheet text and metadata through the database entry interface
- Evaluating and analyzing indicator data
- Graphically displaying spatially distributed indicator data
- Facilitating report preparation in the form of maps, tables and text

Figure 3. GIS-generated thematic data map.

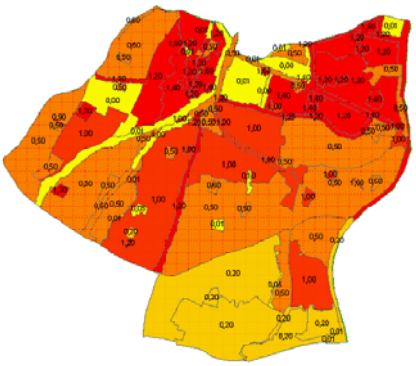


Figure 4. GIS-generated spatial data map.

The GIS system developed is a complete tool that can simultaneously calculate the value and spatial distribution of all indicators included. The tool comprises a series of basic data to which indicator-specific data are overlaid in order to provide spatially distributed information related to the selected indicators. For the successful implementation of the tool, the following geographic and demographic data of the area under study is required:

- Environmental Area (EA) boundaries, as designated by published Development Plans and used by CYSTAT
- Survey Area boundaries, as designated by CYSTAT; these are generally subdivisions of each EA
- Ring area boundaries, as defined by the URBANGUARD project through roughly concentric rings coinciding with major traffic arteries around the centre of each urban agglomeration
- Administrative boundaries of local authorities
- Land uses as designated by published Development Plans
- Building densities as designated by Development Plans
- Development boundaries, designated by Development Plans
- Road networks as designated by Development Plans
- Population distribution, derived from census
- Household distribution, derived from census
- Cadastral maps, provided by the DLS.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

GREECE

1. Policies

1.1 Spatial and Census data access

- Clearance of aerial photography is required for national security reasons.
- The digitization of analogue aerial photos available by the NCMA S.E. has not yet been completed.
- NCMA S.E. does not possess an airborne digital imaging neither a lidar sensor, resulting in lack of raw Digital and Lidar data.
- Some of the data are not available to the public for national security reasons as mentioned in III. *Royalties-Usage Restrictions*.

1.2 Spatial and Census data sharing

- There is not online data availability for many public institutions.
- Some of the data are available to the public with a cost.
- The application Open-Public data retains data produced after 2010.

1.3 Data collection funding

In 2013, €530,000,000 were made available to attract Planning, Environmental and master Cadastral projects (http://www.ypeka.gr/Default.aspx?tabid=866&language=el-GR, http://www.ktimatologio.gr/Pages/Proclamations.aspx#)

1.4 Decision making process

There are no standards for the use of geospatial data in all projects. For instance, in all studies on the general development planning there are specific requirements for the use of geospatial data. In contrast, on transport studies, standards of geospatial data are compiled on case by case basis, depending on the scope and objective of the study (eg types of roads).

2. Data - Applications

2.1 Distribution centers

The National Cadastre has not yet been completed. This national project will be completed in 2020. The NCMA S.A. (National Cadastre & Mapping Agency) in late 2013 and early 2014 announced two international calls. The first call (late 2013) entitled "Assigning contracts for cadastral surveys and support services for the creation of National Cadastre in the rest of the country", has as its main goal the completion of the cadastral survey for fifty seven (57) remaining Regional Sections of the Country. The second call (early 2014) entitled "Production of digital orthoimagery for the country (LSO25)", has the main goal to update all basic base maps (LSO) of NCMA S.A., with new base maps of greater spatial resolution, better geometric accuracy and enhanced radiometric resolution. The project concerns the production of orthoimagery using digital aerial color infrared images, which are characterized by the term LSO25, and the corresponding digital elevation models (DEM) for the entire country. The project has a budget of 5,483,074.40 €, financed by the European Regional Development Fund (ERDF) and national resources, in the context of the OP

(Operational Programs) "Digital Convergence" NSRF (National Strategic Reference Framework 2007-2013).
Other basic activities under development are:

- the creation of protected areas maps.
- the compilation of forest maps, in an accurate, transparent and definitive way

2.2 NSDI / metadata / format

All data is compatible and in accordance with the EU INSPIRE Directive.

2.3 Coverage – Revision cycle

• 35% of data producers or data providers have full coverage of the state. The basic national topographic map scale is 1:5,000 provided by NCMA S.A., followed by 1: 50,000 provided by HMGS. While the general maps at 1:250,000 and 1:1,000,000 scale are provided by ELSTAT.

• Regular aerial survey of the entire territory of the country is being realized by the Hellenic Military Geographical Service (HMGS) and the NCMA S.A. From 2007 NCMA S.A. has initialized the mapping of the entire Greek country with a GSD of 20 (urban areas) and 50 (rural areas) cm to produce true ortho images in RGB spectral channels. The mapping campaign has finished recently and a free viewer web application is available on line under the link http://gis.ktimanet.gr/wms/ktbasemap/default.aspx. Recently (early 2014) the competition entitled "Production of digital orthoimagery for the country (LSO25)", has as its object to update all basic backgrounds (LSO) of NCMA SA, with new backgrounds which will have greater resolution, better geometric accuracy and enhanced radiometric analysis. The project concerns the production with aerial color infrared digital orthoimagery, which are characterized by the term LSO25, and the corresponding digital elevation models (DEM) for the entire country.

• Since April 2010 NCMA is operating a remote sensing monitoring system for the detection of illegal building constructions in the region of Attica, which was affected by the destructive fires of 2009. The Remote Sensing mapping system was created to protect damaged areas. Specifically, for these areas Orthoimagery is produced bimonthly and compared with the corresponding Orthoimagery of the previous period in order to detect changes in land use and land cover in the corresponding areas.

2.4 Costs

The national data for non-commercial purposes are free of charge (from the NCMA S.A.). There are also available hardcopies and digital files from other state and military services for commercial use. The price list is available at:
http://web.gys.gr/portal/page?_pageid=33,36592&_dad=portal&_schema=PORTAL
http://www.hnhs.gr/portal/page/portal/HNHS/Charts
http://www.okxe.gr
http://portal.igme.gr/portal/page?_pageid=33,77661&_dad=portal&_schema=PORTAL
http://geoportal.topographiki.gr/portal/page/portal/Topo/PAGE-%D4%E9%EC%EF%EB%FC%E3%E9%F3%E7

2.5 Cooperation among Agencies

Some of the problems are:

• Different pricing policy among the public agencies/providers geospatial data (e.g. Hellenic Military Geographical Service, National Cadastre & Mapping Agency S.A.).

• Many public agencies (e.g. NCMA S.A) sell geospatial data even to another public agencies.
• There is not a single database of all geospatial data managed by a governmental body. As a result, there is an inability to perform quality control in spatial correlation of the geospatial data.

2.6 Regional Data sets - Global Data sets

Free distribution of geospatial data:
• Variety of geospatial data of Greek territory. Institute for Information Systems /Research Center "Athena» (http://www.geodata.gov.gr/geodata), Greek Open Knowledge Foundation (http://ckan.okfn.gr)
• Satellite images and Digital Terrain Model (http://www.landcover.org/data/, http://earthexplorer.usgs.gov, http://glovis.usgs.gov)
• Timeless images Google Earth (http://www.google.com/earth)

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The following governmental bodies coordinate or are involved in Geospatial data collection-delivery in the country:
• Ministry of Defense:
  • Hellenic Military Geographical Service,
  • Hellenic Navy Hydrographical Service,
  • Hellenic National Meteorological Service.
• Ministry of Environment, Energy and Climate Change:
  • National Cadastre & Mapping Agency S.A. (NCMA S.A),
  • Institute of Geology and Mineral Exploration (IGME).
• The Greek Statistical Authority (ELSTAT).

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Full Name	Web Site	GeoScience
National Cadastre & Mapping Agency S.A.	http://www.ktimatologio.gr/sites/en/Pages/Default.aspx	Cartography/Combination*
Hellenic Military Geographical Service	http://web.gys.gr	Combination*
Greek Payment Agency	http://www.opekepe.gr	Agriculture
Directory of Surveying, Ministry of Rural Development and Food	http://www.minagric.gr	Combination*
Directory of Forest maps, directory of development, forest protection and Natural Environment, Ministry of Rural Development and Food	http://www.minagric.gr	Combination*
EGNATIA ODOS A.E.	http://www.egnatia.eu	Combination*
Agroland S.A. utilization company of agricultural	http://www.agrogi.gr	Agriculture
Geomatics	http://www.geomatics.gr	Combination*
Aerophotographiki	http://www.aerophoto.gr	Combination*
GEOSYSTEMS HELLAS	http://www.geosystems-	Combination*

	hellas.gr	
Inforest Research o.c.	http://www.inforest.gr/	Combination*
HEPOS	http://www.hepos.gr/	-
Chorotechniki A.E	http://horotechniki.com	Combination*
GEOSET LTD consulting for the development	http://www.geoset.gr/	Combination*
TOMI SOCIETE ANONYME OF INFRASTRUCTURE ENGINEERING DESIGN WORKS	http://www.tomh-ae.gr	Combination*
Eratosthenes S.A	http://www.eratosthenes.gr	Combination*
Geoanalysis S.A.	http://www.geoanalysis.gr	Combination*
Department of Rural and Surveying Engineering, The Aristotle University of Thessaloniki	http://www.topo.auth.gr/	Combination*
Department of Rural and Surveying Engineering, National Technical University of Athens	http://www.survey.ntua.gr/	Combination*
School of Geology, Department of physical And Environmental Geography	http://www.geo.auth.gr	Combination*
Faculty of Forestry and Natural Environment Department of Planning and development of Natural Resources, Aristotle University of Thessaloniki	http://www.for.auth.gr	Combination*
School of Agriculture Department of Hydraulics, Soil Science and Agricultural Engineering, Laboratory of Remote Sensing and GIS AUTH	http://labrsgis.web.auth.gr	Combination*
Department of Surveying Engineering Technological Educational Institute of Athens	http://www.teiath.gr/stef/topografias/?lang=en	Combination*
Department of Geomatics and Surveying, Technological Educational Institute of Serres	http://geo.teiser.gr	Combination*
Directory of Surveying, Ministry of Environment energy & Climate Change	http://www.ypeka.gr	Combination*
Institute for Space Applications and Remote Sensing, National Observatory of Athens	http://www.space.noa.gr	Combination*
The Hellenic Statistical Authority	http://www.statistics.gr	Combination*
Foundation for Research & Technology, Institute of Applied and Computational Mathematics	http://www.iacm.forth.gr	Combination*
Hellenic Navy Hydrographic Service	http://www.hnhs.gr	Combination*
Hellenic Centre for Marine Research	http://www.hcmr.gr	Combination*
Archipelagos	www.archipelago.grhttp://www.archipelago.gr	Combination*
Centre for renewable energy resources	www.cres.grhttp://www.cres.gr	Environmental Engineering
Epsilon	www.epsilon.grhttp://www.epsilon.gr	GIS
Hellenic Centre for Biotopes and Aquasystems	www.ekby.grhttp://www.ekby.gr	Urban/Land Planning
Space consulting SA	www.spaceconsulting.gr http://www.spaceconsulting.gr	Combination*
Institute of Geology and Minerals	www.igme.grhttp://www	Combination*

	.igme.gr	
Min. of Environment, Public works (YPEKA) - Ethn. Diktyo Plir. Perivallontos	-	-
Aristotle Univ. of Thessaloniki, Geodesy and Surveying	www.civil.auth.grhttp://www.civil.auth.gr	Civil Engineering
Space Business Unit	www.athena-spu.grhttp://www.athena-spu.gr	Combination*
Harokopeio University of Athens	www.hua.grhttp://www.hua.gr	Remote Sensing
Center for Security Studies	-	Combination*
Centre for renewable energy resource	www.kape.grhttp://www.kape.gr	Environmental Engineering
Demokritus Univ. of Thrace, Electrical Engineering	-	Environmental Engineering
Hellenic Centre for Marine Research - Inst. Of Inland Waters	www.hcmr.grhttp://www.hcmr.gr	GIS
Hellenic National Meteorological Service	www.hnms.grhttp://www.hnms.gr	Meteo
Marac Electronics	www.marac.grhttp://www.marac.gr	Combination*
Miltech Hellas S.A.	www.miltech.grhttp://www.miltech.gr	Combination*
Institute of Environmental Research and Sustainable Development / National Observatory of Athens	http://www.meteo.noa.gr/	Environmental Engineering
Planetek Hellas S.A.	www.planetek.grhttp://www.planetek.gr	Remote Sensing
Space Hellas S.A.	www.space.grhttp://www.space.gr	Combination*
Stamatopoulos and Associates	www.saa-geotech.grhttp://www.saa-geotech.gr	Civil Engineering
Technical University of Crete	www.mred.tuc.grhttp://www.mred.tuc.gr	Civil Engineering
Aristotle University of Thessaloniki / Physics Dept	-	-
WWF Greece	www.wwf.grhttp://www.wwf.gr	Environmental Engineering
Academy of Athens / Science of Space	-	Combination*
University of Athens / Physics Dept.	www.phys.uoa.grhttp://www.phys.uoa.gr	-
University of Patras / ELLAB	www.ellab.physics.upatras.grhttp://www.ellab.physics.upatras.gr	Remote Sensing

*Combination: Agriculture, Architecture, Cartography, Civil Engineering, Environmental Engineering, Geodesy, GIS, Other, Photogrammetry, Remote Sensing, Urban/Land Planning.

PART C. BEST PRACTICE VIGNETTES

GREECE 

1. Introduction

The Egnatia Motorway (http://www.egnatia.eu/page/default.asp?id=5&la=2) is one of the largest transportation projects implemented in Europe during the last years, and it has been integrated into the priority projects of Trans-European Transport Networks (TENs-T). The 670km long motorway crosses Northern Greece, connects most of its major urban centers, and links 4 major harbors and 6 airports. Over 25 Industrial Areas, Industrial Parks, Small Industry Parks and, in general, developmental zones are located within a radius of 5km on either side of the Egnatia Motorway and each of its vertical axes. The motorway also directly or indirectly connects an abundance of touristic and cultural sites. Consequently, the Egnatia Motorway:

- has direct or indirect impact on the development and territorial spatial planning in Northern Greece,
- affects the accessibility of local and regional markets and services, the networking of cities and settlements, and the protection and enhancement of the natural and cultural environment,
- re-organizes international interconnections and accesses of Greece within the wider area of Central and South-Eastern Europe, and via its Vertical Axes becomes a collector route for the Trans-European network.

Within this framework, "EGNATIA ODOS S.A." established and has been operating since 2003, the Egnatia Motorway Observatory, acknowledging that the importance of the project and the size of the investment demand the promotion of supplementary actions that will multiply the benefits and prevent the negative impact of the project operations in the surrounding areas.

An activity of the Observatory is the development of specialized know-how aiming at the organization and operation of an Information System for Spatial Data Management and Indicator Monitoring that enables the recording, calculation and monitoring of 43 features-indicators, as well as their geographic analysis. Through the Observatory, EGNATIA ODOS S.A. assesses the spatial impacts of the Egnatia Motorway and its vertical axes system in relation to the project implementation progress, i.e. in relation to "before" and "after". The Observatory Information System includes the operation of an Internet website, http://observatory.egnatia.gr/index_en.htm, through which Observatory products are presented and disseminated in digital format. Furthermore, an electronic geospatial data and metadata library has been developed, in accordance with Directive 2007/2/EC INSPIRE and Law 3882/2010. The system of indicators concerns:

- 19 Socio-Economic and Spatial planning indicators;
- 15 Transportation indicators;
- 9 Environmental indicators: Population exposed to traffic noise, Air pollution, Cohesion- fragmentation of settlements, Tunnel air quality, Landscape restoration, Fragmentation of natural areas, Land Use changes, Proximity to protected areas and Crossings with surface water.

2. Monitoring the Spatial Impact

Deliverable: Pilot study of changes in land use and land values in selected urban areas around 3 interchanges of the Egnatia motorway, over a 10 years period.

Target: Investigation of changes in the direct impact zone of Egnatia motorway in terms of land use, land values, and business location, over the period 1998-2007, in three typical Interchange I/C zones of 5x5km.

Land use changes: Changes in land use as a result of expected pressures in specific areas along the motorway axis (especially near settlements, industrial areas etc.) and more specifically, rate of change of (a) cultivated land into urban land, (b) natural areas into urban land and (c) natural areas into cultivated land.

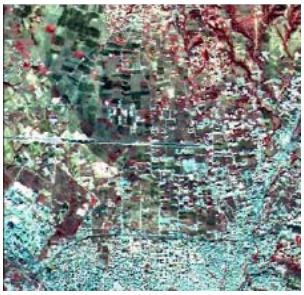


Figure 1. Spot image/year 1998.

Figure 2. Ikonos-2 image/Year 2007.

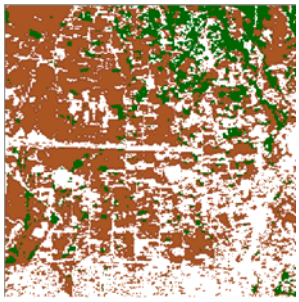


Figure 3. Classified Spot image.

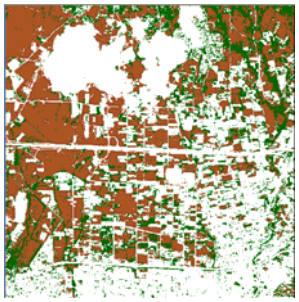


Figure 4. Classified Ikonos-2 image.

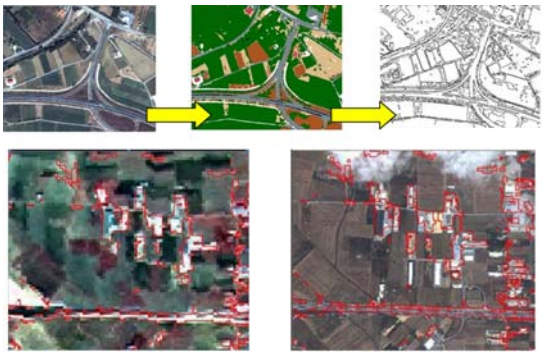


Figure 5. Automatic Vectorization of changes. Sample of the SPOT image and its equivalent IKONOS image sample, showing areas with no land use changes, during the 1998-2007 period.

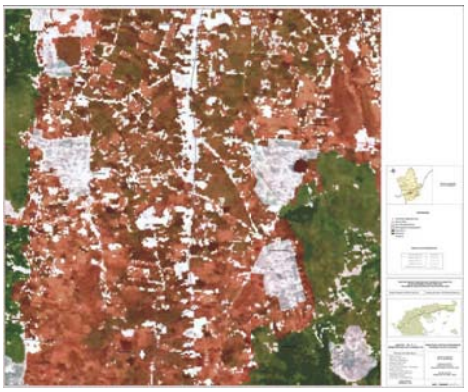


Figure 6. Land use classification in year 1998.

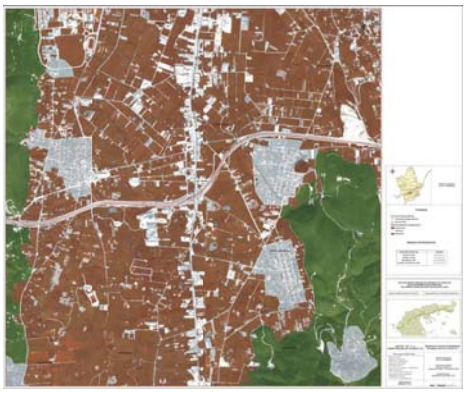


Figure 7. Land use classification in year 2007.

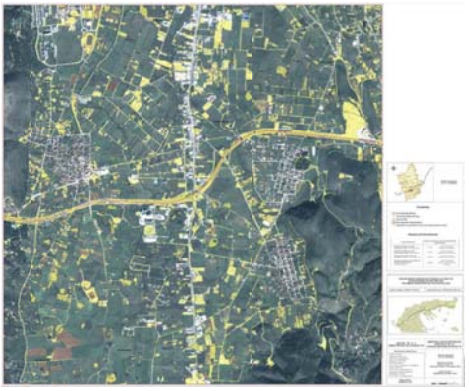


Figure 8. Change of Agricultural and Natural Lands (1998) into Urban Lands (2007).

Figure 9. Change of urban/industrial/service land use between 1998 – 2007.

Reference

Stamou., A., Georgiadis., Ch, P. Patias, (2008) "Land cover change in three selected areas under influence of the Egnatia highway, Greece", The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. XXXVII, Part B6b, ISSN 1682-1750, XXI ISPRS Congress, 3-11 Jul 2008 Beijing, China, Volume XXXVII, Part B6b, Commission YF, pp. 15-20.

Acronyms

Digital Elevation Models (DEM)
The Greek Statistical Authority (ELSTAT)
European Regional Development Fund (ERDF)
Hellenic Military Geographical Service (HMGS)
Institute of Geology and Mineral Exploration (IGME)
National Cadastre & Mapping Agency S.A. (NCMA S.E.)
National Strategic Reference Framework (NSRF)
Trans-European Transport Networks (TENs-T)

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

MALTA 

1. Policies

1.1 Spatial and Census data access

- Currently there is a gap between existing data and the data required by INPSIRE such that full compliance can be achieved. The biggest issue is the transition of large scale and tightly controlled National datasets to an inter-operable system as required by INSPIRE.
- Data sets available from MEPA, Transport Malta, the Malta Resources Authority, Malta International Airport Met Office, the Physical Oceanography Unit, IO-Malta Operational Centre, University of Malta, the Malta Tourism Authority and Heritage Malta can be accessed by the general public. However, other data sets from other entities are not public.
- The SEIS portal is up and running and the following data sets are available: Air, Water, Radiation, Noise, Soil (http://cdr.eionet.europa.eu/mt/eu/inspire/reporting/envuibb3g/INSPIRE_Montitoring_Report_Malta_2013.pdf)

1.2 Spatial and Census data sharing

- Data sharing between public authorities depends on mutual arrangements. Other than the existing legal provisions for access to environmental information, the Public Sector Information Directive and the INSPIRE initiative, there are no specific cross cutting provisions mandating data sharing. Consideration for a broader approach to embed the principles of cross-cutting access and reuse across the public administration will be facilitated through the on-going work of the NSDI stakeholders.
- Barriers to sharing environmental spatial date are generally related to the lack of appropriate skills necessary to utilize the various datasets in their native format, frequently closed coupled with underlying commercial systems.
- The proliferation of software solutions and the INSPIRE data specifications are contributing to the reduction of these barriers.
- Some datasets are currently provided for reuse subject to a fee based license. The administrative processes and revenue association with these arrangements remain as a barrier to the sharing of some data sets.

(http://cdr.eionet.europa.eu/mt/eu/inspire/reporting/envuibb3g/INSPIRE_Montitoring_Report_Malta_2013.pdf)

1.3 Data collection funding

As stated in Part A 3.1 there are no specific Government funds allocated for data collection. However, data collection so far has been co-financed by the EU and by the Government of Malta as listed in Part A 1.6.

1.4 Decision making process

On a national level geospatial data is used for planning and project development processes but no formal records are documented for such cases. As stated in Part A 1.4 the use of geo-spatial data in the local decision making processes is not documented.

2. Data - Applications

2.1 Distribution centers

- The National Mapping Agency within MEPA provides both large and small scale topographic maps of Malta, maintains an archive of aerial photography and produces the national Ortho photo map. Data at large scale range is provided at 1:25,000, 1:10,000, 1:2,500 and 1:1,000 scales. Data sets can be obtained through MEPA's geoportal which contains:
  - Planning Data including Development Planning Data, Planning Constraints Data, Scheduling Data and Listed Natural Heritage.
  - Environmental Data including Environmental Permitting, Environmental Assessments, Marine Data and Terrestrial Data.
  - Base Maps including Survey Control Points, Topography, Background Maps and Archive Survey Sheets.
- Transport in Malta is regulated by Transport Malta. It provides a geoportal to the general public which allows access to geospatial information related to transport. The geoportal contains the below datasets:
  - Core Spatial Data which includes the basic references to all the transport layers containing coast, streets, Local Council boundaries and TenT Network. These are available in both raster and vector. Land Transport Theme displaying bus stops and bus routes.
  - Maritime Theme showing the swimmer zones, anchorage and berth areas, fish farms, lights, wrecks and sea plane landing areas in Valletta and Mgarr (Gozo).
  - Project Theme lists the ongoing large-scale road works projects in Malta, Gozo and the Cirkewwa Ferry Terminal.
  - Residential Road Works Programme Theme which includes the residential road network.
- The Land Registry Department is mainly responsible for collecting applications with regards to the registration of immovable property within registration areas. The general public can buy Land Registry Plans from this department.
- The Malta Resources Authority is a government body which is responsible for regulating water, energy and mineral resources in Malta. The Malta Resources Authority has the following spatial data accessible through the authority's website: Groundwater quality Private Abstraction Sources, Petroleum Filling Stations, Licensed Quarries, Geological maps of Malta, Gozo and Comino.
- The Agricultural Paying Agency makes use of the Land Parcel Identification System (LPIS) which is a key component of the Integrated Administrative and Control System (IACS) with regards to area based subsidies. It is a spatial registers within an IACS environment which identifies agricultural parcels. This system aids farmers to identify their parcels when regards to EU aids: Cultivable Area, Permanent Tree Crops, Water Reservoirs, Non-Agricultural Land, Walls, Buildings, Streets/Pathways, Olives, Reeds.
- The Enemalta Corporation is the main entity responsible for the provision of energy generation and distribution to the Maltese Islands. The corporation has a number of data sets on a geoportal however these cannot be accessed by the public.
- The Water Services Corporation is responsible for the complete water cycle in Malta from the production and distribution of potable water to the disposal of soiled water. It has a geoportal however it cannot be accessed by the general public.
- The Malta International Airport (MIA) Met Office offers a broad and reliable spectrum of meteorological products and services including georeferenced weather forecasting, satellite and radar images which can be accessed through the MIA website.

- Physical Oceanography Unit, IO-Malta Operational Centre, University of Malta offers a compilation of physical oceanographic data and information with links to internationally renowned websites, also providing a gateway to public information. The Malta Blue Pages serves as a marine data and includes varied sources of ocean and coastal marine datasets, data catalogues and data inventories, providing a broad information website which is accessible and presentable in a form which is targeted towards a wide range of end-users.
- The Malta Tourism Authority (MTA) is Malta's tourism industry regulator and motivator, its business partner, the country's brand promoter, and forms, maintains and manages meaningful partnerships with all tourism stakeholders. The spatial data accessible through MTA's website portal are: Accommodation, Food and Drink, Travel Agents, Language Schools, Places of Interests, Sports, Diving Site, Dive Centres, Parks and Gardens, Nightlife, Transport, Health and Wellness, Towns and Villages, Beaches and Bays, Conference Venues, Service Providers, Tour Operators, Wedding Venues, Shopping and Photos.
- Heritage Malta is the national agency for museums, conservation practice and cultural heritage. The datasets available on the Heritage Malta's geoportal are museums and sites.

