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SITE EVALUATION AND TREE SELECTION FOR URBAN ENVIRONMENT

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Selecting the right tree for a particular place can avoid costly disappointments later. There is no one perfect tree for any situation. Urban trees provide a variety of "ecosystem services" or direct environmental benefits for people. The most successful approach is to select trees to match site conditions and limitations, based upon a thorough site assessment. Diversity is one key to a successful tree planting program. Over-planting of one species in an area can result in monocultures that encourage the build-up of insect populations and diseases that can destroy an entire planting.

Keywords: urban trees, site evaluation, tree selection

Introduction

Close to 56 percent of the Slovak population lives in city areas and depends on the essential ecological, economic, and social benefits provided by urban trees and forests.

Street is the first public space of the city. It should provide an opportunity for all and, if properly designed, can become an economic, social and environmental asset of the city (Sidorová a i., 2013).

Site evaluation

The basic way to begin a site evaluation is to walk around the town to find out which species grow well in landscapes with similar site attributes. It is important to keep in mind that no two sites are exactly alike. Various conditions affect the success of a particular tree species (Bakay, 2007; Bakay and Kollár, 2014; Bassuk et al., 2009; Sandifer and Givoni, 2002).

Many authors described site evaluation as the first step in selecting proper trees for a planting site. It is important to consider above-ground and below-ground site attributes. Many times creators use to skip the site evaluation process, which explains why trees planted in urban areas do not so often prosper (Bakay and Kollár, 2014; Bakay and Paganová, 2013; Dirr, 1998). If there is no one perfect tree, it is because there is no one homogeneous urban environment or site. The urban environment is a conglomeration of soils, microclimates and other site conditions. All conditions can change dramatically in the very small space (http://www.galk.de/arbeitskreise/ak_stadtbaeume/webprojekte/sbliste/; Phillips, 2010).

A comprehensive site assessment should occur which considers plant requirements such as climate and microclimate considerations (hardiness zone, light conditions, heat, wind), soil factors (pH, texture, compaction levels, drainage characteristics, yearly salt application), above-ground limitations (wires, proximity to structures), and below-ground limitations (rooting space, utility issues). Only when there is a thorough understanding of the environmental variables at a potential planting site we will be able to make appropriate tree selections (Bakay and Paganová, 2013; Gilman and Sadowski, 2007). It is important to note that some trees are adaptable to a wide range of environmental conditions while others have a narrow range in which they will grow well.

Trees in urban areas provide a number of benefits to the public. Besides their aesthetic value, they provide a number of tangible environmental benefits that often go unrecognized (Bassuk et al., 2009; Gilman and Sadowski, 2007; Phillips, 2010).

Some of the benefits of urban trees:

- Trees improve the environment:
  - reduce pollution (O_3, NO_2, SO_2, CO_2),
  - improve air quality.
- Aesthetic value.
- Reduce topsoil erosion, improve water quality.
- Save energy.
- Reduction in storm water runoff and required infrastructure.
- Increases in private real estate market values.
- Urban trees are found to be the most important indicator of attractiveness in a community (Bassuk et al., 2009; Dirr, 1998; Gilman and Sadowski, 2007).

How it works?

Trees and vegetation help cool urban climates through shading and evapotranspiration. Leaves and branches

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reduce the amount of solar radiation that reaches the area below the canopy of a tree or plant. The amount of sunlight transmitted through the canopy varies based on plant species (Gilman and Sadowski, 2007; Phillips, 2010). As an example of shading, American experts did multi-month study. They measured maximum surface temperature reductions ranging from 11–25 °C for walls and roofs at two buildings (Akbari, Kurn and Hanford, 1997). Another study examined the effects of vines on wall temperatures and found reductions of up to 20 °C (Sandifer and Givoni, 2002). A third study found that tree shading reduces the temperatures inside parked cars by about 25 °C (Scot, Simpson and McPherson, 1999). Evapotranspiration cools the air by using heat from the air to evaporate water. To reduce the wind speed, trees and other large vegetation can also be use as windbreaks or wind shields.

Urban trees and vegetation reduce air pollution and greenhouse gas emissions. In addition to saving energy, the use of trees and vegetation as a mitigation strategy can provide air quality and greenhouse gas benefits. Leaves remove various pollutants from the air. Trees and vegetation remove and store carbon.

