G. L. Merciu, V. Păunescu, S. Plăvicheanu
Resources Development Digital Geospatial Data Using the Digital Topographic Plan of Romania - TOPRO5
The Geographic Information System for Public Administration Regarding the Updating of Green Cadastre. The Case Study of: Bucharest

THE GEOGRAPHIC INFORMATION SYSTEM FOR PUBLIC ADMINISTRATION REGARDING THE UPDATING OF GREEN CADASTRE. THE CASE STUDY OF: BUCHAREST

George Laurenţiu MERCIU, PhD eng. - University of Bucharest, e-mail:merciugeorge@yahoo.co.uk
Vlad PĂUNESCU, PhD student - Technical University of Civil Engineering Bucharest
Sabina PLĂVICHEANU, PhD student - Technical University of Civil Engineering Bucharest

Abstract*: The purpose of this study is to highlight how the Geographic Information System provides permanent access to the updated database and green spaces cadastral map of a particular administrative unit. Green Cadastre emerged from the necessity of creating a management system for green spaces and existing tree species in different administrative units, taking into consideration that the vegetation experiences a dynamic development and structural changes that can be reflected using different GIS applications. Inventory of green spaces was twofold: quantitative (the number of specimens per species, per parcels, quantitative attributes: height, trunk diameter, tree crown) and qualitative (phytosanitary condition of trees, trees belonging to the category of protected species).*

The result of the study lies in creating a digital map (GIS structure) that contains the distribution of compact green spaces and that emphasizes all green spaces features.

Keywords: *public administration, cadastral plan, collector for ArcGIS, digital map*

1. Introduction

Decision-making within public administration is extremely complex and it is based on a large amount of geographical information. On the other hand, the current amount of information generated by a public administration is very high. Public information is the most important resource for economic and social development and at the same time, an easy way of communication between local public administration and population. The necessary mechanisms involved in the decision making process within the public administration are essential for every management system. One of the best solutions is creating and developing a database as a tool used to support institutional capacity, local planning and progress, also able to contribute to decision making for the benefit of all (Cardei, Mihalache, 2012) .

Geographic Information System applications as a tool in effective decision-making support within local public administration is one of the latest trends worldwide. Regarding information valuing by local administration in the GIS environment, many solutions were applied worldwide. Most of them are customized for specific types of problems. Likewise, integrated and complete solutions are adopted especially in developed countries, as well as applications that can be accessed online. The implementation is based on the priorities and needs, therefore GIS sites were drawn nationwide, regionally and locally with varying degrees of accuracy depending on the purpose. Based on GIS solutions studies for local

public administration, the complexity of the activities that they carry is reflected and also related to all areas: education, health, civil protection, social welfare, infrastructure, natural and cultural heritage, sports, award certificates, forest fund, urban management, vineyard cadastre, green cadastre etc. (Volker, Hartmut, 2004; Marco-Simó, Pastor-Collnado, Macau-Nadal, 2008; Vogiatzis, 2008; Iordache, 2008; Grecea, Bala, Bota, 2010; Cardei, Mihalache, 2012; Marian, Matei, 2012; Grecea Musat, Vilceanu, 2012; Hutanu, Nistor, Padure, 2012; Stefan, 2013; Gridan et al., 2013).

The purpose of the study is to highlight the benefits of elaborating the register of green spaces throughout Bucharest (which represents complex documentation on tracking green spaces which is achieved through GIS information systems that includes: inventory, highlighting the type of property and the administration and quantitative and qualitative description of vegetation's characteristics). Information systems of green spaces are a result of measurements in the field, identification and mapping of land defined as green spaces and the collection of specific information on species and existing vegetation, digital maps, the database which comprises attributes on trees). Green Cadastre is a necessity in the current context of structural changes and pressure from the expansion of built space in urban areas. The first program for elaborating the register of green spaces in Bucharest was conducted in 2010.

