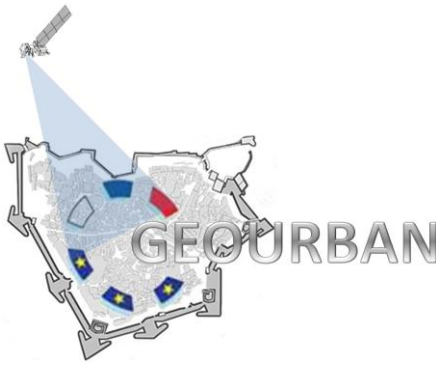
December 2013

Issue 3

GEOURBAN Newsletter



Editorial

As we are getting close to the end of the GEOURBAN project we can look proudly and see the achievements we have reached so far. At the beginning, the consortium members felt that the increasing availability of Earth Observation (EO) technologies has provided new opportunities for a wide range of urban applications. However, they felt also that there's a gap between the research focused results offered by the urban EO community and the application of these data and products by urban planners and decision makers. The goal was to bridge this gap. How? By demonstrating the ability of current and future EO systems to evaluate urban environmental indicators over large areas at detailed level. The Web-based Information System (WIS) reflects the multidimensional nature of urban planning and implements intelligible and transferable indicators which are easily understood and applicable by non-experts. The WIS is accessible via the GEOURBAN web-site and it was demonstrated during an official GEOURBAN Demonstration Event that was held in Basel on November 28

In addition to providing GEOURBAN consortium work progress and achievements information, this Newsletter focuses on GEOURBAN EO activities as part of the Work Packages 3, 7 and 8.

GEOURBAN partners:

1. FORTH **Foundation for Research and Technology, Greece**
2. GRADI Ltd. **Specializes in complex method of urban planning, Russia**
3. GARD Ltd. – **Specializes in HW/SW system developments, Israel**
4. DLR - **The German Remote Sensing Data Center (DFD) of the German Aerospace Center (DLR), Germany**
5. KUZGUN **Specializes in geospatial solutions for urban planning, Turkey**
6. UNIBAS - **University of Basel, Switzerland**

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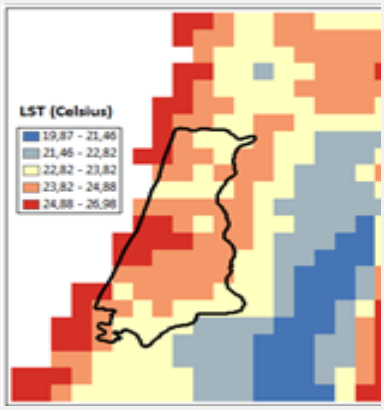


WP3, led by FORTH, is related to EO-based indicators development. It is a central WP in GEOURBAN, because the main research activity focuses on the development of these indicators. FORTH specializes in developing decision support systems for use in environmental, regional, and urban planning, applications of remote sensing techniques, applications of telematics based on digital maps, and applications of spatial statistical analyses.

The Indicators are the result of the synthesis of several EO products at various scales in a way that they result in meaningful information for urban planning and management.
Urban indicators become valuable means in planners' hands, because of their contribution to analyze and characterize urban form and shape, urban dynamics and urban microclimate.

