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Visual characteristics as a key factor in species selection in vegetation planes design [a]

Marko DOBRILOVIČ[1], Ana KUČAN[2], Nika KRAVANJA[3]

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ABSTRACT

In the past, the selection of plants used to rest upon individual taste and fashion dictates of the period, rather than starting from and following directives determined by the goal of creating a certain space characteristics. In the literature the plant species are frequently treated individually and arranged according to the visual effect of each plant. In order for this research to satisfy the needs of design practice, it was necessary to ascertain the hidden designer potential of each plant, which is not identical with the pleasing effect of the plant. This is how the central problem is formulated in this research: to determine the selection criteria (of plant species), arising from the visual characteristics of the plants and, based on these criteria to determine the suitability of plants in order to create visual effects of vegetation planes. In this sense we can expose the importance of proving the connectedness between morphological properties of the plants and the characteristics of vegetation planes, which are formed by these very plants. The subject of this research is plant material, 208 shrubs and 193 trees, systematized according to their size, shape, habitus, texture, colour, as well as the seasonal appearance of individual characteristics. We established the method and criteria for the selection of morphological properties of the plants that allow us to achieve a certain visual character of the vegetational plane. The process of plants selection is shown on concrete examples, whereby certain design demands determine the choice of the adequate plants. For the final selection of plants it is necessary to add criteria arising from eco-physiological needs of the plants and from technological demands.

Key words: landscape architecture, methods, plant material, plant morphology, vegetation plane, selecting species

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[1] Univ. of Ljubljana, Biotehnical Faculty, Landscape Architecture Department, Jamnikarjeva 101, Ljubljana, SI-1111, Ass. Ph.D.B.Sc.

[2] Univ. of Ljubljana, Biotehnical Faculty, Landscape Architecture Department, Jamnikarjeva 101, Ljubljana, SI-1111, Prof., Ph.D.

[3] Univ. of Ljubljana, Biotehnical Faculty, Landscape Architecture Department, Jamnikarjeva 101, Ljubljana, SI-1111, Assist. Prof., Ph.D. B.Sc.

IZVLEČEK

METODA UPORABE MORFOLOŠKIH LASTNOSTI KOT MERILA ZA IZBOR RASTLINSKIH VRST PRIMERNIH ZA IZGRADNJO VEGETACIJSKIH PLOSKEV[b]

Izbor rastlinskih vrst je pogosto temeljil na okusu in modi dobe, bolj kot na nizu izhodišč, določenih s ciljem ustvarjanja določenih prostorskih značilnosti. V literaturi so rastlinske vrste pogosto obravnavane individualno in razporejene glede na vidne učinke posamezne rastline. Da bi raziskava zadostila potrebam oblikovalske prakse, je bilo potrebno ugotoviti skriti oblikovalski potencial rastline, ki pa ga ne enačimo z všečnostjo rastline. Tako je postavljen osnovni problem v raziskavi: določiti merila za izbiranje rastlinskih vrst, ki izhajajo iz vidnih lastnosti rastlin in na podlagi teh meril določiti ustreznost vrst za ustvarjanje vidnih učinkov vegetacijskih ploskev. V tem smislu lahko izpostavimo pomen dokazovanja povezanosti med morfološkimi lastnostmi rastlin in lastnostmi vegetacijskih ploskev, ki jih te rastline tvorijo. Predmet raziskave je tako rastlinsko gradivo, 208 grmovnih in 193 drevesnih vrst razporejenih po velikosti, obliki, habitusu, teksturi, barvi in času pojavljanja posameznih lastnosti. Metodološko so razvita merila za izbor morfoloških lastnosti rastlin, s katerimi lahko dosežemo določeno vidno značilnost vegetacijske ploskve. Postopek izbiranja rastlin je prikazan na konkretnih primerih, kjer se na podlagi določene oblikovalske zahteve izberejo ustrezne vrste. Za končni izbor rastlinskih vrst pa je potrebno dodati še merila, ki izhajajo iz ekofizioloških potreb rastlin in tehnoloških meril.