2.2 NSDI / metadata / format

The level of conformation of the national geodata provided by the public stakeholders in Malta can be found in the excel file published on the following link: http://cdr.eionet.europa.eu/mt/eu/inspire/monitoring/envuibdcw/MR_indicators_Template-v_3-4_MT.xls/manage_document.

2.3 Coverage – Revision cycle

A LIDAR survey was carried out as part of the SEIS project. It was conducted by Terraimaging and consists of maps for terrestrial and bathymetric zones including high resolution three dimensional terrestrial coverage of the Maltese Islands applying both oblique aerial imagery and Light Detection and Ranging (LIDAR) data. The coastal bathymetric survey within one nautical mile off the coast of Malta was realized by using bathymetric LIDAR data, acoustic scans and physical grab sampling.

2.4 Costs

Most of the National Data can be viewed online free of charge. However some datasets are not free of charge; both hardcopies and digital copies can be bought from the various entities.

2.5 Cooperation among Agencies

- Data sharing between public entities is subject to bilateral agreements.
- Entities such as MEPA and the Lands Department sell geospatial data to the public.
- A single database from which all geospatial data can be accessed does not exist. Hence, data congruency cannot be confirmed.
- The NSDI which is being developed by MITA is still in its early stages and the datasets housed on this geoportal are still few in number.

2.6 Regional Data sets - Global Data sets

Free distribution of geospatial data:

- Timeless images Google Earth (http://google.com/earth)

- National Spatial Data Infrastructure for Malta (http://sdi.data.gov.mt/geonetwork/srv/eng/main.home)
- Free viewing of geospatial data from geo-portals of the following entities: Malta Environment and Planning Authority, Transport Malta, Malta Resources Authority, Malta International Airport, Physical Oceanography Unit, IOI-Malta Operational Centre at the University of Malta, the Malta Transport Authority and Heritage Malta.

3. Capacities

3.1 National and Regional Spatial Information collection and processing

- MEPA geo-portal (http://www.mepa.org.mt/mepa-mapserver)
- Transport Malta geo-portal (http://gis.transport.gov.mt/)
- Malta Resources Authority (http://mra.org.mt/hydrogeology/spatial-data/)
- Malta International Airport Met Office (http://weather.maltairport.com/en/weather-services.htm)
- Physical Oceanography Unit, IO-Malta Operational Centre, University of Malta (http://www.capemalta.net/)
- Malta Tourism Authority (http://www.visitmalta.com/en/about-us)
- Heritage Malta (http://heritagemalta.org/museums-site/)
- SEIS Malta (http://www.seismalta.org.mt)
- Timeless Images Google Earth (http://www.google.com/earth).

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Full Name	Web Site	Geoscience
Malta Information Technology Agency (MITA)	(https://www.mita.gov.mt)	Various
Malta Environment and Planning Authority (MEPA)	(https://www.mepa.org.mt)	Various
Transport Malta (TM)	(http://www.transport.gov.mt)	Transport
Lands Registry Department (LRD)	(https://mhas.gov.mt/en/MHAS-Departments/Land%20Public%20Registry/Pages/Home.aspx)	Estate Management
Malta Resources Authority (MRA)	(http://mra.org.mt/)	Various
Agricultural Paying Agency	(https://secure2.gov.mt/MRRA-PA/lpis?l=1)	Agricultural
Enemalta Corporation	(http://www.enemalta.com.mt/)	Utilities
Water Services Corporation	(http://www.wsc.com.mt/content/about-wsc)	Utilities
Malta International Airport Met Office	(http://weather.maltairport.com/en/weather-services.htm)	Meteo
Physical Oceanography Unit, IO-Malta Operational Centre, University of Malta	(http://www.capemalta.net/)	Marine
Malta Tourism Authority	(http://www.visitmalta.com/en/about-us)	Various
Heritage Malta	(http://heritagemalta.org)	Various

PART C. BEST PRACTICE VIGNETTES

MALTA

1. Introduction

The Shared Environmental Information System (SEIS) is a web-portal in Malta which offers open geospatial data. The data can be accessed by the public and is free of charge. The aim behind the project is to provide a system which integrates all the data which relates to EU environmental policies and legislation.

The baseline data used by SEIS was gathered through a project co-financed by the European Regional Development Fund (ERDF) and the Government of Malta. The project was managed by the Information Resources Unit within MEPA and covered the following issues: Air quality, Water quality, Chemicals in soil, Background radiation, Traffic-related noise, 3D maps for terrestrial and bathymetric zones including high resolution three dimensional terrestrial coverage of the Maltese Islands applying both oblique aerial imagery and Light Detection and Ranging (LIDAR) data. The coastal bathymetric survey within one nautical mile off the coast of Malta was realized by using bathymetric LIDAR data, acoustic scans and physical grab sampling.

2. Services

The basic services offered by the SEIS geo-portal are: Searching places, ArcGIS online and The Web, Viewing, Downloading vector data in GDP and SHP format, Extracting raster data in DTM and DEM format, Measuring, Viewing of Attribute Table, Viewing of Stations, Adding data to the Map by browsing to an ArcGIS Server Endpoint, Generating Section Profile Capability.

The user can view the various datasets super-imposed on the following base maps: Streets, Topographic, Imagery, Light Grey Canvas, Terrain, Shaded Relief and Open Street Map.

3. Examples

3.1 Base Maps

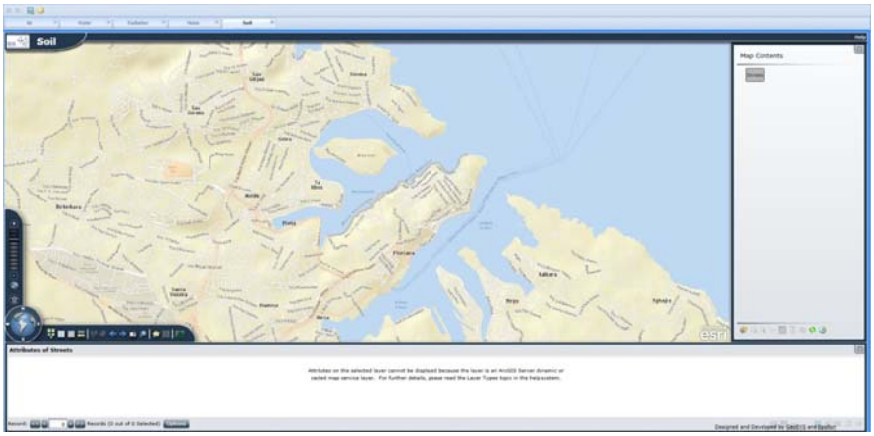


Figure 1. Streets.

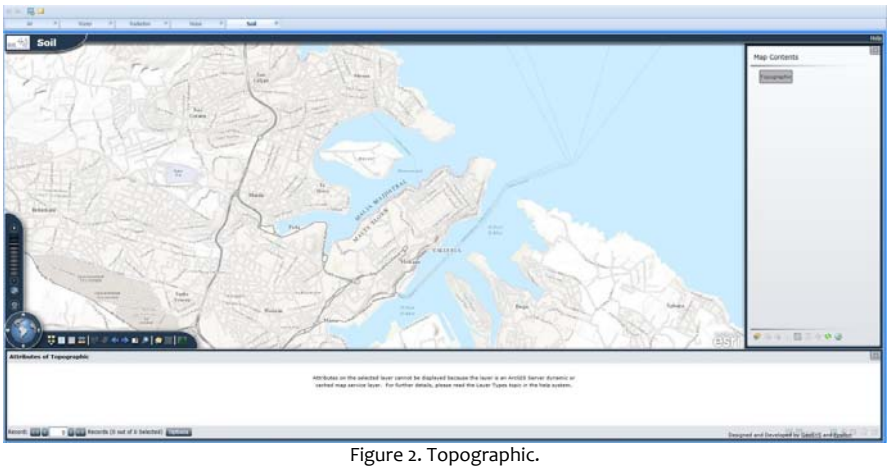


Figure 2. Topographic.

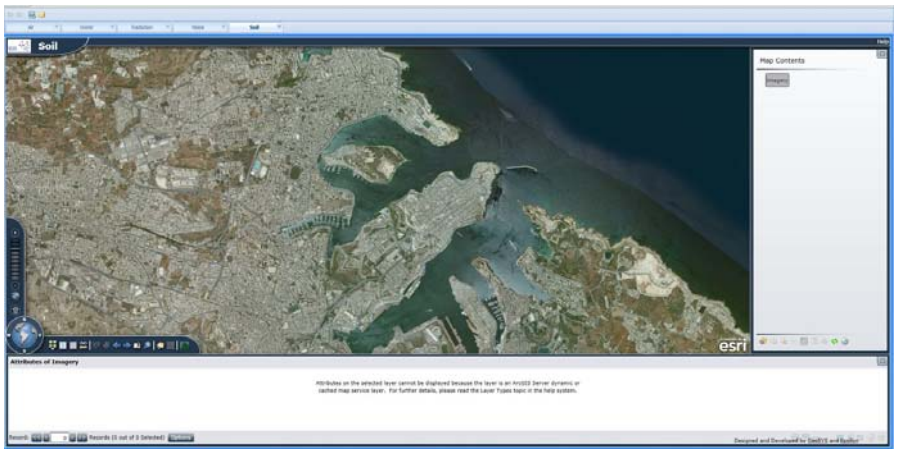


Figure 3. Imagery.

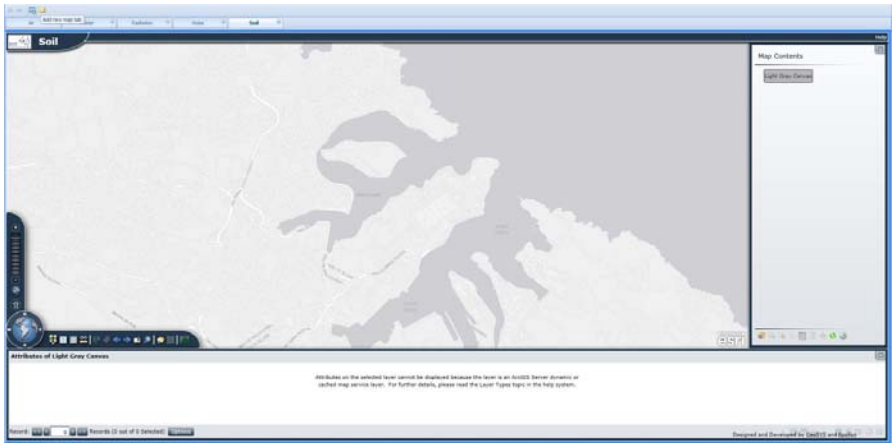


Figure 4. Light grey canvas.

3.2 Environmental Data Sets

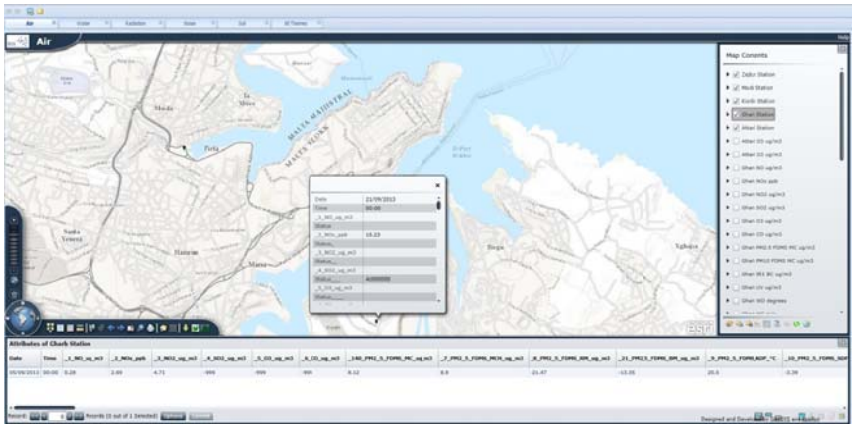


Figure 5. Air.

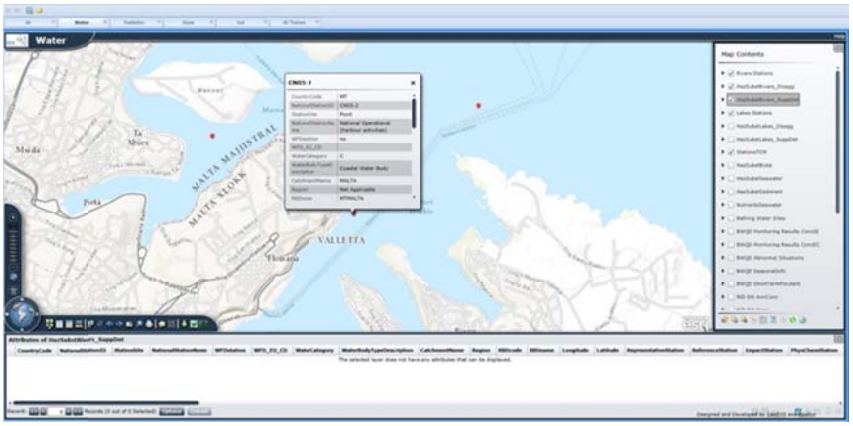


Figure 6. Water.

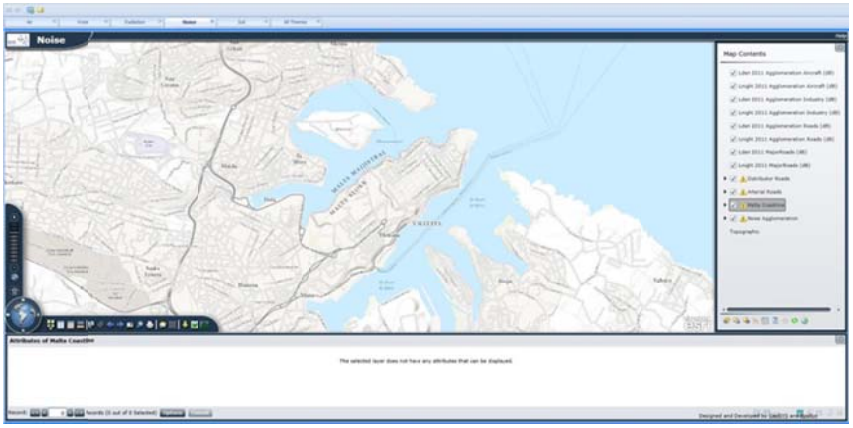


Figure 7. Noise.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

SPAIN 

1. Policies

1.1 Spatial and Census data access

- In spite of the rapid and wide application of the INSPIRE Directive in the country, at local level there is a need to enhance data access for citizen services and better internal coordination among departments and services.
- Very often there are overlaps and divergences among the geospatial information provided by the national agencies, regional agencies and city councils. Examples of these divergences are often the definition of local boundaries, or the differences between Cadastre and Property Registry.
- Need of optimization of geospatial resources of the country in order to avoid duplication of similar works due to the fact of diverse regional and local agencies performing similar projects.

1.2 Spatial and Census data sharing

- For some public institutions, there is still not online data availability. But fortunately an important part of the geospatial data is shared by the administrations.
- There is a need to increase the e-governance tools in order to advance the electronic administration service to citizens.
- Some of the data are available to the public with a cost like in the case of the National Center for Geographic Information (CNIG).
- There is still a need for complete integration of cartographic data of Cadastre and Property Registry in order to avoid very common cartographic divergences.

1.3 Data collection funding

The total investment for the period (2013-2016) would reach approximately 78.42 million euros in the production or renovation of cartographic products and about 5,200,000 euros in implementation or maintenance of web geoservices. Three ministries: Agriculture, Development, and Defense accumulate more than 90% of the cartography budget in Spain. Below we can see the table with the budget for the different Ministries for cartographic products investments (78.42 m. euros):

Nombre	2013	2014	2015	2016	TOTAL
Ministerio de Defensa	4.430	4.677	4.923	5.661	19.691
Ministerio de Hacienda y Administraciones Públicas	0	1.777	1.777	1.777	5.331
Ministerio del Interior	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio de Fomento	3.536	5.360	5.524	5.065	19.485
Ministerio de Educación, Cultura y Deporte	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio de Industria, Energía y Turismo	167	153	153	153	626
Ministerio de Agricultura, Alimentación y Medio Ambiente	8.775	7.907	7.879	7.849	32.410
Ministerio de Economía y Competitividad	321	241	165	155	882
Total	17.229	20.115	20.421	20.660	78.425

Nombre	2013	2014	2015	2016	TOTAL
Ministerio de Justicia	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio de Defensa	15	15	15	16	61
Ministerio de Hacienda y Administraciones Públicas	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio del Interior	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio de Fomento	619	856	826	791	3.092
Ministerio de Educación, Cultura y Deporte	Medios propios	Medios propios	Medios propios	Medios propios	0
Ministerio de Industria, Energía y Turismo	221	221	221	221	884
Ministerio de Agricultura, Alimentación y Medio Ambiente	265	299	340	390	1.294
Ministerio de Economía y Competitividad	Medios propios	Medios propios	Medios propios	Medios propios	0
Total	1.120	1.391	1.402	1.418	5.331

1.4 Decision making process

It is developed by the Law 14/ 2010 of 5 July on the Infrastructure and Geographic Information Services in Spain (LISIGE), through its twenty items divided into five chapters, runs from the object and its fields of application, in the General Provisions (Chapter I), to services organization, production and dissemination of official cartography and geographic information (Chapter V).

The text also develops coordination and the decision making process of the Information Infrastructure Geographic in Spain, together with the establishment of its geoweb and its rules (Chapter II), the description of data, metadata and services and interoperable geographic access conditions (Chapter III), and Geographic Information Infrastructure Administration General of the State with respect to the functions that correspond to her Institute National Geographic (Chapter IV).

2. Data - Applications

2.1 Distribution centers

Spain has a very complex public sector, being both a producer and user of Geographic information. The Central Government exercises both facets by numerous bodies and agencies of various government departments, being the national referent the National Geographical Institute (IGN) of the Ministry of Development, which exercises the Spanish representation in international institutions such as the National Mapping Agency (NMA). Apart from the IGN, other major producers of geographic information also exist in Spain that they need to provide Geographic Information to third parties and also among their own jurisdictional use. For example: the Geographic Center of the Army (CEGET) , the Military Emergency Unit (UME), the Navy Hydrographic Institute (HMI), Cartographic and Photographic Center of the Air Force (CECAF), the General Directorate of Land Registry, the Spanish Agricultural Guarantee Fund (FEGA), Directorate General of Water (DGA) or the National Statistics Institute (INE) , among others.

Moreover, the regions also need to produce and use specific information of their geographic areas to meet their governmental competences or to provide specific services. These regional governments have implemented, with diverse range and scope, units responsible for managing geographic information either in specific subject areas or through horizontal organizations. This is the case of the Institute of Statistics and Cartography of Andalusia, the Cartographic Institute of Valencia (ICV), Institut Cartogràfic de Catalunya (ICC) or the Institute of Land Studies of Galicia, among other services centers and other autonomous regions.

The existence of other public organizations directly or indirectly related to geographic information, such as foundations (Railway Foundation Spanish); committees (Geographic High Council); public bodies research (for example , the Higher Council for Scientific Research , CSIC) ; universities; Spanish delegations of European public agents (European Environment Agency) and others, should also be noted.
The enormous diversity of infrastructures, products and geographic services derived from a previous situation, undoubtedly justified the standardization regulation that has been provided by the current National Cartographic System, to standardize the production, access and use of geographic information in all its possible forms, and avoid duplication of public efforts in this area.
It is noted here, for its importance, the profusion in recent years of numerous spatial data infrastructures (SDI), which operate under standards from the implementation of the INSPIRE Directive, providing interoperable geoservices, as well as being efficient information dissemination platforms of official geospatial data. These infrastructures (SDI), converge in the Spatial Data Infrastructure of Spain (IDEE) by coordinating the National Geographic High Council through the National Geographic Institute (IGN) as its Technical Secretariat, constituting the national geoweb links to other websites counterparts.
As an indicative data of the magnitude of available possibilities, the IDEE working group belonging to the Special Committee on Data Infrastructures Spatial of the Geographic High Council has 62 organizations from Public Administrations. In addition, there are 106 official public centers where is possible to download official geospatial data.

2.2 NSDI / metadata / format

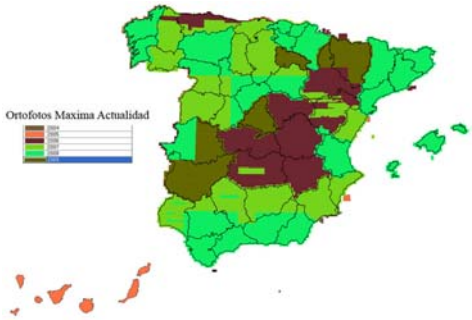
All data is compatible and in accordance to EU INSPIRE Directive.

2.3 Coverage – Revision cycle

The coverage and revision cycle depends nowadays from the PCN (2013-2016) and the PNOT as we mentioned before. So according to the approved budget every year geographic areas are designated for updating information as for example:

- Update of the Agriculture plots registry by the Spanish Agricultural and Guarantee Fund (FEGA) for the Common Agricultural Policy of the European Union.
- Update of the Integrated Water Information System (AIS) and the National Information System Flood Zone (SNCZI).
- Update of the Urban Information System (UIS), by the Directorate General of Architecture, Housing and Land.
- Revision of the geographic positioning service and land navigation from Real-time Permanent Stations, by the Directorate General of IGN.
- Conducting topographic mapping, and official thematic statistics Administration General like the National Plan of Orthophotography (PNOA) and LIDAR coverage reinforcement.

Below we can see some graphics showing the coverage for the different years and regions campaigns for LIDAR coverage and PNOA updates.



2.4 Costs

IGN/CNIG generates and maintains a significant amount of geographic information (data are reflected in the national series and map databases, aerial orthophotos and orthoimages satellite and aerial photographs as initial process data and orthophotos production and cartographic update). These sets, in digital format, constitute the bulk of the continuous and comprehensive Geographic information reference for all Spain. Although demand for this geographic information by the Spanish society has always existed, currently a strong tendency of growth is seen, firstly because the needs of the Ministry of Development and the rest of the Central Government and secondly because of the Administrations Regional and Local Authorities as well as the requirements of the Universities, Agencies Research, public companies, private companies and individuals in general users.

The National Center for Geographic Information (CNIG), Autonomous Body under the Ministry of Development through the Directorate General of IGN, is the organization responsible for producing, developing and distributing the work and publications of geospatial nature. In particular, depending of the CNIG Statute, approved by Royal Decree 663/2007, of 25 May, are the marketing and dissemination of the products and services of the IGN.

Public dissemination of geographic information generated by the Directorate General of the National Geographic Institute is governed by the order FOM/956/2008, of 31 March (BOE No 85 of April 8, 2008). This order establishes the policy of disseminating digital geographic information, establishing the free nature of the noncommercial use of such information and how to define the economic consideration in the general use of it.

For products and services whose rights are owned by the National Geographic Institute or CNIG own, not included in the FOM 956/2008 order, public prices are set by resolution of July 1, 2004 (BOE of 16 July) establishing public prices for the geodata, publications and services.

In the case of products owned by other government agencies, the CNIG sells under agreements established with these agencies. The prices are set by agreement between them. Prices are available on the website itself, in the appropriate sections of products and catalog, and in any case will be shown before signing and agreeing to purchase, with taxes and shipping costs disaggregated (https://www.cnig.es/catalogo.jsp, http://fototeca.cnig.es).

2.5 Cooperation among Agencies

Royal Decree 1545/2007, by which regulates the National Cartographic System (NCS) available in Articles 9 and 10 of Chapter III, "The Planning Official Cartographic Production ', which the National Cartographic Plan shall establish the form of programs and the coordination with other mapping regional administrations plans integrated into that

system. This would in accordance with its essential rules optimize the joint action of different public operators in terms of geographic information, ensuring consistency, continuity, quality availability and interoperability of such geographical information in Spain, and promoting efficiency in public spending. All this is part of the provisions of Law 14/2010 on the Infrastructure and Geographic Information Services of Spain (LISIGE), which is intended to complement the organization of geographic information services and set the general rules for the establishment of geographic information infrastructures in the country.

Up to now, the production and dissemination of geographical information in Spain is much decentralized in two aspects: geographically, as both regional and local administrations took care of it, and thematically, as it was produced by different thematic departments at national or regional level. The regions have hierarchical centers or horizontal institutions to meet their geographic and mapping information needs. Some, particularly Andalucía, Aragón, Castilla y León, Castilla-La Mancha and Catalonia have their own cartographic plans. Meanwhile, there are communities which have their own mapping records with different regulation levels, as is the case of Andalusia, Aragón, Canarias, Castilla y León, Catalonia, and Extremadura. Because of this a Central Cartographic Registry is needed connecting all cartographic records of the regional administrations.

The insufficient coordination in the generation of this information is a source of problems in different fields. For example, in economic resources optimization, this insufficient coordination causes duplicity of economic efforts, and force many plans to be abandoned due to the lack of budget and lead to a distribution of costs not according to the budget capability of the different organizations. In information production the lack of coordination generates "holes" of information, low rhythm of work (that means that databases are not properly updated), etc. In the use of databases and products, the insufficient coordination generates incompatible data, difficulties in interoperability, diversity of data models, scales, resolutions, accuracies, dates, formats, etc. The lack of coordination also causes problems in the data dissemination because of the restrictive access to data that is property of different organizations.

On the other hand most of the regions have their own geodetic networks GNSS. The Positioning National Plan (PNP) is needed to solve this weak coordination and include all these networks in a National Permanent Stations Network, ensuring quality surveying services on a single geodetic reference system (established by Royal Decree 1071 /2007) that meet the needs of all users.

The National Cartographic Plan has as one of its main objectives, the subscription of collaboration agreements among all public administrations integrated in the National Cartographic System for avoiding all the above mentioned coordination and efficiency problems.

2.6 Regional Data sets - Global Data sets

Free distribution of geospatial data:

- Nowadays a huge variety of geospatial data of Spanish territory can be consulted in internet (http://www2.ign.es/iberpix/visoriberpix/visorign.html, http://sigpac.mapa.es/fega/visor/, http://www.cartociudad.es/visor/).

There is also a vast number of different official WMS / WMTS /WMS-C services that can be used freely by citizens: http://www.idee.es/web/guest/directorio-de-servicios.

There are 296 governmental, 845 regional and 609 local WMS services as well as 7 governmental, 47 regional and 3 local WMTS services. Finally there are 4 governmental, 2 regional and 1 local WMS-C services.

- Satellite images and Digital Terrain Model (http://www.landcover.org/data/, http://earthexplorer.usgs.gov, http://glovis.usgs.gov).
- Timeless images Google Earth (http://www.google.com/earth)
- Openstreetmaps (http://www.openstreetmap.org/).

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The national and regional Spatial Data Infrastructure (SDI) of Spain (IDEE) is the common access point to the geographic information collected and processed by the Spanish government provided through their catalog services (CSW). Some of the SDI capacities at national and regional level are:

- National Level: SDI Duero River Basin, SDI Guadalquivir River Basin, SDI Guadiana River Basin, SDI Hydrographic Confederation of the Miño- Sil, SDI Ministry of Agriculture, Food and Environment, Node of the National Geographic Institute (IGN), Node DG Cadastre.
- Regional Level: SDI Andalucía, SDI Cantabria, SDI Castilla y León, SDI Catalonia / Catalunya, SDI Valencia, SDI Extremadura, SDI Galicia, SDI La Rioja, Pais Vasco SDI / Euskadi, SDI Murcia.