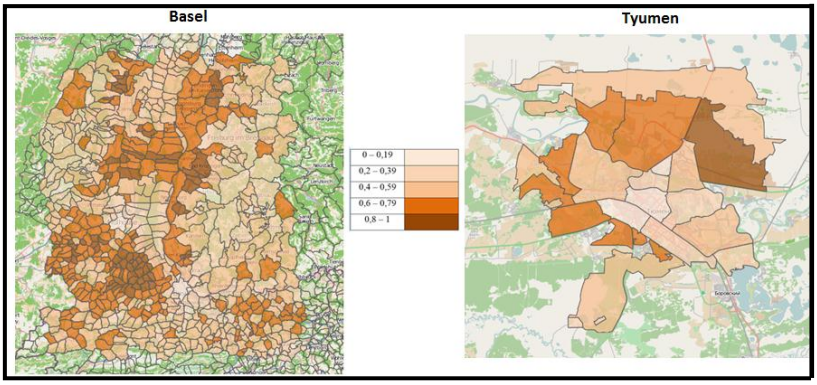
The GEOURBAN EO-based Indicators

Urban environmental indicators are powerful tools in describing urbanization process. They belong to a wider category, the Urban Sustainability Indicators that enable to learn and understand the urban sustainability performance within the environmental, social and economic framework. The great importance of EO urban indicators is based on the ability of easy and quick retrieval by EO data. Therefore, Remote Sensing becomes a unique source of information and methods. Urban management and planning requires tools for decision making support. Urban indicators become valuable means in planners' hands, because of their contribution to analyse and characterize urban form and shape, urban dynamics and urban microclimate.
The method of generating indicators within the GEOURBAN framework of is based on EO data -> products -> indicators schema. Thus, we use for example, raw satellite observations to generate Land Cover maps. Land Cover is the respective EO-derived product, which is further used to generate indicators. For example, the indicator Building Density is derived from Land Cover, by calculating the proportion of the built up areas compared to the total area within specific administrative boundaries. The GEOURBAN Indicators are categorized as follows:

Surface Structure Indicators - extracted from EO products using administrative political community boundaries, or user-defined boundaries (polygons). The value of each indicator is estimated using a dedicated formula within each polygon. The Indicators in this category are:

Density indicators

The **Built-up Ddensity** is the proportion of built-up areas within the polygon boundary. **Open Space Density (OSD)** is calculated as the ratio between the pixels of open spaces and the total number of pixels within the political community boundaries. **Green Space Density (GSD)** is the ratio between the number of pixels of green spaces (forest and grassland) and the total number of pixels within the political community boundary.

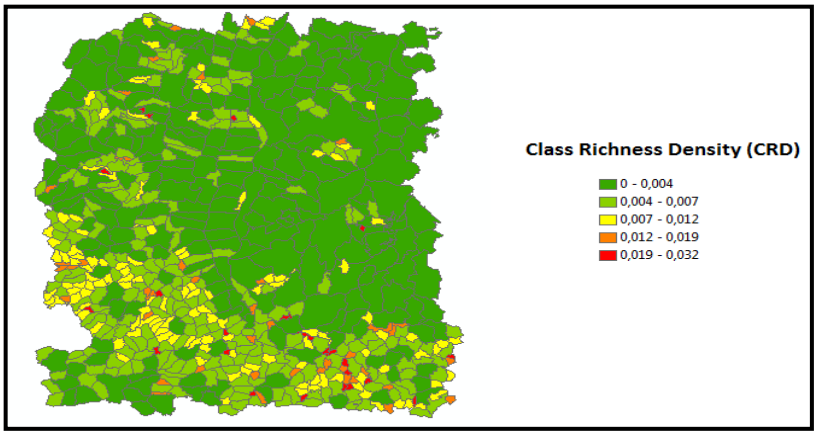


Open Space Density (OSD) for Basel and Tyumen

The GEOURBAN EO-based Indicators (Cont.)

Diversity indicators

The **Class Richness Density (CRD)** is a measure of richness of different land cover classes within administrative boundaries. The **Ecological Effectiveness Ratio (EER)** is the ratio of the ecologically effective surface area to the total land area. The ecologically effective surface area is the result of combining the areas of different ecological parts of the study area, where for each part a weight is suitably assigned.



Display of Basel Map with a Class-Richness-Density(CRD) indicator layer

Area / Edge indicators

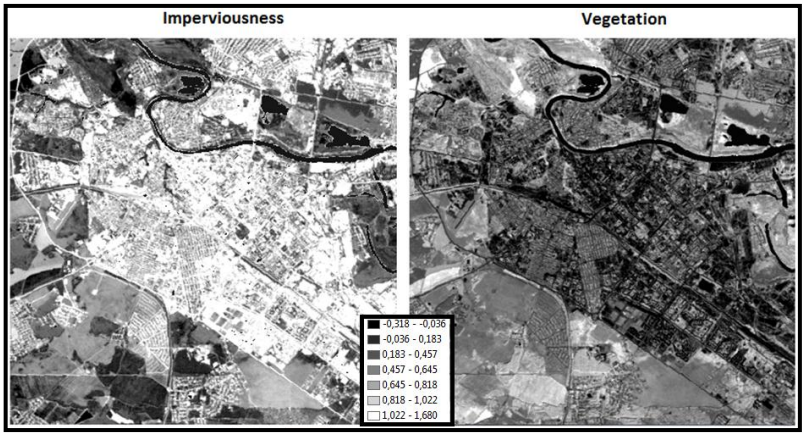
The Edge Density of a class within administrative boundaries is calculated as the total length of the edge of patches divided by total area of administrative boundaries.

