

Utilization of GIS for Palm Conservatory

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Abstract

This article describes a solution of information system for Palm conservatory in Olomouc. This conservatory is a part of a green house complex maintained by Flora Olomouc, JSC. Collection conservatories are located in Smetana garden nearby the town centre.

GIS is also possible utilized for small area, only for one building, in that case for Palm conservatory. Several botanical gardens in the world have information system based on GIS. The aim of designed GIS for Palm conservatory not was only inventorying of tropical plants. The second request was storing information about chemical care in the area of Palm conservatory during years.

Geographical information system for monitoring of chemical care in Palm conservatory has been created. The creation of information system was very difficult. No paper or digital register of plants exists. The first part of the work was mapping of plants and building parts of conservatory. The attribute data of tropical plants were stored in a database. During years 2005 – 2007 several plane and selected chemical sprayings against pests were executed. The information about chemical care was stored in the database too. The geographical information system has been designed for storing the spatial and the attribute information. Information system JANITOR J/2 version 2.3 and database system MySQL have been chosen.

1 History of Palm conservatory

Flora Olomouc Exhibition Grounds, JSC. currently organizes dozens of exhibitions throughout each year and manages 47 hectares of Olomouc parks including Smetana, Čech, and Bezruč Gardens, which are open to public. Company Flora Olomouc organizes several flower exhibitions, especially during the springtime famous FLORA OLOMOUC exhibition. Collection of conservatories belongs also under company Flora. The history of conservatories started in 1927 when first palm conservatory was build. The height of the conservatory was 9 meters and the first tropical and subtropical plants were set to grow. Some plants such as palms, banana trees and agaves were planted in flower pots and were used as decoration in main alley of Smetana garden during summer time. The ceiling of the conservatory was raised up to 12 meters in 1956. The collection of plants was increased by collection of orchids, bromeliads and lianas in 1967 (Unar, 1969).

The plant form evokes tropical primeval forest. Two small lakes were build. In 1978 freshwater aquariums and bird aviaries were added (Velisek, 1979). Some civil reconstructions were executed like pavements heating etc. Aquaterrarium was built for caymans looking like river Amazon.

The Palm conservatory has an area of 1500 m². The collection consists of 14 species of palm in 70 specimens. Some of them are originals from orangery (1886) and Moravian castles. This means some of the plants are older than 100 years. There are *Phoenix canariensis*, *Trachycarpus*. Palms *Livistona australis* and *Areca catechu* are from south-eastern Asia. There are also exotic coniferous trees, e.g. *Araucaria*. There are some species of family *Cycadaceae* and *Strelitzias*.



Fig. 1: Palm conservatory (author: M. Pipal, 2006)



Fig. 2: View to the plants from gallery inside Palm conservatory (author: M. Pipal, 2006)

2 Starting point of information system

The first part of information system was creation of plan with localization of tropical plants. For the primary digitization software Arc View 3 from company ESRI was used. We had only old paper plan from 2003. We received part of cadastral map from the cadastral office Olomouc. We rectified scan plan according cadastral data to coordinates S-JTSK. Coordinate system S-JTSK is specific coordinate system for Czech Republic and it is used for cadastral data. Some new plants were missing in the old paper plan and some plants were cut down in the conservatory. Actual situation of plants was drawn in a digital plan. We decided to represent plants by polygon (circle). Polygon representation is better than point representation. The polygons represent crown of tree or bushes in order as seen from above. Plants create two or more floors of vegetation in some parts of conservatory (bushes under trees, etc.). The fig. 2 illustrates this situation. So some polygons partly overlap. The topology was not created. Polygons were used also for group of herbal. Polygon representation better describes the cover by the plants. The measures were created in winter 2006 when the conservatory was closed to public.

The other layers were also digitized: flower beds, pavements, orchiderarium, bird aviaries, small lakes, terrariums, entrance, sale counter, heating and benches. Latin name of plants and abbreviations were taken from the paper plan. Every plant received number identifier.

The final plan and printed output was finished in ArcGIS 9 (Fig. 3). The reason was better cartographical functions. Rotation of data frame was used for printed plan. Labels of plant are two or three letter abbreviations. We convert these labels to annotations (function of ArcGIS) and move some text to better place. The readability of maps is better. The scale is 1:100. Print output is used by the staff of conservatory.