4. National Stakeholders/Industry

At national level some examples of public stakeholders besides the above mentioned universities are:

- Administración General del Estado
- Confederación Hidrográfica del Duero (MÍRAME-IDEDuero)
- Confederación Hidrográfica del Ebro (IDE-Ebro)
- Confederación Hidrográfica del Guadalquivir (ideCHG)
- Confederación Hidrográfica del Guadiana
- Confederación Hidrográfica Miño-Sil (IDE Miño-Sil)
- IDEAGE
- Instituto Español de Oceanografía (IDEO)
- Instituto Geográfico Nacional
- Ministerio de Agricultura, Alimentación y Medio Ambiente (IDE magrama)
- AENA-UPM

And at regional level:

- Andalucía: IDE Andalucía de datos, IDE Andalucía de servicios, Información Ambiental de Andalucía (REDIAM), Instituto de Estadística y Cartografía de Andalucía.
- Aragón: IDE Aragón (SITAR).
- Canarias: IDE Canarias, Repositorio de Datos Marinos Integrados de Canarias (REDMIC).
- Castilla y León: IDE Castilla y León.
- Cataluña / Catalunya: IDE Cataluña.
- Comunidad de Madrid: Departamento de Geografia de la Universidad de Alcalá.
- Comunidad Foral de Navarra: IDE Navarra.
- Comunidad Valenciana / Comunitat Valenciana: Consellería d´ Infraestructures, Territori i Medi Ambient, IDE Comunitat Valenciana (TerraSIT).
- Extremadura: IDE Extremadura, Servicio de Cartografía Digital e IDE de la Universidad de Extremadura (SECAD).

- Galicia: IDE Galicia (SITGA-IDEG).
- Illes Balears: IDE Illes Balears.
- País Vasco / Euskadi: IDE Pais Vasco (GeoEsukadi).
- Principado de Asturias: Dpto. Biología de Organismos y Sistemas de la Universidad de Oviedo (IDEBOS), IDE Principado de Asturias (SITPA-IDEAS).
- Región de Murcia: Consejería de Agricultura de Región de Murcia, IDE Región de Murcia.

Some representative private stakeholders are: Colegio Oficial de Ingenieros Técnicos de Topografía, Colegio de Geógrafos, Asociación de Ingenieros Geógrafos, Real Sociedad Geográfica, GEREDIS, Asociación Española de Sistemas de Información Geográfica, Sociedad Española de Cartografía, Fotogrametría y Teledetección, Asociación de Ingenieros Geógrafos.

And finally some representative members from the geospatial industry could be: Deimos Space, Indra, GMV, Isdefe, GIM Geomatics, Stereocarto, Heligrafics.

PART C. BEST PRACTICE VIGNETTES

SPAIN 

1. Introduction

The Spanish Spatial Data Infrastructure (Infraestructura de Datos Espaciales de España, IDEE), published in Internet (www.idee.es) on January 2004, is an example of a collective project based on the cooperation of a large number of actors in Spain: governmental bodies at national, regional and local levels, private companies, universities, citizens, etc, designed to freely offer a wide range of geographic resources on the Net. Is mentality is based on cooperation and openness through their consensus and experiences according to INSPIRE guidelines, Open Geospatial Consortium (OGC) interoperability specifications and ISO 19100 standards.

This project has been coordinated by the National Geographic Council, a governmental body, which committed its Geomatic Commission to define the IDEE (Spanish SDI). This Commission launched a Working Group for the IDEE that has produced a set of technical recommendations to harmonize the individual initiatives of its members: How implement WMS; Spanish Core Metadata based on ISO 19115 and Dublin Core; and Spanish Gazetteer Model based on ISO 19112 and other relevant projects.

The IDEE is a distributed, multilingual, internet accessible system in which existing SDIs in Spain cooperates with synergies. It offers a wide range of services compliant OGC standards: Catalogue Service Web (CSW), Web Map Service (WMS), Gazetteer Service (Gaz), Web Feature Service (WFS), Web Coverage Service (WCS), Web Map Context (WMC) and Web Coordinates Transformation Service (WCTS).

Figure 1. IDEE website with access to a high amount of metadata catalogues (www.idee.es)

Recently, some quite interesting applications have been developed using those services: a freeware standard OGC client of WMS and Gaz services for PDAs; a three-dimensional virtual fly programme, also freely available, that can use any available standard WMS as drape image and a DTM served by a standard WCS; spatial analysis applications to explore Corine-Land Cover data and DTM information of a region; and some examples of Web Processing Services offering geoprocessing functionalities with standardized interface, ready to be integrated in other applications and geoservices.

2. Cartographical diversity

Until now Spanish cartographical production was mainly oriented to fulfill the management needs of good governance. There are three levels of cartography producers in Spain:

1st) National Level: Government of Spain. The National Government is composed of 16 Ministries. Many of them are producers of Geographic Information, by example: Agriculture, Defense, Economy and Finances (Cadastre, National Statistical Institute (INE), Infrastructures and Transports (IGN-E - National Mapping Agency), CNIG-E (National Centre of Geographic Information), Education and Science - Geological Institute of Spain (IGME), etc.

2nd) Regional Level: 17 Autonomous Regions + 2 Autonomous Cities (Ceuta and Melilla). Every Regional Government or Autonomous City Government is composed of Departments. Most of them are also producers of Geographic Information on their territories and in some cases there is a Regional Mapping Agency.

3rd) Local Level: There are more than 8 100 Municipalities (Local Authorities). And some Administrative Units composed of a set of Municipalities: Diputaciones Provinciales in Galicia and País Vasco; Cabildos Insulares en Canarias y Baleares. The biggest cities and more populated local authorities are also producing and managing GI on their territory.

3. The need for harmonization

Today official and private cartography is used by public, private sectors and citizens in different applications. To manage cartography from different data producers implies complex processes to transform and harmonize it.

To solve the harmonization problem, the governments has two solutions. On one hand can collect all the cartographical information in a governmental GIS, doing harmonization processes to assure data integration and homogeneity in order to supply GI ready to be used by the users at their own systems. This is a quite complex process, almost impossible, at least when different governmental levels have the cartographical data under their jurisdiction. On the other hand is the definition of a Spatial Data Infrastructure at National level (NSDI) as a collaborative project based on cooperation and agreement among different actors: national, regional and local governments, universities, companies, and also individual citizens, opening geowebs that publish and shares OGC services and complementary resources. The NSDI Geoweb needs to be a key resource and an effective leverage in order: to give visibility to all available SDI implementations; to contribute to the creation of a healthy competitiveness; to stimulate technological innovation on this area showing the new developments in every geoweb or node, as a sort of on-line demonstration; to take advantage of the official corporative image from the main actors at every governmental level. In conclusion, the solution is to set up a true GIS on Internet, fully distributed, offering services and functionality based on the interoperability of standardized resources spread over the Net. In Spain, the solution adopted to harmonize GI has been the implementation of a NSDI.

4. The Spanish National Spatial Data Infrastructure (www.idee.es)

The Spanish NSDI is a SDI composed of many SDIs. The reason is the three levels of Government that they are producing data. Regions needs to set up their own regional SDI and geoweb giving access to data and service servers at Regional Departments, Local Authorities, Public and Private companies, and Academia at the regional territory. At national level some Ministries, public and private companies need also to set up Internet data servers, metadata catalogues, and GI web services.

The National Geographical High Council ("Consejo Superior Geográfico") is the governmental collegiate body appropriate as Public Authority in Spain to define and set up the NSDI (in Spanish: IDEE for Infraestructura de Datos Espaciales de España) and its national Geoweb. This is an advisory collegiate body of the Ministry of Infrastructures and Transports, which technical secretariat is held by National Geographic Institute, and whose members are representatives from the three government levels of Spain. It was established by Art. 9 Law 7/86 for Cartography in Spain and its rules are defined by the Royal Decree 1792/1999.

Its members are:

- President: SubSecretary of the Ministry of Infrastructures and Transports.
- First VicePresident: Director General of National Geographic Institute.
- Second VicePresident: Director of Hydrographic Institute of Army.
- Representatives from Ministries: Foreign Affairs, Public Administration, Economy & Finances (Cadaster, National Statistical Institute), Environment, Agriculture, Interior (State Civil Defense Office), Defense, Education.
- 17 Representatives from every Regional Government.
- 2 Representatives from Spanish Federation of Provinces and Municipalities (Local Authorities).

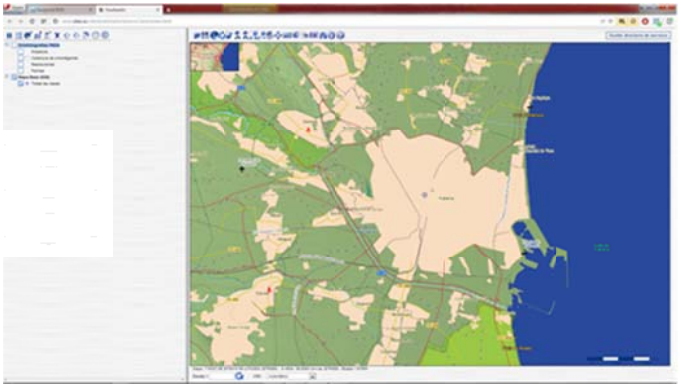


Figure 2. IDEE WMS viewer (www.idee.es).

On April 2002 the National Geographical High Council (NGHC) committed to its Geomatic Commission as Executive Board to define and setting up the NSDI (IDEE).
The Commission on Geomatics is working through a Working Group established on November 2002, which reports to and advises the NGHC. Working Group´s members are technical experts representing NGHC members: geographic data producers, academia and companies dealing with catalogue services and data services. It is open to all relevant actors actually involved in the process and having some activity in this field: data producers, software companies, universities, governmental bodies, up to more than 170 individual members. Its main objective is to develop a Spanish project joining initiatives according to a decentralized and transparent framework, based on data harmonization and interoperability. The Working Group is developing IDEE under the INSPIRE principles and according its rules. WG IDEE organizes three meetings per year and one technical workshop, and produces recommendations based on electronic revisions and consensus: Minimum services to be implemented in a SDI; Spanish Metadata Core of ISO19115 (NEM); Spanish Model for Gazetteer (MNE); How to implement WMS. All of them are available at www.idee.es.
The NGHC´s IDEE is funded by the Government of Spain using the National Geographic Institute (IGN) budget (State General Budget). The IGN-E has established an agreement with University of Zaragoza to set up the National Geoweb.
At the National Government the main agencies managing GI production, as IGN-E, Ministry of Environment, Cadaster, Defense, are funding their own IDEE nodes or portals. Regional SDIs, and partially IDEE, are funded by Regional Governments. That is the situation at the Regional Governments of Cataluña, Aragón, La Rioja, Navarra, Basque Country, Cantabria, Asturias, Galicia, Castilla y León, Castilla-La Mancha, Valencia, Murcia, Andalucía and Extremadura. Every day more Local Authorities are developing and funding Local SDIs.

5. State of play of IDEE Geoweb

The IDEE Geoweb was opened on 2003 December as a provisional beta version, the first version appeared on July 2004, and the second version with a new interface dated from 2005. Today it is available in 7 languages (Spanish, English, Basque, Galician, Catalan,

Portuguese and French) and implements 7 different OGC specifications (WMS, CSW, Gaz, VMC, WFS, WCS and WCTS), in a chainable and usable way.
The main characteristics of the services and application of the Geoweb are:
- The Gazetteer service is based on a database of more than 400,000 geonames, and is implemented as a WFS using the Spanish Gazetteer Model (MNE), a conceptual model for geonames defined by WG IDEE, including some key attributes (language, source and etymology), and allowing several names for the same feature.
- The Map Viewer access directly to more than 70 services coming from all over Spain offering more than 700 layers, classified as reference data at the three levels of government (National, Regional and Local), thematic data and other not official data, following the INSPIRE annexes classification.
- Catalogue service allows search and select in a metadata database describing more than 40,000 datasets produced by IGN and the Catalonia Cartographic Institute. It is now trying to organize a distributed catalogue by harvesting XML files via FTP collection, as a first tentative solution to distributed catalogue.
- A Directory of Services is available showing a captured on-line description from Capabilities information about OGC services available in Spain, and the address to bind them.
-Data Download: It's possible to freely download some general and basic reference data in GML format: Administrative Boundaries of Spain at three scales, Geodetic Networks and a Euroglobal Map Data Base at 1:1,000,000.
- There are also two simple examples of remote analysis: a Corine-Land Cover analysis utility, based on WFS and offering a statistics about land uses in each municipality; and a DTM analysis application, based on WCS, allowing the calculation of maximum, minimum and average height of an area.
- A set of software tools are available as freeware: a simple OGC conformant client application for accessing WMS and Gazetteer services from PDA; the IGN-CNIG 2D/3D Viewer, a thick OGC client to perform virtual flight over a cartography served as an WMS and using a DTM obtained via WCS; a simple light WMS viewer to be inlaid in a web page.
- Two Free Software application: CatMDEdit for metadata capture, multiplatform, with multilingual support, thesaurus facilities, ISO 19115 compliant interface and XML export facilities; and a Toponymic Editor to graphically edit geonames according to MNE and using WMS services.

6. New ways of producing harmonized cartographic data

As a consequence of the existing Spanish SDI, there is a new cooperative way of producing harmonized GI in Spain. IDEE WG data harmonization effort is concentrated on the Reference Information (INSPIRE Annexes I & II): trying to get harmonized national coverage among the three government levels (National, Regional, and Local): harmonizing data specification for data production among them; agreeing to jointly produce and share GI.
As an example on that, the three levels of government are looking for agreement:
- To move the Geodetic Reference System from ED50 to ETRS89, according the INSPIRE rules.

- IGN (National Mapping Agency), Ministry for Public Administrations, INE (National Statistical Institute) and Regional Mapping Agencies Are working together to set up the National Gazetteer.
- Regional Mapping Agencies, Regional Departments dealing with the juridical definition of administrative boundaries, IGN-E, Ministry for Public Administrations are working together to improve High Resolution Administrative Boundaries.
- To work in close cooperation between the National and Regional Governmental GI producers Agencies to set up:
- National Plan of Orthophotography (PNOA) funded by National (68%) and Regional government (32%), to produce a national ortophoto coverage of 50, 25 and 10 cm resolution, depending on the area, every two years, to be published as a free, open WMS.
- Land Cover & Use System 1/25,000.
- Harmonized Topographic Database (BTA), as harmonized by consensus Data Product Specifications for topographic regional DB at 1:5,000 and 1:10,000 scales, compatible with national DB at 1:25,000 scale.
- CartoCiudad, the official street and road database build to harmonize cartography from IGN, Cadaster, Statistical Office and Post Office, published using OGC services. The plan includes: to cover main urban areas this year, 76% of total population; and to get full coverage in 2009.

Σχόλιο [H3]: Is it completed?

7. Level of use in operational practice

Figures of usage and statistics of IDEE Geoweb per month:
- More than 30,000 visits.
- More than 4,500,000 individual petitions to the services.
- More than 16,000 individual visitors.

Some representative use cases:
- Tourist route planner using WMS of IDEE as reference data implemented in regional SDI of Castilla-La Mancha.
- Georreferencing of species in Spain using Gazetteer service in the framework of Global Biodiversity International Facility (GBIF) project.
- A notary uses IDEE and Cadastre WMS in daily work to identify old and not well defined properties described in ancient documentation.

8. Future lines of development

- Web Processing Services (WPS) implementation, according to OGC specification, well defined software packages, easy to be bound and chained to make it possible to have a real virtual GIS implemented in Internet with some kind of toolbox. The goal is to show that is possible to perform a remote analysis combining standard resources from different systems. It is planned to develop services providing: shortest way between two addresses; nearest point of interest from an address; areas of influence around an address; generation of buffers from a point, a line or a surface; overlay and reclassification of surface layers; and others.
- Geolinked Data Access Service (GDAS) and GeoLinking Service (GLS) implementation, to make possible the on-line effective linkage between thematic and surface datasets logically

related to generate maps and diagrams on the fly. IGN and UNIZAR are participating in an OGC experiment to improve and make usable those two specifications.
- Practical and usable implementations of some more complementary OGC specifications, as Style Layer Descriptor to WMS and Filter Encoding to WFS.
- One of the main points of innovation of this project consists in having actual cooperation between: three levels of government in Spain (National, Regional and Local), universities, private companies. But it is foreseen in the near future to get citizens publishing their own maps and Point Of Interest (POI).

Acronyms

Cartographic and Geological Institute of Catalonia (ICC)
Cartographic and Photographic Center of the Air Force (CECAF)
Cartographic Institute of Valencia (ICV)
Catalogue Service Web (CSW)
Confederación Hidrográfica del Duero (MÍRAME-IDEDuero)
Confederación Hidrográfica del Guadalquivir (ideCHG)
Confederación Hidrográfica Miño-Sil (IDE Miño-Sil)
Direcció General d'Ordenació del Territori de la Conselleria d'Agricultura, Medi Ambient i
Gazetteer Service (Gaz)
Geographic Center of the Army (CEGET)
Geolinked Data Access Service (GDAS)
GeoLinking Service (GLS)
Geological and Mining Institute of Spain (IGME)
Geological Institute of Spain (IGME)
Harmonized Topographic Database (BTA)
IDE Aragón (SITAR)
IDE Comunitat Valenciana (TerraSIT)
IDE Galicia (SITGA-IDEG)
IDE Pais Vasco (GeoEsukadi)
IDE Principado de Asturias (SITPA-IDEAS)
Instituto Español de Oceanografía (IDEO)
Integrated Water Information System (AIS)
Law on Geographic Information Infrastructures and Services in Spain (LISIGE)
Ministry of Agriculture, Food and Environment (MAGRAMA)
National Cartographic System (NCS)
National Center for Geographic Information (CNIG)
National Geographic Institute (IGN)
National Information System Flood Zone (SNCZI)
National Plan of Land Observation (PNOT)
National Plan of Orthophotography (PNOA)
National Spatial Data Infrastructure (NSDI).
Navy Hydrographic Institute (HMI)
Positioning National Plan (PNP)

Spanish Agricultural Guarantee Fund (FEGA)
Spanish National Research Council (CSIC)
Spatial Data Infrastructure (SDI)
Spatial Data Infrastructure of Spain (IDEE)
Web Coordinates Transformation Service (WCTS)
Web Coverage Service (WCS)
Web Feature Service (WFS)
Web Map Context (WMC)
Web Map Service (WMS)

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

EGYPT

1. Policies

1.1 Spatial and Census data access

- Clearance of aerial photography is required for national security reasons.
- Some of the data are not available to the public.
- Lack of Lidar data.

1.2 Spatial and Census data sharing

The sharing of spatial and census data between institutes and services is arduous. Some services offer outdated data or products.

1.3 Data collection funding

Data is not available.

1.4 Decision making process

There are no standards of geospatial data for all projects. Each institute define its own requirements for the use geospatial data.

2. Data - Applications

2.1 Distribution centers

-

2.2 NSDI / metadata / format

Data is not available.

2.3 Coverage – Revision cycle

The Military Survey Authority and Egyptian General Surveying authority have full coverage at national level. The basic national topographic map scale is 1:5,000.

2.4 Costs

The national data are not free of charge.

2.5 Cooperation among Agencies

There are some problems:
The geospatial data are sold to the public by all institutes and services.
There is no database of the geospatial data by government.
The prices differ between services for the same geospatial data.
In many cases, the agreement between geospatial data from different sources cannot be matched or checked.

2.6 Regional Data sets - Global Data sets

The following governmental bodies coordinate or are involved in Geospatial data collection-delivery in the country:

- Egyptian General Surveying Authority.
- Military Survey Authority.
- Central Agency for Public Mobilization and Statistics (CAPMAS).
- Egyptian Cabinet's Information and Decision Support Center (IDSC).
- National Authority for Remote Sensing and Space Sciences.

3. Capacities

3.1 National and Regional Spatial Information collection and processing

-

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Full Name	Web Site	GeoScience
National Authority for Remote Sensing & Space Sciences	http://www.narss.sci.eg/home	Remote Sensing
Egyptian General Surveying Authority	http://web.gys.gr	Cartography/Gis
The Ministry of Planning	http://www.mop.gov.eg/	Cartography
Egyptian Cabinet's Information and Decision Support Center (IDSC)	http://www.idsc.gov.eg/	Cartography
Egyptian Public Authority for Mineral Resources	http://www.emraonline.com/media-center/videos/view/18	Cartography/Gis
Ministry of Agriculture	www.agr-egypt.gov.eg/	Agriculture
Ministry of Water Resources	http://www.mwri.gov.eg/	Irrigation/ Cartography
Ain Shams Univ. Faculty of Arts, Dept., of Geography	http://arts.asu.edu.eg/	Remote Sensing and Gis
Alexandria Univ. Faculty of Arts, Dept., of Geography	http://www.arts.alexu.edu.eg/ar/	Remote Sensing and Gis
Cairo Univ. Faculty of Arts, Dept., of Geography	http://arts.cu.edu.eg/	Remote Sensing and Gis
ESRI Northeast Africa	http://www.esri.com/	Cartography/Gis
Holding Company for Drinking Water and Sanitation	http://www.hcww.com.eg/ar/default.aspx	Cartography/Gis

PART C. BEST PRACTICE VIGNETTES

EGYPT

Al Gharbiya governorate is located at the Middle Nile of Delta in Egypt between longitudes 300450 and 310200E and latitudes 300350 and 310150N. The Governorate is bordered by the Governorates of Kafr El Shiekh to north and Monufiya to south, while is aligned by Demietta and Rosetta Nile branches in the east and the west respectively (Fig. 1). Tanta district (the capital of Al Gharbiya Governerate) covers about 33122.43 ha (78862.93 feddan) and Qattour is one of the administrative centers of Al Gharbia Governorate and covers about 22908.6 ha (54544.29 feddan).Tanta and Quttour are the important districts in Al Gharbiya governorate, Middle of Nile Delta, Egypt. Urban sprawl is one of the main problems that reduce the limited highly fertile land in the Nile Delta of Egypt. Computational urban growth

and computer hardware had made possible unprecedented increase in the availability and provision of information inputs to planners. Remote sensing technology has shown its great capabilities to solve many earth resources issues. The aim of this study is to produce land use and cover map for the studied area at various periods to monitor possible changes that may have occurred, particularly in the urban and agricultural areas and subsequently predict likely changes. Two landsat images, Multispectral Scanner (MSS) in the 1972 and Enhanced Thematic Mapped (ETM) in the 2005 were used to assess the changes of agricultural lands, urban encroachment and water areas during this period with integration by GIS. The agricultural areas in Tanta and Quttour decreased by 7.17% and 5.84%, respectively from the year 1972 to 2005, while the urban areas increased by 7.17–5.84%, respectively. This urban expansion causes loss of productive agricultural lands. Finding data is useful for a decision maker to investigate and monitor illegal use of agricultural land in Nile Valley and Delta. The loss of limited cultivated land which is associated with population growth requires the planning for new urban development to be shifted to sites which are less important for food production. Updating the urban database using GIS and RS systematically to detect the new changes, which depend mainly on the frequency and occurrence of urban changes and the socio-economical development of the districts is a crucial task. The main cause of urbanization is the rapid population growth. This problem needs to be seriously studied, through multi-dimensional fields in order to preserve the precious and limited agricultural land and increase food production.

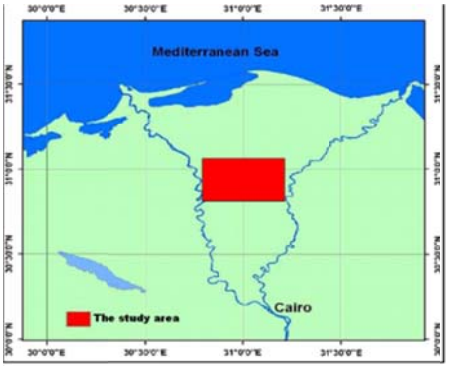


Figure 1. Location map of the study area.

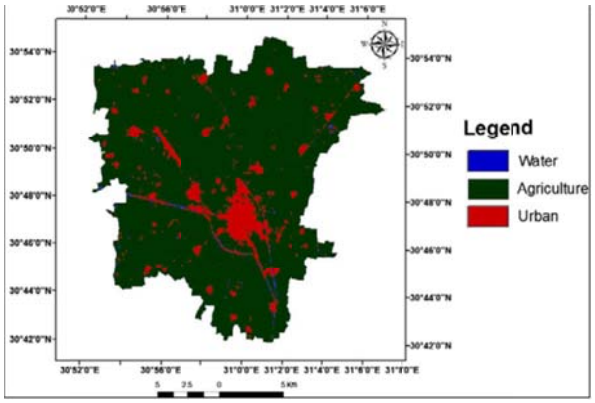


Figure 2. Tanta land use map in 1972.

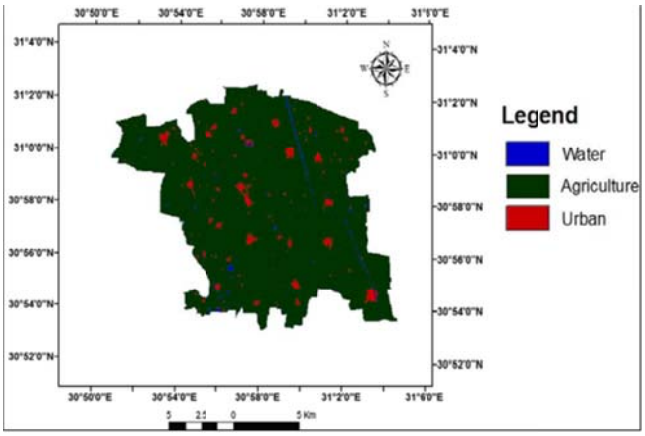


Figure 3. Quttor land use map in 1972.

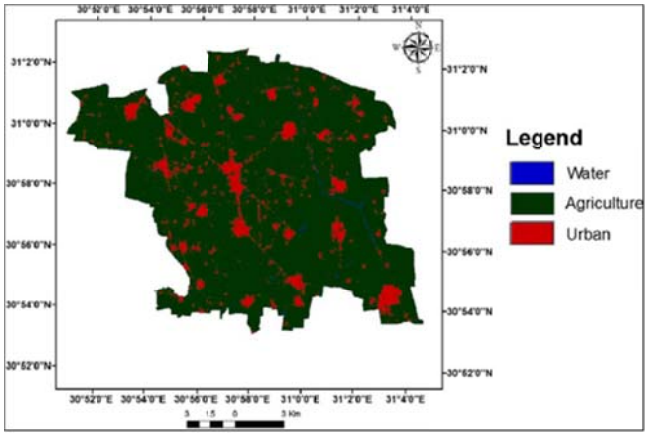


Figure 4. Quttor land use map in 2005.

