Proceedings of the Fábos Conference on Landscape and Greenway Planning

Volume 3
Issue 1 *Proceedings of the Fabos Conference on Landscape and Greenway Planning 2010*

Article 6

2010

Importance of GIS databases in management and planning of public green spaces – case study of the Budapest Zoo and Botanical Garden

Katalin Takács
Corvinus University of Budapest, Department of Garden Art

Vince Zsigmond
Budapest Zoo and Botanical Garden, Section of Development

Importance of GIS databases in management and planning of public green spaces – case study of the Budapest Zoo and Botanical Garden

Katalin Takács [1], Vince Zsigmond [2]
[1]Corvinus University of Budapest, Department of Garden Art, [2]Budapest Zoo and Botanical Garden, Section of Development

Introduction

The development and long term quality maintenance of public green spaces requires various kinds of knowledge. Most of the onsite information (development history, current state of the garden, ground plan, plant stock, etc.) has to be in the mind of the specialist in charge; however, with the growing quantity and complexity of the data there is a limit to traditional personal expertise. Developing and managing GIS databases creates new assets for documentation (data analysis, queries, reporting, etc.) as well as further practical applications based on them: supplying data for constructors, decision makers and visitors; supporting decisions with accurate derived information; assuring more conscious planning and maintenance; helping scientific analysis and public information systems.

The Budapest Zoo and Botanical Garden (BZBG), opened as the first public zoo (Szidnainé, 1991) of Hungary in 1866 (Figure 1.), has nowadays a well known plant collection. During the 20th century, the plant stock of the garden was recorded and published several times in the form of plant lists (Anghi, 1960) or a manual survey (Péntek, 1983). There was, however, no digital database built to document the entire garden content and conditions until the beginning of the 21st century. In accordance with the objectives of the Botanic Gardens Conservation International (BGCI) to develop appropriate information systems (Cheney, 2000), a GIS based botanical survey and garden mapping are ongoing projects of the institution since 2007. This paper aims at presenting our initiatives to record the plant stock of the garden regarding the goals, the up-to-date methods, the first results and their expected future benefits for garden management.

Literature review

While a good deal of literature exists on GIS and mapping in general, less information is known to focus on its uses at botanical gardens (Dawson, 2005). For an overview of GIS methods applied in different natural environments, the book *Managing Natural Resources with GIS* by Laura Lang (Lang, 1998) is a useful source. In garden mapping, the forerunners of modern computerized plant database systems were the Royal Botanic Gardens at Kew, the Royal Botanic Gardens of Edinburgh and the Matthaei Botanical Gardens of the University of Michigan, computerizing their living plant collections data in the seventies of the 20th century (Walter and O'Neal, 2000).

In the USA, the larger needs and early practice for using digital devices in garden mapping appeared in the eighties. During this decade, the first and nowadays industry-leading collections database management system tool, the BG-BASE™ was developed (1985) at the request of the Arnold Arboretum of Harvard University. Since then a large number of literature (technical manuals, articles, users reports, etc.) were published worldwide, amongst which we mention here only two articles of *The Public Garden* written by the software creators (O'Neal and Walter 1993, 2000). Both papers (entitled *BG-BASE: Software for botanical gardens and arboreta* and *Update: BG-BASE - a tool for the 21st century*) contain basic information about the software and its perspectives in use.

An early literature concerning the topic, entitled *Directory of Computer Use in Plant Record Keeping* by David Murbach, is an operation manual, prepared for the University of Delaware with detailed investigation results on the use of digital tools by different American botanical gardens and arboreta (Murbach, 1988). From the recent literature, the *Curatorial Practices for Botanical Gardens* by Timothy C. Hohn (Hohn, 2004) and *A Guide to the Computerization of Plant Records* by the American Association of Botanic Gardens and Arboreta (Brown, 1998) provide excellent guides for creating and managing plant databases. Almost twenty years after Murbach's early surveys, a new thesis, entitled *Selection of GIS software for the mapping of living plant collections,* was written at the same university in 2005 (Dawson, 2005). This work summarises all available digital solutions for garden mapping, and gives up-to-date and highly useful information for us on the different tools in use at other botanical gardens and arboreta.

