

The Botanical Garden of the University of Banja Luka

Gordana Đurić^{1,2}, Ljiljana Došenović^{3,1}, Jelena Davidović^{2,1}, Mira Čopić⁴

¹Genetic Resources Institute, University of Banja Luka, Republic of Srpska, BiH

²Faculty of Agriculture, University of Banja Luka, Republic of Srpska, BiH

³Faculty of Forestry, University of Banja Luka, Republic of Srpska, BiH

⁴Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska, BiH

Abstract

The Botanical Garden of the University of Banjaluka is part of the “University City” complex sprawling over 5.3 ha. The complex began as the “Vrbas” Austro-Hungarian barracks at the end of the nineteenth century and it was used for military purposes until 2004. After being assigned to the University of Banja Luka in 2004, the area was allocated to the Genetic Resources Institute to make use of it. The Botanical Garden facilities are divided into three separate sections. In one section, the setting up of the botanical collections of genetic resources has begun. There is a fruit collection and preliminary characterization has also started on the accessions. In addition, *ex-situ* collections of vegetables, aromatic and medicinal plants and herbs, industrial and wild plants were designed. In the middle section, a pond was planned and the establishment of an arboretum collection was initiated, with representatives of autochthonous woody species. In the third section, green houses were designed and a building with gene bank facilities and laboratories was built. The Botanical Garden of the University of Banja Luka, as a place for *ex-situ* plant conservation, is of great importance for the conservation of biodiversity as well as for scientific research in this field.

Key words: *ex-situ* conservation, genetic resources, fruit collection, arboretum.

Introduction

Botanical gardens are unique facilities of regional and global importance within university centres. As a university city, Banja Luka, which has earlier been known for its green areas and tree alleys, has not yet had a similar facility. Owing to this fact, as well as to wide-ranging global importance of such places, there was an initiative to create a botanical garden within the “University City” complex.

The complex began as "Vrbas" Austro-Hungarian barracks at the beginning of the twentieth century and it was used for military purposes until 2004. By the decision of the Government of the Republic of Srpska, the area was allocated to the University of Banjaluka to make use of it. During 2004, rearrangements started as well as an initiative to found the Botanical Garden which was approved at the City Assembly of Banja Luka on 17 September 2004. From 2005 until 2008, thorough reconstruction and soil recultivation took place including the drafting and approval of a regulation plan that served as the basis for project documentation. In 2008 and 2009, further work on careful preparation of soil and planting of a number of forestry and ornamental dendrological material were done in the Botanical Garden. At the beginning of 2009, the Genetic Resources Institute was founded as an organizational unit of the University that was to use and manage the area of the Botanical Garden. In 2012, the "University City" complex was declared a protected area for resources management whereas the Genetic Resources Institute was assigned to manage this protected area. The complex is protected under the II and III degree regime (Institute for Protection of Cultural, Historical and Natural Heritage of the Republic of Srpska).

Object, materials and methods

Ecological characteristics of the location

The "University City" complex is situated east from the centre of Banja Luka, between the Vrbas River in the east and Vojvode Petra Bojovića Boulevard in the west, Vojvode Živojina Mišića Boulevard in the south and Banjalučko Polje in the north. It sprawls over 28.5 ha, out of which the Botanical Garden covers 5.3 ha.

In terms of relief characteristics, the area belongs to the Pannonian Plain rim with specific undulating terrain and fluvial terraces. The complex itself is situated on the left bank of the Vrbas River on the neogene fluvial terrace, slightly sloping towards east, that is, towards the Vrbas River bank. The natural soil in the area of research comprises alluvial deposits of considerable thickness (Stanivuković and Stupar, 2008.). The original relief was substantially altered at the time when the area was used as a military compound, thus the present pedologic state has undergone changes and become complex due to various anthropogenic influences. The absolute heights of natural terrain are around 156 m.

The climate conditions in Banja Luka can be described as moderate continental with relatively mild winters and warm summers. During the non-vegetation period, warm south westerly winds often occur causing a foehn effect and making snow melt rapidly in the winter period. The average annual air temperature for the period from 1961 to 1990 was 10.6°C whereas the average annual precipitation amounted to 1026 mm. January is the coldest month with average temperature of 0.7°C, while July is the hottest month with average temperature of 20.5°C. The average air temperature during vegetation period is 16.9°C. With 10.9°C mean temperature, spring is slightly warmer than autumn (10.8°C). Maximum precipitation during the year occurs in June and amounts to 111 mm, whereas the minimum has been recorded

in February (63 mm). During the vegetation period, precipitation amounts to 566 mm, 55.17% of total annual precipitation. Detailed characteristics of the climate in Banja Luka can be found in Table 1.

