

Woody plants and stands in the health-resort park Brusno, evaluated for quality and quantity

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Abstract

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Health-resort parks are an important landscaping element, and, from the very beginning of the modern balneology, they have been embedded naturally into each watering place. The landscape design of the spa park Brusno is a close-to-nature one with minimum presence of regular planting. The park area is approximately 11.5 ha. We have inventoried in total 892 trees and shrubs, 2/3 domestic and 1/3 introduced. In both groups are dominant broadleaved woody plants. The inventory results show that the proposed sanitary cutting (148 woody plants in the park and 99 in the alder stand) is necessary for its successful development. We propose planting of new woody plants as substitution for the plants that do not fulfil their function any more, have not appropriate landscaping value and their presence in the stand is also a security risk. Because the stands mostly consist of domestic woody plants, and the National Nature Protection also requires preserving this character, we recommend to preserve it and, at the same time, to improve its attractiveness, by supplementary outplanting of exclusively domestic woody plants in appropriate shape, colour and growth forms

Key words

spa park, woody plant quality, supplementary outplanting

Introduction

Health-resort parks, an important landscaping element, have been, since the very beginning of balneology, naturally embedded into each watering place. They not only provide a picturesque environment for the spa visitors, but they also contribute to the healing process itself, in an organic, indivisible complexity.

This are the main reasons why it is important to revitalize these objects, to manage them with appropriate and permanent care and to protect them from continuous degradation (SUPUKA, 1991).

The for-long-neglected look of some of these spa parks only emphasizes that the case is naturally urgent. The park in the Brusno Spa can be ranked to such parks. It is a very regrettable fact, because the mineral springs are of unique chemical composition and they also have a specific location. They are far distant from heavy traf-

fic, surrounded by the magnificent nature of the Vepor mountains.

The Brusno Spa is situated in Central Slovakia, in the Horehronie Region, 21 km northeast of Banská Bystrica in the direction to the Brezno town, in a forested lateral valley of the Slovenské Rudohorie Mts., at the foot of the northern slopes of the Vepor Mts. at 435 m asl. The spa lies in a narrow valley called Peklo surrounded by conifer forests. In its southern part, the valley passes to the steep slopes of the mountain massive Vepor. The valley is opened to the north (COLLECTIVE, 1999).

There are several springs of carbonic, hydro-carbonic-sulphatic, calcium-sodium-magnesium containing mineral waters in the spa resort. In terms of climate, the area belongs to the mildly warm and mildly wet area with cold winters. Average temperature in January ranges from –5 °C to –6 °C, in July from 17 °C to 19 °C. The growing season encompasses 200–220 days with

an average temperature above 5 °C, 125–150 days with an average temperature of 10 °C and 50–100 days when the average temperature is above 15 °C. The average annual precipitation total is 800–900 mm. The average number of days with snow cover is 80–100. The prevailing winds are western; in winter northwestern, north-eastern ones are much less frequent (COLLECTIVE, 1999).

The area of the Brusno spa is embedded into the river-basin of the upper stream of the Hron River. It is situated at the northern edge of Veporské rudohorie Mts. belonging to the widest Slovak mountain range – Slovenské rudohorie Mts. Major part of the area consists of hills with altitude varying from 420 to 860 m asl.

Methodology

Present state of health-resort park

The park, covering an area of about 11.5 ha is comprehended as a natural-landscaping element with minimum regular outplanting. The majority of woody plants is of domestic origin. Introduced woody plants were planted in the most frequently visited parts of park with the purpose of landscaping adjustments. Grassy areas constitute a base for planting of woody plants: solitary, in groups and the youngest in densified stands.

The core of the whole area of the park is an alder-tree stand (about 3.5 ha), occupying the central zone characteristic with high level of underground water. Around this central zone, the park and spa buildings have been arranged. The park is surrounded by mostly coniferous stands on slopes of the valley. This forest stand is furthermore surrounded by a closed system of sidewalks, used for access to all its function units. Footpaths are covered with asphalt, currently mostly rather damaged.