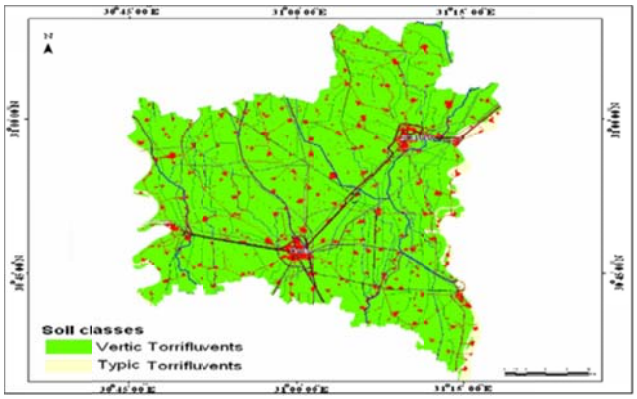


Figure 5. Main type (sub great group) of Al Gharbiya governorate.

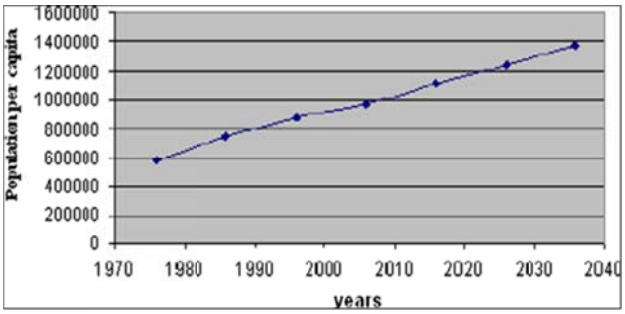


Figure 6. Change population growth in Tanta district.

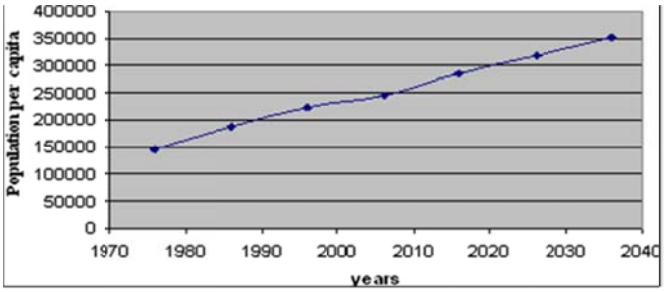


Figure 7. Change population growth in Quttor district.

References

Belal, A.A., Moghanm, F.S., (2012): Detecting urban growth using remote sensing and GIS techniques in Al Gharbiya governorate, Egypt . The Egyptian Journal of Remote Sensing and Space Sciences 14, 73–79.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

JORDAN 

1. Policies

1.1 Spatial and Census data access

Most of the information in this section were extracted from the report "Feasibility Study For A National Spatial Data Infrastructure In Jordan" Link.

Σχόλιο [H4]: Link is missing

- Data access and pricing is handled on a case by case basis contingent upon the requested data, and the requesting entity: Most of Spatial and Census data is available to public agencies while it is limited to individuals and private agencies where their cost of acquisition is very expensive.
- No clear policies are defined for acquisition, ownership, pricing, access, sharing, dissemination, custodianship, preservation, and governance of data.
- The governance boundaries are not clearly defined on the cadastre and municipal levels those include {Basins, Municipal borders, Governorate Borders}.
- Outdated databases.
- Availability of GPS data in Jordan is limited to specific cities, while others are not covered.
- SDI in Jordan is not part of EU INSPIRE.

1.2 Spatial and Census data sharing

- Sharing maps of Jordan publicly and free of charge can be illegal per the article (3) of the Law (18) of 1986 under information security clauses which is entrusted to the (RJGC) only.
- From a data services perspective, of the 15-20 GIS systems in Jordan, there are only a few that are interlinked and exchange data over networks.
- No clear data sharing policies, a significant number of respondents use their data internally only (53%), while the rest have varying data sharing schemes that are applied on a case by case basis.
- Almost all public and private institutions do not have online data availability.

1.3 Data collection funding

Lack of funding is a crucial challenge across all entities. It impedes their ability to procure hardware/software/base maps and limit their ability to update existing maps of various scales, as well as amplifies their human resources retention challenge.

1.4 Decision making process

- Lack of National Regulations and Standardization

There are no (SDI) laws or regulations. Vision and mission statements exist on a limited basis on a per unit or department level. On a national level leadership has been assumed through the National GIS Committee. The committee has lobbied the GoJ to approve the National GIS Strategy of 2006. Unfortunately, its efforts reached a stalemate. On a sub-national level, the 4 major stakeholders (DLS, RJGC, GAM and NRA), which are the core spatial data provider institutions in Jordan (but not limited to), have separately been proactive in extending support for other agencies to establish their GIS systems. Nonetheless, lack of coordination is noticeable although stakeholders are doing what they believe is possible.

- Institutionalization of Spatial Data Infrastructure (SDI) within the stakeholder entities is still lagging (only 23% have related policies, while 29% have related regulations). Instituting SDI policies seems to be a common problem across all entities.
- Human Resources Challenges:

Human resources challenge is manifested in two parts:

- Staff retention is impeded by low salary scales and tight budgets (No software programming expertise):
  - Governmental entities are limited in their ability to offer competitive remuneration to their staff due to the current civil service law with its restrictive salary scales. Most organizations believe they are understaffed across all levels of GIS expertise (technicians, technologists, and professionals)
  - Fresh graduates lack of hands on training and good understanding of broader Geomatics topics, rather than a mere mastery of software packages.
- Operational Challenges:
  - There are differences in defining urban concentrations (city, town,etc) between stakeholder entities.
  - Unavailability of quality control standards.

2. Data - Applications

2.1 Distribution centers

(RJGC) has produced a National GIS database for Jordan, which includes the Topographic maps at scales 1:250000 and 1:50000 and Orthophoto Maps for the major cities. However, the insufficient budget impedes efforts to enhance and expand the center‘s services as well as limit its ability to update existing maps of various scales.

2.2 NSDI / metadata / format

There is no principal Metadata standard in use. From a geo-spatial data and metadata perspective, Jordan has no common maps and no map standards. There is no agreed geodetic datum nor agreed map projection system. While there are at least 15 or maybe 20 viable GIS systems in operation, there is no agreed common data dictionary, no common data model. Few data classification systems exist and neither do inventories of data sets in organizations or lists of maps and aerial photography. Indeed there is much misinformation about them. GIS software providers’ standards are saving the day when it comes to metadata. Most organizations report using the default metadata structures associated with their existing GIS packages. Metadata accuracy, coverage and currency vary between entities.

2.3 Coverage – Revision cycle

The entire territory of the country is being realized by (RJGC); the (RJGC) has produced maps for the entire country at wide range of scales. A few of the main cities are available in a scale of 1:1,250, while the majority of cities and villages have been produced at both 1:2,500 and 1:5,000. Maps of the main cities and their surrounding areas have also been produced at 1:10,000, and the most heavily populated areas of the country have been mapped at the scale of 1:25,000. There are also maps of the entire country at 1:50,000 and 1:100,000 and archaeological maps at 1:250,000, showing all the main cites of antiquity, as well as tourist maps at 1:5,000 and 1:1,500.

2.4 Costs

No clear policies are defined for pricing: Pricing policy at present is usually done on a case-by-case basis, while on line pricing does not exist. Fees are assigned only through law and regulations and must go through legal and legislative channels.

2.5 Cooperation among Agencies

- Lack of coordination is noticeable among the different stakeholders in this domain.
- Ownership of data layers is not defined; multiple entities claim ownership of common layers and update them independently.

2.6 Regional Data sets - Global Data sets

Un-updated Google earth maps (Timeless).

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The following governmental bodies coordinate or are the core spatial data provider institutions in Jordan (but not limited to):

- Royal Jordanian Geographic Center (RJGC)
- Department of Lands and Survey (DLS)
- Greater Amman Municipality (GAM)
  - Department of totalitarian Planning
- Natural Resource Authority (NRA)
- Ministry of Municipal Affairs(MoMA)
- Department of Statistics (DOS)

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Full Name	Web Site (Link)	GeoScience
Royal Jordanian Geographic Centre (RJGC)	Link	Combination of the above
Department of Lands & Survey (DLS)	Link	Combination of the above
Ministry of Planning and International Cooperation (MoPIC)	Link	Combination of the above
Ministry of Information Technology and Communication (MoICT)	Link	IT (Information Technology)
Ministry of Water and Irrigation (MWI)	Link	Combination of the above
Water Authority of Jordan (WAJ)	Link	Combination of the above
Jordan Valley Authority (JVA)	Link	Combination of the above
Ministry of Interior Affairs(MOI)	Link	Combination of the above
Ministry of Municipal Affairs (MoMA)	Link	Civil Engineering/ Planning
Public Security Directorate (PSD)	Link	Combination of the above
Natural Resources Authority (NRA)	Link	Environmental Engineering
Greater Amman Municipality (GAM)	Link	Urban/Land Planning
Aqaba Special Economic Zone Authority (ASEZA)	Link	Combination of the above
Department of Statistics (DOS)	Link	Combination of the above
Ministry of Public Works and Housing (MoPWH)	Link	Combination of the above

Σχόλιο [H5]: Have a look at page 25 in Greek Report and use the same way to define the "combination of above", eg. Use asterisk and name explicitly what are the categories.

Ministry of Tourism and antiquities (MoTA)	Link	Tourism
Department of Antiquities (DoA)	Link	Archeology
Royal Scientific Society (RSS)	Link	Combination of the above
Ministry of Agriculture	Link	Agriculture
National Electric Power Company	Link	Electrical Engineering
National Centre for Agriculture Research and Extension (NCARE)	Link	Agriculture
Land Transport Regulatory Commission (LTRC)	Link	Combination of the above

PART C. BEST PRACTICE VIGNETTES

JORDAN

1. Introduction

The City of as-Salt is one of the oldest urban settlements in Jordan; it is unique in Jordan and probably in the whole region, rich with tangible and intangible cultural heritages including historic townscapes and buildings that backs to early stages of settlements, traditional spaces and distinctive cultural values in addition that is one of the most glorious cities in Jordan during 20th century.

In 1990 one of the largest documentation studies was conducted by Royal scientific society (RSS), in cooperation with Regulation and Planning Department of the municipality of as-Salt, to work on the main area of as-Salt Central District (CBD).The aim of this study was to declare Heritage Zone for as-Salt and to develop criteria and conduct a value based assessment of the heritage resources to finalize the Classification of (buildings/categories). This was done in order to prevent the irrational demolition of heritage buildings in parallel with the protection of the traditional urban fabric and also by controlling the construction of new buildings that damage the heritage environment.

The project identified three zones; central zone "detailed study area", second zone "implementation area" and the outer zone which is as-Salt historical district boundary, (see Figure1).

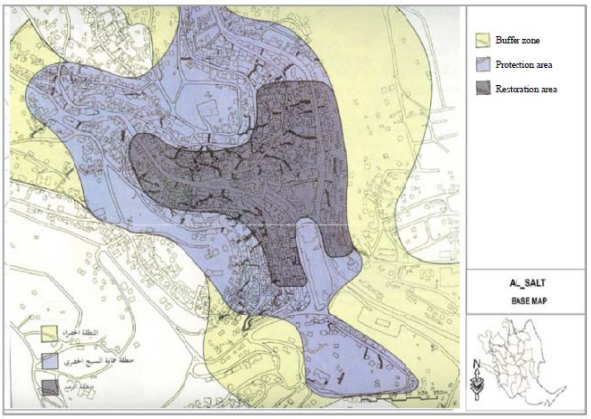


Figure 1. As-Salt historical district boundary, RSS study 1990.

A full GIS database was developed -based on the RSS Study- for the historic core of as-Salt, and included the following:

- Plot parcelation, building/roof plan survey, number of floors, ownership, material used, date of construction, current use.
- 4400 buildings were surveyed, including all building in the historic core (new and old).
- Within the central zone (CBD), identification of 675 buildings that were classified into "Grades" according to four main characteristics; architectural quality of the exterior, townscape value, historical interest and condition. Moreover, the database comprised infrastructure survey, household's socioeconomic backgrounds and some historical information.

Figure 2. Arial Photo.

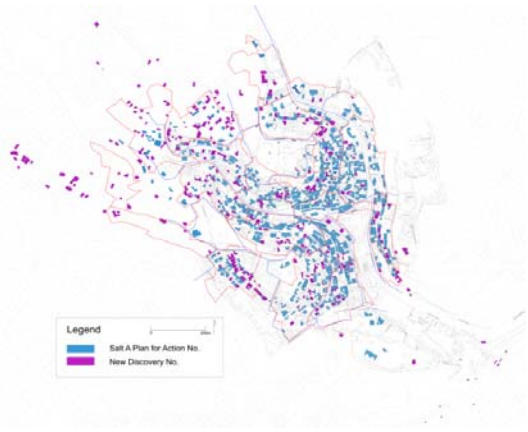


Figure 3. Base map of the study area.

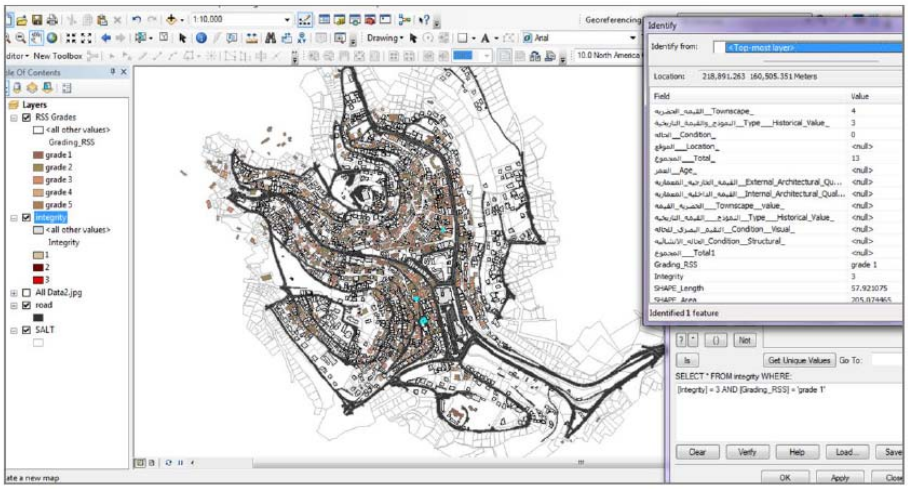


Figure 4. Shot for the GIS window with the classification for as-Salt heritage buildings.

One of the main outcomes of this GIS database for the city is the categorization of historic buildings and monuments according to their significance and condition, including the required level of protection for each category, the degree of alteration and level of interventions which will be accepted to make the buildings suitable for reuse in aiding city

core economic development whilst sustaining the heritage culture, as well as the recommended uses allowed. Guidelines also were prepared on criteria under which demolition and reconstruction will or will not be permitted. The project established a framework for grading historic buildings that can subsequently be applied nationally.
Based on the above, an evaluation grid was developed to the city of as-Salt; the grid scores buildings on their historical and architectural importance, but also on their potential value for tourism development.

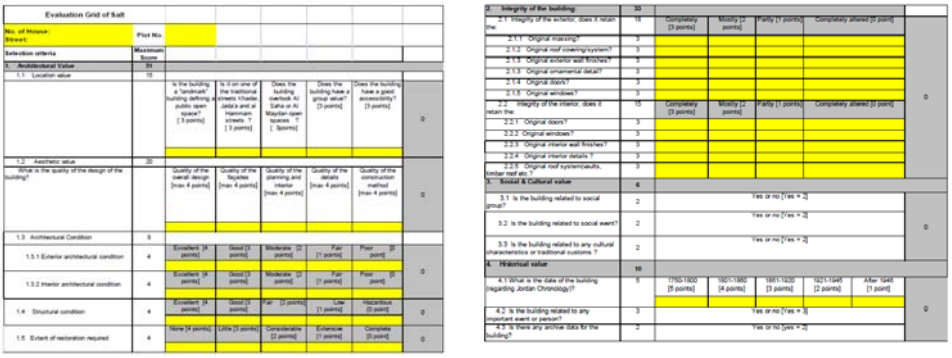


Figure 5. Part of as-Salt evaluation grid.

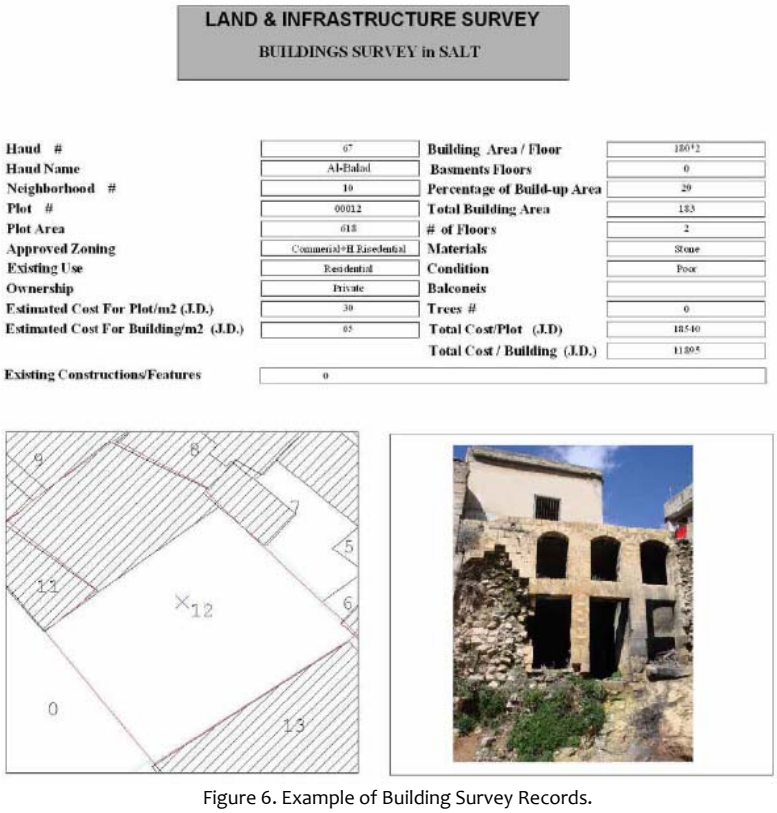


Figure 6. Example of Building Survey Records.

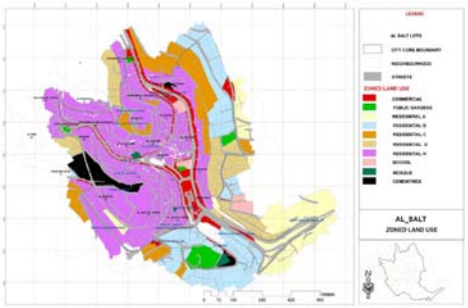


Figure 7. Zoned Land use of as-Salt

Figure 8. Streets network, paths and walls map

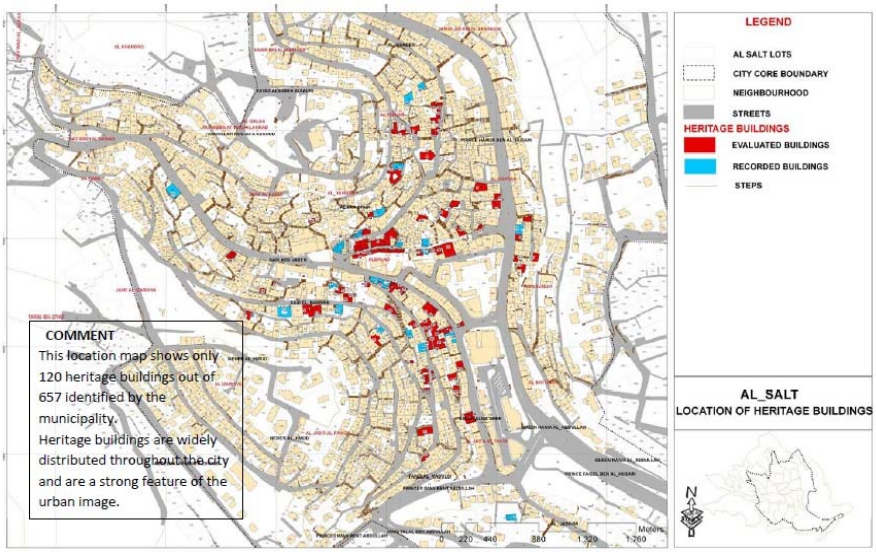


Figure 9. Heritage Buildings map.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

LEBANON 

1. Policies

1.1 Spatial and Census data access

- Clearance of aerial photography and any topographic map is required for national security reasons.
- Lack of periodic census which is mainly based on surveys.
- Census is limited to governorate scale.
- Cost of spatial information is a constraint.
- Some of the data are not available to the public for national security reasons
- There is unidentified geo-spatial data available in several universities and academic center, but this is neither archived nor covering wide spatial areas.

1.2 Spatial and Census data sharing

- For many public institutions, there is not online data availability.
- Some of the data are available to the public with a cost.
- The application Open-Public data is limited to low resolution maps.
- Spatial and census Data are not shared between institutes, however CNRS have initiated a process by which a protocol is signed between CNRS and different institutes for sharing spatial and census data.
- No data sharing whether spatial of census between Lebanese institutions except in case of applying joint projects, which is also limited. This does not follow a specific protocol.

1.3 Data collection funding

- Currently Budget allocated for spatial data collection is below one million US dollar.
- There is no fund for aerial surveys to collect spatial data.
- Funding is related to projects needs and thus it is neither periodic nor planned.

1.4 Decision making process

In urban planning and development, quarries licensing, and cadastral service there are defined requirements for the use of geospatial data. All other fields lack defined rules for geospatial data use.

2. Data - Applications

2.1 Distribution centers

- DGA: The DGA did not complete yet the recent airborne photo of the country undertaken in 2007 which can be used to complete cadastral mapping and create high resolution DTM. The fact that only 60% of the municipalities in Lebanon have cadastral maps reflects negatively on natural resources management at all levels. Land tenure is one of major factors of land degradation.
- CNRS: Despite the updated land cover and land use map, soil maps and flood hazard maps, updating this information is not periodic and depends on the project requirements.
- CAS: CAS is implementing projects upon needs and funding and provides free access at governorate level and upon authorization at local level.

2.2 NSDI / metadata / format

All data are not compatible and are not in accordance to EU INSPIRE Directive.

2.3 Coverage – Revision cycle

100 % of data producers or data providers have full coverage of the country. The basic national topographic map scale is 1:20,000, followed by 1:50,000, 1:100,000 and 1:200,000 are produced and provided by DGA.

Regular aerial survey of the entire territory of the country is being realized by the DGA since 1962. From 2007 the DGA has initialized the air borne coverage of the entire country with GSD of 20 cm (urban areas) and 50 cm (rural areas) to produce true orthoimages. Only 70% of the mapping campaign has been completed for security reasons.

The land cover land use maps are periodically updated and revised at CNRS. The CNRS-Center for Remote Sensing is updating the digital terrain elevation models (DEM) for the entire country. CNRS is building a remote sensing assessment and monitoring platform for flood, forest fires, drought and crop mapping and crop yield prediction.

2.4 Costs

The national data are not free of charge. They are available hardcopies and digital files from DGA and CRNS-CRS. The price list is available, upon a written request, at:
http://www.lebarmy.gov.lb/Documents/NDE52.asp#.U1zK5_mSySo, http://www.dlrc.gov.lb/, http://www.dlrc.gov.lb/Common/pdf/aff.pdf

2.5 Cooperation among Agencies

Some of the problems are:

- Different pricing policy among the public agencies/providers geospatial data (e.g. DGA, CNRS-CRS)
- The geospatial data is sold to other public agencies.
- There is not a single database of all geospatial data managed by a governmental body.

As a result, spatial harmonization of data cannot be checked.

The Lebanese GIS Portal website of the Ministry of Administrative Reforms (OMSAR) serving as a one-stop gateway to a network of geospatial information provided by government and noncommercial organizations is still at the metadata level.

2.6 Regional Data sets - Global Data sets

Only small resolution geospatial data are distributed free of charge by CNRS-CRS.

CNRS has developed an automated system to collect and process MODIS images for drought monitoring.

ESA provided CNRS free of charge ALOS images to produce DEM covering the whole country.

CNES provided CESBIO and CNRS free of charge spot images to monitor snow cover extend in the Lebanese mountains.

Satellite images and Digital Terrain Model (http://www.landcover.org/data/, http://earthexplorer.usgs.gov, http://glovis.usgs.gov)

Timeless images Google Earth (http://www.google.com/earth)

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The CNRS-CRS is downloading and processing available open source satellite data. High resolution air borne data are purchased with licenses. The following governmental bodies coordinate or are involved in Geospatial data collection and delivery in the country: DGA, CNRS-CRS, MoEW with several specialized centers (LECE, GIS center), MoA, MoE, MoEconomy, MoInterior, Litani Authority, LARI.

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Institute/agency full name	Web Site	Area of specialization	type	Geospatial Technology
Khatib and Alami	www.khatibalami.com/projects.htm	Electricity and water solutions, construction, Environment and waste management	Private	GIS
Fugro	www.fugro.com	Aerial surveys, mapping solutions, satellite image dealer	Private	Remote sensing
Dar El-Handassah Shair and Partners	http://www.dargroup.com	Environment, transportation, water supply, waste water, agriculture and irrigation	Private	Remote sensing, GIS
Army Directorate of Geographic Affairs (D.A.G.)	http://www.lebarmy.gov.lb/english/Geographictaalil.asp	Mapping topographic, Printing and marketing , Aerial surveys	Public Ministry of Defense	Remote Sensing, Geodesy, GIS
National Centre for Remote Sensing - CNRS	http://www.cnrs.edu.lb/index.php?option=com_content&view=article&id=62&Itemid=27	Environment, natural resources management, natural risks, climate studies	Public - Prime Minister	Remote Sensing GIS
Development and Reconstruction council (CDR)	http://www.cdr.gov.lb/study/indexstudye.asp	Planning and construction	Public - Prime Minister	GIS
Central Administration of Statistics	http://www.cas.gov.lb/	Demographic, economic, social statistics surveys	Public- Prime Minister	GIS
Lebanese Agriculture Research Institute (LARI):	http://www.lari.gov.lb/	Agricultural monitoring, hydro-meteorological data acquisition	MoA	GIS
Litani River Authority	http://www.litani.gov.lb/en/	Measuring stream flow in rivers, plus quality monitoring	MoEW	GIS

PART C. BEST PRACTICE VIGNETTES

LEBANON 

1. Introduction

Production and use of geospatial information is realized by the National Council for Scientific Research-Center for Remote Sensing (CNRS-CRS).

The CNRS-CRS was established in 1995 and became fully operational in 1997. This came as the culmination of a focused effort to catch up with recent advances in remote sensing and GIS technology. The Centre has proved to be an important tool for decision makers as it is supporting various activities that are essential to several ministries.

The CNRS-CRS has to its credit various studies dealing with land cover and land use change, watershed and forestry management, urban settlements, archaeology and the environment, integrated coastal zone management, public participation, land degradation/desertification, natural hazards, updated and new soil map of Lebanon. Furthermore, the Centre is securing highly needed upgraded information as well as cooperating with several development projects necessary for environmental monitoring and data acquisition in various sectors, and producing various thematic maps, training staff of various public agencies on requirements and applications of remote sensing and GIS.