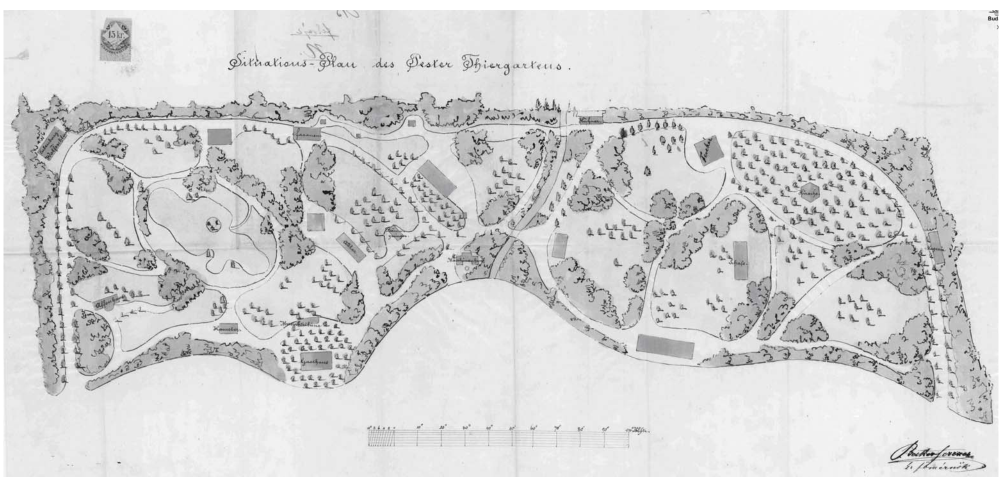

Figure 1. Plan of the garden from the times of its opening, 1866. (original title: Situations-Plan des Pester Thiergartens, source: BFL XV.17.b 312)

Objectives

The management of living collections is complex and demanding due, on the one hand, to the complexity of plant nomenclature, and on the other hand to the quantity of, and frequent changes to, spatial and attribute data on a large number of objects. BG-BASE™ is a powerful database system, ideally suited to plant collections management. As do many botanical gardens worldwide, BZBG would like to use this tool to manage its plant records.

A central goal of our project since 2007 is to build up a detailed plant stock database of the garden and create a geographically linked base-map and plant register in order to be able to introduce/apply special database management system tools for the garden management. In parallel, we aim at reviewing the actual botanical situation of the garden by creating the actual plant stock database of the thematic collections and the accurate plant-index*,* equally for the outdoor and indoor living plants. Also, we would like to revise the collection development activity of the past decades using the data analyzing facilities (layering historical maps and surveys, querying attribute data, etc.) of the GIS system.

By means of an accurate database that conforms to the up-to-date GIS methods, we hope the BZBG reaches the international standards in management of living plant collections, and has its professional recognition grown equally at national and international level.

Methods

To start-up this garden mapping project we needed a base-map of the garden. This was available by means of a digital geodetic survey carried out for the entire garden property. By 2007 we disposed of a digital 'dwg' map containing all built elements and trees of the garden, and being geometrically registered to the HUN-EOV72 coordinate system. Concerning the outdoor living plant collection, the digital survey contained the location of trees and evergreens, but not that of the shrubs, bushes, groundcovers, herbaceous plants, etc.

During the plant stock survey, first we had the task to register all the missing elements equally précising its location on the map and creating for each single plant a separated record in the database. The process was separated in two distinct phases: the manual survey on the field when we located, specified and described each plant on the printed base-map by hand, and then the digitalization and database building phase with entering all geographic and attribute data directly into the GIS software. For précising the location of the missing plants we used different manual tools like tape-measure and laser distance measurer.

The digital map is developed and managed in AutoCAD Map3D, that's why the plant's attribute data are now kept in a spatial data file ('sdf') linked to the feature data points representing each a single plant or a group of plants. The database is easily convertible to other file formats in order to facilitate the future conversion to BG-BASE and the exchange of the botanical and conservation data with other institutions.