Ključne besede: krajinska arhitektura, metodologija, rastlinsko gradivo, morfološke lastnosti, vegetacijske ploskve, izbor rastlin

1 INTRODUCTION

The knowledge about plant material and its applicability is an important factor in achieving quality in landscape design. It manifests in the appropriate selection of plant species for individual design solutions.

In nature the distribution and expansion of plants is determined by biotic factors (soil, climate, fauna) whereas in a designed landscape humans represent the main factor. Here the plants become material, and humans make choices, arrange and remodel according to their needs and wishes.

In the past – and it is often still so nowadays - the selection of plants was wont to rest upon individual taste and fashion dictates of the period, rather than starting from and following directives determined by the objective of creating a certain space characteristics.

The primary elements or rather 'building blocks' of a designed landscape are called landscape elements. These can be vegetational (lawn plane, tree avenue) or non-vegetational (water and sand planes, buildings) (Ogrin, 1996). Examining the relevant literature (Zion, 1970; Robinson, 1992; UCONN Plant Data Base of trees, shrubs and vines, 2005; Wyman, 1956) it was ascertained that the research of plant suitability as regards the construction of vegetational plane phenomena had been fragmentary. Merely a few basic elements have been treated, such as hedges and ground-cover plants. The procedures of selection are non-transparent and quite inadequate for the use of serious design.

[b] Prispevek je del doktorske naloge, mentorica izred. prof. dr. Ana Kučan

Therefore the main research problem can be seen as determining criteria for the selection of plant material**,** arising from the visual properties of the plants and, based on these criteria, subsequently determining the suitability of plants as to their capacity to create visual effects of vegetational planes. This paper focuses on vegetational planes; it is in this light that the objective is set - examining the morphological properties of plant species with the aim to establish a means of selection of plant species suitable for the construction of vegetational planes.

2 VEGETATIONAL PLANES

Vegetational planes represent one of the possible plane features (water, rock, sand, buildings, vegetation). In terms of their direction in space they can be horizontal, slanting or vertical; in terms of surface properties they can be flat or modulated (concave or convex).

The properties of the materials by means of which a plane is composed are uniformity, homogeneity, coherency (Ogrin, 1996). Significant characteristics of the plants that form horizontal planes, are low variability within one species, equalized texture of shoots, leaves, blooms, and regular growth.

Figure 1. Vertical vegetational plane (*Pterocarya fraxinifolia*, BF, Ljubljana)

The character of the plane also depends on the size of the planting area. One of the important properties we expect from a good cover plant is its habitus. However, the suitability of the habitus is not estimated by the appearance of each individual plant. It is important to see the park as a whole. Importance is given to the holistic aspect of the park. This is where the dense growth of the different plants plays an important role (the direction of the offshoot growth, the intertwining of shoots). Good cover plants should cover the ground rapidly and form a condensed vegetational cover. This requirement is best fulfilled by quick-growing species with even growth (with no intervals of quick and slow growth).

Vertical vegetational planes occur in nature at the juncture of two different eco-systems. They can be found alongside water phenomena like river banks or lake shores. Alternatively they can develop due to the influence of geomorphologic phenomena (karstic edges, earth depressions). In the cultured landscape they occur when land use is change**,** like at the juncture of forest (or its remnants) and farming

land, the juncture of near-water vegetation with cultured landscape and similar. In landscape design vertical vegetational planes play a significant part in the articulation of space. They define spatial boundaries and the measurement of the space, create effects of depth, form backgrounds, sceneries and similar. In order to create an effective sense of the plane, it is important to respect the homogeneity of material, especially with regard to its vertical direction (trunk, branches, shoots). This can be accomplished by means of appropriate species selection and by choosing the appropriate planting density (Dobrilovič, 2005:18).

Properties of plant species suitable for the construction of vertical vegetational planes are uniform branch and shoot growth along the whole length of the prolongation of the trunk or main shoot, and good adaptability of the plants to the change of lighting. Furthermore the shoots and branches should sprout low (above-ground), the length of side branches and shoots should be even. A long life span, equalization within the species, clearly determined periods of pheno-phases in development flowering, growth).