Ratio indicators

Imperviousness Open space Ratio (IOR) is an urban indicator which combines the built up density indicator with open space density indicator. The **Imperviousness Green space Ratio (IGR)** is a comparison of impervious and green areas exist within an administrative boundary.

Surface Type Indicators - consist of the following indicators:

- Land Cover
- Imperviousness
- Fractional Land Cover
- Surface Albedo and Surface emissivity



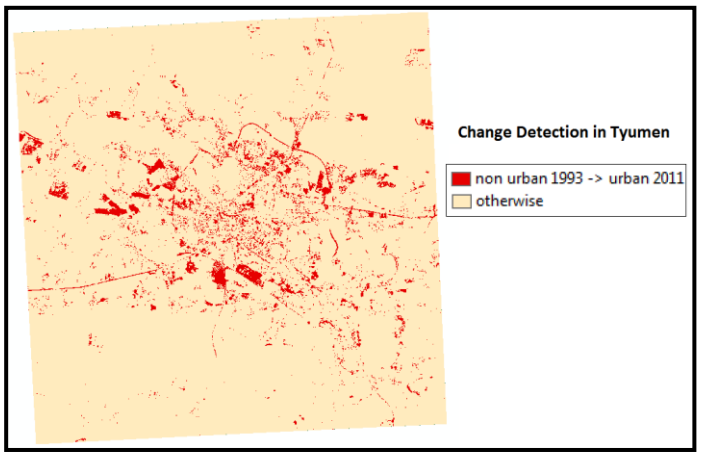
Fractional Land Cover maps of Tyumen

The GEOURBAN EO-based Indicators (Cont.)

Urban Sprawl Indicators - Urbanization usually leads to an undesirable growth, called urban sprawl. The reduction of urban sprawl not necessarily implies reduction of urban expansion, but rather becomes more functional.

The GEOURBAN urban sprawl indicators are:

Urban Fringe - is defined as 30-50% built up neighborhoods.
Scatter Development - less than 30% built up neighborhoods.
Change Detection - the process of identify the differences of a phenomenon is taken place within a time interval.

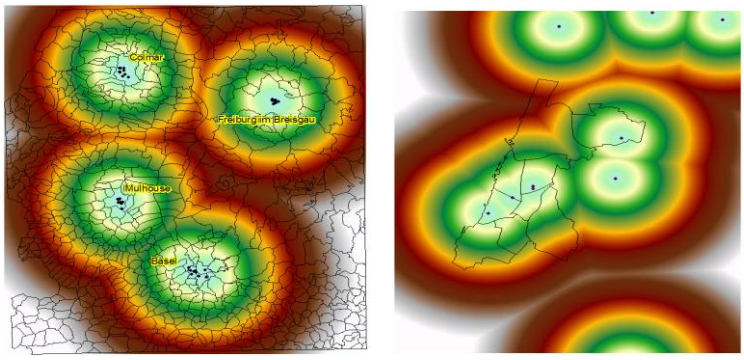


Change Detection for built-up areas in Tyumen between 1993 and 2011

Urban Environmental Quality Indicators:

Surface Urban Heat Island (SUHI) intensity - describes the difference in surface temperature between a conurbation and the surrounding rural area.
Aerosol Optical Thickness (AOT) - is an important aerosol parameter estimated using low spatial resolution satellite observation (MODIS). Within GEOURBAN framework we use the MODIS AOT product daily available at 10 km × 10 km.