Tab. 1. Air temperature values and precipitation throughout a year (Stanivuković, Stupar, 2008)
Вриједности температуре ваздуха и количине паавина у току године (Станивуковић и Ступар, 2008.)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Temp. (°C)	-0,7	1,9	6,1	10,9	15,7	18,9	20,5	19,7	15,9	10,8	5,8	1,2	10,6
Precip. (mm)	69	63	79	87	98	111	95	93	82	72	91	86	1026

Based on the above mentioned climate indicators, we can conclude that in terms of climate the locality is very suitable for most woody and shrub species (Stanivuković and Stupar, 2008.).

Original vegetation

The garden area is located in the natural belt of climatogenic forests of sessile oak and hornbeam (*Quercus-Carpinetum betuli*). Alluvial terraces with higher-moisture types of soils were mostly covered by common oak and hornbeam (*Carpino betuli – Quercetum roboris*) including the complex itself, whereas the river banks were under the forests of willows and poplars. (Stanivuković and Stupar, 2008).

Following a detailed land surveying record (1:500) and field prospection, dendrological vegetation was analysed with the aim to ascertain the current state-of-affairs and guidelines for renewal, that is, removal of trees.

The vegetation found in the area of the Botanical Garden was mainly of ruderal origin indicated by a great number of black locust trees (*Robinia pseudoacacia* L.) as a prevailing species, boxelder maple (*Acer negundo* L.) and myrobalan plum (*Prunus cerasifera* Ehrh.). Also, a number of honey locust trees (*Gleditsia triacanthos* L.) were identified that were part of the hedges at this location. Alongside the existing roads towards the campus, a number of Lawson cypress (*Chamaecyparis lawsoniana* (A. Murray) Parl.) trees were identified as well as northern red oaks (*Quercus rubra* L.), but also a Jeffrey pine tree (*Pinus jeffreyi* Balf.) and a paper birch tree (*Betula papyrifera* Marsh.), as very rare species in our ornamental woody flora (Urban Planning Institute of the Republic of Srpska).

Study

Because of its original purpose and considerable anthropogenic influence within the complex, it was necessary to make a detailed study on the current state-of-affairs prior to beginning any work on establishing of the Botanical Garden. The area intended for the Botanical Garden had been organized as part of military compound

with exercise facilities which had mostly been removed, except the concrete bottom of a pit used for immersion of army vehicles that was to remain and fit in within the water surface being planned.

As a consequence of a number of difficulties that left this location in quite a derelict state, there was a need for radical professional action, both growing and sanitary, as well as reconstruction and revitalisation of this area that resulted in a special study being made that encompassed the area of the Botanical Garden, that is, requirements for its establishment, protection, conservation and purposeful use of biodiversity for research and education (Genetic Resources Institute).

Taking into account the need for harmonisation of all the above listed functions of this facility and the then state-of-affairs, what followed was the study of environment conditions within the area planned for the establishment of the Botanical Garden including the analysis of necessary reconstruction and revitalisation work of the area concerned as well as the proposal of further measures for recultivation and enhancement of the said area with a specific purpose. After analysing the factors, natural and anthropogenic, for the establishment and development of the Botanical Garden, microclimatic factors of the location were considered primarily in regards with humidity and sun exposure, vicinity of the Vrbas River and potential water retention in the topsoil profile. As a final step, the best positions for planting of various plant species were determined in accordance with their biological requirements, planting dynamics and species specification being recommended. Also, the plan was made to remove and renew trees found at the location.

Results and discussion

The Botanical Garden area was divided into three sections according to the planning solution: a section for warehouse and mechanisation facility, gene bank and green houses; an arboretum and pond; botanical collections, alpinums and flower section. Surrounding the Botanical Garden, protection fence was planned and partly constructed with the main and additional gates. Carefully selected fertile humus substrate was spread all over the Botanical Garden whereby necessary soil alteration and levelling of terrain were done so the planting could start.

In the south section of the Botanical Garden at around 1.5 ha, botanical collections and alpinum have started being set up. Given the parcel size, botanical collections have been created as systematic collections. Furthermore, as various departments have their specific needs, the following are to be created, too: vegetables collection; medicinal and aromatic plants and herbs collection; field crops, industrial and edible wild plants collection. These collections will be completed successively, i.e. seasonally, by planting seedlings or transferring plants from their natural environment to a previously prepared parcel.