The area in front of the treatment facility Poľana, at the edge of the alder stand, needs to be adjusted. The area in front of the treatment facility Ďumbier is unsuitable, due to planting without conception. Between the alder stand and the Vepor spring, the Brusnianka brook is crossing the park. Two concrete pools built on the flux offer a very rough and neglected picture.

Plants in all the parts of park reflect the poor level of management. The mobile elements are in a similar state. There are a number of benches spread throughout the park, however absolutely unsuitable for a spa park due to their state and appearance. The same is true ugly waste bins. The lighting badly requires reconstruction, as well.

Natural conditions

The soil cover is the result of former geological conditions and by quarter-geological processes which created substrates of postglacial soils:

- o Typical Rendzina, leached, shallow, in a small extent containing debris with prevailing dark calcites and dolomites. They constitute an almost continuous stripe crossing the middle part of the area from southwest towards northeast.

- o Cambisols.

Vegetation conditions are extremely variable, resulting from geographical position, geomorphology, altitude, soil fertility.

Practically the whole area belongs to the zone of the 4th (beech) forest vegetation tier. Marginally present is also the 5th forest vegetation tier – in two small areas (east and southwest part). The 3rd forest vegetation tier is only present in one case, namely in the middle part of the territory.

Evaluation of woody plants inventory

Land area of the surveyed 121,669 m²:

Area A – 10,168 m²

Area B – 4,604 m²

Area C – 10,594 m²

Area D – 11,228 m²

Area E – 7,055 m²

Area G – 13,944 m²

Area H – 9,025 m²

Area I – 9,232 m²

Area J – 3,273 m²

Area K – 35,948 m²

Total – 115,071 m².

We have summarized all available published materials, maps, stand descriptions from the forest management plans. The original planting plans are not available. However, some important woody plants could be found on maps with a scale of 1:500, and the patterns were completed in a field survey. We made complete biometric measurements (tree height, diameter $d_{1,3}$, crown width), as well as assessment of the landscape value, health state, damage degree, and we also proposed the modes of treatment. In all areas and stands, there were labelled trees for cutting – a tending intervention with negative selection (removing dead, damaged, disabled woody species, thinning over-dense groups) (SUPUKA and FERIANCOVÁ, 2002).

The inventory was carried out using for-our-purposes-adjusted methodology of woody plants evaluation according to MACHOVEC (1982), JUHÁSOVÁ (1999), and in the forest part of the park (alder stand) according to SANIGA and LUKÁČIK (2000).

In the area, we delineated units – plots marked A–K – for separate evaluation corresponding to the logical and spatial arrangement of the park structure.