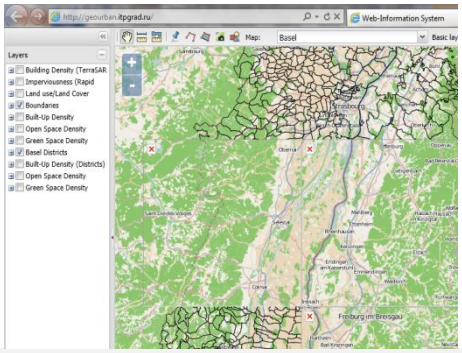
Vulnerability to Natural Hazards Indicators - The vulnerability to natural hazards should be carefully assessed. Droughts, floods, earthquakes and other natural hazards have become frequent and therefore, **disaster response** plays an important role in case of emergency. **Distance to critical services** is vulnerability indicator that was used in GEOURBAN.



Distance to Critical Services(hospitals) in Basel and Tel Aviv.

Deliverables

- Project Management Plan
- Semester Progress Reports
- Urban Planning Requirements relative to EO
- EO Products Database (VHR)
- EO Data Analysis Protocol (VHR)
- Dissemination and Use Plan
- GEOURBAN Web Site
- EO Products Database
- Mid-term Report
- GEOURBAN Published Material
- Guidelines for Future Missions Data Analysis
- EO-based Indicators Development
- GEOURBAN Information System
- Demonstration Proceedings
- Final Report



Get to know GEOURBAN WP7 activity

WP7, led by GRADI, is dedicated for WIS development including its design and development activities. The main WIS's objective is to provide spatial data for end-users such as urban planners, architects and engineers by using over the Web services.

The **WIS 1st prototype** released at the beginning of 2013. It included a standard set of tools, enabling the user to manage map layers, changing scale and displaying object's attributes. The 1st WIS prototype provided three indicators layers of **Built-Up Density, Open Space Density and Green Space Density** that were evaluated for the Basel and Tyumen case studies.

The WIS 2nd prototype released on April this year. It includes additional data and capabilities such as raster **Land Cover map,** with **Building Density and Imperviousness indicators** as well as the use of Google satellite and Google hybrid.

The WIS 3rd and 4th prototypes were released on this summer and autumn. New capabilities were user's registration, online evaluation tools, raster and vector downloading tool.

Final WIS prototype released is at the end of November 2013. It includes more layers with indicators and separate legend for each layer, searching panel etc. By that time all spatial data was already integrated with the WIS.

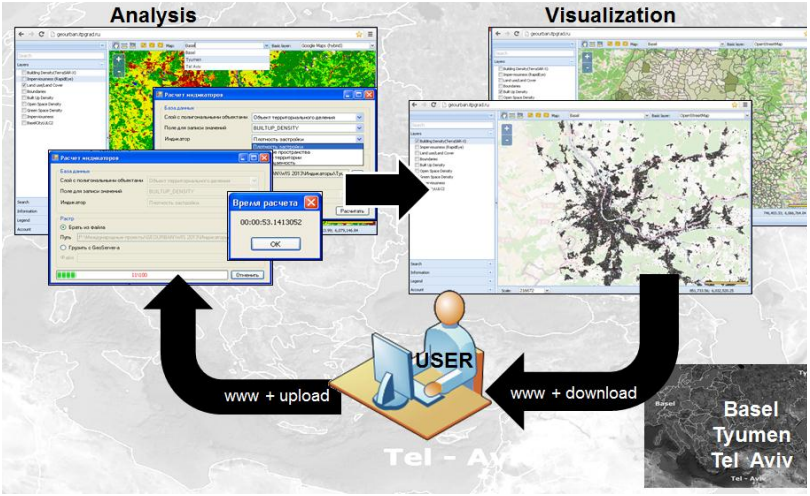
The GEOURBAN Web Information System

The GEOURBAN WIS reflects multidimensional nature of urban planning and management, as operationalized in intelligible indicators which are easily understood and applicable by the non-experts. It was developed by GRADI using in-house developed software and algorithms for spatial analysis and web visualization

The WIS is a fully dynamic system exploiting all internet capabilities and the "open layers" availability. The user solely needs a web-browser and internet connection to access the WIS.