As the capital city has a large area, the administration and maintenance of green spaces require a distribution of responsibilities assigned to the six local public administrations (distributed by sectors) that are centralized and managed by the City Hall of Bucharest. Thus, considering the need to intercept the structural changes that occur over time in the urban landscape and implementing effective features and tools that enable management and forecasting the evolution of tree species, it was decided to update the register of local green space in 2014. Also, updating green cadastre in Bucharest enables updating existing records by inventorying isolated trees that are situated in the private sector, which is a new action program that includes mapping and inventory of green spaces in the capital city and also updating all registry-specific data on green spaces within the public domain. To be mentioned the legislative framework requires the local public administration to ensure periodic review of the data and information contained in the register of local green spaces, in order to fit with the actual situation in the field (Law no. 24/2007, republished in the Official Gazette .PI no. 764 / 10.11.2009).

2. Methodology

Multiple applications were used in order to develop green cadaster in Bucharest, such as: ArcGIS Desktop 10.2.2, 10.2.2 ArcGIS Server, ArcSDE for MS SQL Server, ArcGIS Viewer for Flex 3.4, MS SQL Server Express 2012, MS SQL Reporting Services, MS SQL Reporting Builder.

Enterprise Geodatabase was populated with data and information regarding the topographic support, the orthophotomap resulted from a photogrammetric flight conducted in 2014, data on green spaces (outline, state), trees (with the attributes described in the application), streets (outline, name), buildings (outline), alleys and degraded land.

G. L. Merciu, V. Păunescu, S. Plăvicheanu
Resources Development Digital Geospatial Data Using the Digital Topographic Plan of Romania - TOPRO5
The Geographic Information System for Public Administration Regarding the Updating of Green Cadastre. The Case Study of: Bucharest
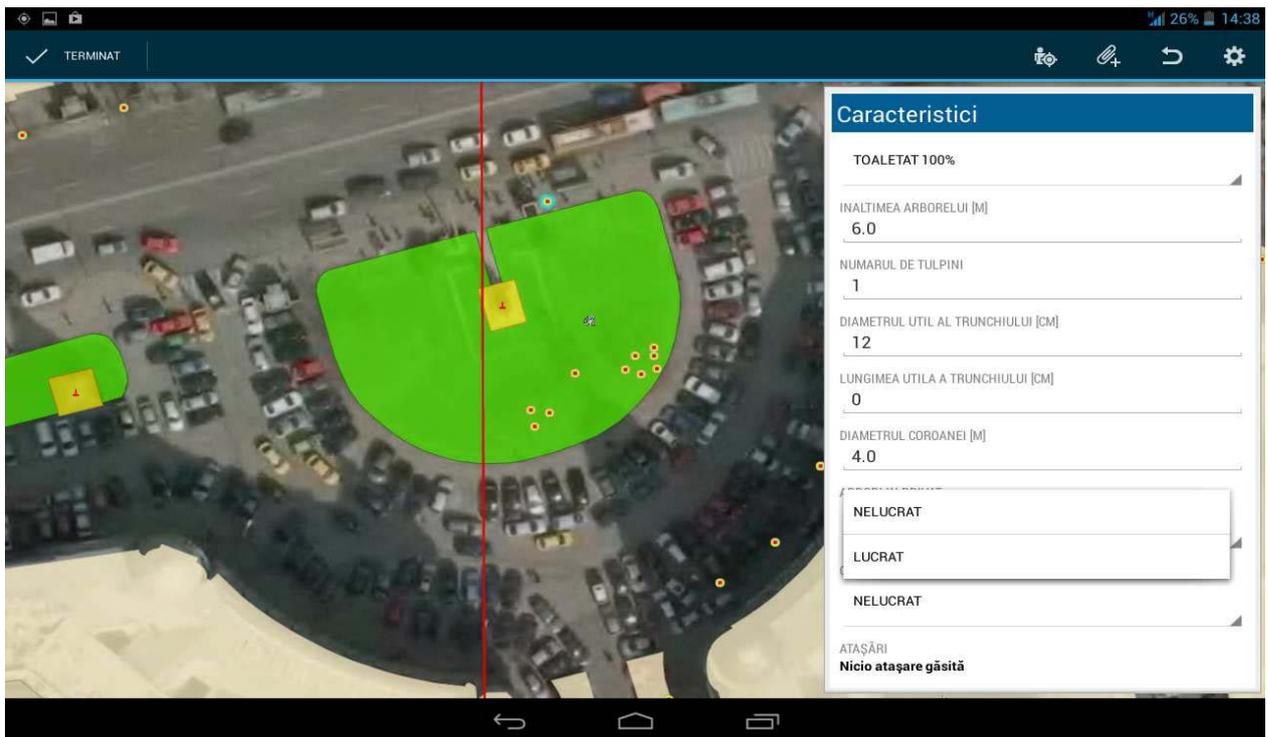
Fig. 1. Attributes on inventoried trees

