

CARTOGRAPHIC ASPECTS OF CREATION OF PLANS FOR BOTANICAL GARDEN AND CONSERVATORIES

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ABSTRACT

Botanical information system BotanGIS is an information system about plants in Botanical Garden and Collection conservatories Flora. One step of creation of information system was the creation of detail plans of the area. Information was collected by terrain measuring of building parts. The plans were created in GIS software. Next step was punctual measuring and localization of plants.

Several plans in different scales were required for practical utilization of botanical information system BotanGIS. There were produced both paper plans and digital plans for web application. The main stage was a good suggestion of map key for plant and building parts. Plants are identified by numerical labels. Subsequently, the placing of a large amount of numerical labels was cartographical challenge. The plans were used by the garden administrator, university students of botany and public visitors. All users have different demands to the contents of the map. All requirements have been respected by cartographers, authors of plans to create understandable and usable plans. The unifying of the paper plans and digital plans in the map key was a necessity.

As a result, the orientation plan of all area was created. Each of the four conservatories (palm, tropical, subtropical and cactus conservatories) has own plan of plants. The Botanical Garden has a plan with trees and detail plan with herbs. Finally, the plans were used for large information posters at the entrances.

Keywords: cartography, plan, information systems, plant, botany

INTRODUCTION

Geographic information systems (GIS) have very important role in many application areas, for example in the management of energy and water systems, in crisis situations such as floods or accidents, in the management of protected areas and geological deposits, forestry, meteorology or agriculture. They are used in the creation of land-use plans, land development concepts and optimization of transport services.

GIS is used by the public sector and large firms. Apart from them, GIS is also used by smaller companies. These smaller users work with the systems and they are mostly focused on one specific task. The main tasks of GIS are data collection, data management, spatial analysis and visualization [1]. In this article is described an information system designed for the Botanical Garden and conservatories. This system uses several basic GIS tasks. Data collection is represented by localization and mapping

of plants and data management is carried out through a spatial database. Essential part is visualization. All data is needed to visualize especially for visitors to the exhibition area. Therefore, plans are made for visitors to Botanical Gardens and conservatories. These plans are made in a large scale, and they are focus to the selected part of the thematic elements and significant objects for orientation of visitors. Plans have been developed with regard to the user part and cartographic accuracy.

INFORMATION SYSTEM BOTANGIS

Botanical information system BotanGIS is one of extraordinary utilization of GIS. The area of interest is the small bound area in the centre of Olomouc city in the Czech Republic. Botanical information about plants from the University Botanical Garden and tropical and subtropical plants from the Collection conservatories Flora are stored in the database. Database information about plants is connected to the interactive orientation plans of all area [2], [3].

The information system is developed mainly for support the education of botany at the Palacký University [4]. The garden administrator and the administrator of conservatories maintain plants also by this information system. Each plant has a unique identification number. The evidence of plants is stored in database [3]. Each record of the plant is connected to real individual plant. The localization of plants was measured and putted to the plans. The connection of botanical information to the orientation plans enable to study the plants in reality. The information system can be used also by public visitors beside the botanic experts.

The impact of information systems BotanGIS is also way on students of geoinformatics. They took a part in the stage of measuring of the area. The design of plant database is the practical example for the learning the relational database. Additionally, the suggestion of map key for plans can be discussed at the lectures of thematic cartography.

GEOINFORMATICS AND CARTOGRAPHY ASPECTS

The base for measurements was a cadastral map for the area of garden and conservatories. The buildings and building parts as walls, pathways and ponds were measured firstly. The more detailed part as a division to the plant beds and park parts were followed. The building parts of Botanical Garden and conservatories can be assumed as topographic base for the plans. The sketch of the position of plants was the final part of measurements.

Software ArcGIS, by ESRI company, was use for creation and storing data. Data was stored in a file geodatabase. Separate geodatabases were created for each of conservatories and garden. The inner structure of each geodatabase was divided into two datasets. The first dataset "Topo" contains the base data with building parts. The second dataset "Plant" contains the feature class with plants. The dataset of Botanical Garden contains separate feature class for woods, bushes and herbs. The separate geodatabases were used in the stage of creation data.