Material and methods

For site evaluation we should note north arrow, soil factors as pH levels, texture (clayey, sandy, loamy), sunlight levels (full sun, partial sun, shade), visual assessment of trees (species, cultivar, size (height, width)) (Bassuk et al., 2009). Before selecting the tree it must be also evaluated location of overhead wires, underground utilities, buildings and pavement, as well as problem drainage areas.

Results

Selection of the most frequently used urban trees in the climatic conditions of Slovakia is shown in table 1. Characteristics show species and cultivar name, the width and height of trees, crown brightness, lighting requirements and brief comments.

Table 1 Assortment of recommended urban trees in the Slovak climate conditions

No.	Scientific name	Height	Width	Crown brightness	Lighting requirements	Comments
1	*Acer campestre* 'Elsrijk'	6–12 (15)	4–6	middle	○–◗	– straight continuous stem, growth in narrow and uniform, dense, compact crown
2	*Acer platanoides* 'Cleveland'	10–15	7–9	low	○–◗	– such as the type, with oval, aged broad ovoid, compact and regular crown
3	*Acer platanoides* 'Globosum'	to 6	5–8	low	○–◗	– densely branched, closed ball crown, pay attention to gauge, hard frost, heat and drought tolerant, wind resistant and shade tolerant, suitable for pots and containers
4	*Acer platanoides* 'Olmsted'	10–12 (15)	2–3	low	○–◗	– narrow, columnar; suited for tight spaces in exposed, dry air inside the village
5	*Acer platanoides* 'Royal Red'	to 15 (20)	8–10	low	○–◗	– leaves sprouting in red, then purpleblackred constant until the autumn, shiny, very hardy, tolerates heat, wind resistant
6	*Acer pseudoplatanus* 'Erectum'	15–20 (25)	6–8	low	○–◗	– Such as the type, later grows stronger in the width
7	*Acer pseudoplatanus* 'Leopoldii'	12–20	12–20	low	○–◗	– the leaves are sprouting yellowish or pink copper, later green with white or yellowish areas
8	*Acer pseudoplatanus* 'Rotterdam'	22–25	20–25	low	○–◗	– such as the type, but columnar, frusto-conical crown when young, later broadly conical
9	*Aesculus* × *carnea* 'Briotii'	10–15	8–12	low	○–◗	– such as the type, but strong colored flower
10	*Aesculus hippocastanum* 'Baumannii'	15–28	15–20 (25)	low	○	– such as the type, but longer and double flowered, no fruiting
11	*Carpinus betulus* 'Fastigiata'	15–20	4–6 (10)	low	◗	– columnar falling apart to conical and dense crown, at the age
12	*Carpinus betulus* 'Frans Fontaine'	10–15	4–6	low		– as Carpinus betulus 'Fastigiata', but columnar in age, crown in the youth does not fully close
13	*Crataegus laevigata* 'Paul's Scarlet'	4–8	4–6	middle	○	– regular, broad-conical, aged more rounded crown with wide spreading lateral branches, straight central shoot