All these data were grouped within the database in a Feature Dataset, which contains a number of Feature Classes, which subsequently can become editable or visible, were published as Feature Service sites using ArcGIS for Server. At the moment, these services are published on the server, along with geoprocessing tools. In order to populate the database and for updating it, it was necessary to create an application that works on both operating systems iOS and Android, compatible for tablets, mobile phones, laptops and desktops. RLSV application (Register of local green spaces) was created using Collector for ArcGIS, which allows collecting the information. This application uses the services published on the server and allows viewing, editing and saving data. To access the application, an organization account has been created that contains a series of ArcGIS Online users. The access to ArcGIS Online requires a user and password and then the connection to the application is established. Working Menu application was customized and contains the necessary tools for conducting the specific activity of green cadastre.

Thematic layers (published services) on the server are available on tablet and are shown in the figure below (Figure 2):
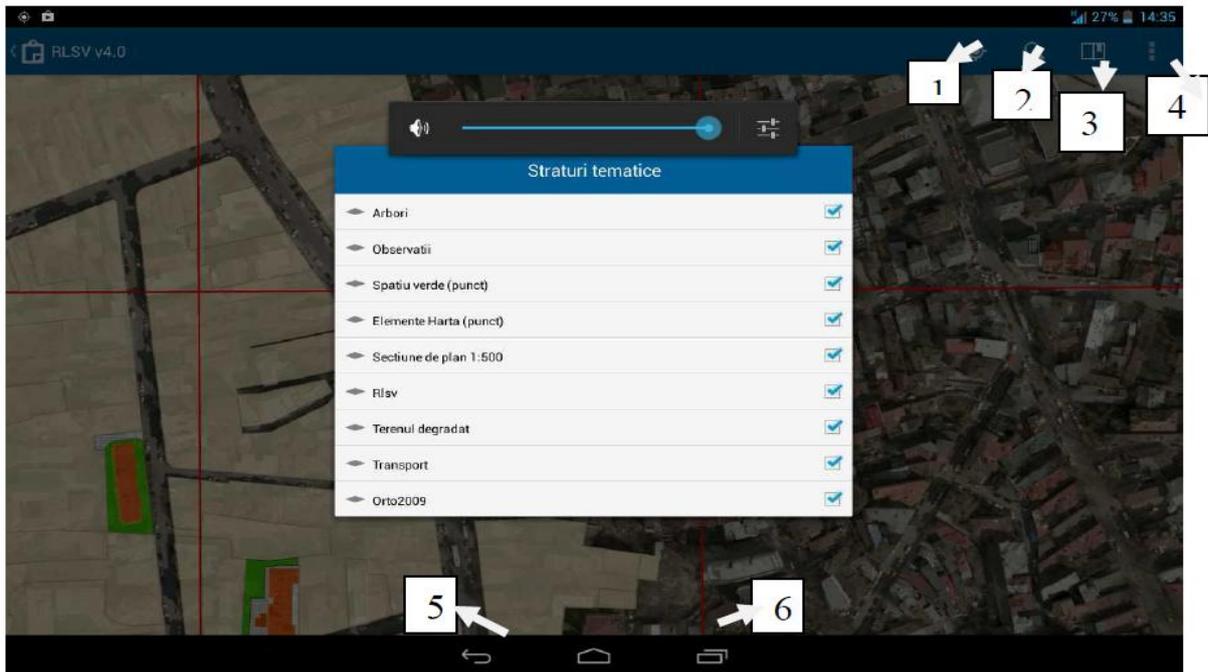
Fig. 2. RLSV application commands

1 - Position determining with GPS on tablet (on / off). It is used only for orientation in the field.
2 - Search (Find) - used for selecting keystone by nomenclature.
3 - Insert bookmarks or labels. The operator is able to save his map's image. A spatial bookmark identifies a particular geographic location you want to save and access later. In this way you can easily return to the study area by accessing Bookmark / label.
4 - Access the thematic layers of the application, where you can turn on or off certain layers whenever you want and also select editable thematic layers (trees, observations, drawings) in order to update / edit the data mentioned above. Should be noted that the thematic layers in the application are set to be seen at different dynamic scales, to enable accessing information easily, increasing quality and operating speed.
5 - UNDO / CANCEL - to cancel, save or certain edits or updates you do not wish to save.
6 – Exist the RLSV application button.