Documented data

1. Number of the woody plant, identical with the number in the drawing documentation
2. Latin and Slovak name

3. Form of occurrence:
 - 1 Solitaire tree
 - 2 Shaped solitaire tree
 - 3 Tree in lane
 - 4 Shaped tree in lane
 - 5 Scattered group of trees
 - 6 Connected group of trees
 - 7 Connected group of trees mixed
 - 8 Woodlots outside of forest stand area
 - 9 Natural seeding
 - 10 Solitaire bush
 - 11 Bush in tree understorey
 - 12 Bush in tree lane understorey
 - 13 Scattered group of bushes
 - 14 Connected group of bushes
 - 15 Connected group of bushes mixed
 - 16 Densified group of bushes
 - 17 Riparian stand.
4. Tree diameter at a height of 1.3 m above ground was measured with a calliper
5. Tree height, measured with an altimeter SUUNTO
6. Tree-crown width, the vertical projection of its widest part, measured with a tape, for bushes sqm of the area occupied
7. Landscaping value as expression of the woody plant quality. We evaluated the overall aspect, in younger woody plants their ability for further development and suitability for use in composition, suitability for the site or purpose according to the following scale – 5 point scale (MACHOVEC, 1987):
 - 5 – Absolutely healthy woody plant, without damage, habitus corresponding to the species and cultivar, vigorous growth and development. Tree crown representing at least 1/2 of tree height
 - 4 – Healthy woody plant, admitted can be minor damages, shape typical for the taxon, tolerated can be minor irregularities in shape. Good prospect of further existence
 - 3 – Woody plant with distorted crown shape, crown relatively short, irregular or untypical. Woody plant mostly healthy or only partially damaged. Requiring adjustment and treatment
 - 2 – Woody plant is shapeless, damaged, deformed, without perspective, detrimental for health, non-aesthetic. Determined to gradual or immediate liquidation (cutting)
 - 1 – Tree or shrub evidently disabled, completely dry or drying out, threatening the safety of pedestrians or traffic, distinctively disrupting composition of alleys or parks. Appointed to immediate cut.
8. The overall health state is, similar to the landscaping value, expressed using a decreasing 5-point scale, assigning to the best quality the highest score of 5 points:
 - 5 – Completely healthy woody plant without signs of diseases, pests and damage
 - 4 – Rare occurrence of diseases and pests, partial wood drying out up to 1/3 of the crown volume, cavities on the trunk rare and small, non-impaired stability
 - 3 – Partial drying or dying of the crown up to 1/2 of its volume due to diseases and pests, medium-size cavities on the trunk caused by wood-destroying fungi or mechanical damage
 - 2 – Diseases, pests or non-biotic elements causing drying out of 2/3 of the volume of the branches, prevailing damage to the main branches, large cavities on the stem, lowered stability caused by decomposition and disintegration of wood by fungi
 - 1 – Totally dry or drying woody plant up to the extent of 2/3 of the crown volume. Extensive cavities and rot on trunk caused by diseases. Stability evidently impaired, wood absolutely unsuitable.
9. Type and character of woody plant damage:
 - 1 Stains on leaves caused by microscopic fungi
 - 2 Sufficient callus on wounds after crown trimming
 - 3 Insufficient callus after crown trimming
 - 4 Rot on branching spot
 - 5 Rot on stem
 - 6 Cavity in trunk
 - 7 Deformed woody plant- non-suitable for shaping
 - 8 Low tree stability
 - 9 Non-perspective wood, unsuitably situated
 - 10 Drying out of branches, needles, leaves
 - 11 Trunk and branches infected by fungus
 - 12 Unsuitable, non-proportionally trimmed branches, unsuitably reduced tree-crown
 - 13 Bugs and other pests occurring on leaves
 - 14 Broken and incorrectly treated branches
 - 15 Unsuitably grown tree-crown
 - 16 Trunk shoots
 - 17 Multitrunk
 - 18 *Cameraria ohridella* – leaf insect and fungus occurrence on horse chestnut
 - 19 Unsuitable localization of the woody plant
 - 20 Flag-like crown
 - 21 Mechanical damage to the trunk base, caused by mowing.
10. Proposed mode of treatment:
 - 1 Trimming and removal of dry and infected branches
 - 2 Trimming of main branches
 - 3 Treatment of wounds
 - 4 Treatment of cavities
 - 5 Covering of cavities
 - 6 Equilibration of the crown (landscaping trimming of crowns)
 - 7 Treatment of wounds caused by broken branches
 - 8 Recovery of old cut wounds

- 9 Treatment of roots
- 10 Removal of parts infected by decay fungi
- 11 Treatment of other infected parts
- 12 Proposal of chemical conservation
- 13 Proposal of cut
- 14 Binding branches in tree-crown
- 15 Immediate trimming of branches (threatening danger of break and fall)
- 16 Lower the tree-crown by trimming the top
- 17 Raking of fallen leaves
- 18 Removal of root shoots
- 19 Removal of trunk shoots
- 20 Maintaining perspective shoots for cultivation
- 21 Removal of natural seeding
- 22 Continual regeneration
- 23 Determining the extent of rot on the stem base
- 24 Hoeing, fertilization
- 25 Transport to more suitable location.

Results

We have pursued inventory on in total 892 woody plants in the park. From this amount, about 2/3 are of native origin and 1/3 are introduced. The majority of both – native as well as introduced, are deciduous woody plants (Table 1). The use of the introduced species can be reasoned with the fact, that they can survive relatively easily and have more attractive habitus. Moreover, the usable portfolio of autochthonous coniferous species and blooming leafy shrubs is rather poor. Despite this, the domestic species should be preferred in outplanting in landscaping and urban context.