3 MATERIAL AND WORK METHOD

The subject matter of this research project are plant species designed for greening of public spaces. They are chosen on the basis of assessing their hardiness, their resistance to urban climate, to diseases and pests, the cost of maintenance and their design potential.

The research encompasses autochthonous species (Kotar and Brus, 2003), suitable for the use in public parks and foreign species or sorts of trees and shrubs, which are wide-spread in our country and fulfil users demands (Šiftar, 2001).

The principal goal of the research is to define appropriate criteria for plant species selection in order to obtain the desired effect of the vegetational plane. In order to achieve this it was first necessary to establish the connection between the morphological and the visual properties of the vegetational plane (height, texture, colour and similar) formed by the plants, and to determine which morphological properties of the plants affect the desired character of the vegetational plane.

As far as the work method is concerned it is imperative to emphasize that the aspect here treated as far as the knowledge of plants is concerned, covers a fairly unknown ground and does not provide well-established methods of research. Therefore in the continuation the work process is introduced in some detail. It was necessary to systematize all plant species (the research subject matter) according to their visual properties (size, shape, habitus, texture, colour) and the properties determined by their seasonal appearance (e.g. foliage colour – autumn, colour of blossoms – spring …). All plants were classified on the basis of data obtained by observing visual properties in situ, and subsequently comparing them with findings of other authors. This was followed by a meticulous analysis in terms of visual properties (size, shape, colour, texture, durability of foliage). Next step was the setting of criteria for the selection of morphological plants by means of which we can achieve the desired visible characteristics feature of the vegetational plane. In order to help establish the afore-mentioned connections, in the continuation two schemes are being demonstrated in which the grey colour designates those morphological plant properties by which the character of horizontal (Figure 2) and vertical (Figure 3) vegetational planes is being defined. A finely textured green horizontal vegetational plane best agrees with plant species displaying morphological properties of small shrubs, above-ground growth, spreading habitus, fine foliage texture and green leaf colour.

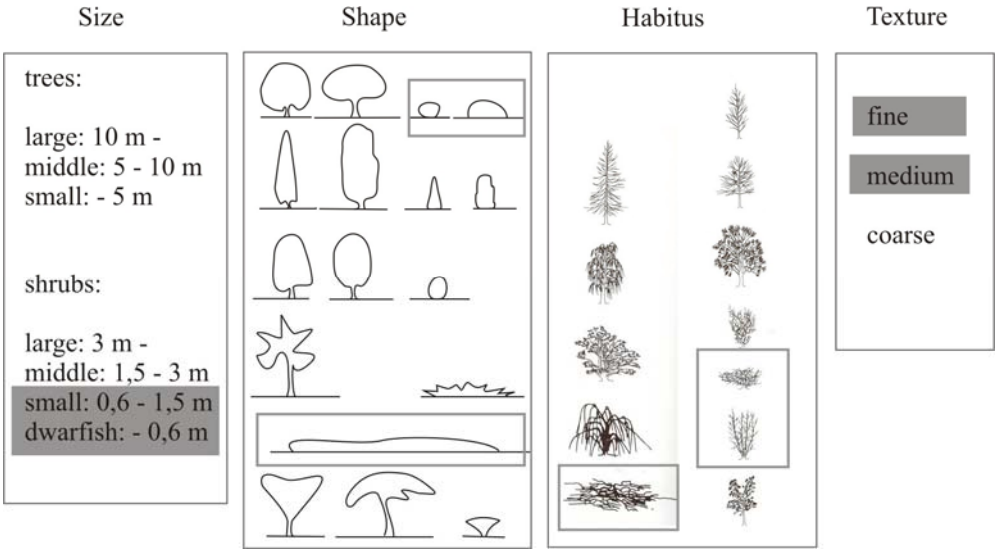

Figure 2. Morphological characteristics of plants used for horizontal vegetation plane