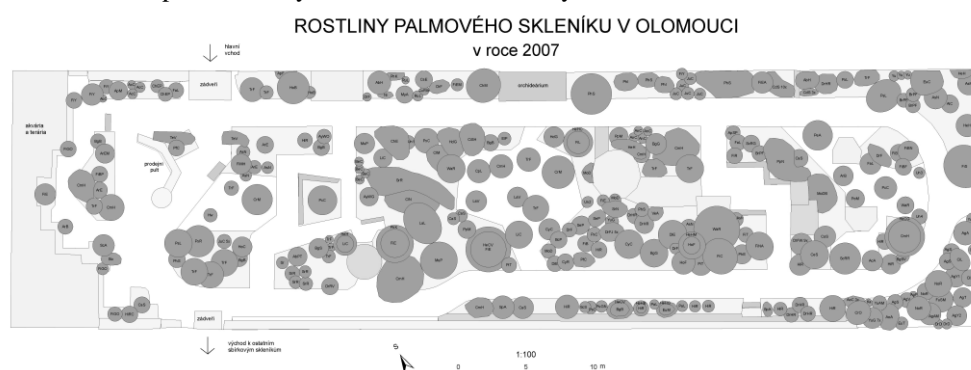


Fig. 3: Printed plan of Palm conservatory from ArcGIS 9

3 Chemical care

Dipl. Ing. Pavel Havranek from botanical department of Palacky University in Olomouc made exploration of pests and diseases on the plants in 2005. The result of exploration was detection about 20 species of insect. About five found species of insect were resistant to insecticide and brought out everlasting danger for plants. The strategy of phytosanitation was changed. At present timely monitoring of pests and diseases is done and the other

insecticides were chosen. Plane sprays against pests are used in winter time, once a year. Selected sprays are used during the whole year according to monitoring of pests, normally every month. The chemical care is difficult because birds, fishes and caymans are located in conservatory.

Storing information about date of spays, pesticides, concentration of solution, pests are necessary. The reason for storing information is evaluation of effectiveness of sprays. The first record about chemical care we received from Mr. Havranek in the form of Microsoft Excel sheet.

4 System JANITOR J/2

Although we created the plan of Palm conservatory in software ArcGIS 9 we had to choose another geographic information system for operation directly in conservatory. The Flora, JSC has no licence of software ArcGIS 9. The request was select software, which is free of charge. The JANITOR J/2 version 2.3 and database management system MySQL have been chosen. Software JANITOR is produced by department LabGIS (from Zdar nad Sazavou, Czech Republic). This department belongs to Czech Environmental Information Agency - CENIA. The former purpose of JANITOR was for discovery report in nature (animals, plants).

JANITOR consists of several stand alone cooperative applications: JanMap, JanDat, SQLTools, DataBuilder and DataRuntime. Application JanMap displays and maintains graphical data in SHP format. Application JanDat and SQLTools maintained data in MySQL database. Application DataBuilder serves for design of interface and forms for editing and selecting data from database (CENIA, 2007). Application DataRuntime serves for design and for start-up of main interface.

5 Design of database of plants and chemical care

Database model consists of five tables. There are tPlant, tPest, tInsecticide, tSpray and tRegister. Fragments of tables tPest and tInsecticide are on Fig. 4 and Fig. 5. No paper registers of plants exist, they were destroyed because of fire. The table tPlant about plants include Identification number, Latin name, abbreviation, genus and family. Botanist was made determination of plants. The table has 286 records.

ID	Rod_cesky	Druh_cesky	Rad_cesky	Rod_latin	Druh_latin	Rad_latin	Celed
1	Molice	skleniková	Molice	<i>Trialeurodes</i>	<i>vaporarium</i> (Westwood)	Hemiptera	Aleyrodidae
2	Molice	bavlniková	Molice	<i>Bemisia</i>	<i>tabaci</i> Gennadius	Hemiptera	Aleyrodidae
3	Červec	citroníkový	Červci	<i>Planococcus</i>	<i>citri</i>	Hemiptera	Pseudococcidae
4	Červec		Červci	<i>Palmicitor</i>	<i>palmarum</i> Monroe	Hemiptera	Pseudococcidae

Fig. 4: Fragment of table tPest

ID	Preparavek	Ucin_latka	Objekt	Skudce	Koncentr	Ochr_lhuta	Pro_lidi	Pro_ryby
1	Actellic 50 EC	pirimiphos-methyl	okrasné rostliny	třásněnky	0,20%	3 dny	Xn (zdraví škodlivý)	jedovatý
2	Applaud 25 WP	buprofezin	okrasné rostliny	červci, molice (ovicid, laricid)	0,10%	1 den		jedovatý
3	Confidor 70 WG	imidacloprid	okrasné rostliny	mšice (+ červci a molice)	0,030%		Xn (zdraví škodlivý)	jedovatý

Fig. 5: Fragment of table tInsecticide (Whole table has 81 records.)

Records about former sprays (years 2005-2006) were stored in Microsoft Excel sheet. The table was not suitable from the point of the first normal form - 1NF (Dobesova, 2004). One record had contained several pest and several plants. The value of attribute was not atomic. The 1NF defines, that the table must directly and faithfully represents a relation, not tables. The final decomposition produces table of pests and table of insecticides. E-R model of database is on Fig.6. The main table is tSpray. Each record in table tSpray has primary key ID_S. Attribute Date stores date of chemical care. Attribute TypeAppl describes type of chemical application (plane from the floor of whole conservatory or selected spray). The chemical insecticide used in concrete spray and the pest is determined by relations to tables tPest and tInsecticide. The cardinalities between tables are 1:N.