3. Results and discussions

Due to the fact that the vegetation experiences a dynamic development and growth and in order to reflect the structural changes that may occur in time in the landscape of Bucharest, it was necessary to extend the green cadastre solution currently used by developing and implementing features and effective tools to enable administrating and forecasting the evolution of tree species found in Bucharest's green spaces (parks, squares, alignments, rounds etc). Currently, following campaigns related to the green cadastre project, trees and green areas were mapped and data on tree location (geographical coordinates) and the attributes associated with each were collected and processed and stored in a GIS database. Multispectral recordings were obtained (during the year 2014) and processed in order to obtain necessary information to assess the health of trees and vegetation, type of property, determining and recording features for both isolated trees and protected trees situated on

G. L. Merciu, V. Păunescu, S. Plăvicheanu
Resources Development Digital Geospatial Data Using the Digital Topographic Plan of Romania - TOPRO5
The Geographic Information System for Public Administration Regarding the Updating of Green Cadastre. The
Case Study of: Bucharest

private sector (in the previously contract, only trees on public and private domain of central and local administration were recorded), determining and recording the buildings situated on green areas.
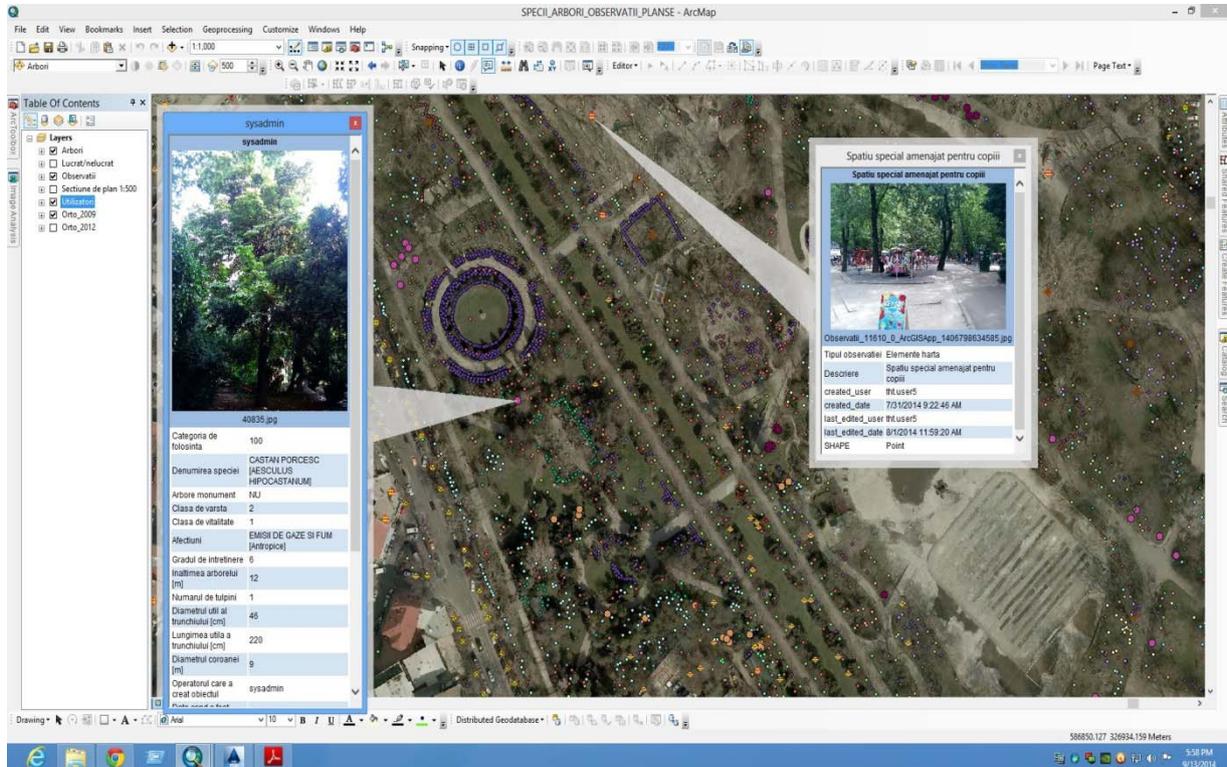

