For. review 43: 37 - 41. Skopje, 2012

ISSN: 0585-9069
UDC: 630*27(497.11)
Original scientific paper
Paper submission: May, 2012

# THE CONCEPT OF LANDSCAPING THE PARK ZONE OF THE ARBORETUM OF THE FACULTY OF FORESTRY IN BELGRADE

VUKIN M., ZIVANOVIC M.
*University of Belgrade Faculty of Forestry, Belgrade, Serbia*
*Correspondig author e-mail address:* marina.vukin@sfb.bg.ac.rs

ABSTRACT: The Arboretum of the Faculty of Forestry in Belgrade is a natural monument with representative floristic characteristics, which covers an area of 6.69 ha. It is a unique spatial-environmental unit within the city green space system with outstanding landscape features emphasized by its views towards the central area of the city of Belgrade and other sites of interests. This paper presents a landscape design plan for the extended zone of the Arboretum, which should make a separate compositional and functional unit of this protected natural area. It will be 0.40 ha in size. The concept of landscaping involves construction and establishment of the following garden-landscape elements and other facilities: an entry area with a system of pathways, a multi-purpose plateau, a sensory garden, pavilions, water area, lawns, perennial gardens, tree groups and alleys.
Keywords: arboretum, park zone, design

## 1 INTRODUCTION

*The Regional Spatial Plan for the City of Belgrade Administrative Area* (2011) puts a special emphasis on the necessity to create new landscape site design plans for certain spatial-environmental units and other areas of the urban city structures [9]. As a special-purpose area and a spatial-environmental unit located in the vicinity of the city center, Arboretum of the Faculty of Forestry in Belgrade has a multi-functional significance in the city system of green spaces.

The Arboretum of the Faculty of Forestry is a protected natural area in the category of natural monuments and anthropogenic urban ecosystems with an array of functions: educative, scientific, decorative, ecological, cultural, tourist and many others [5,6]. Since the area is in the process of reconstruction, some parts of the central zone of the Arboretum as well as the extended zone do not still serve their primary purpose. One of the most important tasks of the reconstruction and recultivation of the extended zone is to landscape the park zone.

Considering the above mentioned the following research task ensued:

- to define the present state of the area planned for the park zone;
- to present the concept of landscaping the park zone with new facilities, using model presentations.

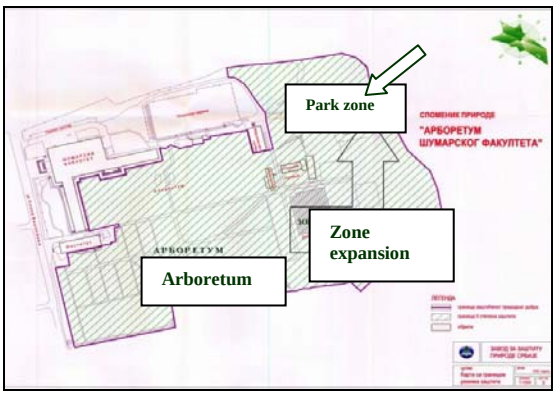
## 2 MATERIAL AND METHODS

This paper is based on the material obtained from the plans and technical documentation of the Faculty of Forestry yard and arboretum, which together cover an area of 9.70 ha. The arboretum itself covers an area of 6.69 ha. According to the *Master plan for the Natural monument `Faculty of Forestry Arboretum`* for the period from 2011 to 2020, a park zone is planned to be build within the zone of extension of this spatial entity [11]. The future park zone, which is the subject of this paper, will cover an area of 0.40 ha. Methodology of work is based on graphic presentation of the concept of landscaping the zone. Software packages AutoCAD 2013 and digital modelling - 3D presentations were used for this purpose [1,3,7]. The work was carried out in three stages: preliminary stage (inspection of surveying basics – Cadastral and Topographic plans of the faculty yard, field surveying), recording the current state and landscape design plan development.

## 3 RESULTS AND DISCUSSION

### 3.1 Basic data on the current state

*Map 1* shows the current state of the Arboretum. The area of the future park zone, which makes the northeast part of the extension zone, is marked. This spatial presentation of the Arboretum reveals its outstanding landscape characteristics determined by its location in the vicinity of the city center and by the essential values that are reflected in the authenticity, representativeness and landscape attractiveness of this place. [5].