Regarding the health state of the inventoried woody plants, we can in general say that it is mostly appropriate (Table 2), in spite of the fact that the basic care is neglected. However, some of inventarized species show signs of damage and diseases indicating unsuitable

Table 1. Occurrence of woody plants in the spa park area according to the origin; native and introduced species

Native woody plants	Pc	Species
Coniferous trees	157	<i>Larix decidua</i> Mill., <i>Picea abies</i> (L.) H. Karst. , <i>Pinus silvestris</i> L.,
Broadleaved trees	389	<i>Acer pseudoplatanus</i> L., <i>Alnus glutinosa</i> (L.) Gaertn. , <i>Betula pendula</i> Roth, <i>Carpinus betulus</i> L., <i>Fraxinus excelsior</i> L., <i>Prunus avium</i> L., <i>Salix alba</i> L., <i>Tilia platyphyllos</i> Scop. , <i>Tilia cordata</i> Mill.
Bushes (broadleaved/coniferous)	77	<i>Corylus avellana</i> L., <i>Sambucus nigra</i> L., <i>Rosa canina</i> L., <i>Juniperus communis</i> L., <i>Pinus mugo</i> Turra, <i>Taxus baccata</i>
Native total	623	
Introduced woody plants		
Coniferous trees	95	<i>Picea omorica</i> (Pančič) Purk., <i>Picea pungens</i> Engelm. , <i>Pinus nigra</i> L., <i>Pseudotsuga menziesii</i> (Mirb.) Franco, <i>Thuja occidentalis</i> L. , <i>Thuja orientalis</i> L. , <i>Thuja plicata</i> D. Don ex Lamb.,
Broadleaved trees	124	<i>Aesculus hippocastanum</i> L., <i>Robinia pseudoaccacia</i> L., <i>Prunus</i> sp., <i>Malus</i> sp.,
Coniferous bushes	22	<i>Chamaecyparis pisifera</i> Siebold et Zucc. 'Squarosa Aurea', <i>Chamaecyparis lawsoniana</i> Parl.,
Broadleaved bushes	28	<i>Berberis thunbergii</i> DC. 'Atropurpurea', <i>Chaenomeles japonica</i> (Thunb.) Lindl., <i>Deutzia scabra</i> Siebold et Zucc., <i>Forsythia x intermedia</i> Zabel , <i>Forsythia suspensa</i> Vahl, <i>Ligustrum ovalifolium</i> Hausskn., <i>Philadelphus coronarius</i> L., <i>Pyracantha coccinea</i> M. Roem., <i>Spiraea x vanhouttei</i> (Briot) Zabel, <i>Swida alba</i> (L.) Opiz, <i>Syringa vulgaris</i> L.
Introduced total	269	

Species marked in bold are dominant in groups.

Table 2. Evaluation of quality of woody plants and stands

Evaluated characteristics and features	Plot									
	A	B	C	D	E	G	H	I	J	Total
Number of inventoried woody plants	110	53	183	82	86	111	139	96	32	892
Average health condition	3.44	3.60	3.49	3.26	3.16	3.56	3.04	2.85	3.34	3.30
Average landscaping value	3.45	3.47	3.60	3.40	3.39	3.59	3.07	2.85	3.31	3.34

location and conditions for these species. Mass occurrence of *Cameraria ohridella* (insect) was found in all horse chestnut (*Aesculus hippocastanum* L.) exemplars and on rowan trees (*Sorbus aucuparia* L.).

Proposal for the stand recovery (A, B, C, D, E, G, H, I, J parts) is described in Table 3, Appendices 1, 2.

Proposal for the recovery of neighbourhood of track curve between plots E and D – K / D is seen in Table 4. This part was designed with focussing on the woody plants diversity, vitality of spruce trees and overall improvement of aesthetic effect and balancing of groups of trees and bushes in the composition assembly.