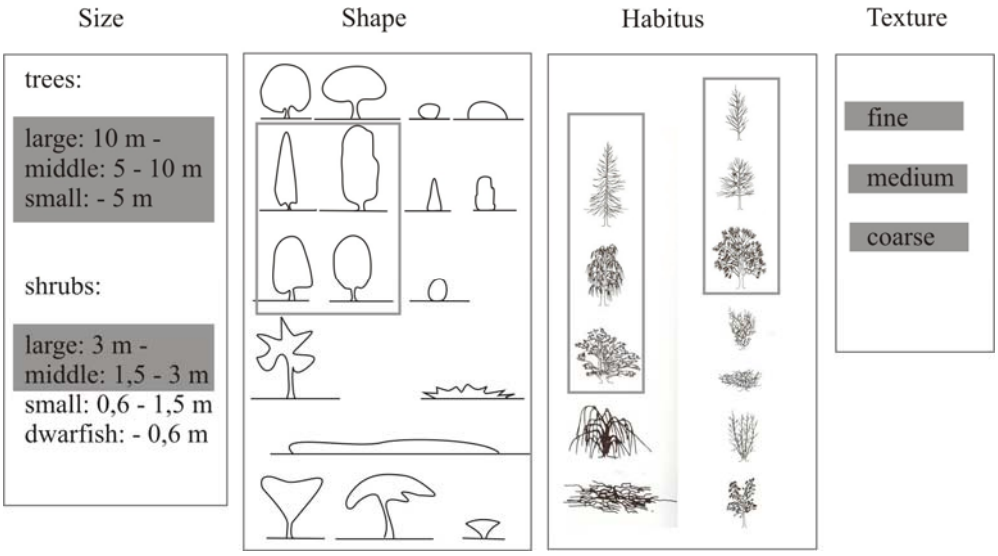

Figure 3. Morphological characteristics of plants used for vertical vegetation plane

The next step is the selection of plant species according to the desired visual effects of the vegetational plane. The selection process is introduced by means of a concrete example and represents one of the results of this research. The suitability of plant species for the construction of vegetational planes is determined according to the following criteria: size, foliage durability, shape, habitus, colour (leaf, blossom, shoot). The criteria are introduced gradually, each added criteria representing a new level or rather combination of morphological properties. We consider the most suitable those species that conform most optimally to all levels of selection and all combinations of criteria.

4 RESULTS AND DISCUSSION

Results of this research are presented in two condensed complexes:

1. Systematizing the plant species according to their morphological properties; this comprehensive part of the results is not shown in the article. It is however of great importance for the process of selection itself. By the same token it represents an autonomously applicable outcome, since the elaborate complex classification enables us to look for adequate plants with regard to their visual properties (size, shape, habitus, texture, colour) and seasonal appearance.
2. The process of plant selection itself in terms of the effect that the plant species is capable of expressing when appearing as a constituent part of a certain vegetational element.

The selection of plant species in terms of desired visual effects of the vegetational plane shall now be demonstrated on a concrete example. Prior to the selection of certain plant species a distinct design goal (or respectively a pre-formulated design request) for a certain visible effect of the landscape element is presented. Thus, for example, by making a certain choice we wish to find the best possible plant species for the construction of a vegetational plane whose visual effects are defined by its height, texture, colour and the point in time when a certain effect will be taking place.

Example: horizontal vegetational plane
The expected properties (design requirements): height 60-150 cm, uniform, homogenous, compact; upper surface modulated in the shape of low clumps, small heaps (clumpy structure), finely textured both in the leafy and the leafless state, of green colour in the period of vegetation, shoots of a distinct colour during winter time.

Stipulating morphological properties of adequate plant species:

- size: *shrub (60 -150 cm)*
- foliage durability: *deciduous*
- shape: *rounded to broadly spreading*
- habitus: *densly packed mass*
- texture - leaf: *fine*
- colour - leaf: *green*
- colour – shoot: *intensive*

Definition of criteria for selection and a list of species that conform to these criteria:
1. Size - foliage durability - habitus

Caryopteris incana
Cytisus praecox 'Hollandia'
Cytisus scoparius
Cytisus x praecox
Cytisus x praecox 'Allgold'
Genista tinctoria
Prunus tenella 'Fire Hill'
Prunus triloba
Rhamnus frangula
Ribes alpinum
Salix helvetica
Salix purpurea 'Nana'
Salix rosmarinifolia
Spiraea japonica 'Goldflame'
Spiraea japonica 'Litlle Princess'
Spiraea x bumalda 'Anthony Waterer'