**Map 1:** Map of the Arboretum with its protection regime borders
(source study: *Protection of the Arboretum of the Faculty of Forestry in Belgrade*, Institute for Nature Conservation, 2010) [8]

The existing vegetation was recorded (*Map 2*) and a manual of dendroflora evaluation was done (*Table I*). Each existing specimen had its area determined, estimation elements measured, health state and vitality evaluated and functional-aesthetic values determined. Among the registered broadleaved species, Turkey oak *Quercus cerris* L. and Flowering ash *Fraxinus ornus* L., are dominant and they will be preserved. On the other hand, 19 specimens of different autochthonous broadleaved species are planned to be felled due to their bad health state and low quality. Silvicultural-sanitation measures (such as removal of diseased, damaged and

ISSN: 0585-9069

dead trees, crown pruning and shaping, application of control measures etc.) should be carried out on the retained trees. The soil of the whole protected natural area is characterized as *lessive brown soil* [6]. The soil cover of the whole studied area (0.40 ha), which includes the park zone accessible to wheeled vehicles and adjacent to tennis courts is of poor quality and anthropogenically altered.

**Map 2:** The existing vegetation site plan

**Table I:** Manual of dendroflora evaluation

| Species | $D_t$ (cm) / h (m) | Crown width (m) | Health state | Decorative value | General assessment | Note (to be |
|---|---|---|---|---|---|---|
| *Robinia pseudoacacia* L. | 60,0 / 19,5 | 6,0 | 4 | 2 | 3 | - |
| *Acer pseudoplatanus* L. | 34,0 / 19,0 | 5,0 | 4 | 2 | 3 | - |
| *Acer pseudoplatanus* L. | 32,0 / 15,0 | 6,0 | 5 | 4 | 4 | + |
| *Acer pseudoplatanus* L. | 43,0 / 19,0 | 6,0 | 5 | 4 | 4 | + |
| *Acer pseudoplatanus* L. | 36,0 / 19,0 | 6,0 | 5 | 4 | 4 | + |
| *Juglans regia* L. | 25,0 / 10,0 | 8,0 | 4 | 3 | 3 | + |
| *Juglans regia* L. | 25,0 / 11,0 | 8,0 | 4 | 3 | 3 | + |
| *Populus nigra* L. | 35,0 / 19,0 | 5,0 | 4 | 4 | 4 | + |
| *Juglans regia* L. | 24,0 / 11,0 | 5,0 | 4 | 3 | 3 | + |
| *Juglans regia* L. | 25,0 / 9,0 | 7,0 | 4 | 2 | 2 | + |
| *Juglans regia* L. | 30,0 / 15,0 | 8,0 | 4 | 3 | 3 | + |
| *Populus nigra* L. | 32,0 / 19,0 | 5,0 | 4 | 4 | 4 | + |
| *Populus nigra* L. | 28,0 / 18,0 | 5,0 | 4 | 3 | 3 | + |
| *Populus nigra* L. | 37,0 / 19,0 | 6,0 | 4 | 3 | 4 | + |
| *Betula pendula* Roth. | 27,0 / 18,0 | 5,0 | 5 | 5 | 5 | + |
| *Betula pendula* Roth. | 22,0 / 16,0 | 5,0 | 3 | 3 | 3 | + |
| *Betula pendula* Roth. | 24,0 / 15,0 | 5,0 | 3 | 2 | 3 | + |
| *Betula pendula* Roth. | 18,0 / 12,0 | 4,0 | 3 | 3 | 3 | + |
| *Betula pendula* Roth. | 32,0 / 15,0 | 6,0 | 3 | 3 | 3 | + |
| *Prunus cerrasifera* Ehrh. | 5,0 / 5,0 | 2,0 | 5 | 3 | 3 | - |