Results and perspectives

As a result of our activity, we have produced a map and a database of the arboreal species of the garden (Figure 2.). The survey covers the whole garden area (approximately 10,5 hectares) with over 3000 recorded plants. Currently, the database comprises the following data: location of the arboreal plant specimens, item code, botanical name, taxonomical classification, trunk perimeter at breast height and descriptive comments. Analyzing the input data, we specified the outdoor living arboreal plant list of the BZBG, which means ~ca. 600 different taxa representing over seventy plant families.

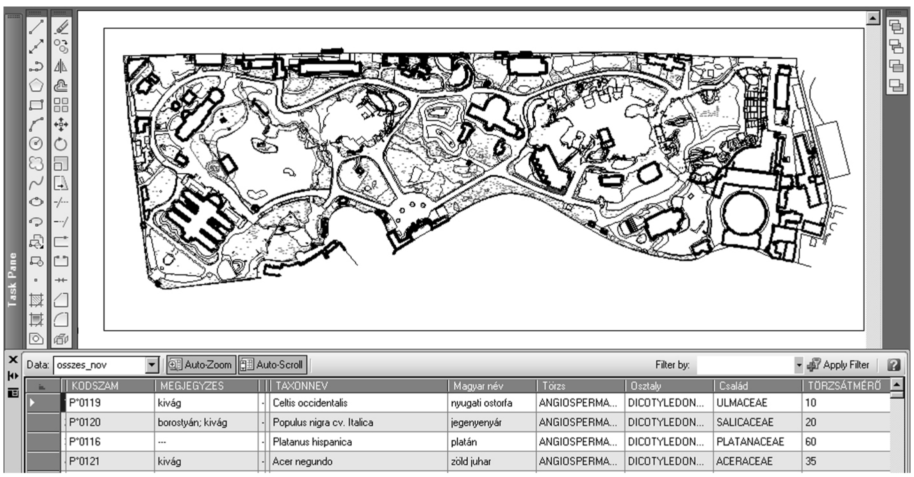

Figure 2. Ground plan of the garden with details of the GIS database

Botanical features registered: due to our recording work, we were able to locate all the arboreal plants of the garden, amongst them the 56 '*giants*' over 200cm breast-perimeter. These oldest and most remarkable sized species are the following: *Platanus x acerifolia* (of which the biggest reaches 448cm), P*opulus x canadensis*, *Sophora japonica*, *Acer saccharinum*, *Fraxinus excelsior*, *Populus nigra*, *Populus alba*, *Celtis occidentalis*, *Aesculus hippocastanum*, *Quercus robur*, *Gleditsia triacanthos*, *Robinia pseudoacacia*, *Ailanthus altissima*. We also specified several invasive species in the garden like *Acer negundo*, *Broussonetia papyrifera*, *Robinia pseudoacacia* or *Celtis occidentalis* representing each a frequency over fifty specimens. In the Japanase plant collection, we recorded over 250 specimens with a wide range of Asian plants like *Acer japonicum, Callicarpa bodinieri var. giraldii, Cephalotaxus harringtonia, Chamaecyparis obtusa, Cryptomeria japonica, Eriobotrya japonica, Euonymus japonicus, Hamamelis japonica cv. Arborea, Kerria japonica, Magnolia kobus, Nandina domestica, Pinus mugo, Pinus parviflora, Pinus thunbergii, Prunus serrulata, Rhododendron japonicum, Rubus phoenicolasius,* *Sophora japonica, Spiraea japonica, Spiraea nipponica, Syringa reticulata, Taxus cuspidata, Thuja standishii, Thujopsis dolobrata var. Hondai, Torreya nucifera*.

Current application: the detailed dendrological survey and the base map we created are used as a source for creating landscape design plans in the actual development projects of the BZBG. These ongoing projects cover the reconstruction work of the rock-garden, the environment of the big lake (already in execution), and the development of the Japanese plant collection and the main entrance area in the garden (still under planning).