Fig. 3. Multispectral recordings of green spaces and pictures taken in situ

4. Conclusions

Updating and modifying the application dedicated to the Register of local green spaces of Bucharest are intended to reflect changes and additions that have occurred in its structure, including supplementing it with new functionalities on the particular incidence of trees with other urban objectives and vegetation management. The register of local green spaces will be correlated with the general urban plans and urban planning regulations. Green Cadastre is a work of great importance, considering the role of green spaces in ensuring a favorable ambient in the urban environment, ensuring ecological balance, harmonization between anthropic and natural landscape. Among the most important outcomes of green cadastre is creating interactive digital maps that allow visualization for isolated and protected trees' features, green spaces and degraded land's features, allowing better management of green spaces and proper use and maintenance of all tree species.

5. References

1. Cârdei, M., Mihalache (Ficiuc), R. M., Aspects regarding the necessity of a unique management of all the cadastral information in the local public administration, RevCAD Journal of Geodesy and Cadastre, University "1 Decembrie 1918" Alba Iulia, 2012.

2. Grecea, C., Bala, A.C., Bota, C. I., Spatial planning – modern tool of urban management control, RevCAD Journal of Geodesy and Cadastre, University "1 Decembrie 1918" Alba Iulia, 2010.

3. Grecea, C., Musat, C. C., Vilceanu, C. B., GIS – an efficient support for urban planning – framework of Timisoara, Romania, 12th International Multidisciplinary Scientific GeoConference SGEM 2012 Conference Proceedings, 1057-1064, 2012.

4. Gridan, M.-R., Bala A. C., Brebu, F. M., David, V., GIS applicability in urban management, Recent Advanced in Geodesy and Geomatics Engineering Proceedings, pp. 92-97, 2013.

5. Hutanu, C., Nistor, Gh., Padure, D., Data base of vineyard cadastre information system, RevCAD Journal of Geodesy and Cadastre, University "1 Decembrie 1918" Alba Iulia, 2012.

6. Iordache, E., Application of GIS in the forest management in Romania, RevCad Journal of Geodesy and Cadastre, University "1 Decembrie 1918" Alba Iulia, 2008.

7. Marian, M., Matei, A. N. Aspects of green cadastre in the campus of University of Pitesti, Journal of Current Trends in Natural Sciences (CTNS), 2012.

8. Marco-Simó Josep, Pastor-Collnado Joan, Macau-Nadal Rafael, Public procurement of IS/IT services: past research and future challenges. In proceedings of the 11th IFIP TC 8 WG 8.6 International Working Conference, pp. 16-21, 2008.

9. Stefan, M.-M., Dendrofloral mapping in the University Campus, a small step towards green cadastre, Journal of Young Scientist, 2013.

10. Vatafu (Tiganesteanu), F., A centrally managed GIS system for protection of the Romanian archaeological sites, ensembles and historical monuments, RevCAD Journal of Geodesy and Cadastre, University "1 Decembrie 1918" Alba Iulia, 2012.

11. Vogiatzis, M., Cadastral mapping of forestlands in Greece: current and future challenges, Photogrammetric Engineering & Remote Sensing, pp. 39-46, 2008.

12. Volker, E., Hartmut M., GIS implementation at the German Regional Public Administration Level, 7th Agile Conference on Geographic Information Science, 29 April-1 May Heraklion Greece 2004, pp. 613-623, 2004.

**** Law no. 24/2007 on the regulation and management of urban green spaces, Official Gazette no. 36/18.01.2007.*

**** Law no. 24/2007, republished in Official Gazette nr. 764/10.11.2009*