It provides analysis and visualization capabilities of GEOURBAN indicators, such as Built-Up Density, Open Space Density, Green Space Density, Building Density and Imperviousness which are evaluated for Basel, Tel Aviv and Tyumen case studies.

The indicators evaluation algorithms implemented as a fixed set of base mathematical operation with raster input data such as **Land Cover**. OpenStreetMap was used as basic layer.



WIS Operational Schema

Major WIS Functionality Includes:

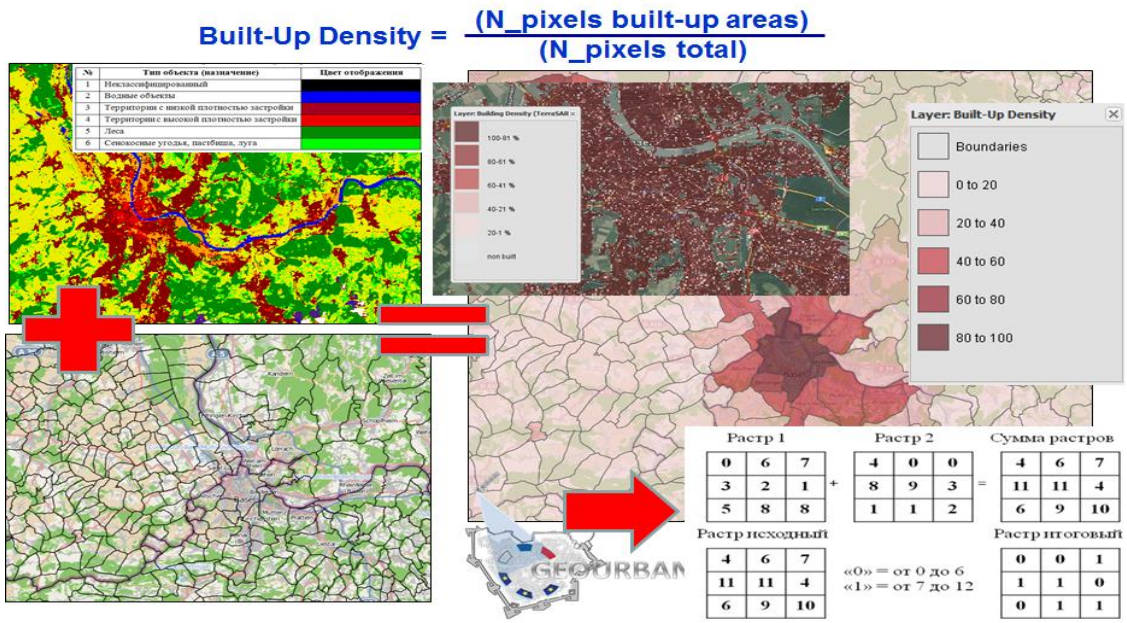
- Objects searching
- View object's attributes
- Manage map's (layer) scale and displayed area
- Hide/Show layers
- Distance Measure
- Area size evaluation
- Create objects like point, line or polygon
- Layers Management (Admin. Only)
- Raster / Vector downloading and uploading (Admin. Only)
- Online Indicators evaluation

All WIS data is based on Mercator map projection. Interactive web maps are using "Spherical Mercator" system based on Mercator projection over a sphere.

The GEOURBAN Web Information System (Cont.)

The WIS vector-based indicators are evaluated using administrative political community boundaries. The value of each indicator is estimated using an appropriate formula within each polygon of political community boundaries. Following maps and indicators are currently available for Basel, Tyumen, Tel-Aviv Maps (Datasets):

Map / Indicator	Basel	Tyumen	Tel-Aviv
Building Density (TerraSAR-X)	✓	✓	✓
Imperviousness (Rapid Eye)	✓	✓	✓
Land Cover (Landsat)	✓	✓	
Distance to critical services	✓		✓
Built-Up Density	✓	✓	✓
Open Space Density	✓	✓	✓
Green Space Density	✓	✓	✓
Fractional Vegetation Cover		✓	
Fractional Imperviousness		✓	
Change Detection		✓	
Urban Surface Heat Island			✓



Generating a Built-Up Density Indicator Map

The WIS provides two methods of generating Indicators

1. Using fixed layer with boundaries.
2. User-defined Areas of Interest using polygons.

WIS can be easily transferable to any city and thus, the WIS Administrator is equipped with a set of tools to define new layers, boundaries and add raw EO data maps.