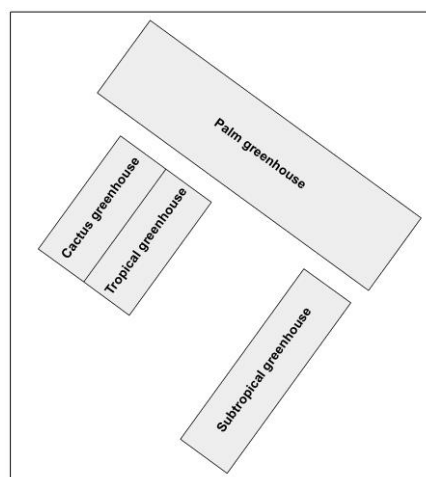


Fig. 1: Base arrangement of Collection conservatories

For final storing of data, it is assumed the storing in one geodatabase. The base data were putted to one database for the purpose of creation the whole area plan (Fig. 5). The recommended route for visitors was sketched. The route has three variations. First route is for the period of Flora exhibitions when all area is freely opened. Next route is only for Botanical Garden. The collection conservatories have own route for the season outside the Flora exhibitions. Routes have been expressed by red color.

The storing data in file geodatabase has several advantages. The same coordinate systems can be set for all feature classes. Also, the storing of annotation for labels was used. The plants were labeled by ID number. The labels were converted to annotation. The placement of annotations was edited to ensure good readability. Finally, the geodatabase ensures the creation of topology and arrangement of spatial integrity for polygon feature classes. Polygon features as plant beds, path ways and buildings cannot have overlaps and gaps.

DESCRIPTION OF THE CURRENT PLANS

There were developed and created plans for four conservatories and plan for a Botanical Garden. Plans for conservatories and Botanical Garden were created for several reasons. The main reason is their use for visitors of exhibition places. Plans are used to obtain basic information about the distribution of plants, rocks, sidewalks and other objects. At the entrance of each conservatory, there is a plan of the area. Visitor can get an instant overview of the overall situation.

Another use is a publication of plans on the web. On the website of the Botanical Garden is located database of all plants which is connected with the plans. Spatial database and map visualization is one of the key things for the concept of distribution of plants. Plans located on the site are also possible to print and can be used during the visit.

Plans may also be used for archiving and recording status in the current phase. Plants in the collection can be varied continuously. Therefore, staff of Garden archived plans. Archived plans can be used to survey the development of collections and decide where new plants can be plant and where would be restored.

Plans of garden and conservatories were prepared according to experts in cartography [5], [6], and [7]. We focused on user aspect together with cartography accuracy. Only

this combination of factors can lead to plan without mistakes [8]. Proper visualization is a very important step which helps people to understand the plans [9]. Eye-tracking technology can be used to evaluate user perception and cognition of maps and other cartographic methods of geographical data visualization [10]. Mainly the choice of colors and symbols fulfill the cartography associativity rule. The cartographers recommended the green color for park places, brown for plant beds, etc. Then was very important discussion with cartography experts and specialist of botany. All decision of cartographers had to be approved by the botanist. After discussion, plans of conservatories and Botanical Garden have the similar key for plants (same green), the same color for walkways and water features etc.

As methods of expression was used the methods of point and polygon symbols. These methods were selected because of the simplicity and readability. In plans, there are not used line symbols. Polygon symbols are used for objects that have linear character. It is because plans are in the large scales. When choosing a representation of real plants and trees, there was a problem with their assignment as point or polygon. Some plants are very large and at the selected scale is better to represent these plants by polygon. On the contrary, small plants would be better to represent by the point. Finally, it was decided that all plants will be expressed by polygon. In some of the conservatories also occur trees. These trees usually have a large treetop. Therefore, it was questionable whether should represent only a tribe or a treetop in the map. In addition, some of the treetop extends into space of path. In the plan, it looks that tree is located in the area of the path but in reality treetop is above the path. Even so, polygon representation of treetop for trees representation was selected. Exception is the plan of Botanical Garden. In this plan, every plant and every tree are represented by point symbols because there are usually a large number of plants next to each other. In addition, in the Botanical Gardens are not exactly measured the size of trees.

The labeling of plants and parts was also cartographical task. In the plans, there is very important to describe of all plant by unique identification number. Plants have to be described by numbers because text labels would not fit into the plan. The numbers are four digits (e.g. 4078). The first number identifies the conservatory, the other three numbers are then assigned to plant in alphabetic order. For creating of ID numbers in the plans was used the automatic tool for labeling. Moreover, position of all the labels had to be adjusted. Manual adjustment had to be done because of the overlaps of labels. In some cases, it was not clear that the number belongs to which polygon. This measure ensures particularly good readability and unambiguous identification of selected plants. The numbers of plants and their names are displayed in the legend. In addition to the description of plants in the plans, there are also described important objects in conservatories, such as aviaries or aquariums.

Four plans were created for each of conservatories, and one plan for a Botanical Garden was created. In addition, the whole area plan of locality was made. There is an overview of all plans:

The Plan of Palm conservatory

The Palm conservatory is one of the largest of its kind in the country. It is 72.5 meters long, 20 meters wide and 12 meters high. More than 200 plants of numerous species are to be found in the 1500 m² area. Plan of this conservatory is in scale 1 : 70 (Fig. 2).