At first we considered, that table tPlants with plants would be joined directly to the table of sprays. But very often whole categories were sprayed (all palms, all hibiscus, etc). That means that several plants belong to the same genus and they were sprayed by the same spraying. We added table tRegister with categories of plants (palms, hibiscus, strelitzias). Table with tropical plants tPant is joined to table tRegister. Several plants belong to one category in table tRegister.

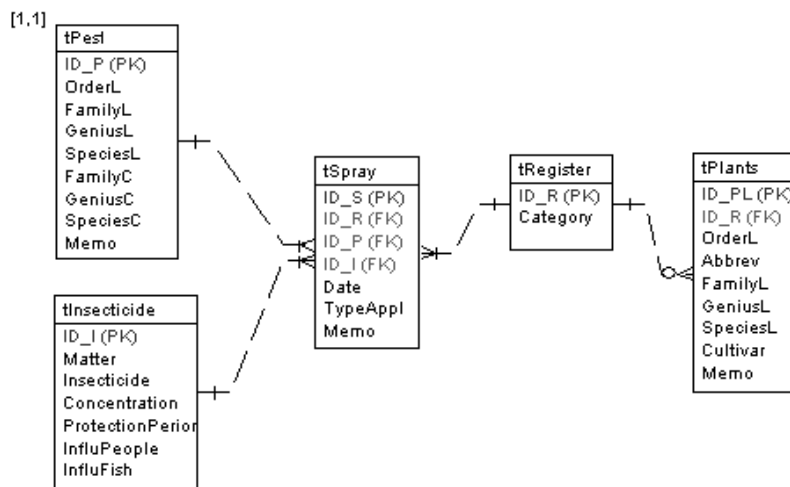


Fig. 6: Database model

5 Application

Application Janitor DataRuntime starts the main interface. It is possible to open four forms for storing data about plants, pests, sprays and insecticides. The forms open corresponding table. The arrangement of forms was prepared in DataBuilder. Example of one form is in Fig.7. The titles of cells are differenced by colour. It is possible to add new records, edit records, select required records and delete records. Operation delete is implemented in case when a plant is cut down. In the form for plants it is possible to select by ID, name or filter according abbreviation, genus or family. Every form contains button Export for exporting data to table in DBF format.

Installation of desktop application is easy and quick. MySQL database is located on server. Client desktop application connects to the database. The back up of database is provided by software on server, where is MySQL database is located.

Fig. 7: Form for editing data about chemical spray

6 Conclusion

The connection of more professions and branches of knowledge together were necessary to realize the geographical information system. The cooperation of botanists, plant scientists, phytopathologists, geoinformatics and informatics scientists was necessary. Geographical information system is rarely used for realisation information system about plants and especially for chemical care from the point small mapped area.

Collecting data about plants, their origin, their age etc. was difficult because no paper register existed. The paper register was destroyed because of fire. The contribution of the information system is actual digital register of about 300 trees and plants. The information system will record plants and phytosanitation sprays in following years. Dates of chemical sprays, insecticides, pests and diseases on the plants will be recorded. It will be possible to evaluate effect of phytosanitation sprays and spreading of pests and diseases of plants.

The selection of information system was under requirement of low cost of software. Digitization was prepared according to cadastral map in program ArcView 3. The print output was prepared in ArcGIS 9. The reason was better cartographical functions. These were rotation of data frame and creation of annotations for labelling plants by abbreviations. For the final information system program JANITOR J/2 version 2.3 and database management system MySQL were chosen. Interface of application program was discussed with staff of Palm conservatory.

The conclusions and recommendations are: The creation of digital plan and creation of print output with GIS are without problems. Creation of attribute table about plants with correct information depends on botanic knowledge and recognition of some tropical plants. There were some problem and some information will be filled in future. Changes of plants in that area are small and editing of geometry is necessary only one times a year.

The design of database model of chemical sprays was not simply part of information system. There was some no ordinary situation of chemical care. Some spays are make for all conservatory or some sprays are make only for some categories or only for one plant. The correct database model has to consist of more tables as result of decomposition. The suggested result database model is simplified and reflects requirement of staff of conservatory.

The actual information system is designed for management of conservatory. It is also possible to use the results of data collection for the public and for teaching pupils and students from basic up to high schools in future. For example printed plan of conservatory makes orientation in conservatory easier for its visitors. There will be necessary generalized plan and highlight interesting plants for amateur visitor.

An extended version of the information system is being worked on nowadays. Three neighbouring conservatories are being mapped. These are tropical, subtropical and cactus conservatory. Digitization of building parts and determination of plant with full attributes are being prepared. Especially determination of cactuses is very difficult. The reason is lack of specialists. In the end a complex information system is planed.

7 References

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