WIS Object Creation Tool

The WIS is accessible at the URL: www.geourban-fp7-eranet.com/links/GEOURBAN WIS

WIS Demonstration and Feedback

The demonstration event provided the means to disseminate the GEOURBAN achievements to urban planners and local/regional Authorities. The application of the WIS prototype for different case study cities demonstrated during this event.

Users' feedback is important to address the requirements for adapting the system in future missions. Thus, the goal was to get feedback from the end-users regarding the applicability, usefulness and potential impact of the GEOURBAN WIS. As a result, a Demonstration Proceedings report included urban planning guidelines, based on the application of the WIS, was produced.

Demonstration of the GEOURBAN WIS system prototype functionality was presented by GRADI. Following indicators delivered by the WIS were demonstrated:

- Urban Surface Structure Indicators
- Urban Surface Type Indicators
- Urban Sprawl Indicators
- Urban Environmental Quality Indicators
- Surface Urban Heat Island intensity
- Vulnerability to Natural Hazards Indicators
- Distance to critical services

Among others, Boris Stern from SIGRS - GISOR provided important feedback for further development of the WIS.
In addition users' needs and valuable comments regarding the functionality were introduced by Florence Prudent from TEB. She described the following main needs:

- Additional city districts, not just Basel.
- Additional political administrative boundaries.
- Use of high resolution based on required accuracy. Additional data input (e.g. census data), which is then displayed for community level, user layers.

The most important comments agreed to be implemented in WIS by GRADI. Additional comments and user needs will be addressed by the consortium in the framework of future projects.

Get to know GEOURBAN WP8 activity

WP8, led by GARD, is dedicated to the activities of demonstration events management and handling the feedback received from the end-users regarding the applicability, usefulness and potential impact of the GEOURBAN Information System.
It's important to remember that the exploitation of the project's results does not depend solely on success of the research but actually, it is strongly depend upon how the GEOURBAN initiative is perceived by the potential users of the target system. For this reason, WP8 well planned the dissemination in advance and implement it during the project to ensure that a wide audience is reached.

***A* GEOURBAN demonstration event** was organized in the framework of WP8. WIS demonstration and hands-on applications were taken place during this meeting, providing the means to disseminate the GEOURBAN achievements to urban planners and local/regional Authorities.

Feedback Management

The feedback coming from the WIS users is meaningful information helping in evaluating the project activities.

GEOURBAN Final Meeting

MCR, University of Basel, Switzerland
November 28-29, 2013

This Conference was held to discuss strategy issues and to serve as a platform for discussing and disseminating the final project results to target groups of decision-makers from local and regional authorities from Europe.

Following is a list of speakers:

- DLR – German Aerospace Center
- FORTH - Foundation for Research and Technology - Hellas, Greece
- GARD – GARD R&D Ltd, Israel
- GRADI – GRAD Information,
- KUZGAN - Rational open source GIS/RS solutions, Ankara, Turkey
- SIGRS-GISOR – GIS group. Conseil général du Haut-Rhin, Colmar, France
- TEB - Trinational Eurodistrict Basel, Palmrain. France
- UNIBAS - Meteorology, Climatology and Remote Sensing, University of Basel, Switzerland

Beyond GEOURBAN

Final Meeting Summary and Future Plans

Welcome and meeting objectives were introduced by E. Parlow (UNIBAS).

N. Chrysoulakis (FORTH) introduced ERA.Net-RUS and GEOURBAN. He summarized the main project achievements:

- User requirements capture.
- Urban environmental indicators selection.
- VHR methodology specification and data processing.
- HR/LH methodology specification and data processing.
- Web-site and Newsletters dissemination tools.
- GEORBAN WIS release.
- Presentation in conferences, journal articles submission.

The vision is towards a fully operational tool

The GEOURBAN **WIS has the potential to lead to new services**. The consortium may further exploit the prototype by updating it with new processing modules and by adapting it to future missions (i.e. Sentinels, EnMAP, HyspIRI, etc.). A fully operational tool can be developed, provided that EO data at the requested spatial and temporal scales are available.