| *Acer negundo* L. | 22,0 / 12,0 | 10,0 | 5 | 1 | 3 | - |
| *Juglans regia* L. | 13,0 / 11,0 | 6,0 | 5 | 5 | 5 | + |
| *Ulmus campestris* L. | 17,0 / 12,0 | 5,0 | 4 | 5 | 5 | + |
| *Fraxinus ornus* L. | 12,0 / 10,0 | 1,5 | 2 | 1 | 2 | - |
| *Fraxinus ornus* L. | 4,0 / 4,0 | 1,5 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 17,0 / 15,0 | 5,0 | 5 | 5 | 5 | + |
| *Quercus cerris* L. | 5,0 / 7,0 | 2,0 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 11,0 / 11,0 | 3,0 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 14,0 / 12,0 | 3,0 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 42,0 / 21,0 | 10,0 | 5 | 5 | 5 | + |
| *Quercus cerris* L. | 6,0 / 5,0 | 2,0 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 11,0 / 11,0 | 3,0 | 2 | 2 | 2 | - |
| *Robinia pseudoacacia* L. | 23,0 / 18,0 | 5,0 | 2 | 1 | 2 | - |
| *Fraxinus ornus* L. | 16,0 / 13,0 | 3,0 | 2 | 2 | 2 | - |
| *Fraxinus ornus* L. | 14,0 / 9,0 | 3,0 | 5 | 4 | 4 | + |
| *Fraxinus ornus* L. | 9,0 / 10,0 | 3,0 | 5 | 4 | 4 | + |
| *Fraxinus ornus* L. | 10,0 / 12,0 | 3,0 | 5 | 4 | 4 | + |
| *Quercus cerris* L. | 24,0 / 21,0 | 6,0 | 5 | 5 | 5 | + |
| *Quercus cerris* L. | 5,5 / 9,0 | 2,0 | 2 | 2 | 2 | - |
| *Quercus cerris* L. | 42,0 / 23,0 | 10,0 | 5 | 5 | 5 | + |
| *Fagus moesiaca* (Maly) Czeczott. | 17,0 / 13,0 | 4,0 | 2 | 2 | 2 | - |
| *Fagus moesiaca* (Maly) Czeczott. | 19,0 / 13,0 | 3,0 | 2 | 2 | 2 | - |
| *Juglans regia* L. | 70,0 / 26,0 | 20,0 | 5 | 5 | 5 | + |
| *Juglans regia* L. | 70,0 / 25,0 | 20,0 | 5 | 5 | 5 | + |
| *Acer pseudoplatanus* L. | 15,0 / 10,0 | 1,5 | 2 | 2 | 2 | - |
| *Acer negundo* L. | 18,0 / 12,0 | 1,5 | 2 | 2 | 2 | - |
| *Ailanthus altissima* (Mill.) Sw. | 22,0 / 16,0 | 6,0 | 2 | 1 | 2 | - |
| *Ailanthus altissima* (Mill.) Sw. | 25,0 / 16,0 | 7,0 | 2 | 1 | 2 | - |
| *Juglans regia* L. | 18,0 / 10,0 | 9,0 | 2 | 2 | 2 | - |

3.2 The concept of landscaping the park zone

The proposed park zone is a value of great functional and structural significance within the Arboretum. The value of this park zone is increased by the fact that it allows a view of the newly built Ada bridge over the river Sava and other sites of interest in the center of the city.

*Map 3* presents the site-grading plan, with the spatial arrangement of the basic elements of the designed park zone. This park zone as a macro-unit contains the following elements:

- entry area with a system of pathways;
- a multi-purpose plateau;
- sensory garden;
- pavilions;
- water area;
- lawns;
- perennial gardens;
- groups of trees;
- alleys.

**Map 3:** Site-grading plan of the park zone

The design of the park composition with its garden and architectural elements and with other infrastructure elements is presented in *Map* 4.