Moreover, a special collection of autochthonous apple and pear varieties was set up comprising 62 seedlings, out of which 38 apple and 24 pear seedlings (the collection contains 18 apple and 13 pear accessions).

In the middle part of the garden area, the forming of an arboretum collection and a pond has begun. Taking into account space limitation and educational intent, native woody species are primarily present including their green companions at the ground level. The whole arboretum area is divided into a number of sections whereas each section is further divided into bigger number of parcels that will be mutually separated by pathways. Each parcel contains close representatives of particular genera and families. Currently, the Botanical Garden has 215 trees of various age, out of which 174 deciduous and 41 coniferous encompassing 36 different taxons.

The second stage in the development of the Botanical Garden will aim at the setting up of a pond, alpinum, botanical collections and pathways. The pond and alpinums with specific vegetation are one more form of biological diversity, that is, a unique botanical, geological and ecological collection that is to complete the botanical collection.

Conclusion

Biological diversity, i.e., diversity of living organisms – within and between various species and ecosystems, is an important resource for human subsistence and plays a key role in the sustainable development. As regards the necessity and significance of conservation of biological diversity as a requirement for sustainable development and survival of people, botanical gardens, as part of a global system for conservation of biological diversity, are especially important in safeguarding endangered representatives of regional flora. Therefore, considering and designing them in this way, such as this one in Banja Luka, botanical gardens become regional centres of *ex-situ* conservation of endangered flora across the region.

A great number of educational institutions are immediate beneficiaries of such facilities, first of all the faculties of natural sciences and mathematics, forestry and agriculture, then secondary schools where biological and biotechnical disciplines are studied, but also overall student population. According to the definition, botanical gardens are collections of live plants and, apart from *ex-situ* conservation and propagation of endangered species, they mainly serve to improve knowledge of botany, that is to say they have an educational function. On the other hand, these kinds of facilities help raise ecological culture and awareness of the whole population. To see the plants from other parts of the world (exotic), a variety of quite unusual cultivars and hybrids is a possibility that openly encourages citizens to learn more about plants, to protect, grow and nurture them. In addition, these educational facilities primarily aim at gathering and directing as wide circle of people as possible towards particular actions as regards protection of nature and the environment. This is particularly crucial in urban areas with tendency of extensive expansion including Banja Luka.

All these activities are of public interest and, although it is sometimes difficult to explain why such activities are important for people and the community, projects like these require substantial support from the state and local administrations. It takes a lot of effort and endurance to start a botanical garden which slowly grows and thrives

but lives long and, only after 50 or 100 years, it can virtually shine out in the full sense of the word.

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Ботаничка башта Универзитета у Бањој Луци

Гордана Ђурић^{1,2}, Љиљана Дошеновић^{3,1}, Јелена Давидовић^{2,1},
Мира Ћопић⁴

¹Институт за генетичке ресурсе, Универзитет у Бањој Луци, Република Српска, БиХ

²Пољопривредни факултет, Универзитет у Бањој Луци, Република Српска, БиХ

³Шумарски факултет, Универзитет у Бањој Луци, Република Српска, БиХ

⁴Министарство пољопривреде, шумарства и водопривреде Републике Српске, БиХ

Сажетак

Ботаничка башта Универзитета у Бањој Луци, као дио комплекса “Универзитетски град”, простире се на површини од 5,30 ha. Комплекс је настао као аустроугарска касарна “Врбас” крајем XIX вијека и све до 2004. године имао је војну намјену, када је додијељен Универзитету у Бањој Луци. Простор баште је дат Институту за генетичке ресурсе на коришћење. Садржаји Ботаничке баште подијељени су у три засебне цјелине. На једној цјелини започело је постављање ботаничких збирки генетичких ресурса. Подигнута је колекција аутохтоних воћака на којима је започета прелиминарна карактеризација, а пројектоване су *ex-situ* колекције поврћа; љековитих, ароматичних и зачинских биљака; ратарских, индустријских и самониклих јестивих биљака. У средњој цјелини пројектовано је језеро и започето је успостављање арборетумске збирке којој су заступљене аутохтоне дрвенасте врсте. У трећој цјелини пројектовани су стакленици и изграђен објект у коме су смјештени банка гена и лабораторије. Ботаничка башта Универзитета у Бањој Луци, као мјесто за *ex-situ* конзервацију биљака има изузетни значај за очување биодиверзитета као и за научно-истраживачки рад у тој области.

Кључне ријечи: *ex-situ* конзервација, генетички ресурси, колекција воћака, арборетум.

Gordana Đurić

E-mail Address:

gordanadju@gmail.com