2. Monitoring of geospatial data

2.1. Land cover/Land use

In 1998 the CNRS-Center for Remote Sensing (CNRS-CRS) updated, in cooperation with the MoE and MoA, the FAO land cover/land use map at 1:50,000 of 1990 into more detailed at 1:20,000 using Corine classification. This map was again updated in 2006 by the CNRS-CRS with the financial support of the FAO. The FAO Regional office funded national study on land tenure and land degradation in Lebanon (2012). The study used a large set of geospatial information to analyze land degradation and link it to environmental conditions, human practices and governance and land tenure while emphasizing the shortcomings in legislation and their implementation. The land use planning developed by the Council for Development and Reconstruction (CDR) with the assistance of DAR, IAURIF and technical support from CNRS-CRS, which developed the land capability map of Lebanon, identified the territories of urban expansion, special natural, agricultural and environmental interest (http://www.cdr.gov.lb/study/SDATL/French/Chapitre%205.PDF).

2.2. Rangeland

In 2000 the area of rangeland in Lebanon was 4,066 km2 consisting of grassland (400 km2), shrub land, and land with little or no vegetation represented 3,825 km2 (MOS, 2000). In 2010, the area was reduced to 3,666 km2. According to CNRS-CRS evaluation based on land capability classification, the estimated area of marginal land which can be used for grazing and reforestation is 388,200 ha. The area of non-arable lands exceeds 165,000 ha.

2.3. Soil Information

In 1998 the JRC supported a project to update the soil information in cooperation with the CNRS-CRS. It consisted of converting the soil map of Lebanon at 1:200,000 produced by B. Geze in 1956 into digital format and updating the soil nomenclature using FAO-UNESCO and

WRB legend. The European Soil Bureau supported the production of the Euro-Mediterranean soil geographical database at 1:1,000,000.
This soil information was used for the elaboration of national hazards maps like erosion, landslides, land capability serving the land use planning and the elaboration of national action program to combat desertification.
Land degradation/desertification
The BGR supported in cooperation with ACSAD and the CNRS-CRS a project on the protection of the soil and groundwater from heavy metal (1997-2000) and nitrate (2001-2003) contamination in Central Bekaa of Lebanon. Results showed the profile and spatial distribution of Cr, Ni, As, Pb, Cd, Cu and Zn in the soil and groundwater (http://www.bgr.bund.de/EN/Themen/Boden/Projekte/Ressourcenbewertung_und_management_abgeschlossen/ACSAD_Management/ACSAD_management_schutz_en.html).
The study used the Eickman-Klocke concept on soil contamination levels and land suitable use for agricultural and nonagricultural purposes including the specific crops like green leafy vegetable, fruit trees, technical crops, agroforestry or playground, recreational area, industrial zones. The developed capacities were used to assess land quality in North Lebanon which can be used for zoning and land use planning

2.4. Combating land degradation and desertification
The UNDP and GIZ supported the development of the national action program (NAP) to combat desertification implemented by the MoA 2002 with direct support from CNRS-CRS http://www.unccd.int/ActionProgrammes/lebanon-eng2003.pdf. The NAP was based on the GIS maps of five layers consisting of aridity index, vegetation state index, soil vulnerability to desertification index, land use intensity and demographic pressure. The combination resulted in spatial identification of desertification prone areas which are mostly concentrated in North east Bekaa, North and south Lebanon.

2.5. Flood management
The UNDP has recently (2013-2014) supported a national project on flood management which was implemented by the Prime Ministry Disaster Management Unit and executed by the Center for Remote Sensing-CNRS. The project mapped the flood hazard in all Lebanese watersheds using WSM and projected hazards up to 2100.

2.6. Territorial Information System (TIS)
The TIS with web address: tis.cnrs.edu.lb has been set up by CNRS with the assistance of IT Synergy and MoA in order to provide a substantial support through the available data processing. The CNRS and the MoA provided most of the spatial information, including high resolution satellite images, while IT Synergy was sub contracted by IAM-Bari as one of the key players in the GIS field to provide the TIS software platform and training. This pioneer tool is based on "Open Source" (free of charge) software; it is therefore fully accessible to everybody since no special hardware or software is required. CNRS and MoA staff was thoroughly trained to be able to keep update and enrich the information collected in the TIS ensuring the sustainability of this initiative. The tackled by TerCom project areas were: Tyre, Baalbeck and Byblos and part of Baalback cazas (Figure 27) and in the future the system developed could be expand in order to cover other areas Lebanon with the contribution of other interested sectors to sustain eco-tourism and agro tourism. Forest fires.

2.7. Local assessment of forest fires risks

A case study on Nahr Ibrahim Watershed (NIW) developed a model to assess the natural factors (vegetation, topography, and climate and soil characteristics) and the anthropogenic activities to generate the natural and hazard forest fire risk maps (Assaker, 2011). The results showed that human activities like road construction, housing, agriculture caused an increase of risk areas with very high and moderate risk from 5% to 38% and from 7 % to 25%, while areas with low risk revealed a significant decrease from 37% to 12% respectively.

2.8. Loss of arable lands by urban expansion

The comparison of the land cover map with the expansion of urban settlements between 2000 and 2010, showed a total loss of 308 km2 of land resources. A total of 194 km2 (63%) belong to agricultural lands, 53 km2 (17.2%) and 50 km2 (16.2%) occurred at the account of wooded land and grassland respectively.

2.9. Suitability for quarrying activities

Assessing land suitability to quarries based on the concept of less damage and more chance for successful rehabilitation to initial land cover revealed large areas suitable for quarries notably in central mountains, eastern mountain chain and south Lebanon.

2.10. Water

Water resources management is a major component among the CAPWATER Project which is funded by GEF and implemented by World Bank. A principal output from the water component is the production a "Groundwater Potential Map", which can be built by integration several influencing factors. Thus, "Permeability" is one of the most effective factors, and it is done by analyzing the lithological and structural geology.
The map below show the produced "Permeability map of Lebanon", as a geospatial layer to be used in GIS with the other layers to produce the Groundwater Potential Map.

3. Examples

Figure 1. Lebanon simplified land cover map 2004.

Figure 2. Dominant land uses suggested by the SDATL 2004.

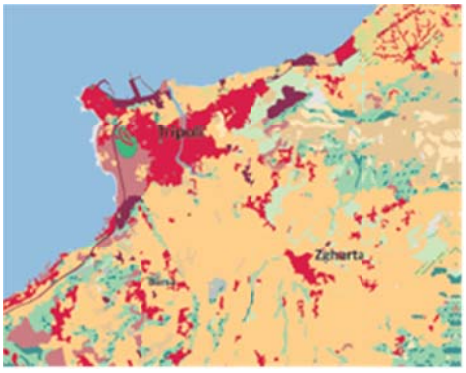


Figure 3. Land cover Tripoli, North Lebanon.

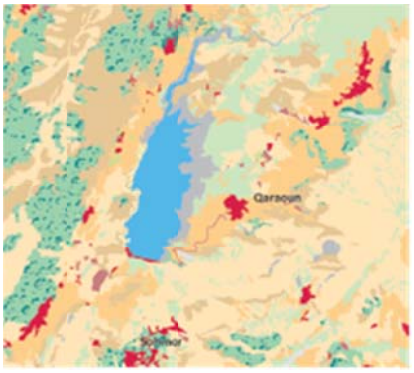


Figure 4. Land cover, South Bekaa.

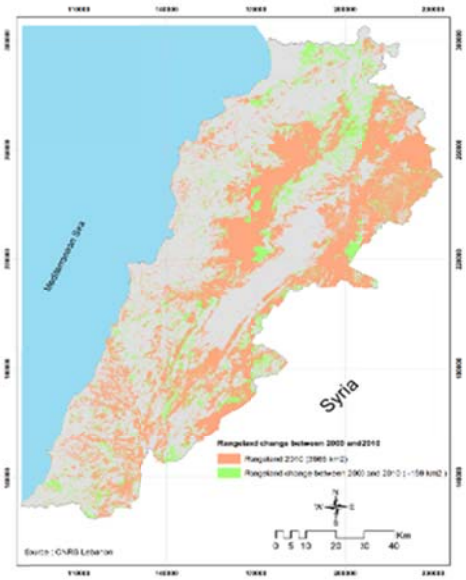


Figure 5. Rangeland distribution in Lebanon (Source: CNRS, 2011).

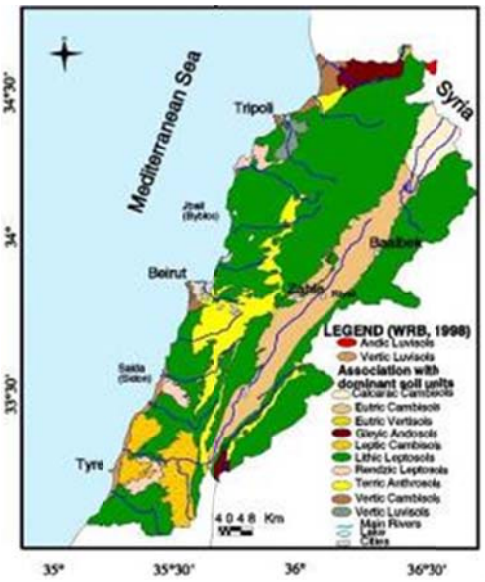


Figure 6. Soil map of Lebanon at 1:1 M. Scale.

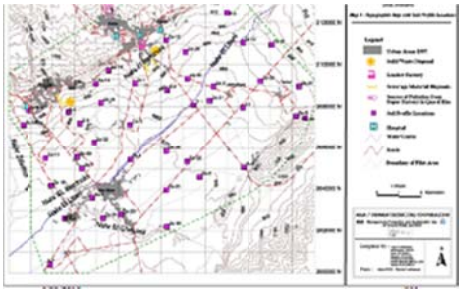


Figure 7. Soil sampling and sources of contamination in Central Bekaa.

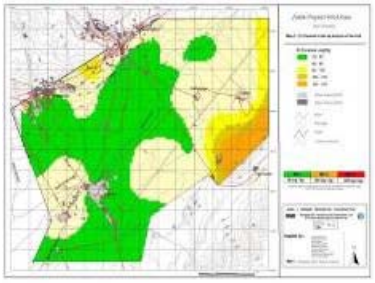


Figure 8. Land use classification in year 2007.

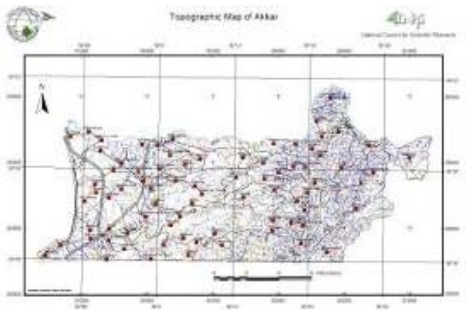


Figure 9. Location of soil sampling in Nortth Lebanon.

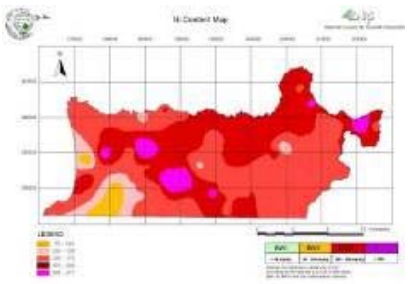


Figure 10. Spatial distribution of Ni content in ghe plow horizon.

Figure 11. Flood hazard mapping.

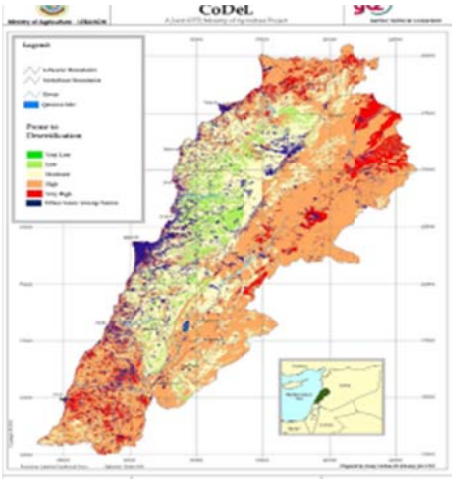


Figure 12. Areas prone to desertification in Lebanon

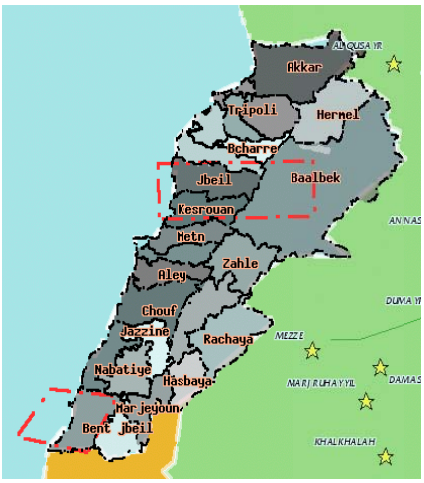


Figure 13. Pilot areas chosen to develop territorial information system

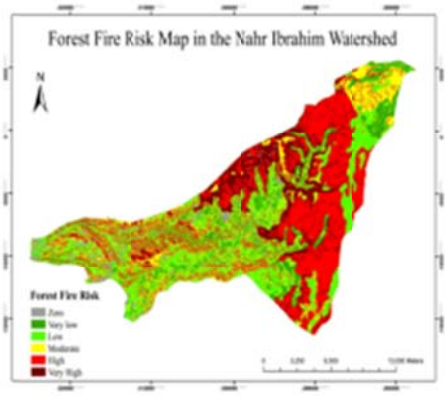


Figure 14. Forest fire risk map for the NIW.

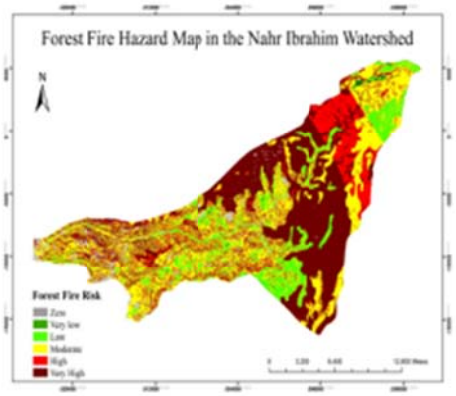


Figure 15. Forest fire hazard map for the NIW.

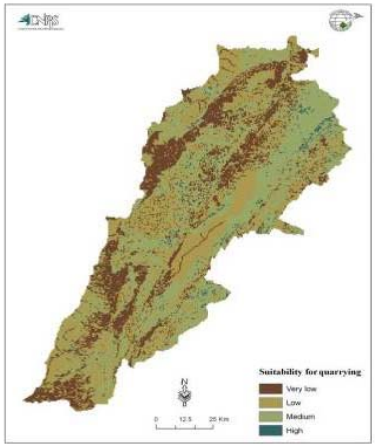


Figure 16. Land suitability for quarrying activities.

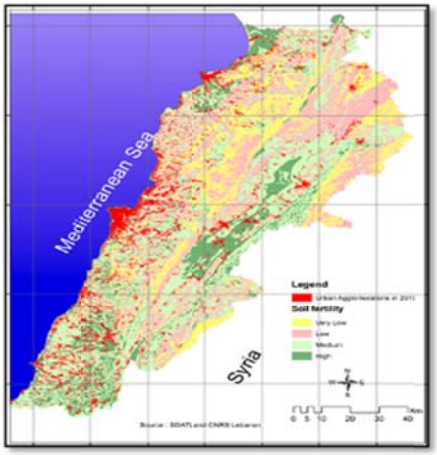


Figure 17. Land capability and historical urban agglomeration on fertile lands in Lebanon.

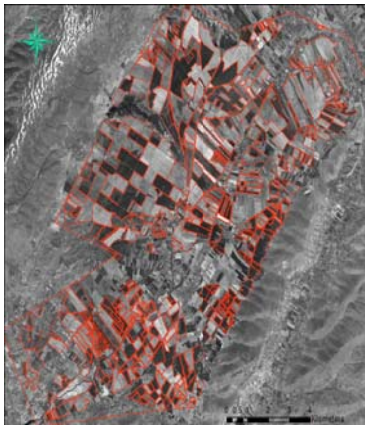


Figure 18. Potato and wheat Field limits.

Figure 19. Field crops limits.

PART B. IDENTIFIED WEAKNESSES, CRITICAL POINTS AND GAPS

PALESTINIAN AUTHORITY

1. Policies

1.1 Spatial and Census data access

- The difficulty of acquiring aerial photos: Palestinian organizations are not able to fly aircrafts and capture photos for mapping purposes. Acquiring aerial photos with high resolution is therefore a major problem, as the Israelis fully control and restrict the use of airspace without security clearance from the Israeli Ministry of Defense.
- Data collection limitations: Collecting capacity by the field workers on the ground is also affected by Israeli restrictions. First, the movement of the field workers from one area to another is often restricted due to closures, checkpoints, the presence of closed military areas and second, the restrictions to enter the Israeli settlements. On top of all that, the Segregation Wall has made it difficult to access areas isolated behind the Wall to collect necessary and needed information.
- The lack of a national GIS source of information: There isn't any national spatial data infrastructure in Palestine which allows direct access to all available digital geo-information across the country, through the internet.
- The "Right to Information Law" is not endorsed yet: Palestinian civil society and media organizations have been worked hard in the past few years to influence the adoption of a "Right to Information Law" by the Palestinian Authority. Accordingly, a draft law is on its way of being officially and legally endorsed. Through the "Right to Information Law", the Palestinians will have the possibility to access, generate, process, and communicate information in the context of governance and citizenship. This of course applies to geo-information among other type of data. Once endorsed, this law will also contribute to the empowerment of community and civil society enabling them to hold duty bearers accountable..

1.2 Spatial and Census data sharing

- No national policy for sharing geo-spatial data: As we included in part A, there are many Palestinian, ministries, centers and organizations that have geo-spatial data but they do not have a policy for sharing the data between them including geo-spatial data. Yet, such data is sometimes shared through mutual cooperation between certain organizations.
- Geo-spatial data is not always up to date: very often the available geospatial data is not modified on regular bases. For example, certain data might be prepared for a certain project but once the project is completed, there is not enough follow up to make sure the GIS data is up to date.
- Lack of consistency: sometimes the geospatial data might vary and be inconsistent based on its sources. Accordingly, the credibility of the data depends on the reputation of the organization.

1.3 Data collection funding

In spite of the different funding opportunities in Palestine in general, there are rarely any programs that directly support the collection and updating of geo-spatial data at a national level. Nonetheless, the use of geo-spatial and applications and data is very often a component of many projects, especially those funded by the European Union.

1.4 Decision making process

There are no standards for collecting geospatial data for all purposes and projects, because each organization applies its own standards depending on its uses. For example, the Ministry of Local Governance uses certain standards related to taking aerial photos in the master plans. The Ministry of Public Work and Housing (MoPW) also uses geospatial data in its functions and roads planning.

2. Data - Applications

2.1 Distribution centers

As mentioned in part A of the report, there are many ministries and organizations that have geospatial data related to their work and projects. Nonetheless, the main gap here is that there are no distribution centers that are particularly specialized in geospatial issues. Moreover, the mentioned organizations and ministries use the geospatial data for their own purposes and not for distribution purposes to the public. Actually, the only official distribution center in Palestine is The Palestinian Central Bureau of Statistics (PCBS) as already included in part A. Nonetheless, PCBS does not share geospatial data with the public.

2.2 NSDI / metadata / format

No solid metadata is available; multiple formats are used.

2.3 Coverage – Revision cycle

The Palestinian Ministry of Agriculture has land- use land -cover layers that covers all the Palestinian Territory.
The Applied Research Institute Jerusalem (ARIJ) has up to date aerial photos and satellite images covering all the Palestinian Territory. ARIJ also has topographic maps, road networks, water networks, and points of interest (POI).
The Palestinian Ministry of planning also has national spatial plan for that covers the West-Bank Area.

2.4 Costs

Since there are no official distribution centers for geospatial data, accordingly there are no costs involved. However, private companies sell geospatial data charging relatively high prices based on the requested data.

2.5 Cooperation among Agencies

- Some ministries and organizations have high degree of cooperation, while others do not prefer to cooperate since there is no binding cooperation policy.
- Private companies sell geospatial data to the public charging relatively high prices.
- There is not a single database of all geospatial data managed by a governmental body. As a result, spatial correlation of data cannot be checked.

2.6 Regional Data sets - Global Data sets

Free Access of geospatial data:

- A set of global climate layers (climate grids) with a spatial resolution of about 1 square kilometer. The data can be used for mapping and spatial modeling in a GIS or with other computer programs (http://www.worldclim.org/).
- Satellite images and Digital Terrain Model (http://glovis.usgs.gov).

- Timeless images Google Earth (http://www.google.com/earth/).

3. Capacities

3.1 National and Regional Spatial Information collection and processing

The following ministries and non-governmental organizations coordinate or are involved in Geospatial data collection-delivery in the country:

- Ministry of Planning (MoP)
- Ministry of Agriculture (MoA)
- Ministry of Local Government (MoLG)
- Ministry of Environmental Affairs (MEnA)
- Palestinian Water Authority (PWA)
- Palestinian Land Authority (PLA)
- Ministry of Public Work and Housing (MoPW)
- Applied Research Institute Jerusalem (ARIJ)
- Land Research Center (LRC)

4. National Stakeholders/Industry

Table 1. National Stakeholders/Industry.

Full Name	Web Site	Geo-Science
Ministry of Planning (MoP)	Link	Urban/Land Planning
Ministry of Agriculture (MoA)	Link	Agriculture(Land use/Land Cover)
Ministry of Local Government (MoLG)	Link	Master Plans-Local Level
Ministry of Environmental Affairs (MEnA)	Link	Spatial Data-Environment
Palestinian Water Authority (PWA)	Link	Spatial Data-Water Resources
Palestinian Land Authority (PLA)	Link	Land Ownership and Cadastral Maps
Ministry of Public Work and Housing (MoPW)	Link	Road Networks
Applied Research Institute Jerusalem (ARIJ)	Link	Geo-Spatial Data (Geopolitical, Agriculture, Environment, Water, Poverty and Vulnerability mapping etc.) Geo- Informatics Training Good Governance Training
Land Research Center	Link	Geopolitical and Agriculture Data Geo- Informatics Training
United Nations Office for Coordination of Humanitarian Affairs (OCHA)	Link	Geopolitical Maps and Reports Humanitarian Reports
The Palestinian Central Bureau of Statistics (PCBS)	Link	National Data
Good Shepherded Engineering and Computing	Link	Aerial-Photographs Cadastral Maps Geo-Spatial Data
Sky Map Engineering Company	Link	Aerial-Photographs Cadastral Maps Geo-Spatial Data
AXIS GPS & Surveying Instruments LTD	Link	GPS & Surveying Instruments Aerial-Photographs Cadastral Maps Geo-Spatial Data

Ramallah Maps - road map, satellite view	Link	Road Map Satellite View Street View GPS Navigation System
Hebron University	Link	Academic Courses
Palestine Polytechnic University	Link	Academic Courses Professional Training
An-Najah National University	Link	Academic Courses Professional Training
Al-Quds University	Link	Academic Courses
Bethlehem University	Link	Academic Courses
Birzeit University	Link	Academic Courses Professional Training
Palestine Technical University- Kadoorie	Link	Academic Courses
Palestine Academy	Link	Academic Courses

PART C. BEST PRACTICE VIGNETTES

PALESTINIAN AUTHORITY

This first good practice involves the use of GIS in Managing Water Distribution in one of the biggest Palestinian cities. Hebron city is a city in the Hebron Governorate, located in the southern part of the West Bank. According to the Palestinian Central Bureau of Statistics (PCBS) Census, the total population of Hebron city is approximately 200,000 residents, living in 35,000 housing units. As for the land area, it is about 45 km2 including a road lengths of 400 km and land parcels of 79 blocks.

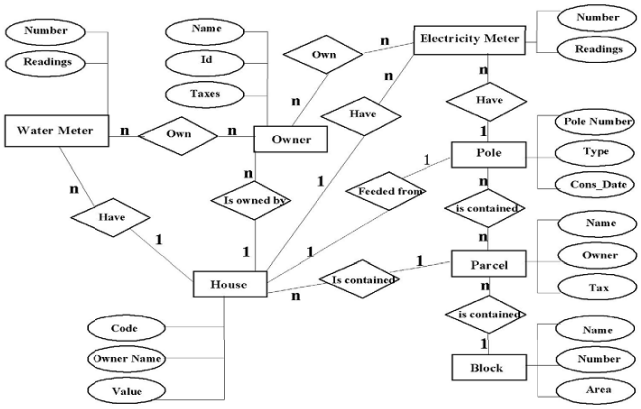


Figure 1. Water Distribution System in Hebron Municipality

The Hebron Municipality is the largest institution in the city of Hebron in terms of operational labor force, number of services offered, and projects carried out. Thus the Municipality is the backbone of development in the city and the engine that keeps it going. Consequently, the city has recently demonstrated signs of rapid development in public

services and infrastructure. There are approximately 1,200 employees who currently work for the municipality.

The Municipality offers a variety of services, the most important of which are electricity, water, roads, sanitation, the environment and construction. In addition, the Municipality provides services to the industrial and agricultural sectors, as well as cultural and sports services to all sectors of society.

The Hebron Municipality office established the computer unit in 1987 as a branch of the Department of Finance. In 2002, it established the unit of Geographic Information Systems (GIS) which was centrally managed. The unit provided all the Geographic Services like drawing units, maps, naming and numbering unit and information entering unit. In the year 2010, a new function was introduced to the GIS system which is the management of Water Distribution in Hebron City.