**Map 4:** Design plan of the park zone

A 3D modelling design with the layout of vegetation and plant collections is presented in *Figure 1.*

**Figure 1:** Concept plan of park zone landscaping (3D presentation)

The entry area (1) starts in the north-west part of the park zone, and the system of pathways (2) enables a good interconnectedness of all elements of the designed object and good movement dynamics, directing the visitors towards the focal points and other parts of the Arboretum. The total area of pathways and roads within the entry area and the park zone itself amounts to 1 278.70 $m^2$. Pathways account for 374.00 $m^2$, and roads for 904.70 $m^2$. The system of communication lines designed in such a way makes an impression of spatial unity and harmony, with a strong balance between the contents of the space and the logical sequence of garden-architectural and other components of the contents. Vegetation is modelled in the style of parterres and emphasizes the movement direction. The multi-purpose plateau (3), 82.41 $m^2$ in size, is designed as a circular area, with semi-circular stone benches and a rectangular wooden pergola (*Figure 2*). This area, characterized by outstanding views of the Ada bridge and other parts of the central and wider area of the city is designed for visitor receptions and educational activities. The sensory garden (4), 90.00 $m^2$ in size, is designed to meet the needs of horticultural therapy and education of people with special needs, (*Figure 3*), with the purpose of stimulating different sensations and abilities. It is designed in four circular plateaus. The proposed plant species are planted in semi-circular concrete plant boxes, 70 cm in height. Each plant box contains species that encourage specific senses – smell, sight, touch or taste. Pavilions (5) make 2 separate units, where visitors can spend some time and enjoy the views of the city sites of interest (*Figure 4*). Water area (6) covers 46.20 $m^2$ and makes a microambient along the south-east border of the park zone with vegetation typical of aquatic ecosystems (*Figure 5*). Most of it receives enough sunlight, but a smaller part is in the shade of the existing dendroflora.

**Figure 2:** Multi-purpose plateau

**Figure 3:** Sensory garden

**Figure 4:** A part of the pavilion by the sensory garden

**Figure 5:** Water area

3.3 Landscaping the spare areas

Since this paper presents a design solution with the definition of the basic elements, it will provide general guidelines for landscaping and designing the spare areas.

For. review 43: 37 - 41. Skopje, 2012
Ss. Cyril and Methodius University in Skopje
Faculty of Forestry in Skopje
ISSN: 0585-9069

(*Table II*). The total area of the green spaces, which comprise lawns, areas covered with deciduous and evergreen shrubs, perennials, and prostrate conifers amounts to 2,588.89 $m^2$. Landscaping the spare areas consists of establishing lawns, perennial gardens, groups of trees and alleys (*Map 5*). The total area of lawns is 2,548.89 $m^2$ (*Map 6*). Lawn $T_1$ accounts for 960.00 $m^2$ of the area, lawn $T_2$ for 1,093.89 $m^2$, lawn $T_3$ for 195.00 $m^2$ and lawn $T_4$ for 300.00 $m^2$.

