BOLESTRASZYCE BOTANICAL GARDEN RESOURCE MANAGEMENT USING SPATIAL INFORMATION SYSTEMS (GIS)

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Summary

The need to build a Spatial Information System (GIS) for Arboretum (Botanical Garden Bolestraszyce) is related to very intensely developed spatial area. The essential part of this system is the localisation of plant collection copies, that are attach to specific locations. However, there are other elements of the system that include; collection of greenhouse plants, the store-house for reproduction materials and museum exhibition collections.

All of the elements in the collection are linked to dictionary tables; that contain indepth information about plant names, provenances, origins, donors' names, verifiers' names, verification levels, bibliography, plant growing information, utilisation of plants and photography. Therfore, a database can contain all the fulfilments definded by International Transfer Format for Botanical Garden Plant Records, Version 2 (ITF2). A database is managed by an ArcGIS System (ESRI) and SprintMap-Arboretum extensions, designed by a company called SmallGIS. The System designed for Bolestraszyce Botanical Gardens provides new tools and possibilities through using advanced computer techniques for information management, knowledge transfer and communication. Routine tasks such as map creation, label printing, reporting and history changes for all plants including scientific research, can be performed more efficiently through using such a system. Furthermore, all collected information in the database is suitable for education teaching and research.

Introduction:

Is it really necessary that the Botanical Gardens use Geographical Information Sysyem (GIS), for just 30 hektars of land? Furthermore, should the system be called GIS? Therefore the above questions may be asked by experts, such as surveyors, cartographers and photogrameters. All of these professionals use similar systems to design maps for significantly larger areas. The need to implement a GIS for Arboretum (Botanical Garden Bolestraszyce), is normally related to very intensely developed spatial area, that include parcels, buildings, infrastructure, small architecture, ponds, roads and lines, that are all important elements for spatial development.

On the other hand, such systems are also important for spatial planning in plant growing and tourism. However, these additions are not sufficient reasons for implementing GIS. The essential part of this system is the localisation of the plant collection copies, which are attach to the specific locations. This part and its spatial reference suggest that using GIS is the best system for information storing and management within botanical gardens. Obviously, information such as plant names, donor's names, provenances, plant materials (seeds, spores), mobile plants in greenhouse collections, has no spatial reference. As both parts of the systems, spatial and non spatial are stored in the same database.

Implementing a GIS system for a Botanical Garden is quite a large financial commitment. It is important to purchase the appropriate computer hardware, and to identify the correct requirements for designing the necessary database to hold all of the spatial elements. Furthermore, it is important to understand the time needed to populate the database with the relevant information, in order to effectively handle all the information that will support the institute's everyday tasks.

Element of recent System

Hardware Requiremnets

High efficiency PC computer: Intel Pentium 4, 3 Ghz processor, 2GB RAM, 256 MB-DDR2 graphic card and a 19' LCD.
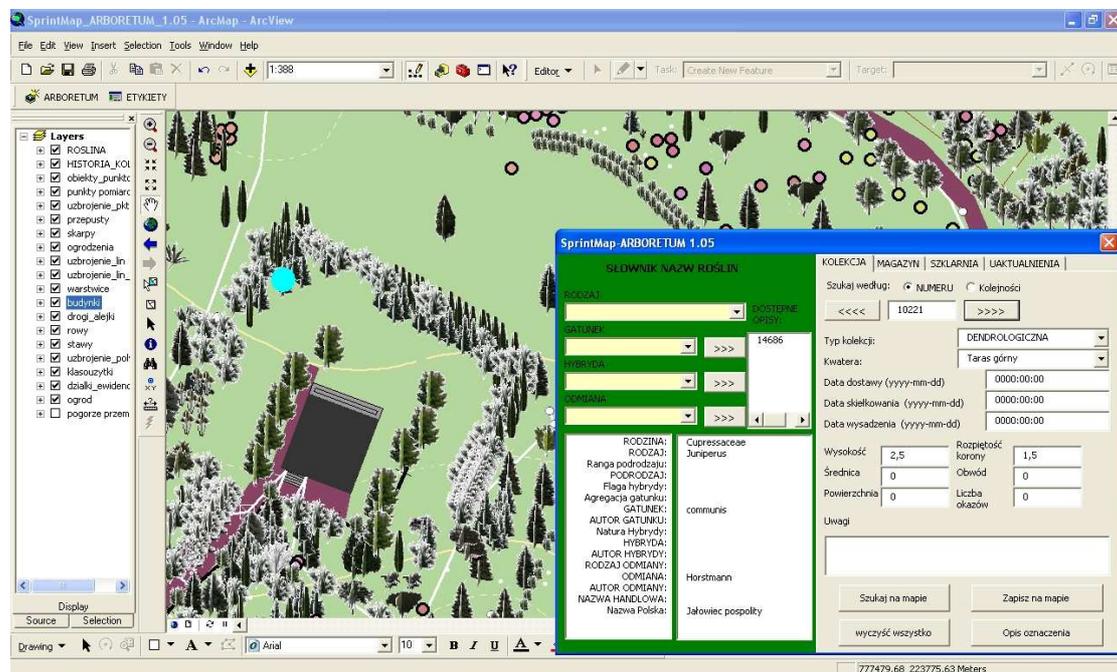
Database