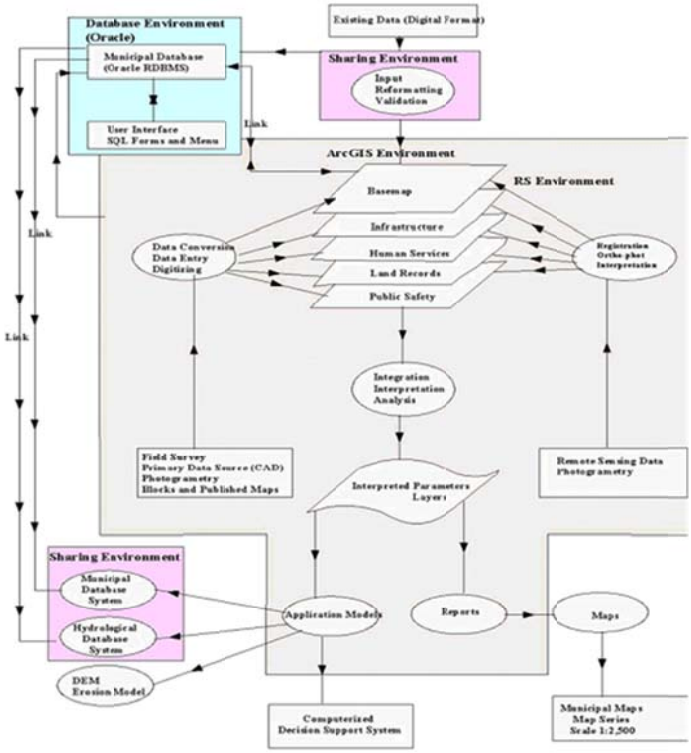
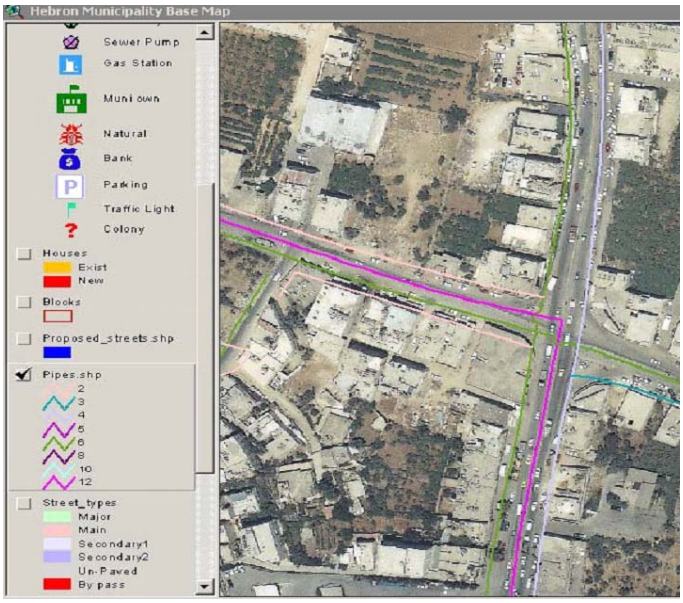


Figure 2. Conceptual Model of Hebron Municipality GIS Database.

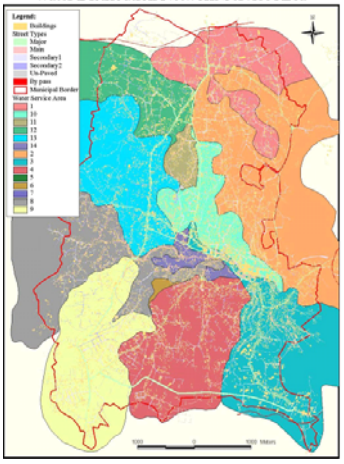
It is worth mentioning here that the citizens of Hebron face real shortage in drinking water quantities, especially in the summer months. They go through hardships to obtain drinking water and pay unreasonably exaggerated water prices from private sellers. Unsurprisingly, the primary water-related challenge is due to the Israeli occupation, which hinders the provision of fair services by local authorities. Naturally, the introduced water management system did not increase the water resources but it helped the municipality to manage its available water resources in an efficient and fair manner.

Before introducing this GIS system, the distribution of water was managed manually. Accordingly, many citizens were questioning the fairness of the systems in terms of

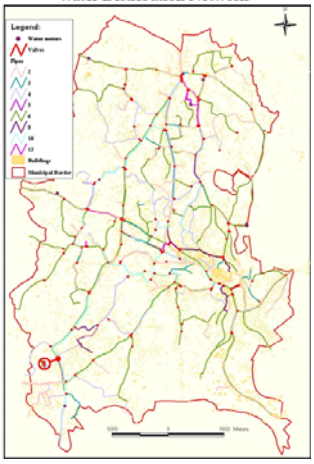
allowing different neighborhood with equal water resources. After using the GIS systems, the water distribution was managed through a computerized system making sure that all roads are provided with running water based on an automatic schedule. As a result, the GIS System increased the responsiveness of the municipality towards the needs of the citizens and encouraged the citizens to trust their own local authority.



Water Distribution Network Service Area



Water Distribution Network



Improving the local governance processes through exchange of good practices, pilots and training in geospatial technologies "LOCAL – SATS"

D4.2.1 Appendix (More best practice vignettes)

PART C. BEST PRACTICE VIGNETTES

CYPRUS

1. Land Information System

DLS operates, partially on a manual and partially on a computerized basis, a graphical multipurpose cadastre. The Department records a considerable amount of land related data. Cadastral plans are widely used as a fundamental graphic record by a wide range of agencies. Information about development, utilities, land use, water resources, geology, and even statistical data for population, industry, agriculture and planning, are recorded on, or closely related to the cadastral plans.

The Government of Cyprus through the Department of Lands and Surveys (DLS), implemented a system to improve the efficiency and effectiveness of Departmental activities taking advantage of available information technology and modern cost effective survey instrumentation and techniques.

The general strategic objective of the country is the establishment of a fixed boundary coordinated cadastral system after a systematic resurvey, the computerization of the land records, cadastral plans, and topographical maps, the development of a number of computerized systems to support the survey, registration, valuation and management functions of the Department, and the staged development and implementation of a National Land Information System (LIS), where all agencies with land related activities can share available data for the benefit of the economy of the country.

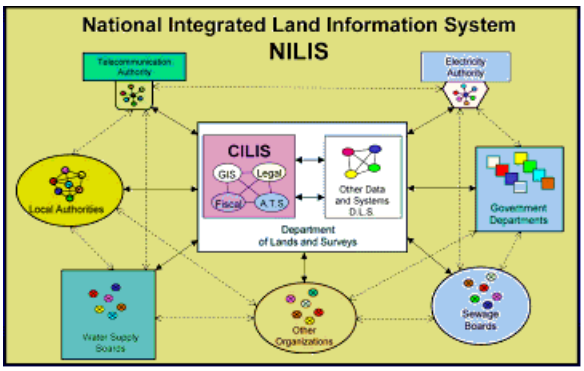


Figure 1. National Integrated Land Information System NILIS.

The Cyprus LIS project is a program covering the following groups of activities:

(a) The strengthening and re-computation of the National Grid System and the systematic resurvey, for cadastral purposes, of the entire island. All modern equipment and techniques such as GPS, photogrammetry and EDM tacheometry are being used, in an attempt to reach the most efficient and cost effective method.

(b) The computerization of land transactions, the improvement and acceleration of valuation assessments, the reduction of duplication of land administration work among Government Agencies, and the increase of the ability of the Government to effectively manage state-lands, and expedite acquisition and requisition orders.

(c) The development of a Digital Cadastral Data Base (DCDB), a Survey Data Base (SDB) and a Topographical Data Base (TDB), suitable to support an Integrated Land Information System.
(d) The development of a computerized system, capable of supporting all the registration, valuation and land management functions of the Department, and the development of a Legal/Fiscal Database as a substantial component of the Land Information System.
(e) The introduction of computer-assisted techniques into the Valuation processes, to achieve optimum performance, and to enable a semi-automated general revaluation program at frequent time intervals.
The LIS in the Department of Lands and Surveys has been designed and developed having two major application components:
a. The Survey Related Applications (Geographical Component)
b. The Legal/Fiscal Applications (Legal/Fiscal Component)
Basically, all Legal/Fiscal application systems have been developed in Cyprus using the case tools of ORACLE Relational Database Management System. The spatial applications are based on Arc/Info, Arc/View and other ESRI GIS products and RDBMS technology, on surveying packages (such as LISCAD) and on CAD packages (eg. AutoCAD and MicroStation).
Four main databases have been developed in the Department:
a. The Survey Database,
b. The Digital Cadastral Database,
c. The Topographical Database, and
d. The Legal/Fiscal Database.
The Survey Database, the Digital Cadastral Database and the Topographical Database constitute the spatial component of the LIS, and the Legal/Fiscal database mainly constitutes the aspatial component. The objective of the Department to operate and maintain an integrated system, where the four databases would operate as one single corporate database, has been achieved.
The corporate database contains the survey data-set, the digital cadastral data-set, topographical overlays, the legal/fiscal data-set, sales history data, and other useful information. A number of application systems have been developed around the system. These systems basically include applications for data entry, maintenance, storage, enquiry and output (displaying, reporting, plotting and printing).

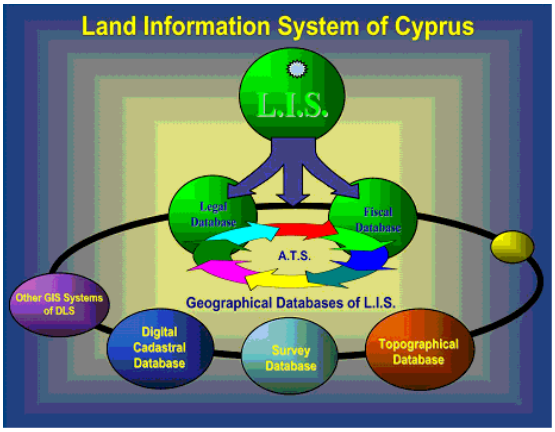


Figure 2. Digital Databases of the Cyprus LIS.

1.1. Survey Database

The Survey Database (SDB) stores information related to the geodetic network, current survey data, and historical records of all surveys. The SDB is the repository for detail from the original source records of the surveys that underpin the cadastral framework. It is also the reference system for applications that require dimensions or survey accurate coordinates.

The objective of the SDB is to assure that the country is supported by a system able to efficiently provide timely, accurate and comprehensive survey information. It also contains the underpinning data for the Digital Cadastral Database.

1.2. Digital Cadastral Database

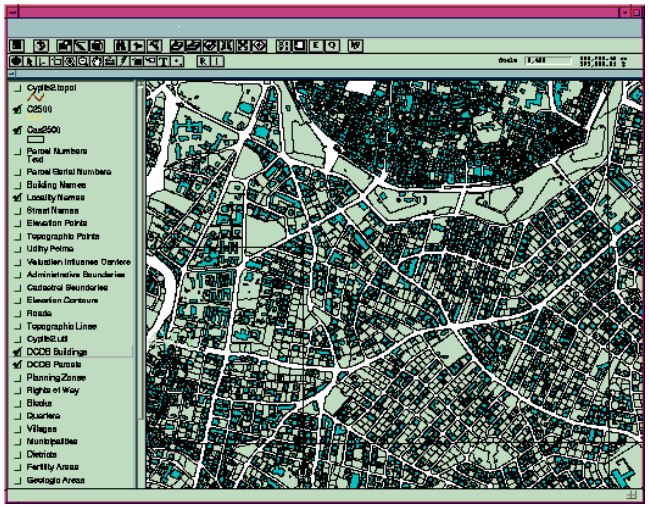


Figure 3. Digital Cadastral Database.

The Digital Cadastral Database (DCDB) has been designed to provide an up-to-date continuous cadastral map base to support cadastral mapping and the LIS functions. The DCDB is the database that stores the current cadastral framework, thematic overlays and topographical data in a seamless form.

The main objectives of the DCDB are:

a. Replace the manual techniques associated with the creation and maintenance of the cadastral plans at various scales.

b. Provide the spatial underlay for an integrated LIS.

c. Ensure that the spatial underlay is correct and up-to-date for all users, both in DLS and in other organizations.

1.3. Legal/Fiscal Database

The basic general objectives of the Legal/Fiscal component of the proposed LIS are:

a. Store and maintain in digital form the land registers and other land records.

b. Facilitate transactions by providing on-line access and maintenance.

c. Provide administrative and statistical support.

d. Provide a document tracking system.

e. Support Computer Aided Valuations.

The Legal/Fiscal activities of the Department are diverse. The functional areas that are supported, and the facilities that are provided, were carefully selected during the users requirements and analysis stages. Consideration was given to the scope of the initial system and from this, the system functionality was determined. The volume of the work involved, the proposed use of the data, the complexity of some functions, and the benefits gained were among the criteria for deciding which functions should be automated.
The system provides on-line support to almost all branches of a District Lands Office, including applications, declarations, mortgages, forced sales, attachments, local enquiry, registration, checkers, tenure, land consolidation, leases, license, notations and valuations.

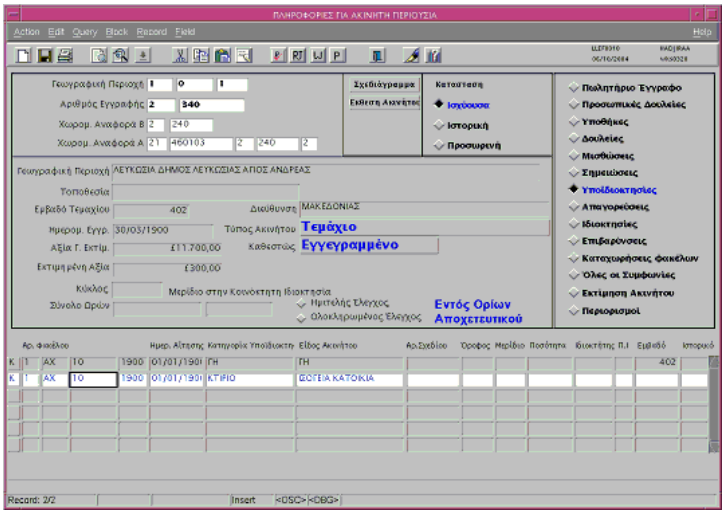


Figure 4. Legal/Fiscal Database.

PART C. BEST PRACTICE VIGNETTES

GREECE 

1. Introduction

Geodata.gov.gr is the first web service in Greece offering open geospatial data and interactive maps free for all citizens. It was designed, developed, and is with the aim to provide a focal point for the aggregation, search, provision and portrayal of open public geospatial information.

Geodata.gov.gr is one of the Greek Government's open government initiatives in the framework of the Open Government Partnership. Further, its operation is included in the Road Map to support the enforcement of Law 3979/2011 for eGovernment, as a best practice example for the application of Information & Communication Technologies (ICT) in the public administration, and as an open data repository for the provision of geospatial information. Finally, geodata.gov.gr provides technical support to the National Spatial Data Infrastructure, in accordance to the National Strategy for ICT and eGovernment. http://geodata.gov.gr/geodata/

Geodata.gov.gr offers data sets from Ministries, Public Organizations, Local and Regional Administration. The available data on the application are currently including base maps, environmental data, cultural heritage data, administrative data, and infrastructure and communications networks data etc. The application is developed using open access software.

2. Services

User, using the three basic services, "search", "download" and "view", manages the available geospatial data.

He can search for data based on keywords, by selecting a specific public organization, alphabetically or by uploading date. All datasets are offered with complete metadata, according to INSPIRE requirements.

Datasets are simultaneously offered for downloading in various formats, as SHP, GML and KML as well as XLS and ODS depending of the nature of data. For the geospatial data are offered national and international reference systems, so that they can be reused by everyone, throughout the globe without requiring the expertise and/or purchase of commercial software.

Finally, user can view the selected geodata in interactive web maps, as Google, Microsoft Bing, orthophotomaps produced by NCMA S.A, along with open Street Maps as the basic cartographic layer. He can view multiple datasets at a time, freely zoom in/out and pan, search for areas and datasets, and even integrate the interactive maps in third-party systems. Furthermore the data are available in different datum as EGSA87 and WGS84.

3. Examples

3.1. Environmental data

Figure 1. Corine 2000.

Figure 2. Natura 2000.

Figure 3. National Parks.

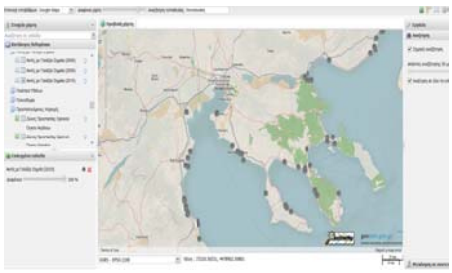


Figure 4. Blue Flags.

3.2. Base maps

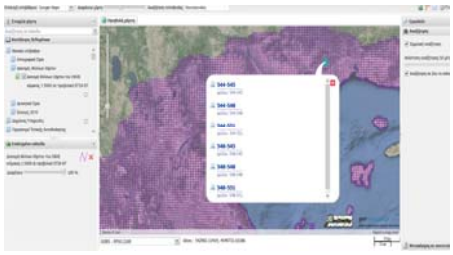


Figure 5. Distribution of 1:5000 maps.

Figure 6. Boundaries of Regions.

3.3. Ministries and Public Organizations

Figure 7. Ministry of Environment, Energy and Climate Change: General urban plans.

Figure 8. Ministry of Health: Hospitals.

3.4 Local Authority

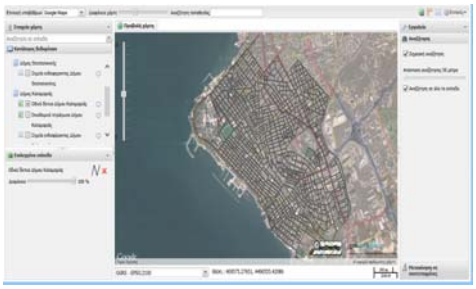


Figure 9. Municipality of Kalamaria (Thessaloniki): Network of Roads

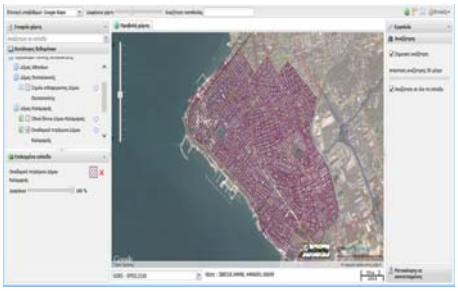


Figure 10. Municipality of Kalamaria (Thessaloniki): Blocks

3.5 Infrastructure and communications networks

Figure 11. Railway network.

Figure 12. Multiple datasets: Gas pipeline and Egnatia Motorway.

PART C. BEST PRACTICE VIGNETTES

MALTA

1. Introduction

The geo-portal of Transport Malta offers geospatial information relating to transport. The data is free for viewing for the general public. The themes accessible on the Geoportal are:

- Core Spatial Data which includes the basic references to all the transport layers containing coast, streets, Local Council boundaries and Ten-T Network. These are available in both raster and vector.
- Land Transport Theme displaying bus stops and bus routes.
- Maritime Theme showing the swimmer zones, anchorage and berth areas, fish farms, lights, wrecks and sea plane landing areas in Valletta and Mgarr (Gozo).
- Project Theme lists the ongoing large-scale road works projects in Malta, Gozo and the Cirkewwa Ferry Terminal.
- Residential Road Works Programme Theme.

2. Services

Users can view and search geo-spatial data. One can search the geo-spatial data by selecting the relevant Local Council and Street Name. Users can also zoom, pan and measure.

The user can select multiple data sets at once. Geo-spatial data can be displayed on three base maps: Orthophotos, Base Map and Local Councils.

3. Examples

3.1. Base Maps

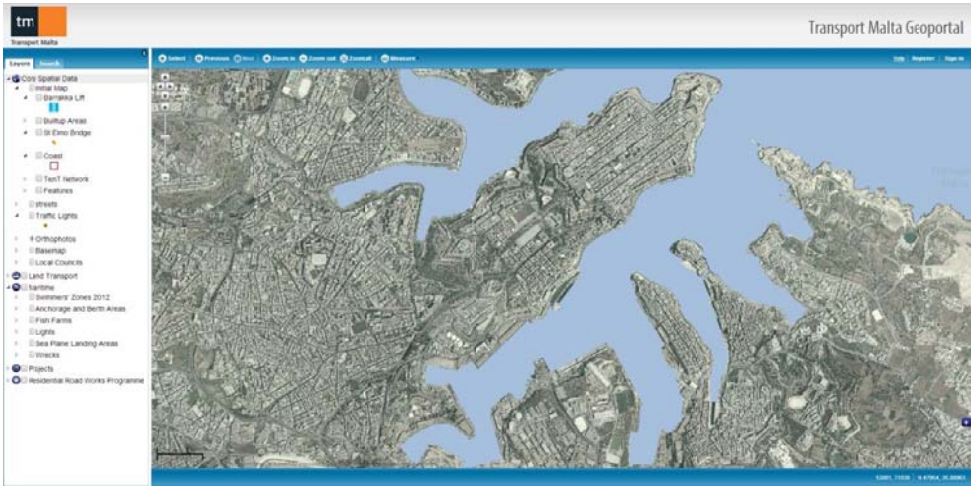


Figure 1. Orthophoto.

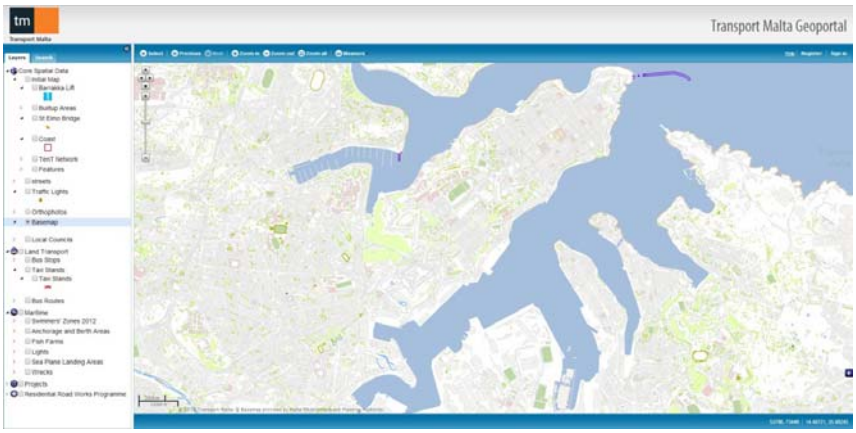


Figure 2. Basemap.

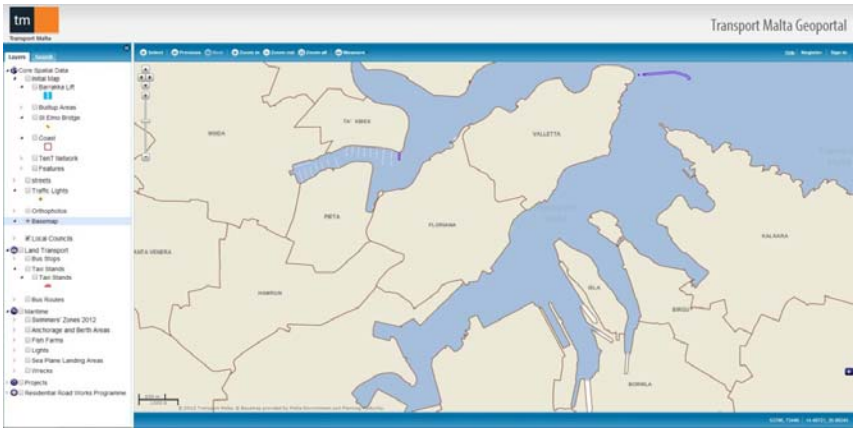


Figure 3. Local councils.

3.2. Transport Data

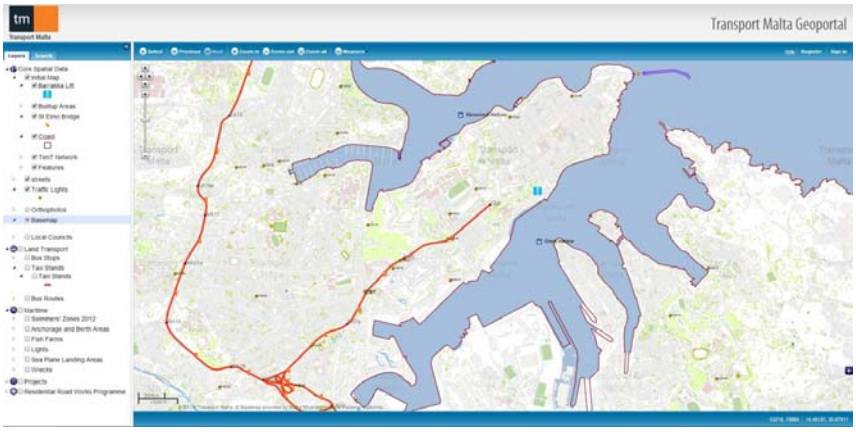


Figure 4. Core spatial data.

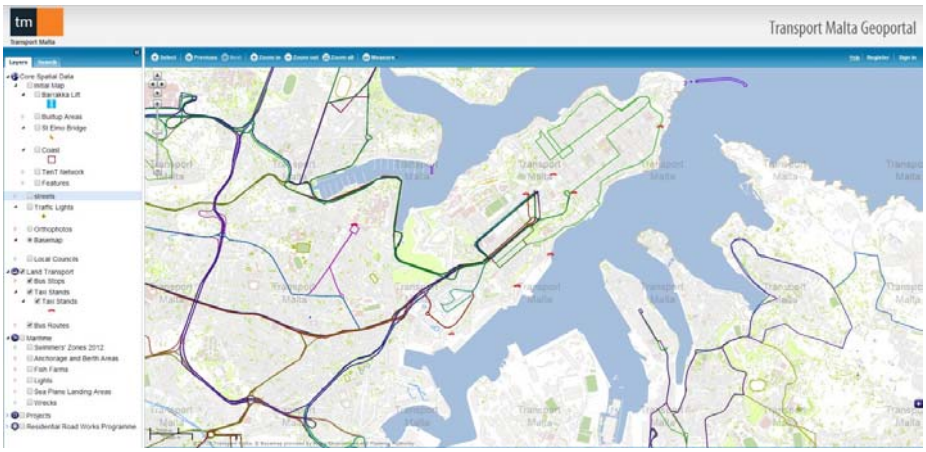


Figure 5. Land transport.

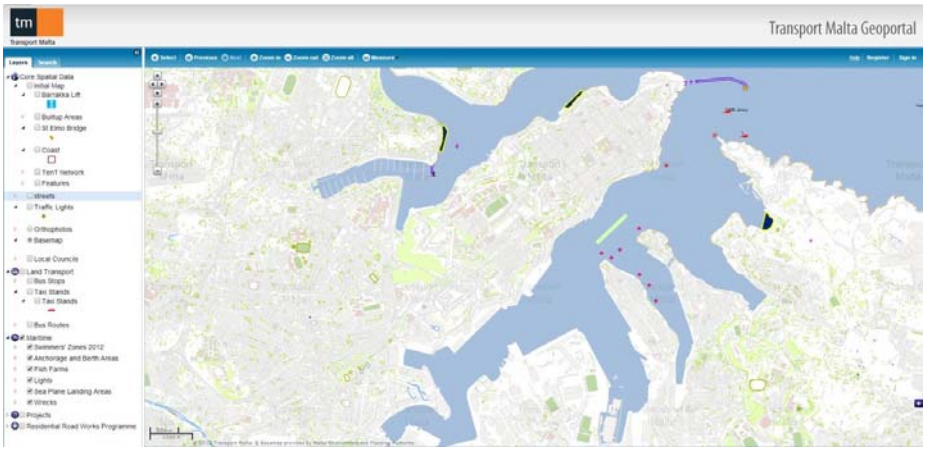


Figure 6. MARITIME.