**Table II:** Growing stock specification

| ordinal number | Species | pieces |
|---|---|---|
| **I Broadleaved trees** | | |
| 1. | *Fraxinus excelsior "Globosa"* | 21 |
| 2. | *Ginkgo biloba* L. | 3 |
| 3. | *Liriodendron tulipifera* | 4 |
| 4. | *Magnolia x soulangeana* Soul.-Bod. | 4 |
| 5. | *Albizia julibrissin* Durazz. | 10 |
| 6. | *Liquidanbar styraciflua* L. | 6 |
| 7. | *Fagus sylvatica "Atropurpurea"* | 9 |
| 8. | *Acer platanoides "Crimson King"* | 16 |
| | **TOTAL**: | **73** |
| **II Coniferous trees** | | |
| 9. | *Chamaecyparis lawsoniana "Ellwoodii"* | 4 |
| 10. | *Cedrus atlantica "Glauca"* | 3 |
| | **TOTAL**: | **7** |
| **III Prostrate Conifers** | | |
| 11. | *Juniperus horizontalis "Wiltonii"* | 16 |
| | **TOTAL**: | **16** |
| **IV Evergreen shrubs** | | |
| 12. | *Prunus laurocerasus* L. | 24 |
| | **TOTAL:** | **24** |
| **V Deciduous shrubs** | | |
| 13. | *Weigela florida* (Bunge) A.DC.) | 10 |
| 14. | *Deutzia gracilis* Sieb. et Zucc. | 7 |
| 15. | *Spiraea bumalda* | 5 |
| | **TOTAL:** | **22** |
| **VI Perennials** | | |
| a. | *Santolina rosmarinifolia* | 72 |
| b. | *Lavandula officinalis* | 50 |
| c. | *Coreopsis grandiflora* | 45 |
| d. | *Thymus sp.* | 25 |
| | **TOTAL:** | **192** |
| **VII Decorative grasses** | | |
| e. | *Imperata cylindrica* | 55 |
| f. | *Festuca glauca* | 70 |
| g. | *Carex sp.* | 61 |
| h. | *Cortaderia selloana* | 2 |
| | **TOTAL:** | **188** |
| **VIII Plants in the sensory garden** | | |
| | **Taste and Smell/1** | |
| | *Ocimum basilicum* | 10 |
| | *Allium schoenoprasum* | 16 |
| | *Petroselinum sp.* | 15 |
| | *Melissa officinalis* | 16 |
| | *Origanum vulgare* | 16 |
| | *Anethum gravedens* | 16 |
| | **Smell** | |
| | *Lavandila officinalis* | 21 |
| | *Santolina chamaecyparissus* | 13 |
| | *Rosmarinus officinalis* | 10 |
| | *Helychrisum arenarium* | 5 |
| | **Touch** | |
| | *Stachys lanata* | 10 |
| | *Salvia officinalis* | 10 |
| | *Festuca glauca* | 10 |
| | *Sedum spectabila* | 16 |
| | *Sedum acre* | 16 |
| | **Taste and Smell/2** | |
| | *Coriandrum sativum* | 16 |
| | *Mentha sp.* | 24 |
| | *Thymus citrodorus* | 20 |
| | *Apium graveolens* | 26 |
| | **TOTAL:** | **286** |
| **IX Climbers** | | |
| $p_1$ | *Lonicera caprifolia* | 100 |
| $p_2$ | *Parthenocissus tricuspidata* | 86 |
| $p_3$ | *Wisteria sinensis* | 6 |
| | **TOTAL:** | **192** |

**Map 5:** Planting plan with growing stock specifications

The lawns are exposed to direct sunlight and they are intended to be established by sawing grass seed, in the quantity of 2.5-4 kg/100 $m^2$. The grass mixture has the following composition:

*Festuca rubra* var. *commutata* ..... 40%
*Poa pratensis* ..... 20%
*Lolium perennials* ..... 25%
*Trifolium repens* ..... 15%

*Map 5 and 6* presents the design of 5 areas covered with perennials (a, b, c, d). Several tree groups and alleys are also planned to be established. A detailed analysis envisages planting of decorative broadleaved cultivars, that will be dominant in the future dendrofund and a smaller number of conifers of different modes of growth, structure and colour. Broadleaved seedlings should be 6-8 years old (*Figure 6*) and coniferous seedlings should be 4-6 years of age. The seedlings of prostrate conifers aged 2-4 years, evergreen shrubs aged 2-4 years and deciduous shrubs aged 2-4 should be used.

The alleys are composed of attractive species of diverse forms. They are not straight, but follow the pathways within the park zone along the lawns. All species should be of great functional-esthetical and ecological value, adapted to urban living conditions [2,4].