The database contains the geometry of the digital map (GIS layers) based on geodetic data (base maps at 1 :500 scale) supplied by survey inventory of plant copies in the collections. Maps are projected to the National Geodetic Coordinate System in Poland - PUWG 1992 (Transverse Mercartor Projection, Elipsoid WGS84) and then stored in a personal geodatabase. However, other non-spatial elements have representations in the database as records in tables. Among the non-spatial elements are:

collection of greenhouse plant (because of possible movement), the store-house for reproduction material (Index Seminum seeds, nursery plants, exchanged or purchased plants, etc.) and museum exhibition collections. All of the elements in the collections are linked to the dictionary tables; that contains full information about plant names, provenances, origins, donors' names, verifications' name, verification levels, bibliography, plant growing information, utilisation of plants and photography. The database can contain all the fulfilments defined by the International Transfer Format for Botanical Garden Plant Records, Version 2 (ITF2). Furthermore, the database can also support elements such as photos, documents and sounds, and is not limited to the information specified in the ITF2. However, the size of the information already collected is very impressive. For example the plant name dictionary tables contain almost 25000 records and the plant collection tables contain about 12000. Overall the database contains about 50000 records in total.

1.3   Application

Data management and utilisation is performed using ArcGIS Desktop Applications (ESRI) and SprintMap-Arboretum extension for ArcGIS, designed by SmallGIS. SprintMap-Arboretum extension facilitates specific functionality as database editing, data consistency the checking, exporting and importing of ITF2 text format files, label printing, selecting and querying.

Figure 1. Application window.

2.   System possibility

2.1   Information storage

The base of the System is Relational Geodatabase stored on PC computer (server based system is planned in future). The Geodatabase stores tables

with spatial and non-spatial features. Data management, editing and updating is performed using a SprintMap application that works within the ArcGIS System. Populating the database with information stored in an analogue way is the most important challenge and has been one of the most time consuming processes during recent system developments.

2.2 Communication and information exchanging

Storing data in digital from using computer communication technology, has various potential possibilities. One such possibility, is the creation of electronic passports used during interchanging plants between gardens. The system generates (export) or reads (import) a text file that contains information about exported plant/seeds, according to ITF2 during plant interchange.

2.3 Identification and querying

GIS Systems allows for the querying of information about any element within a map, through a point and click mechanism. Furthermore, it is also possible to located information through specified attributes such as identifiers for plant types, name and provenances.

2.4 Selecting, combinating and reporting

The most comprehensive tools for retrieving information from a database is through using Structured Query Language (SQL). Additionally, in ArcGIS we can use spatial querying and combine effects of both querying methods to reach our goal. Results can be presented through thematic maps, tables or text reports. Therefor, there is almost no limit to selecting and presenting information.

2.5 Map composition and information presentation

The rich set of cartographic tools presents all the details of the Garden using various combination of database elements and graphical symbols. Therefore, it is possible to create a large formated map of a garden as well as simple drawings and general maps for everyday needs. The cartographic output can be presented in many different graphical formats, or even manually stored through printing. Another functionality of the system is the automatic creation and printing of labels for all species (taxons) in the database. Furthermore, the more advanced GIS techniques present whole spatial and non-spatial information on a website as a dynamic map (WebGIS) or as a logical map to be used as a guide for visitors.

2.6 Time series overview and researches

As a result of storing and updating all important events in the Arboretum plant collection, the information can then be prepared as a time series which can support scientific researches, statistical and cause-consequence dependency overviews. Temporal information can be stored in two ways; firstly, through recording information in a database and secondly, through

copying whole databases and archiving. Comparing the time versions of databases can help to give an overview of changes that have happened in the Garden.

Finally, the segregation and storage of large sets of information, provides an excellent opportunity to use advanced computer techniques, through using statistical evidence to reach definitive conclusions. Such techniques would have previously been extremely difficult to implement and very time consuming if traditional methods were to be used. The accuracy of the information and temporal changes stored will leave an information rich legacy for future generations, who will be able to continually refer and add to the clarity and functionality of the information that was create.