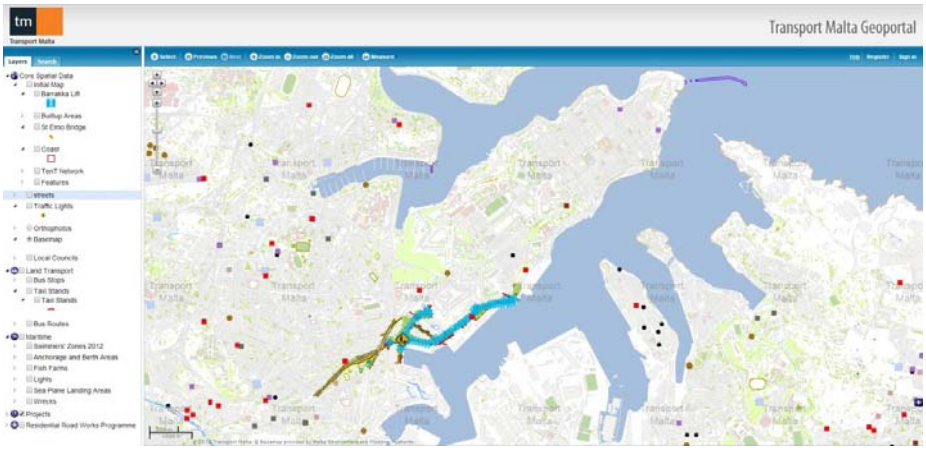


Figure 7. Projects.

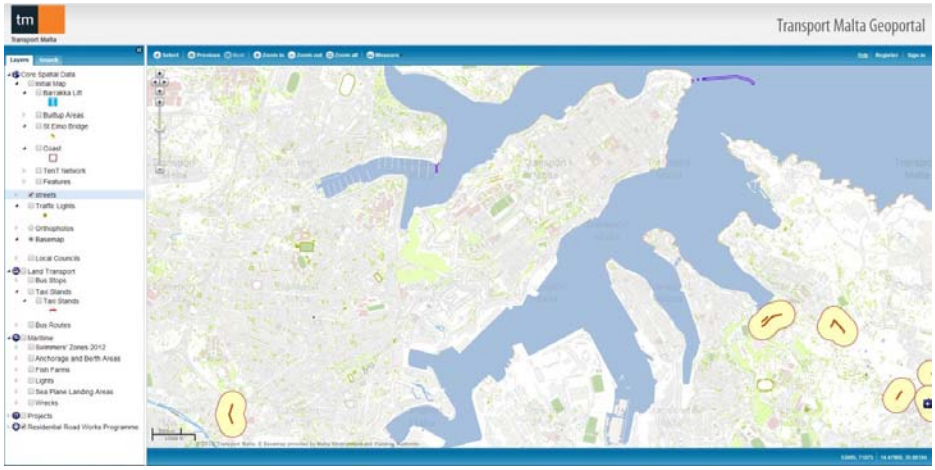


Figure 8. Residential road works programme.

PART C. BEST PRACTICE VIGNETTES

SPAIN

"CartoCiudad", the Official cartographic Data Base of the Spanish cities and villages with their streets and roads networks topologically structured. It has been built from the harmonization and integration of official digital cartography and information produced by several of the main suppliers of Geographical Information in de National Government of Spain: the General Directorate of Cadaster, the Statistical Office, the Post Office and the General Directorate of the National Geographic Institute. Its data make up a continuous collection of information over which it is allowed to carry out operations of cartographical visualization (both urban and non-urban zones) with no gaps, navigation on the Spanish road-street network, spatial analysis and direct and inverse location searches. "CartoCiudad" Data Server in one of the data servers accessible at the Spanish NSDI (IDEE). Users and added value services providers can use these data through different OGC services (WMS, WFS, CWS, Gaz…).

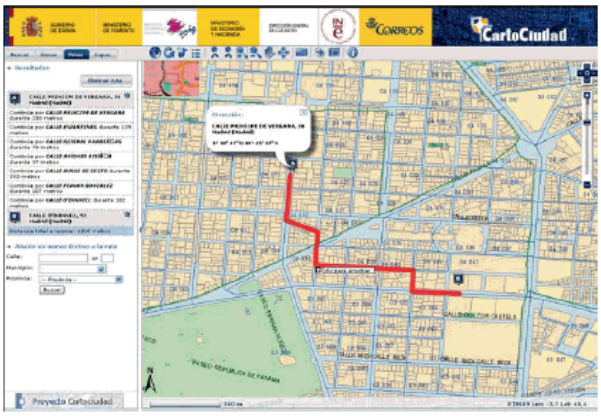


Figure 1. Cartociudad viewer (www.idee.es).

CartoCiudad was born within the philosophy set in the strategic objective 4th of the Strategic Plan of the General Directorate of the National Geographic Institute (IGN-E): "To cooperate to the economic and social development of Spain according to its commitments". This is performed through several operative objectives as "To promote products and services taking into account the society and citizens needs and to guarantee the general access to them, as well as to promote among the GI public and private sector quality, competitiveness and technical development". Therefore, the commitment acquired by CartoCiudad in this sense is to set up and to keep its Database and Services. CartoCiudad is the official cartographic Data Base of the Spanish cities and villages and their streets and roads networks topologically structured, with spatial continuity all over Spain. This project, which has vocation of becoming the streets "official" Database of the National Government of Spain, is the result of harmonization and integration of official digital cartography and information produced by several of the main sources of Geographical Information in de National Government of Spain.

CartoCiudad is a component of the Spanish NSDI (IDEE) as a GI structure composed of data distributed in different GIS systems and accessible via Internet with a minimum of protocols and standardized specifications. CartoCiudad get national coverage of Reference and Thematic Data shared by the three government levels (National, Regional and Local). These national projects are developed according to data harmonization specification for jointly to produce and share GI. The access to these GI projects is set up by OGC (Open Geospatial Consortium) Services.

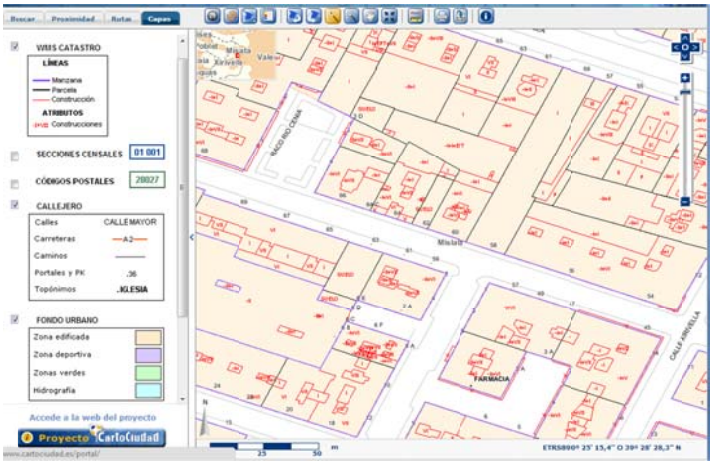


Figure 2. Cartociudad showing a cadaster layer. (www.idee.es).

CartoCiudad project began in 2005 with the methodological analysis and a pilot test. During the year 2006, it began the process to create the CartoCiudad Database for 323 Spanish municipalities. Among these are included municipalities bigger than 50,000 inhabitants as well as other many of smaller population. These municipalities processed mean 51.52% of the total population from Spain. Processing was performed by specialized companies by public tenders. Using automated processes the CartoCiudad Database quality control for the 323 municipalities was performed between the end 2006 and the beginning of 2007. The works have continued until now incorporating a huge amount of cities and nowadays IGN/CNIG is migrating their DDBB to a free software environment (PostgreSQL), therefore Cartociudad is migrating too to the new data model PostgreSQL-PostGIS.
CartoCiudad Project has confirmed the collaborative way of working among the three levels of Spanish Administration. CartoCiudad shows the capability to harmonize geographic information from different sources to get new uses from the resulting GI. The access to the official CartoCiudad information will improve many different services from the participant institutions and from the public and private sectors. And it will generate, with no doubt, a very important added value chain of many applications and services with specific performances of public or private interest.

PART C. BEST PRACTICE VIGNETTES

EGYPT

1. Location of the studied area

The study area is located between longitude 310 50`and 320 15` E and latitude 300 45` and 310 00`N. It is situated north-east of Cairo, east of the Nile Delta, south of the Manzala lakes and west of the Suez Canal as shown in figure 1 below. The total surface area of the study area is approximately 103,000 hectares. Three test areas based on soil types and management processes were selected within the study area to subsequently develop a crop growth model for precision farming technology. A detailed description of the soil types and management processes. The total area for test area one is approximately 37.29 hectares, test area two is 19.8 hectares large while test area three is 8.69 hectares. The study area is highly heterogeneous comprising three main zones i.e., coastal plain, alluvial plain and an interference zone lying in between. This area is considered as an unstable ecosystem due to the active degradation processes resulting from climate, relief, soil properties and inadequate farming system. The most active factors of land degradation are; wind, water erosion, water logging, salinisation and compaction. On the other hand, land reclamation processes are very active in this study area due to human activities. The land use and land cover systems are agriculture, bare soil, sand area, sabkhas, swamps, salt, fish farms, water bodies and urban areas.

2. Object based image analysis

As mentioned above the object oriented image analysis classification was performed using eCognition software which it is specialist for object based classification approach. The basic processing units of object-oriented image analysis are image object or segments, not single pixels. The object oriented image analysis was used to extract land use and cover classes in the whole study area on all the scenes (Landsat TM, ETM+ and SPOT 5). The classification of the crop types on the three test areas was done using only the SPOT 5 scene due to the high resolution (2.5m) of SPOT 5 data which it was suitable to delineate the different management zones in small farmland scale in test areas.This procedure involves segmentation (bands selection, bands weight, segmentation parameter determination, and segment hierarchical levels), sample selection, feature selection and classification. The software offers two classification algorithms: standard nearest neighbour and membership function.

3. Image segmentation

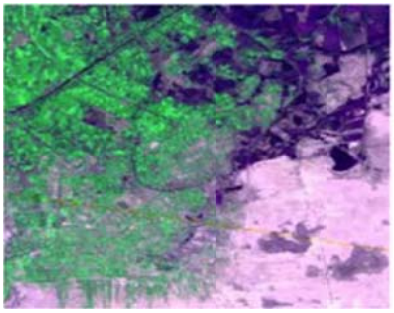
Object oriented processing of image information is the main feature of eCognition. The first step in eCognition was to extract image object primitives by grouping pixels. The image objects became building blocks for subsequent classifications and each object was then treated as a whole in the shortest possible time. After segmentation, a great variety of information was derived from each object for classifying the image. Throughout the segmentation procedure, the whole image was segmented and image objects were generated based upon several adjustable criteria of homogeneity in colour and shape. Two systems were used for image segmentation, original bands and original bands plus transformed bands (PCA, TCT and NDVI).

4. Image segmentation for the whole study area (TM, ETM+ and SPOT 5)

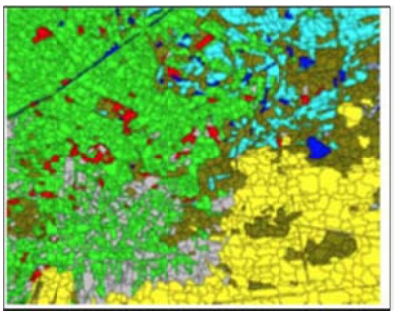
Several combinations of input image channels were tested and the resulting segmentation was visually evaluated (Lennartz and Congalton, 2004). Two segmentations were performed. Firstly, band 5 of the original TM and ETM+ data was attributed a weighting of 1 and considered for the segmentation. Band 3 in the original SPOT 5 was attributed a weight of 1 and considered for the segmentation. The original TM bands (1, 2, 3, 4, 7) and SPOT 5 bands (1, 2) were attributed the weighting value 0 and consequently were not considered for the segmentation due to the fact that they do not provide sufficient information on the land use and land cover classes in the study area. A second segmentation was later performed using the original TM and ETM+ bands and transformed bands (PCA, TCT and NDVI). The original bands and transformed bands (NDVI and PCA) were used for SPOT 5 data analysis. The composition of homogeneity criterion was: colour 0.8, shape 0.2. For the shape criterion, smoothness was 0.9 and compactness was 0.1. The composition of homogeneity criteria was the same for the Landsat and SPOT images. The purpose of performing multi-resolution segmentation is to form image objects, which are the basic building blocks in object oriented image analysis. In object oriented image analysis, these object-pixel groups will be treated as a whole in the classification. The segmentation with the scale parameters 5, 10, 15, 20 was tested for the Landsat scenes. In the visual comparison and feature space plot evaluation a scale parameter of 10 was selected because the segmentation result fits the information class extraction best in TM data. On the other hand, a scale parameter of 200 was selected for the SPOT 5 (2.5 m spectral resolution) after testing scale parameters 20, 50, 100, 150, 200, 250 and 300. Figure 1 below shows the image segmentation and different scale parameters between TM, ETM (scale parameter 10) and SPOT 5 (scale parameter 200) data.

5. Image segmentation in the test areas (SPOT 5)

Multi-resolution segmentation, in particular, extracts regions of local contrast. The algorithm uses a description of heterogeneity weighted by the size of the image objects. Multi-resolution segmentation was also applied in these small test areas (which deviate in tone from their surroundings) with a smaller scale parameter, extracting principal image objects of smaller average size. The original and transformed (PCA and NDVI) bands were included for the process. Band 3 of the original SPOT 5 data was attributed a weighting of 1 and considered for the segmentation. The original SPOT bands (1, 2) and transformed bands (NDVI, PCA) were attributed the weighting value 0. The scale parameter was set at 20. The composition of homogeneity criterion was: colour 0.8, shape 0.2. For the shape criterion, smoothness was 0.9 and compactness was 0.1. Scale parameters 5, 10, 15, 20, 25, 30, 50 were tested and evaluated by visual comparison and feature space plot. Scale parameters of 15 and 20 were selected because the segmentation result fits the information class extraction best in SPOT data. Figure 2 shows the segmentation results in the three test areas with different scale parameters

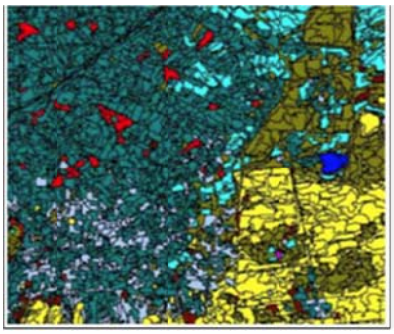


TM 1990

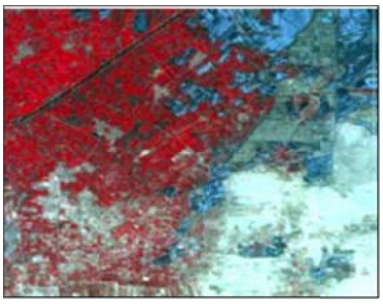


Scale parameter 10 for TM

EMT+ 1999



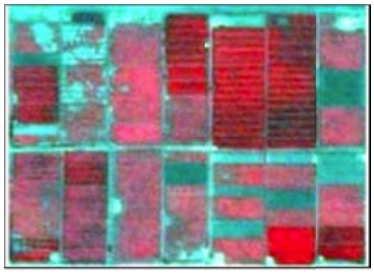
Scale parameter 10 for ETM+



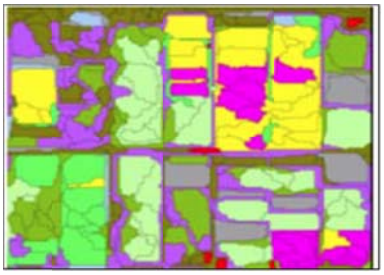
SPOT 5 2.5 m MSS

Scale parameter 200 for SPOT5

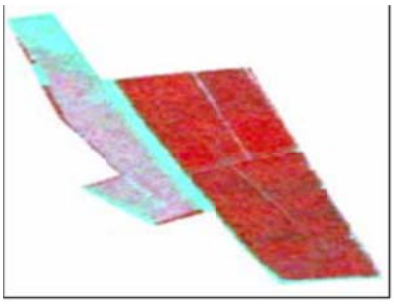
Figure 1. Different scale parameter depending on the different image resolution.



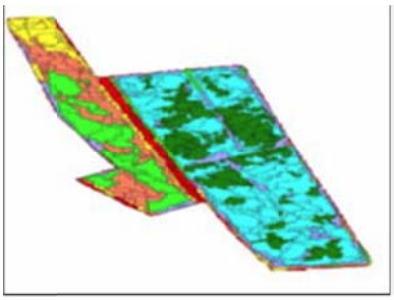
SPOT 5 data for test area one



Scale parameter 20 for test area one

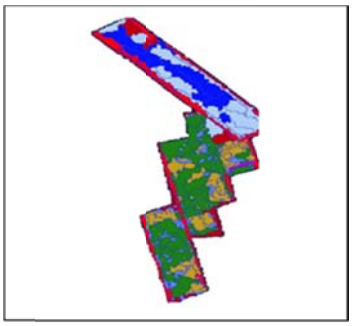


SPOT 5 data for test area two



Scale parameter 20 for test area two

SPOT 5 data for test area three



Scale parameter 20 for test area three

Figure 2. Scale parameters in the small area (test areas) for high resolution data

6. Image classification based on object oriented image analysis

Multi-resolution segmentation was followed by classification of the primitive objects of each level into semantic objects. The object oriented classification included several stages. In the first stage, the thematic classes were identified and their classification features were defined. Classes and features were then represented within the object oriented knowledge base environment of eCognition. Classification followed by samples selections, standard nearest neighbour operator (SNN) and membership function definition. image segmentation, classification and accuracy assessment. Since the different segmentation levels tested in this study have already been explicitly documented in the methodology, this section will focus on presenting the results of the classification and subsequent accuracy assessment. As mentioned before, object oriented image analysis was used to classify the whole study area and the test areas. The classification of the whole study area was important to monitor the changes in land use and land cover, i.e. to give indictors of land use increase or decrease (especially agricultural) related to the active land reclamation and increase in population in the study area. The three test areas were used to test the ability of segmentation processes to separate the crop types because the old agricultural land had very small land parcels and different crop types all close together. Also, the extent of applying remote sensing and image interpretation for precision farming in Egypt was tested on these areas.

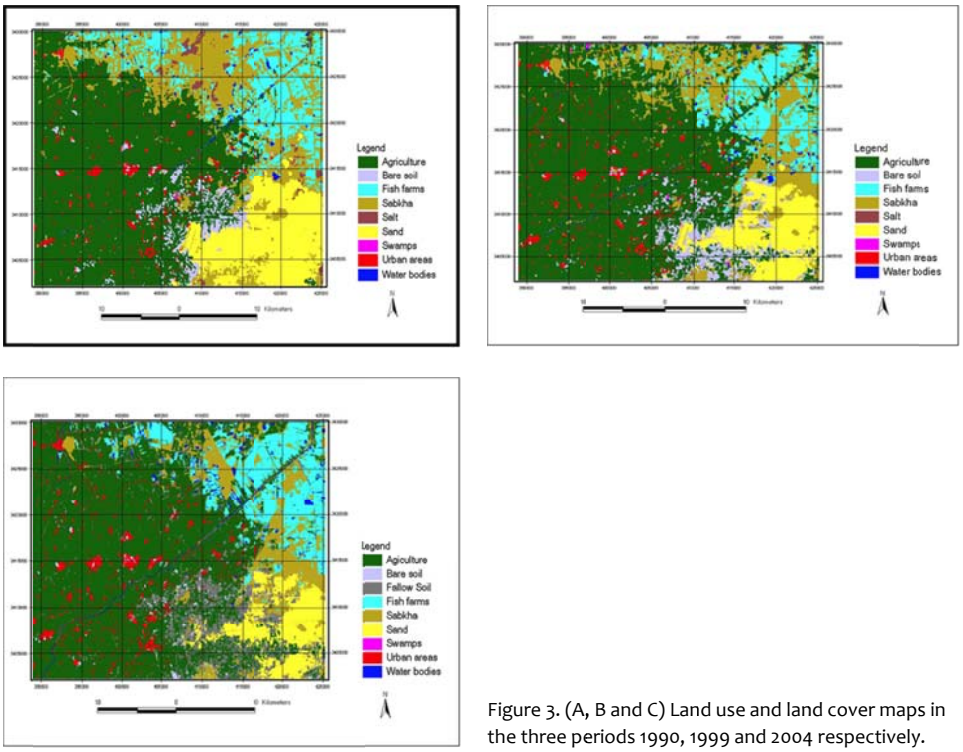


Figure 3. (A, B and C) Land use and land cover maps in the three periods 1990, 1999 and 2004 respectively.

The object based classification was performed using Landsat (TM and ETM+) and SPOT 5 images. It should be remembered that transformed bands were calculated from the original images and included in the image analysis. Using discriminant analysis the bands that could best separate the nine classes in the whole study area were determined. For Landsat, the best set of bands was Tasselled Cap 5, NDVI while for SPOT 5 they were Band 3 and PCA. The standard nearest neighbour was applied to define the thematic classes. Figure 3 (A, B and C) shows the classification results of the object oriented interpretation for land use and land cover in the study area by using the low resolution satellite data (TM and ETM+) in 1990 and 1999 respectively and high resolution SPOT 5 data in 2004.

The classification of the three test areas was done from coarse levels to more detailed levels using the high resolution SPOT 5 image (2.5m). The standard nearest neighbour was selected to extract thematic classes from the first level to classify the main classes in each test area; for example in agriculture, sabkha and fallow soil in test area one; agriculture and road in test areas two and three. In the subsequent level, the class agriculture was classified into field crops by using the membership function based on the mean values of band three. After testing all the bands, band three was selected. The last level was the classification of the field crops depending on the yield (high, medium and low) using membership function. Figure 4 (A, B, and C) shows the results of object based classified maps of the SPOT 5 image for the three test areas. The classified maps clearly show the pattern of crop growing areas and crop yield.

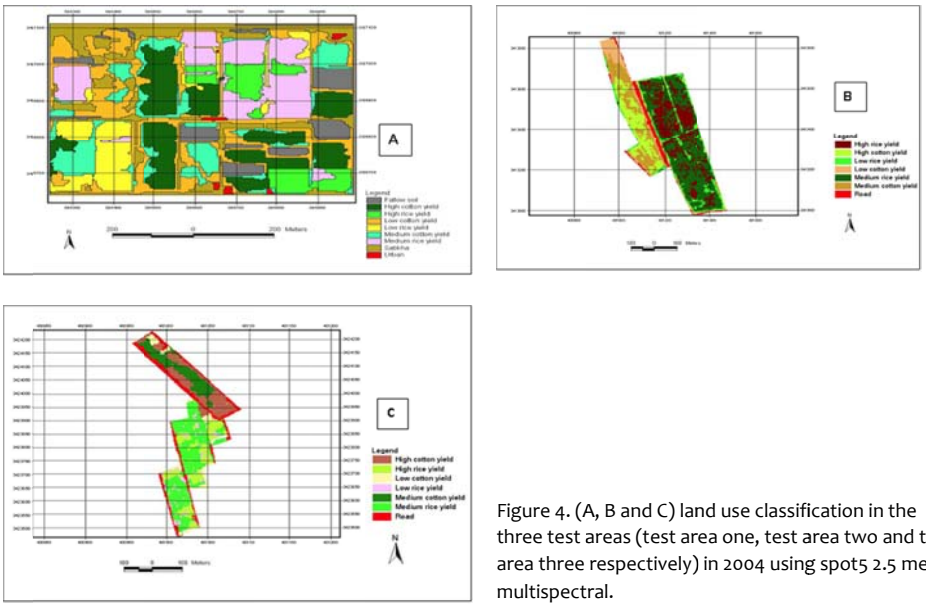


Figure 4. (A, B and C) land use classification in the three test areas (test area one, test area two and test area three respectively) in 2004 using spot5 2.5 meter multispectral.

7. Post classification comparison change detection

In this research study a fourteen-year time span, (1990 to 2004) was investigated, which is a short time span in a long history of land cover and land use. This time period was chosen based on the availability of data in the study area. In the last two decades, the Eastern part of Nile Delta has been amongst the most dynamic and highly changing areas in Egypt. The area has been affected by many natural and human activities. Results obtained from current and previous land cover studies basically summaries the main factors responsible for these changes, which include increase in the total cultivated land, active urbanization processes, decreasing sabhka and sand. The land use and land cover change detection was assessed using traditional post classification cross-tabulation approach. Possible change and no change classes were identified. Nine major land use and land cover classes were selected for analysis. Changes in the land cover were unidirectional for all land use and land cover. The absolute rates of change for sand, salt, swamps, sabkha, fish farms and bare soils were lower during the period 1990-2004. These decreased areas have been converted into agricultural land and urban areas, which have consequently have increased. The overall rate of change in land use and land cover for each interval was highest for agricultural land and lowest for water swamps. Figure 5 (A, B, and C) shows the land use and land cover changes maps in the different three periods (1990-1999, 1990-2004 and 1999-2004 respectively).

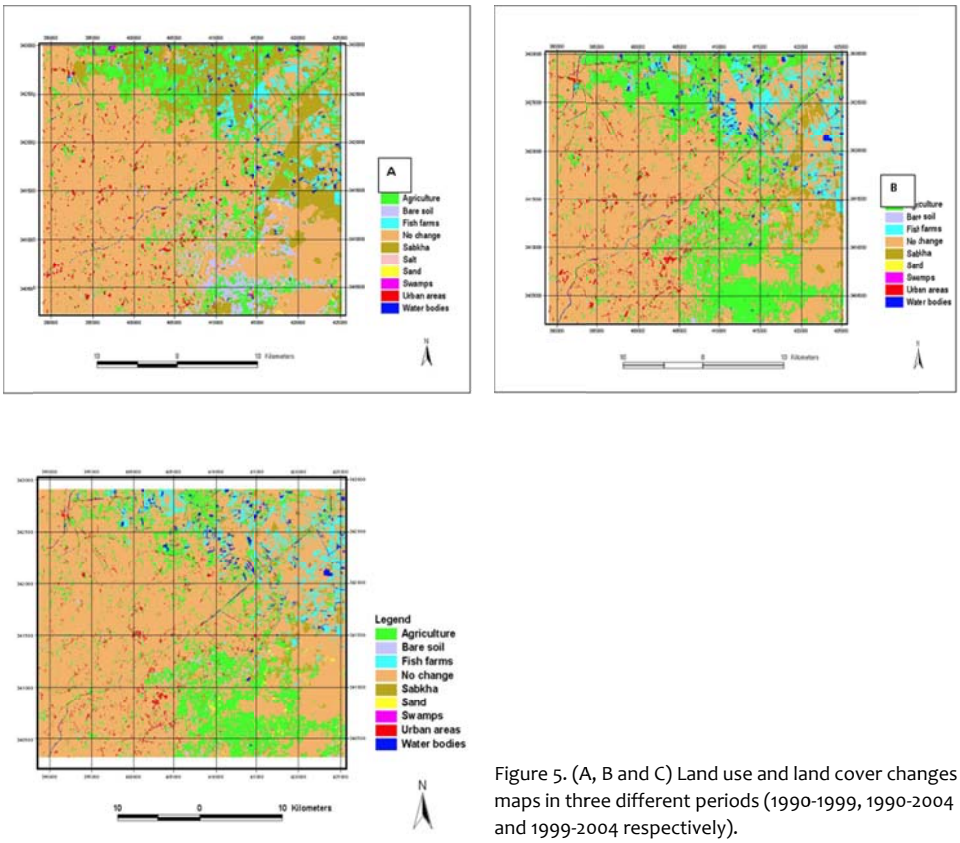


Figure 5. (A, B and C) Land use and land cover changes maps in three different periods (1990-1999, 1990-2004 and 1999-2004 respectively).