Proposal for the recovery of zone by the brook between plot I and B – K / I is presented in Table 5. Regarding the species, the area is identical with the alder stand K. The plot needs a sanitary cutting. Dry woody plants should be removed and the zone wetted with completed young alder (*Alnus glutinosa* (L.) Gaertn) trees.

Plot K – Alder stand

The alder community is one of the dominant elements of the park. It is situated in a typically wetted site with groundwater ascending to the ground surface. This community plays the key role in this part of the park. Alder is functioning as a so-called “draining pump” which prevents the groundwater soaking through the surface and hampers anaerobic processes on the surface. Fast decaying leaf-litter improves the surface properties of the soil.

The goal of the reconstruction proposed for this stand is to prevent disconnection of crowns of the alder trees. The planned sanitary cutting should improve vitality and increase total volume of tree-crowns in high quality classes. The spots with dead alder trees in which occur anaerobic processes providing conditions for methane creation need to be planted by complementary seeding of this woody plant.

Table 3. Proposal for tree removal in accordance with their age

Park plot	Year	Number of removed trees
Proposal for removal	2003	30
	2004	33
	2005	46
	2006	0
	2007	16
	2008	23
	Total	148

Table 4. The numbers and total volumes of trees determined for removal

Species in Latin	Species in English	No.	Quantity of timber
<i>Pinus sylvestris</i> L.	Scots pine	1	3.25 m ³
<i>Fagus silvatica</i> L.	Beech	4	2.65 m ³
<i>Fraxinus excelsior</i> L.	Ash	2	0.92 m ³
<i>Acer platanoides</i> L.	Norway maple	1	0.11 m ³
<i>Tilia cordata</i> Mill.	Lime tree	8	0.87 m ³
<i>Aesculus hippocastanum</i> L.	Horse chestnut	1	1.71 m ³

Table 5. The numbers and total volumes of trees determined for removal

Species (Latin)	Species (English)	No.	Quantity of timber
<i>Alnus glutinosa</i> (L.) Gaertn.	European black alder	62	12.51 m ³
<i>Alnus incana</i> (L.) Moench	White alder	9	1.87 m ³
<i>Salix fragilis</i> L.	Crack willow	6	1.84 m ³
	Total	77	16.22 m ³

For the same reason, it is also necessary to complete alder trees on plot I / K. This intervention should improve the aesthetical and functional impact of this part of the park.

The results of the inventory of the woody plants in the health-resort park show that the suggested interventions are crucially important for its development. We especially point out the threat to the *Aesculus hippocastanum* L. species, not by the massively spread *Cammeraria ohridella*, a leaf damaging insect, but because the tree trunks are suspected to be attacked by advanced rot. Its extent is to be determined by a phytopathologist. We assume that the extensive hidden rotting can endanger the basic stability of some trees, with regards to their age and health condition. Spontaneous uprooting may occur.

Proposal of new outplantings

The accent on the landscape value of the spa park can be given with an appropriate design of the area between the bathhouse Poľana and the alder stand that is at the moment characterized by a ruderal hydrophilous community. Possible solution can be in its extension by an attractive landscape area presenting different growth, shape and colour forms of our native hydrophilous woody plants (trees and shrubs) and permanent herbs – in consistence with a strict landscape style.

Proposal of an additional outplanting of woody plants represents a replacement of those exemplars that ceased to fulfil their function, mostly because of their health state, and as such, they are of unsuitable landscaping value. Their further presence in the stand should threaten the whole area (disrupted stability, negative influence on buildings static, unwanted shadowing, etc.).

The existing stands mostly consist of native woody plants and this trend is to be maintained. The park is to become more attractive, but only with additional outplanting of various shape, colour and growth forms of native species.

Additional outplanting is proposed for the plot „A“ – *Picea abies 'Inversa'*, *P. abies 'Virgata'*, *Larix decidua 'Pendula'*, *Taxus baccata 'Aurea'*.

On plot „B“ new outplanting will be provided with cultivars of dwarf pine *Pinus mugo*.

On plot „C“ around the water pool with swans, should be planted native willow species *Salix alba 'Tristis'*, *S. caprea*, *S. cinerea*, *S. pentadra*, *S. viminalis*.