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Continuation of Table 1

No.	Scientific name	Height	Width	Crown brightness	Lighting requirements	Comments
14	*Crataegus* × *lavallei* 'Carrierei'	5–7	5–7	middle	○	– broad-conical shape, shoots with strong spines, long-adhering, shiny leathery, dark green foliage, suitable for pots and containers
15	*Fraxinus excelsior* 'Atlas'	15–20	10–15	strong		– such as the type, but more compact, narrower crown
16	*Fraxinus excelsior* 'Nana'	3–5	3–5	middle		– such as the type, but small and spherical, with densely branched crown, slow growing, note gauge, suitable for pots and containers
17	*Fraxinus excelsior* 'Westhof's Glorie'	20–25 (30)	12–15	strong		– such as the type, but very late foliation, therefore hardly late frost, straight, continuous stem
18	*Fraxinus ornus* 'Meczek'	5–7	3–4	middle	○	– small, spherical, very frugal, urban climates, pay attention to gauge, beautiful flower
19	*Ginkgo biloba* 'Fastigiata Blagon'	15–20	4–6	strong		– narrowly conical, dioeciously, note the case of the fruit of the female insect, autumn color
20	*Ginkgo biloba* 'Princeton Sentry'	15–20	4–6	strong		– in youth slow-later, very regular and compact crown, acute upright aspiring, evenly branched branches, narrowly conical, pointed straight trunk
21	*Gleditsia triacanthos* f. *inermis*	10–25	8–15 (20)	strong	○	– such as the type, but thorn less variety, in the later thorns can be made in individual cases, sensitive to frost as a young tree
22	*Gleditsia triacanthos* 'Skyline'	10–15	10–15	strong	○	– such as the type, but equally compact crown with distinguished branches, thorn less variety, in which can be made in individual cases subsequently thorns, is no fruit from
23	*Gleditsia triacanthos* 'Sunburst'	8–12	6–8	strong	○	– such as the type, but spineless, pale yellow bud, later green, pay attention to gauge
24	*Malus* 'Evereste'	4–6	4–5	middle		– wide-upright crown, overhanging side branches, gauge note the age, small orange-red fruits, low flesh firmness, for tubs and containers suitable
25	Malus 'Red Sentinel'	4–5	3–4	middle		– note slender crown, deep overhanging side branches, gauge, dark red fruits, low flesh firmness, suitable for pots and containers
26	*Malus* 'Rudolph'	5–6	4–5	middle		– upright crown, broad-ovate to roundish, note gauge later, orange yellow fruits; low flesh firmness, tends to superficial cracks in the bark, suitable for pots and containers
27	*Populus simonii*	12–15	6–8 (10)	middle	○	– narrowly conical, wide at the age and round, short-lived, snow breakage due to early bud
28	*Prunus avium* 'Plena'	10–15	8–10	low	○	– such as the type, but regular pyramidal, dense, compact crown, double flowered, no fruits urban climates
29	*Prunus sargentii* 'Accolade'	5–8	3–5	middle		– roundish to slightly funnel-shaped crown, pay attention to gauge, attractive flowers and autumn color
30	*Prunus serrulata* 'Kanzan', 'Hisakura'	7–12	4–8	middle		– wide funnel-shaped, later spreading crown, making sure gauge, attractive flowers and autumn color, rarely fruiting
31	*Prunus subhirtella* 'Autumnalis'	5–8	3–5	middle	○	– small tree suitable with striking blooms and fall color, pay attention to gauge, for pots and containers
32	*Pyrus calleryana 'Chanticleer'*	8–12 (15)	4–5	middle	○	– narrow conical crown, later loosely, broadly pyramidal, leaf fall after heavy frost (snow breakage), isolated fruiting, early senescence
33	*Pyrus communis* 'Beech Hill'	8–12	5–7	middle		– initially straight upright growing, later falling apart, fire risk from fire, some regions pear rust, fruiting

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The second Table 1 continued

No.	Scientific name	Height	Width	Crown brightness	Lighting requirements	Comments
34	*Quercus robur* 'Fastigiata'	15–20	5–7	low	○	– broadly conical crown, wide spreading, long-adherent, slowly rotting foliage, planting not before December, tolerates flooding, responds to lowering of ground water with tops drought, frost hardy
35	*Robinia pseudoacacia* 'Bessoniana'	20–25	10–12	strong	○	– aged broad rounded and densely branched crown, usually straight continuous main trunk, and only a few small spines, rarely flowering
36	*Robinia pseudoacacia* 'Umbraculifera'	4–6	4–6	low	○	– dense, tubby, more broadly oval, note gauge the age, can withstand radical pruning, no flower, suitable for pots and containers
37	*Sorbus aria* 'Magnifica'	8–10	4–7	middle	○	– such as the type, but smaller and narrower, wider with regularly constructed crown, at the age
38	*Tilia cordata* 'Erecta'	15–18	8–10	low		– such as the type, but slow growing small and regular crown, small leaves, as a young tree
39	*Tilia cordata* 'Greenspire'	18–20	10–12	low		– narrow, regular and dense crown, aged broad, branches ascending, urban climates
40	*Tilia cordata* 'Rancho'	8–10	5–6	low		– such as the type, but with narrow ovate, broadly rounded at the age, regular crown, slow and compact growth
41	*Tilia cordata* 'Roelvo'	12–15	8–12	low		– such as the type, but broadly conical to rounded crown, not so compact growing as 'Rancho'
42	*Tilia tomentosa* 'Brabant'	20–30	15–22	low	○	– broad conical crown dense and regular structure, selection with straight continuous strain

Source: http://www.galk.de/arbeitskreise/ak_stadtbaeume/webprojekte/sbliste/; Dirr, 1998 and own research data

Conclusion

Urban trees are a various and valuable elements of the city's infrastructure. The benefits of urban trees are often unnoticed. As was mentioned before they provide a number of valuable services for the public.

The information in this paper has been collected from many sources. Among them are Dirr's Hardy Trees and Shrubs by Dirr (1998) and GALK street tree list, query from 9. 21. 2014 workgroup city trees.

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