Reference

Belal, A.A., (2006): Precision Farming in the Small Farmland in the Eastern Nile Delta Egypt Using Remote Sensing and GIS. PhD thesis, Freiburg University, Germany.

PART C. BEST PRACTICE VIGNETTES

JORDAN 

1. Objectives

The specific objectives of Municipal Services and Infrastructure (survey, baseline and database--MSI) project are to:
Support municipalities and MOMA to develop a municipal infrastructure baseline and establish minimum acceptable infrastructure and service standards for the services the municipalities provide;
Help put in place systems that ensure these standards are met and proper infrastructure planning is implemented3

2. Participating municipalities

The following 13 municipalities are participating: Greater Irbid, Greater Mafraq, Greater Ajloun, Greater Jerash, Zarqa, Greater Salt, Greater Madaba, Greater Karak, Greater Tafilah, Greater Maan, Ain Al Bash, Maadi, Showbak.

3. Tasks

There are 3 main municipal tasks as follows:
Task 1. Municipal infrastructure inventory and condition assessment
Task 2. Municipal fixed asset inventory and database
Task 3. Municipal capacity rapid self-assessment diagnostic survey and tools
In addition, there are 3 other tasks related to MOMA and including capacity building, technology transfer and training.

4. Task and sub-task objectives

The following are the key Task objectives:

4.1. Task 1: Municipal Infrastructure Inventory and Condition Assessment

The ultimate objective of this early baseline is to provide the basis to develop an integrated municipal infrastructure and services delivery strategy for each Municipality and for MOMA, and to build capacities at municipal level for viable Infrastructure Planning functions, to identify infrastructure requirements and priorities according to the strategy, and identify the following:
To identify the state of existing infrastructure assets and their conditions with the aim of considering them in the planning. This also includes the infrastructure renewal and determining the maintenance costs.
To evaluate the level of performance demanded for the municipal infrastructure with the aim of evaluating the needs.
To prepare a preliminary technical evaluation of the infrastructure to build, showing dimensions, characteristics, and cost.
To prioritize the list of needs in infrastructure taking care of the available funding.

[3] RFP, Regional and Local development Program, Loan # 7422-JO, CJO 3002 02 N, Municipal Services and Infrastructure (Survey, Baseline and Database), Amman – Jordan, 30-4-2008.

To promote a public consultation with the aim of finding the population and stakeholder consensus to the proposed planning.
Sub-Tasks and Objectives
Task 1.1: Quick stocktaking and rapid review of existing databases of municipal infrastructure, previous studies and pilot/good practices in Jordan.
Task 1.2: Develop the infrastructure baseline for all the municipalities, in terms of both the inventory of municipal infrastructures within the municipal territory and their conditions (i.e. this will imply setting quality standards for each infrastructure type).
Task 1.3: Identify key performance indicators (KPI) and performance targets (KPT) to be used also to update the annexes of the Municipal Compact.
Task 1.4: Prepare a basic methodology for investment planning, and related Capital Budgeting and Capital Improvement/management Planning.
Task 1.5: Transfer to Municipalities and key stakeholders (e.g. MOMA, CVDB) the methodology of how to carry out the Inventory and Condition.
Task 1.6: Propose joint multi-sectoral municipal infrastructure planning methodology and targets.
Task 1.7: Propose an institutional framework at municipality and regional levels for infrastructure planning and development.
Task 1.8: Develop and conduct capacity building and training programs of the LPDU at the target municipalities.

4.2. Task 2: Municipal Fixed Asset Inventory and Database

The main objective of the asset database is to enhance municipal management from strategic development planning, to planning preventive and periodic maintenance, planning operation of facilities and equipment, planning revenue generation, billing and collection of locally generated revenues, and last but not least for financial management (budgeting, revenues and expenditures, periodic monitoring of financial management, fiscal planning, and annual financial statement reporting). In addition, the task includes the preparation of a Model for Asset Management Plan and Database for all municipalities as follows:
The Modular design of asset management plan, database and strategy should reflect the following functional requirements or components:
Asset value: It must be recognized that municipal infrastructure assets have monetary value.
Life cycle management: Assets have a limited life expectancy, and their rate of deterioration can be estimated.
Sustainability: An asset management plan should identify a financial plan to sustain the assets. The financial plan should ensure that resources are available to operate, rehabilitate and, ultimately, replace the assets at the optimum time to achieve the lowest life cycle cost.
Integration of Technical and Financial Plans: Develop a model asset management plan for a large municipality of population above 1m inhabitants that minimizes life cycle costs for infrastructure assets while maintaining an adequate level of service. An asset management plan should also include a financial plan that identifies the financial investment level required from the public.
Inventory of Municipal Assets (fixed and non fixed): The model shall include a complete list of assets with functions for a detailed breakdown for assets with sub-systems. Initially, the consultant will input the information available but set up the methodology and system for verification of data by municipalities upon building institutional capacity.

Valuation of Municipal Assets: Design of the module to input the value of assets but it is not required to actually undertake the valuation. Such valuation will be carried out by the municipality on its own upon receiving training.
Inventory and Stock of Spare Parts and Consumables: The model shall include the functions for inventory under assets requiring consumables and spare parts. Municipalities would complete the database on its own.
Openness and Transparency of Evaluation: The module shall be designed with functions for friendly verification. Evaluation of assets shall follow Client approved and accepted criteria and procedures following internationally accepted standards.
Municipal Assets Financial Statements: The model shall be designed to enable producing periodic financial statement and projections of revenues and expenditures.
Analytical Tools to Evaluate Options for Asset Use and/or Disposal: The model shall facilitate the use of analytical tools to evaluate options for asset use and or disposal.
Assets and the Municipal Financial Management Information System: The consultant is expected to coordinate with the Municipal Financial Management Information System team to establish cohesiveness between the asset inventory and infrastructure database and baseline.

4.3. Task 3: Municipal Capacity Rapid Self-Assessment Diagnostic Survey and Tools

The main objective is to develop a self-assessment tool relevant to Jordanian municipalities and test it out in on a sample of pilot municipalities (Irbid, Salt, Zarqa and Karak) before training all the others to carry out the rapid self-assessment and diagnostic survey on their own, with minimum technical assistance support.
Additional tools to be developed to integrate the Self-Assessment of the quality of delivered services would include a survey of the users/citizens (e.g. balanced score cards, quick opinion surveys, etc).

5. Issues and data requirements

5.1. IT Capacity

- Networks and Systems
- Equipment
- Staffing
- Usage for management and planning

5.2. GIS Capacity

- Mapping
  - Layers
  - Date
- Licenses
- Staffing
- Usage for management and planning

5.3. Infrastructure Inventory Data

- Direct Responsibility
  - Roads
  - Street Lighting
  - Storm Water
  - Solid Waste
  - Retaining Walls??

- Indirect Responsibility
  - Water
  - Waste Water
  - Electricity

5.4. Infrastructure and Services Condition Data
- Internal Assessment
- Public assessment

5.5. Asset Inventory
- Equipment
  - Construction and Maintenance Equipment
- Buildings
  - Markets
- Vegetable
- Goods
- Meat
- Mixed
  - Main Municipal Buildings
  - Commercial Building Owned
  - Commercial Building Rented
- Lands
  - Main Municipal Buildings Lands
  - Main Municipal Services lands
  - Lands used for commercial purposes
  - Miscellaneous Lots in subdivisions
  - Lands held for road and other reservations
  - Other Lands for which the purpose is not determined

5.6. Municipal Budget Data (2007-2009)
- Overall Income and expenditure
- Capital Expenditure
  - Capital expenditure on Infrastructure,
  - Capital expenditure on Equipment
  - Capital expenditure on Buildings
  - Capital expenditure on Lands
- Recurrent Expenditure
  - Recurrent expenditure on Infrastructure asset maintenance
  - Recurrent expenditure on Equipment asset maintenance
  - Recurrent expenditure on Buildings asset maintenance

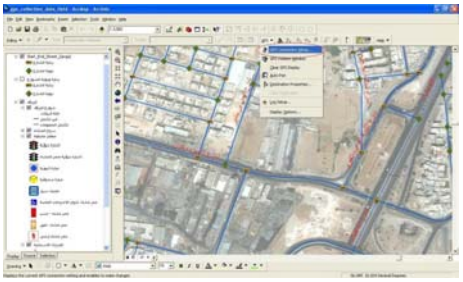
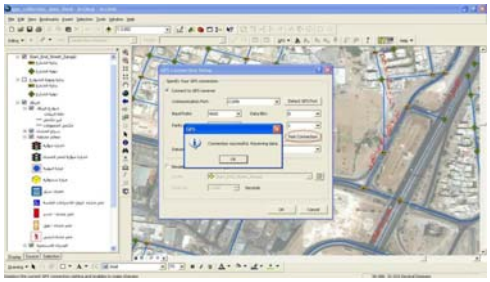
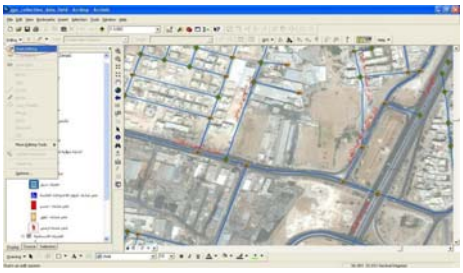
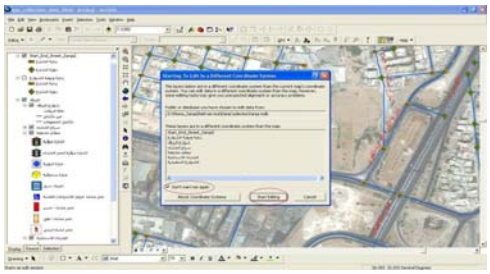
5.7. Organization and Staffing
- Overall Organizations Chart
  - IT Department
  - GIS Department
  - Engineering Department
  - Urban Planning Department
  - Accounting Department

- Properties Department
- Public Information Department

5.8 Municipal Capacity Rapid Self-Assessment Diagnostic Survey and Tools

- Questionnaires being prepared for Municipalities to fill in.

These are some figures related to the database project:

PART C. BEST PRACTICE VIGNETTES

LEBANON

1. Introduction

Urban expansion on natural and agricultural lands and coastal cities management was developed with the support of UNEP and EU (http://planbleu.org/sites/default/files/publications/villes_lbn_syr_tur.pdf).

The Global Urban Observatory (GUO) implemented an exercise on urban mapping from space using satellite images and Geographical Information Systems (GIS) technology to analyze the population situation and needs. The information gathered and researched provides a database of statistics and indicators on the state of urban development in Lebanon and around the world. Figures from 2010, show that 87% of the population in Lebanon currently lives in urban areas with the majority–estimated 64% –residing in large agglomerations mostly in the metropolitan areas of Beirut and Tripoli (http://unhabitat.org/lebanon/). The urban economy is dominated by the service sector where most of the country's working force is employed (41.6%), followed by trade (22.6%), industry (13.8%), and agriculture (7.2%). Beirut in particular, which comprises one third of the total population in Lebanon, contributes to roughly 75% of the total country economy (World Bank, 2008).

The JRC, CNRS and UN HABITAT workshop held in Beirut/Lebanon on the 14-15-16 February 2012 at the CNRS Center for Remote Sensing demonstrated the derivation of City relevant indicators to pursue and deepen the analysis of remote sensing imagery at the national level using automated mapping with high resolution satellite imagery.

Thus the need to create national urban observatory. This observatory would allow deriving the following information and urban indicators:

Box 1: Satellite based indicators calculation

1. Built-up area (relative)
   - Sum of area of buildings divided by the area of the administrative unit
2. Average building size (m²)
   - Sum of the area of buildings divided by the number of buildings
3. Average height (m)
   - Sum of the height of buildings divided by the number of buildings
4. Average volume (m³/m² of administrative unit)
   - Multiplying the area of a building with the height of the building to derive the volume per building
   - Sum the single volumes to derive the total volume per admin unit
   - Divide the sum by the sum of the area of the administrative unit to derive the average volume
5. Building density per hectar
   - Number of buildings in a given admin unit divided by the area of the unit in m² then multiplied by 10.000 to derive the number/ha
6. Vegetated area (relative)
   - Sum of area with NDVI > 0.3 divided by the area of the administrative unit

2. Services

2.1. Human development

UNDP has been assisting the Lebanese Government in various sectors of social development, including the Integrated Rural Development Program of Baalbeck-Hermel, the Reintegration and socio-Economic Rehabilitation of the Displaced Persons, Post-conflict

Rehabilitation in Southern Lebanon, Reform of the Basic Education Program, and Strengthening Institutions for Women Enterprise Development. Furthermore, UNDP cooperates to improving the state of statistics on living conditions, notably through a National Household Living Standards Measurement Survey (CAS, 1998), a Manpower and a Labor Market Survey (NEO, 1997) and a Gender and Poverty Profile of Baalbeck-Hermel. The "Mapping of Living Conditions for Lebanon" is the first mapping to be undertaken in Lebanon. It focuses on the level of satisfaction of Basic Needs and poverty. It is essentially an analysis of the data produced by the Housing and Population Survey conducted by the Ministry of Social Affairs. The Mapping of Living Conditions for Lebanon is designed to provide sufficient information needed for the elaboration of program and projects aimed to improve living conditions in Lebanon. Its objective is not limited to the presentation of further data, rather to be used as a tool for policy makers in targeting their interventions for social development, where it is relevant. The Mapping for Living Conditions has so far culminated in the elaboration of a project aimed to formulate a National Program for Improving Living Conditions of the Poor in Lebanon". Through this project, UNDP will support the efforts of the Ministry of Social Affairs to design a national program of action, implement targeted interventions in disadvantaged areas and promote the participation of all sectors of society and the government to work together towards improving living conditions in Lebanon (http://www.undp.org.lb/programme/pro-poor/poverty/povertyinlebanon/molc/sotundp.htm).

2.2. Protected areas

The UNEP is funding project on protected Mediterranean areas (PMA), implemented at the MoE (2014). The project aims at promoting the local development and sustainability of protected areas in Lebanon through building geodatabase on biota serving the elaboration of management plan and the production of thematic maps for users, visitors and local governance. Specifically, the project is targeting the use of remote sensing and GIS as geospatial application for local management for the assessment of the state of geoenvironmental setting, identification of natural and human risks to PMA arising from land cover/use change environmental and manmade risks in nesting areas. Local administrations and technical experts will maintain a shared platform for the participatory diagnosis of problems and sharing of solutions, indicators and good practices.

Through developing geographic information database, the project will exchange and propose joint initiatives, strengthen know how and capacity of stakeholders and local administrations to improve their management and ability to provide sustainable services for the citizens and the administrations to enforce good governance. The protected areas were mapped recently by GFA Consulting Group with the support of the EU for better management (http://www.cdr-adelnord.org/5/8/5/7/0/9/Rapport_mission_Parc_-_Version_finale-low2.pdf).

2.3. Environment and Biodiversity

The State of the Environment report in Lebanon (2011-2012), with a slightly revised title "State and Trends of the Lebanese Environment" in line with global calls to not only understand the current situation but also assess current trends and future environmental change including water sector, forestry, biodiversity, air quality and other environmental threats. Funded by the Lebanese Government/Ministry of Environment (MOE) in coordination with the United Nations Development Program (UNDP), this edition follows two earlier versions, the first issued in 1995/1996 with funding from the Mediterranean Technical Assistance Program through the World Bank and the second in 2001/2002 with funding from the Lebanese Government in coordination with UNDP

(http://www.undp.org/content/dam/lebanon/docs/Energy%20and%20Environment/Publications/SOER_en.pdf).
The UNDP funded a project for the mapping of bottle neck area for the migrating birds (2013). Also, it supported the mapping of the Palm and Rabbit Islands in North Lebanon for the identification of slightly and heavily oiled shores polluting and threatening wild life. Also, the land cover and trails of Jabal Moussa was supported by the EU but later on it was developed into UNDP supported small project (2013) to map wildlife trails including birds, hereptiles and mammals which were mapped to promote ecotourism and protect wild life in the reserve. A special attention was paid to spatially identify the core zone, buffer zone and development zone.

2.4. Flood
A previous project (2002) supported by the UNDP and GTZ (GIZ) and Spanish Cooperation implemented a project to map the vulnerable zones for flush floods in north east Lebanon and identification of suitable sites for anti-erosion measures and water harvesting to protect life and infrastructure in this affected area.

2.5. Forestry
The first National Forest and Tree Assessment based on systematic sampling in Lebanon was implemented by the Directorate of Rural Development and Natural Resources (DRDNR) of the Ministry of Agriculture as a project (TCP/LEB/2903) during 2003-2005 under the Technical Cooperation Program of the FAO. This information is used for sustainable management of forest resources based on an environmentally, socially and economically balanced forest policy and development of a National Forest Action Plan.
(http://www.fao.org/forestry/15565-0f921641e230ef06f11d15b8856f2ff07.pdf).

2.6. Forest bioclimatic zones in Lebanon
According to altitude, the Lebanese mountains are divided into bioclimatic zones, namely the Thermo-Mediterranean, Eu-Mediterranean, Supra-Mediterranean, Mountainous Mediterranean and Oro-Mediterranean zones.
The Lebanon Reforestation Initiative is a project funded by the United States Agency for International Development (USAID) and implemented by the United States Forest Service (USFS) that provides technical assistance and institutional support for sustainable native tree reforestation and wildfire prevention. With administrative offices in Beirut, LRI technical experts manage a multi-year work program of activities throughout Lebanon in collaboration with grassroots organizations and local communities (http://www.lri-lb.org/mapping.php#mapping).

2.7. Sustainable practices: zero tillage
No-tillage/direct planting system was applied by the German Development Cooperation (GIZ) in cooperation with ACSAD and MoA on Lebanese farms. Acreage for this application increased from 40 du (2 farms) on 2007 to reach an area of 5620 du by the year 2010 (20 farms). Humanitarian issues
The UNHCR developed maps showing the return of Lebanese refugees from Syria in August 2006 (http://www.unhcr.org/453f21484.html) and recent concentration (http://data.unhcr.org/syrianrefugees/country.php?id=122), registration trend and winterization of Syrian refugees across Lebanon (http://www.unhcr.org/pages/49e486676.html) and distribution at the Cadastral level (Even

the maps showing the origin of registered refugees residing on the Lebanese territories are available on line).

2.8. Water studies

In 2012 BGR supported a project assessing the protection of Jeita springs feeding the capital Beirut with drinking water showing the vulnerability of the upper and lower sub basins (http://www.bgr.bund.de/EN/Themen/Wasser/Projekte/laufend/TZ/Libanon/factsheet_gw-vulnerability.pdf?__blob=publicationFile&v=2).

3. Examples

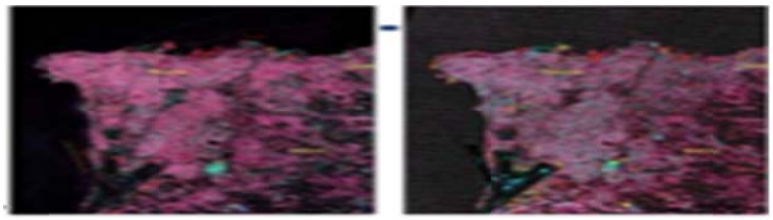


Figure 1. Monitoring of urban land use change in Beirut using Ikonos images.

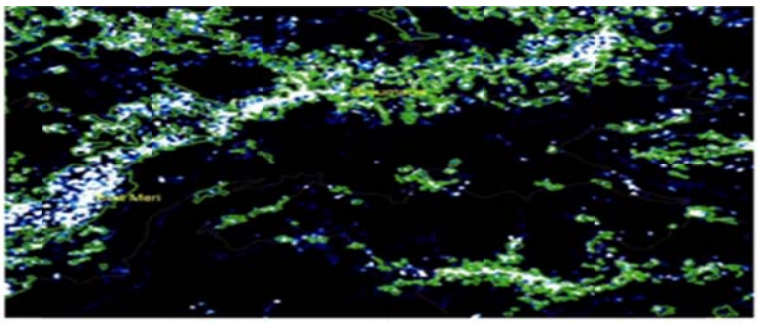


Figure 2. Visual extrcation of urban layer from IKONOS images (in green) versus urban areas (in white) retrieved from the Global Human Setlement Layer.

Figure 3. Urban expansion and major cities.

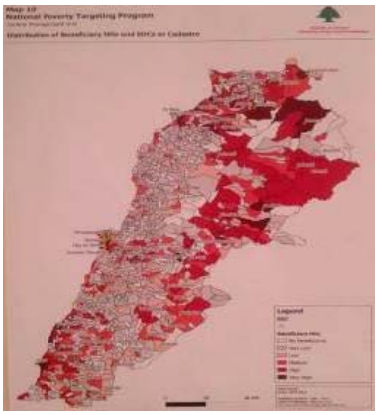


Figure 4. Poverty targeting program: Beneficiary of help.

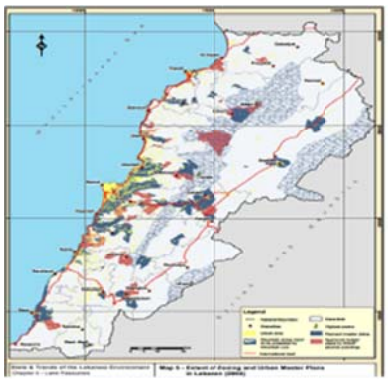


Figure 5. Urban zoning.

Figure 6. Solid waste facilities and disposal sites.

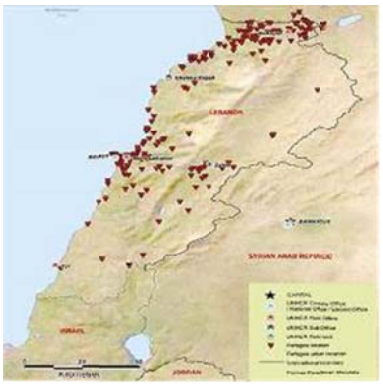


Figure 7. Distribution of Syrian refugees.

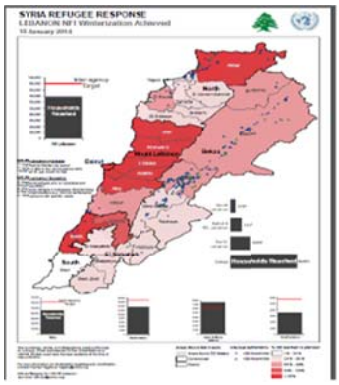


Figure 8. Winterization of Syrian Refugees.

Figure 9. Location of Palm islands in North Lebanon.

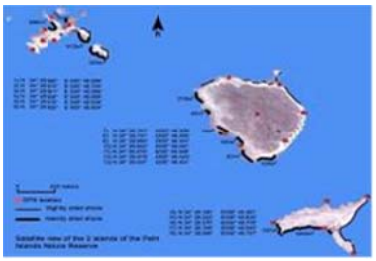


Figure 10. Contamination with oil of Palm islands.

Figure 11. Zonation map of Jabal Mousa Reserve.

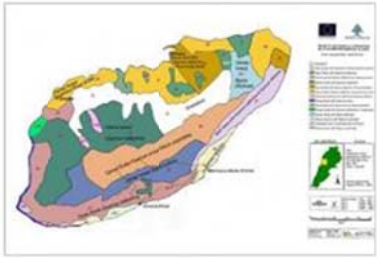


Figure 12. Trail in Jabal Mousa.

Figure 13. Qadisha and cedar reserve.

Figure 14. High Akkar reserve.

Figure 15. Southern coast reserve.

Figure 16. Flood prone area in Qaa, North east Bekaa.

Figure 17. Water harvesting structure at the sub watershed outlet.

Figure 18. Derived forest map of Lebanon.

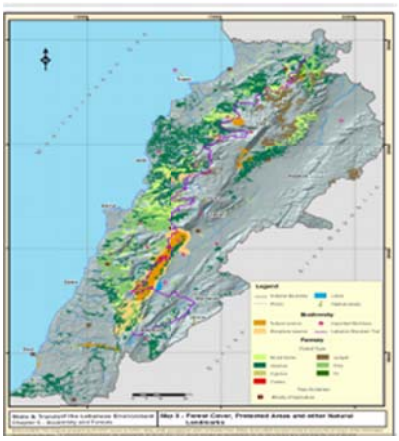


Figure 19. Forest-biodiversity.

Figure 20. Suitable reforestation site.

PART C. BEST PRACTICE VIGNETTES

PALESTINIAN AUTHORITY

The last good practice has to do with the development a functioning road maintenance management for the Ministry of Public Works and Housing (MOPWH) by the Applied Research Institute Jerusalem (ARIJ), a system that improved the efficiency and effectiveness of the Ministry's Maintenance Management Program. This resulted in better services provided to the Palestinian people by the application of enhanced road maintenance operations. This process of developing the system also included a capacity building component. It focused on building the capacity of 30 of the Ministry's staff made up of three female engineers, three male engineers, and ten members of the road maintenance department, ten surveyors and four Geographic Information System (GIS) technicians. Furthermore, 600 ministry staff and numerous decision makers in other Palestinian ministries indirectly benefited from this good practice by using both the collected data and information provided by the system to enhance their own decision making process.

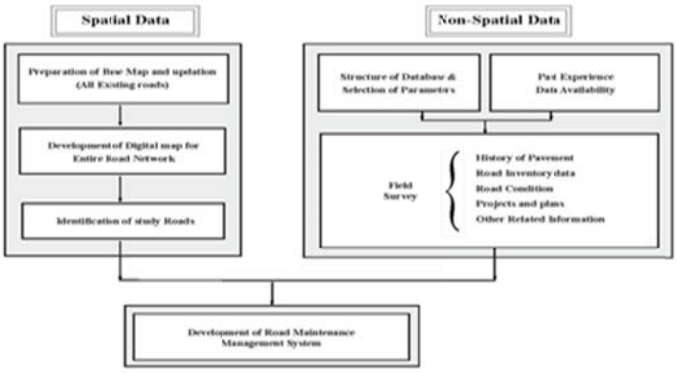


Figure 1. Building Road Maintenance Management Capacity of (MOPWH) Using GIS.

This good practice enhanced the roads maintenance services, helping the Ministry of Public Works and Housing in the decision-making process, based on reliable background information, through the following functions:

- Full integrated database for all public roads network including roads conditions and categorizing the roads according to the maintenance index.
- All data systematically documented within the system designed, developed and operated.
- Reports and digital map for road planning and management.
- The maintenance management system led to efficient retrieval of information which enables decision makers in effective planning towards an efficient road and road transportation system.
- Networking the priorities of maintenance/rehabilitation in a cost-effective repairs; in addition to strengthening the measures and optimal utilization of limited available resources.
- Planning better maintenance management system through database enhancing.

• Roads condition data changes with time and must be updated to reflect such condition changes.

This chart clarifies the development of the system Building road maintenance management capacity using GIS in the Palestinian Ministry of Public Works and Housing (MoPWH). This entire System based and framed into two major blocks: (i) the Spatial Data, (ii) the Non-Spatial Data. The results are displayed graphically highlighting the history of pavement, road inventory data, road condition, projects and plans, and other related information.

Figure 2. Networks in West B.

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