**Map 6:** Lawn area plan

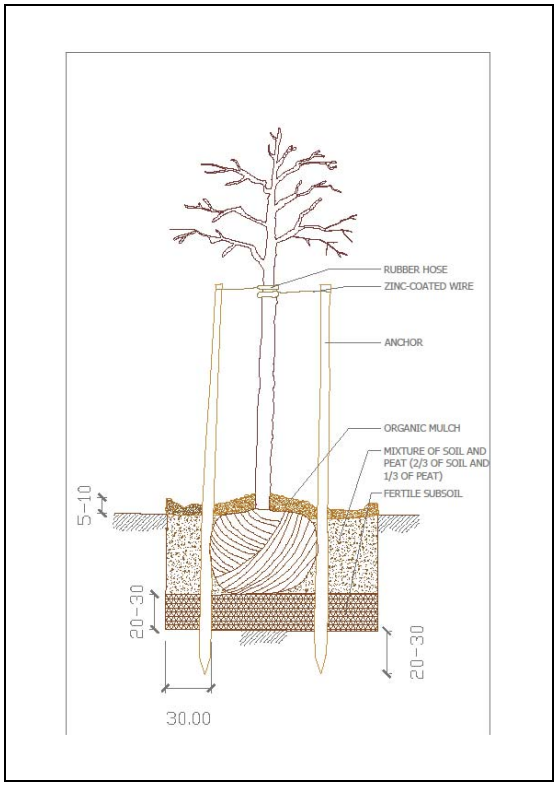



**Figure 6:** Planting a standard broadleaved balled and burlapped seedling

## 4 CONCLUSIONS

The concept of landscaping the park zone of the Faculty of Forestry Arboretum in Belgrade involves planning the layout of landscape-architectural elements and enhancing the functionality and esthetics of the space in this spatial-environmental unit which is of great importance in the system of city green spaces and protected areas. Area park zone is 0.40 ha. In line with the need to present and promote this multi-functional space, the following components have been defined by using graphic presentations and 3D modelling: an entry area, a system of pathways (1,278.70 $m^2$); a multi-purpose plateau (82.41 $m^2$); a sensory garden (90.00 $m^2$); water area (46.20 $m^2$); lawns (2,548.89 $m^2$); pavilions; perennial gardens; groups of trees and alleys. Along with the registration and evaluation of the existing vegetation (components that will be largely preserved), landscaping and designing of the spare areas also involve establishment of lawns, perennial gardens, alleys and groups of trees. Composition design of the park zone of the Arboretum is an overall graphic-modelling presentation of landscaping this functional unit. An elaborate analysis of the defined units will be the next stage of the spatial design of this structure. Besides other elements of this spatial entity, the designed green spaces and the planned park and architectural furniture contribute to the harmonization of the whole area as an protected environmental entity.

## 5 REFERENCES

[1] Cantrell, B., Michaels, W. (2010): Digital Drawing for Landscape Architecture: Contemporary Techniques and Tools for Digital Representation in Site Design. John Wiley and Sons Ltd, United Kingdom.

[2] Cvjeticanin, R., Perovic, M. (2010): Prakitikum iz dendrologije za osnovne akademske studije na Šumarskom fakultetu za studijske programe Šumarstvo i Ekološki inženjering u zaštiti zemljišnih i vodnih resusrsa. Univerzitet u Beogradu Šumarski fakultet. Beograd.

[3] Finkelstein, E. (2006) AutoCAD 2007 and AutoCAD LT 2007 Bible. Indianapolis: Wiley Publishing.

[4] Vukicevic, E. (1982): Dekorativna denrdrologija. Udžbenik. Beograd.

[5] Vukin, M., Stavretovic, N., Ostojic, D. (2010): Significance of the Arboretum of the Faculty of Forestry in Belgrade in public Participation in Environmental protection. Procedeeings. *XVIII Scientific and Professional Meeting 'Ecological Truth' Eco-Ist'10*. University of Belgrade – Technical Faculty in Bor. Banja Junakovic, Apatin, Serbia, June 01-04.

[6] Vukin, M. (2010): Arboretum Šumarskog fakulteta u Beogradu. Univerzitet u Beogradu Šumarski fakultet. Beograd. (pp. 1-113)

[7] Tanasic, R., Bajkin, A. (2007): Grafički programi u pejzažnoj arhitekturi. Savremena poljoprivredna tehnika. Vol. 33, br. 3-4. Novi Sad.

[8] (2010): *Studija zaštite Arboretuma Šumarskog fakulteta u Beogradu*. Zavod za zaštitu prirode Srbije. Beograd. Rukovodilac studije dr Dragana Ostojić.

[9] (2011): *Regionalni prostorni plan administrativnog područja grada Beograda. http: //www.beograd.rs*

[10] (2011): *Plan upravljanja Spomenika prirode „Arboretuma Šumarskog fakulteta" za period 2011-2020. godine*

For. review 43: 1 - 76. Skopje, 2012
Ss. Cyril and Methodius University in Skopje
Faculty of Forestry in Skopje

ISSN: 0585-9069