In this time, inventory of plants and trees in the conservatory is updated, and the plan is verified.

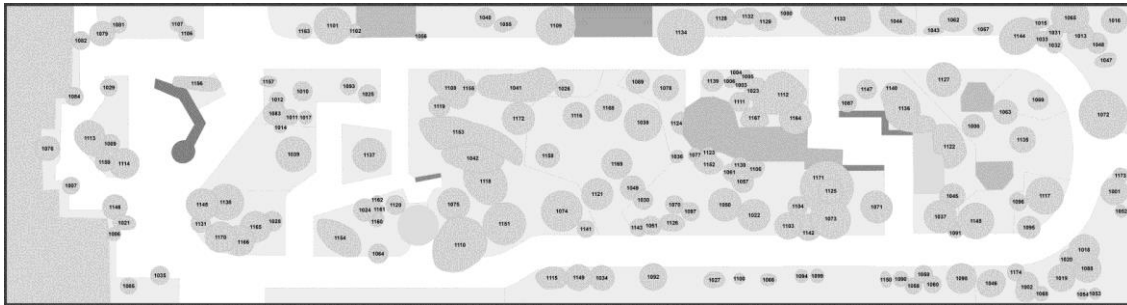


Fig. 2: The Preview of Plan of Palm Conservatory (map field only)

The Plan of Subtropical conservatory

This conservatory is second largest and its home largely for plants coming from the area of Mediterranean. Plan for this conservatory is completed, and it is available for visitors. This plan shows overall 70 species of plant (Fig.3). Scale of this plan is 1 : 40.

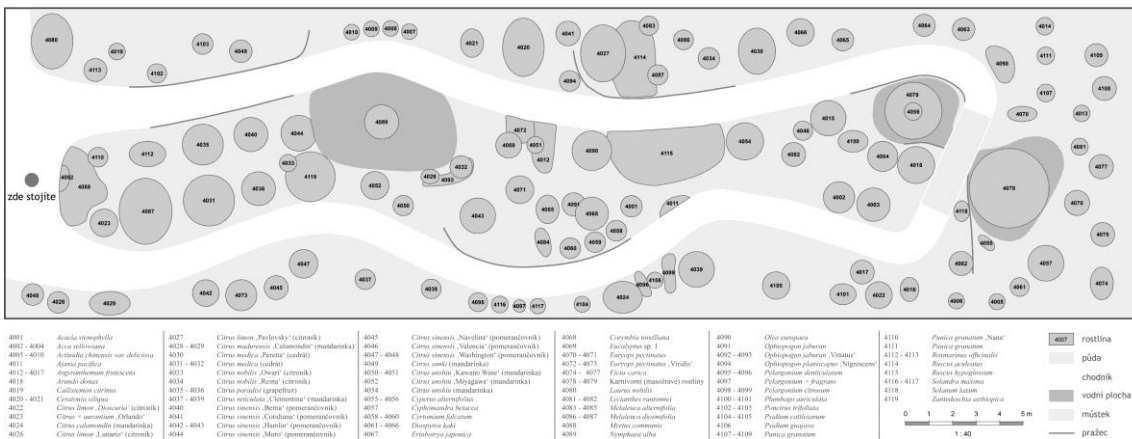


Fig. 3: The Plan of Subtropical Conservatory

The Plan of Cactus conservatory

The Cactus conservatory is the exhibition of various species of cactuses. Nowadays all data for the plan are collected, and we develop the first draft.

The Plan of Tropical conservatory

The Tropical conservatory is exhibitions of various species of tropical plants. Manager of this conservatory makes inventory of plants in this time. The plan for this conservatory will start to compile in June.

The Plan of Botanical Garden

This plan is little different from previous plans for conservatories. The Plan of Botanical Garden is specific because it was compiling like information panel. This panel not only contains plan, but here are other additional information – text information about Botanical Garden, three illustrative photos and contacts (Fig. 4). Panel is made in Czech and also in English and stands next to the entrance to Botanical Garden.



Fig. 4: The Plan of Botanical Garden

The Plan of the whole area

The Plan of the whole area serves as an overview for the visitor's tour through conservatories (Fig. 5). It was made like a first plan, and it is available in the print version.