As mentioned, the geographical and attribute data are stored now in AutoCAD Map3D, but in the near future (2010 fall) the data will be transferred to the internationally acknowledged botanical garden database management system: BG-Map and BG-BASE. In Hungary BG-BASE is already used by three institutions, but their descriptive data has yet to be linked to any spatial information systems. Since our database is already linked to a GIS system (although not specialized for botanical garden use), we are quite likely to be the first to use the BG-Map software in our country. In addition, the database will be further developed to fulfil the standards of documentation in botanical gardens and that of the ITF (International Transfer Format for Botanical Garden Plant Records) (Leadlay, 1998).

Further perspectives: in the near future, we plan to add the herbaceous plant and glass-house collections to the database, as well as to prepare a uniform documentation system and to analyse the development history of the garden by comparing our data to former survey maps and numeric data. Considering that BZBG is a part of the oldest public city park (Városliget) which is maintained by the municipal authorities of Budapest, it might be reasonable to extend the GIS database to include the entire park (ca. 100 hectares). Of course the different databases and documentation systems would have to be rendered interchangeable, and this would require collaboration between several institutions.

Conclusion

Although GIS based landscape planning and green space management is an existing practice in Hungary, it is still inadequately exploited. As a special type of green spaces, all botanical gardens should strive to become collectors and distributors of biodiversity by making relevant information available to a variety of users (Cheney, 2000). In the 21st century the most propitious way for doing so is by using GIS systems. GIS has the potential to be an important tool in support of botanical gardens and there is little question that such systems will become more often applied in the planning and management processes of public gardens.

The GIS database of BZBG, since its inception in 2007, has been aimed at achieving more conceptual planning, maintenance and related purposes. As a final goal we would like to have the database of the garden partially accessible via the Internet that will help to introduce the garden to the public, to improve the visitor's experience, and to allow sharing more information on our living collections. By developing this detailed GIS database, we also wish to provide a positive example in Hungary and to help other institutions who want to use this internationally accepted method of detailing spatial information for the professional management of green spaces.

References

Anghi, Cs., 1960; *Plantae – Növények (Plantae – Plants)*, in: Budapest Főváros Állat- és Növénykertjének Ismeretterjesztő Füzetei, Vol.4., Budapest

Brown, R.A., 1998; *A Guide to the Computerization of Plant Records*, American Association of Botanical Gardens and Arboreta, Swarthmore PA

Cheney, J., Navarro, J.N., Jackson, W., 2000; Action plan for botanic gardens in the European Union, *Scripta Botanica Belgica*, Vol. 19, Meise, pp. 36

Dawson, S.E., 2005; *Selection of geographic information system (GIS) software for the mapping of living plant collections*, University of Delaware, Newark, Delaware

Hohn, T.C. 2004; *Curatorial Practices for Botanical Gardens*, Edmonds Community College, Washington (http://hort.edcc.edu/Curatorial%20Practices.pdf, 16.02.2010.)

Murbach, D., 1988; *Directory of Computer Use in Plant Record Keeping*, University of Delaware, Newark, Delaware (http://dspace.udel.edu:8080/dspace/handle/19716/3724, 16.02.2010.)

Lang, L., 1998; *Managing Natural Resources with GIS*, ESRI Press, Redlands

Leadlay, E., Greene, J., 1998; *The Darwin Technical Manual for Botanic Gardens*, London, pp. 95-98

O'Neal, M.J., Walter, K.S. 2000; Update: BG-BASE - a tool for the 21st century. *The Public Garden*, 15(4) pp.21-25.

Péntek, Gy., Tarján, L., 1983; *A Fővárosi Állat- és Növénykert faállományának vizsgálata és értékelése (Dendrological survey and assessment of the Budapest Zoo & Botanical Garden)*, Budapest

Szidnainé, Cs. A., 1991; *A 125 éves budapesti Állat- és Növénykert története (The history of the 125 year-old Budapest Zoo & Botanical Garden)*, Budapest

Walter, K.S., O'Neal, M.J., 1993; BG-BASE: Software for botanical gardens and arboreta, *The Public Garden*, 8(4) pp. 21-22, 34-35.