Basel regional GIS and planning institutions objectives and the different working experts groups work process and needs were presented by B. Stern (SIGRS – GISOR).

EO potential in urban planning and possible future needs were introduced by T. Esch (DLR). The Conclusions were in regards to the following topics:

- Remote Sensing meets Urban Planning – vision and strategies
- Role of Remote Sensing
- Optimal Instrument for Monitoring and Documentation

S. Düzgün and M. Çavur (KUZGUN) and C. Freingenwinter (UNIBAS) presented the **EO products analysis:**

- Basel, Tel-Aviv and Tyumen Case Studies
- EO Data Analysis Protocol and EO Product Database
- High potential of these products to be used for Land Cover maps as well as urban impervious layer maps
- The new EO data types to be available in near future will provide opportunities to derive more indicators

Initial proposal for **implementation of GEOURBAN results** was introduced by M. Çavur (KUZGUN). The future explotation was discussed between commercial partners GARD, KUZGUN, GRADI.

Possible future continuation plans were introduced by N. Chrysoulakis (FORTH). The partners expressed their opinion regarding possibilities of the future projects directions.

GEOURBAN meetings and demonstration events

Biannual GEOURBAN progress meetings were held to secure the highest level of information exchange among beneficiaries. Minutes of these meeting were prepared by the coordinator, sent to all partners by email and published on the GEOURBAN website. In addition, regular Skype meetings were organized among partners to discuss particular subjects, or to exchange related information.

Current Status and Upcoming events

Final Meeting

The GEOURBAN Final Meeting was held in Basel on November 28-29, 2013.

Management Board (MB) Meetings

The 9th MB Meeting was held in Tel Aviv, June 28, 2013

The 10th MB Meeting was held on Skype, September 12, 2013

The 11th MB Meeting was held on Skype, November 14, 2013.

Demonstration Event

The GEOURBAN Demonstration event was held in Basel on November 28-29, 2013.

Conferences

GEOURBAN partners recently attended and presented the project in the following conferences:

1) **The 11th Russian conference «Urban planning and territorial development of Russia. Modern technologies in urban planning»** held in Tomsk Russia, July 23-26, 2013
2) **The 13th International Scientific and Technical «From imagery to map: digital photogrammetric technologies»** held in Fontainebleau, France Sep 23-26, 2013 see presentation: http://www.racurs.ru/France2013/ru/?page=66
3) **BMBF-FASIE Conference «The way Forward: German-Russian Cooperation between Research Organizations and Innovative SMEs»** held in Berlin, Germany Oct 23, 2013 see presentation: http://www.internationales-buero.de/de/6541.php)

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Publications

Marconcini, M., Thomas, E., Chrysoulakis, N., Düzgün, H. S., Tal, A., Feigenwinter, C. and Parlow, E., 2013. Towards EO-based sustainable urban planning and management. In Proceeding of IEEE International Geosciences and Remote Sensing Symposium (IGARSS 2013), held in Melbourne, Australia, July 21 – 26, Session Urban Remote Sensing III; paper FR4.T07.5.

Esch, T., Taubenböck, H., Chrysoulakis, N., Düzgün, H. S., Tal, A., Feigenwinter, C. and Parlow, E., 2013. Exploiting Earth Observation in Sustainable Urban Planning and Management - the GEOURBAN Project. In Proceeding of Joint Urban Remote Sensing Event JURSE 2013, held in Sao Paulo, Brazil, April 21 - 23.

Chrysoulakis, N., Esch, T., Parlow, E., Düzgünd, S. H., Tal, A., Sazonova, A., Feigenwinter, C., Triantakonstantis, D., Marconcini, M. and Kavour, M., 2013. The role of EO in sustainable urban planning and management: the GEOURBAN approach. In Proceeding of the RSCy2013: First International Conference on Remote Sensing and Geoinformation of Environment, held in Pafos, Cyprus, April 8 - 10.

To learn more about GEOURBAN project activities please visit our web site:

http://geourban-fp7-eranet.com/

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CAPACITIES

ERA.Net RUS