Surroundings of the access footpaths contacting plot „K“ should be completed with lane outplanting of cultivars of native alders *Alnus incana 'Pendula'* and *A. incana 'Laciniata'*.

For plot „D“ we suggest arolla pine *Pinus cembra 'Compacta'*, *P. cembra 'Aureovariegata'*, Scots pine

Pinus sylvestris 'Watereri', *P. sylvestris 'Fastigiata'*, *P. sylvestris 'Globosa'*.

On plot „E“ should be completed with missing trees in the maple *Acer platanoides 'Globosum'*. Alley.

On plot „G“ add missing pines *Pinus sylvestris 'Watereri'*, spruces *Picea abies 'Nidiformis'*, *P. abies 'Remontii'*.

On plot „H“ we propose the outplanting of a new alley bordering the edge of the alder stand, exclusively with cultivars of *Alnus glutinosa 'Aurea'*, *A. glutinosa 'Pyramidalis'*, *A. glutinosa 'Quercifolia'*, *Alnus incana 'Variegata'*, *A. incana 'Dalecarlica'*, *A. incana 'Coccinea'*.

On plot „I“ we propose additional outplanting: by the playgrounds with cultivars of *Sambucus nigra 'Laciniata'*, *S. nigra 'Albovariegata'*, by the pavilion with cultivars of *Taxus baccata 'Aurea'*, *T. baccata 'Dovastoniana'*, *T. baccata 'Adpressa'*.

Along with stand restoration, it is also necessary to rebuild the infrastructure: communications, suitable traffic and ensure new functions appropriately supplementing its purpose.

Conclusions

The above analysis shows that the outplanting of native woody plants is well-reasoned. Their colour, shape and growth aspects can be utilized in pronouncing their environmental impact. The landscaping value of these species has hitherto been severely underestimated, despite of their full adequacy in substituting the introduced ones. For the natural environment of the spa park Brusno which is transcending to the cultural close-to-nature landscape, the cultural forms of our native species are especially suitable: namely *Picea abies*, *Sorbus aucuparia*, *Alnus* sp., *Acer* sp., *Salix* sp., *Prunus* sp., *Pinus* sp., *Taxus baccata*.

The health state of the introduced woody plants in the spa park Brusno is evidently worse compared with the native species. It is caused by outplanting them in unfavorable climatic conditions, which is manifested by several frost cracks in tree trunks. It is also worth to mention that their exotic appearance is a strongly disturbing element to the natural character of the spa park (*Thuja* sp., *Chamaecyparis* sp., *Juniperus* sp.,...).

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Kvalitatívne a kvantitatívne hodnotenie drevín a porastov v kúpeľnom parku Brusno