2. Size - foliage durability - habitus – shape

Caryopteris incana
Cytisus praecox 'Hollandia'
Cytisus scoparius
Cytisus x praecox
Cytisus x praecox 'Allgold'
Genista tinctoria
Ribes alpinum
Salix helvetica
Salix purpurea 'Nana'
Salix rosmarinifolia
Spiraea japonica 'Goldflame'
Spiraea japonica 'Litlle Princess'
Spiraea x bumalda 'Anthony Waterer'

3. Size - foliage durability - habitus – shape- texture

Caryopteris incana
Cytisus praecox 'Hollandia'
Cytisus scoparius
Cytisus x praecox
Cytisus x praecox 'Allgold'
Genista tinctoria
Salix purpurea 'Nana'
Salix rosmarinifolia
Spiraea x bumalda 'Goldflame'
Spiraea japonica 'Litlle Princess'
Spiraea x bumalda 'Anthony Waterer'

4. Size - foliage durability - habitus – shape – texture – color (shoots, leaves)

Cytisus praecox 'Hollandia'
Cytisus scoparius
Cytisus x praecox
Cytisus x praecox 'Allgold'
Genista tinctoria

The last five chosen plant species represent the result of the selection and conform to all selection criteria. The choice of plants is adequate in terms of desired effects of the horizontal vegetational plane - yet sparse. The differences among the species appear in terms of their capacity to modulate the surface (clump structure). When choosing suitable species, adequate for the creation of a certain visible effect of a horizontal vegetational plane (the example of choice here shown) the most important property to be considered is the *size* of the shrubs and the way they grow – *habitus* (before *shape*). Therefore in selection criteria *habitus* comes before *shape*. The most suitable is *Genista tinctoria* (compact shrubs, tightly packet stems form a low clump). *Cytisus praecox* 'Hollandia' in *C. x praecox* 'Allgold' are somewhat taller, the shoots are longer and ascend, and therefore show some difficulty in intertwining, their clump structure is less pronounced.

The species *Cytisus scoparius* presents the greatest difficulty in how to predict the form of its growth. It is nevertheless suitable for the construction of vegetational planes on larger surfaces (it is a good ground-cover plant to be used for the greening in the landscape). For all the enumerated species it is imperative to consider their demands for heat, good lighting as well as the soil reaction.

5 CONCLUSION

The method used and here described for the selection of plant species represents a novelty in the field pf landscape design. By means of this research it was ascertained that the manner of selecting plants according to their visual properties is appropriate. For a final selection it is necessary to add to the morphological criteria some other criteria, which are

formulated on the basis of eco-physiological needs of each plant (lighting, temperature, soil conditions) and technological demands (cultivation requirements).

Therefore it is imperative that we emphasize the relativity of such plant selection, as is evident from the above commentary, relating to a concrete example of choosing appropriate plants.

The results of the research are applicable on different levels. By using the data gained in the research (systemizing the plant species according to their visual properties) we can find species that belong to certain size classes, shapes, colours, and textures.

The data can be combined arbitrarily in order to search for cross-section multitudes that in essence repreent combinations of morphological properties.

The data and the above mentioned systematizations are not presented in tis paper, due to the ampleness / extensiveness of the material.

Alongside the selection criteria as such it is also important in which order or rather sequence the criteria, upon which we base the selection of the plants, are applied.
Which criteria are to be included and in what order, largely depends on the design goal.
The paper demonstrates the process of selection of plant species suitable for horizontal vegetational planes. In a similar way suitable plants for other landscape elements can be chosen (line, point, clump and similar).

The presented process of selection is not applicable only in landscape architecture. It can be equally useful in selective breeding, since it can help determine the need for a particular shape, habitus, colour … In terms of its informative quality it can be applied by tree planters, horticultural experts and may also be seen as a welcome aid in the education of landscape architects and horticultural experts.

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