CONCLUSION

Plans of Botanical Garden and conservatories are designed for visitors, staff and students of botany. The basic requirements of plans are simplicity and clearness. Users of plans do not have cartographic professional education, so we choose comprehensible and clear cartographic method of expression. The content of the plan has been created by experts from the fields of botany, and the final products were formed by cartographers. An important aspect of this cooperation is the mutual communication and utilization of previous experiences. Plans have been developed with the help of GIS technology. Thematic information was contained in spatial databases and was visualized by using cartographic tools. The resulting plans are placed at the entrances of individual parts of the Botanical Garden and conservatories and served to visitors. They were print on durable plastic material for long life. Plans are also posted on the website of the Botanical Garden and the website of BotanGIS project. Printed versions are also available for staff. Plans are used for the review of plants and like an aid in the field inventory of plants. They will also be archived for a review of the development of individual species in the future. Therefore, plans of Botanical Garden and conservatories are a valuable tool and have a wide application.

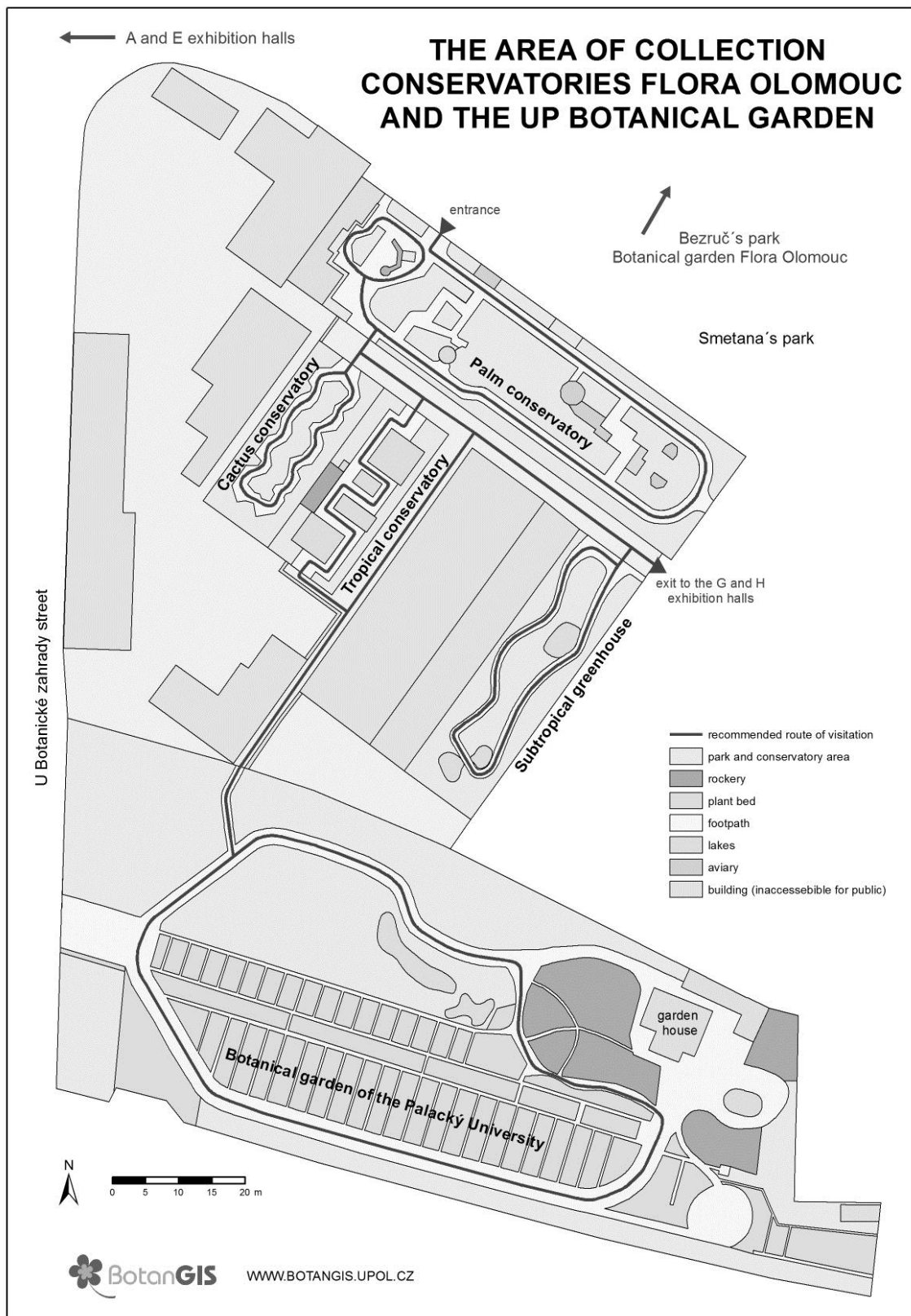


Fig. 5: The plan of the whole area

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