Súhrn

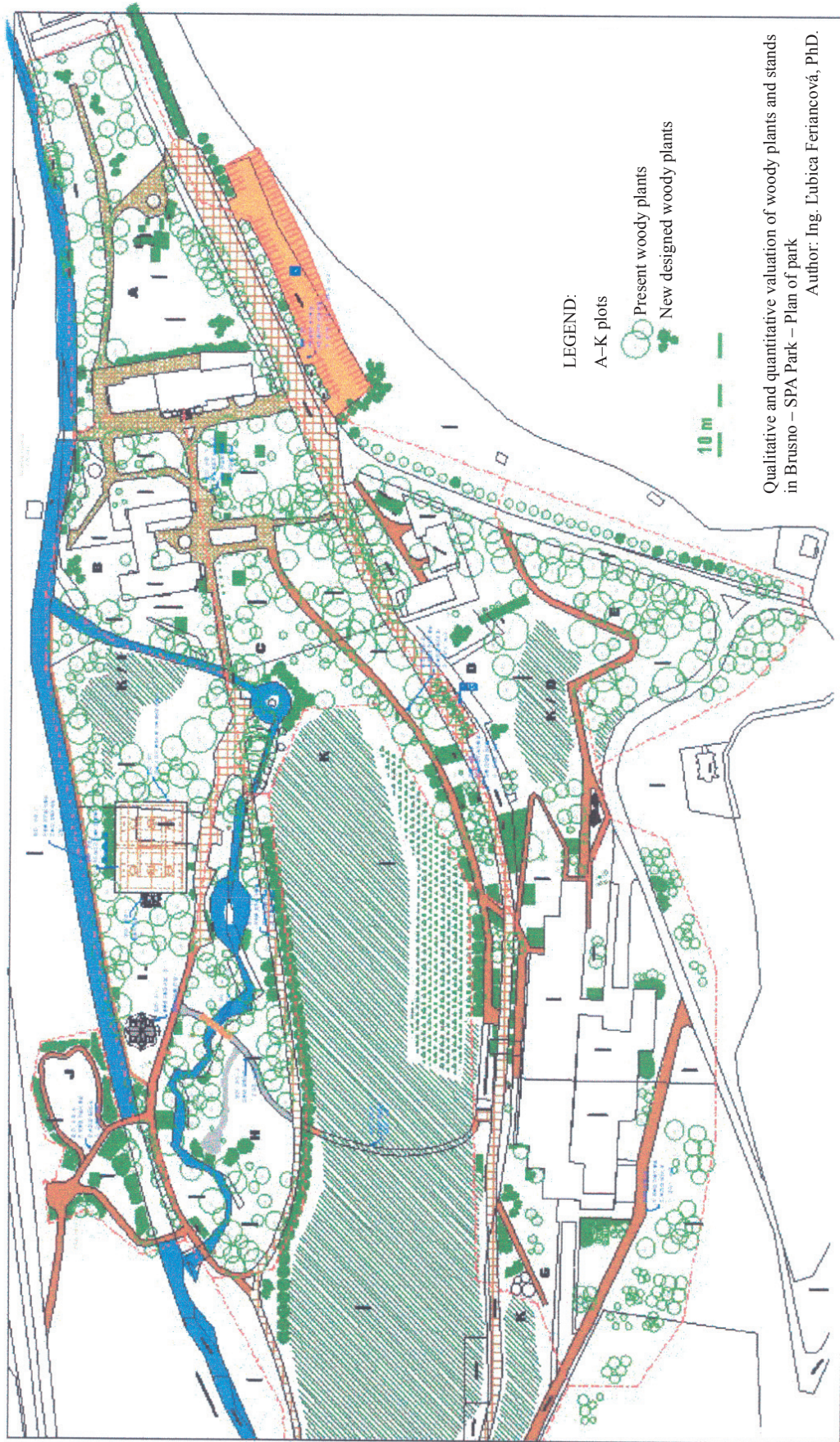
Kúpeľné parky tvoria významný krajinotvorný prvok a od počiatkov moderného kúpeľníctva sú neodmysliteľnou súčasťou každého kúpeľného miesta. Vytvárajú pre návštevníkov kúpeľov nielen malebné prostredie, ale svojimi vlastnosťami sa priamo podieľajú na liečebnom procese. Kúpele v Brusne sú špecializované na liečenie žľzníka, žľčových ciest a pečene, keďže ako jediné na Slovensku majú na to minerálnu vodu vhodného chemického zloženia.

Kúpeľný park je riešený v prírodne krajinárskom slohu s minimálnym zastúpením pravidelných výsadiieb na ploche cca 11,5 ha. Bolo tu zinventarizovaných celkom 892 drevín. Z toho je približne 2/3 domácich a 1/3 introdukovaných. U domácich aj introdukovaných prevládajú listnaté druhy.

Z výsledkov inventarizácie je zrejmé, že bez odporúčaných zásahov (výrub 148 drevín v parku a 99 v jelšom poraste) nie je možné počítať s jeho perspektívnym rozvojom.

Návrh nových výsadiieb drevín predstavuje náhradnú výsadbu za dreviny, ktoré najmä zo zdravotného hľadiska prestali plniť svoju funkciu, majú nevyhovujúcu sadovnícku hodnotu a ďalším zotrvaním v poraste sú rizikovými drevinami z hľadiska bezpečnosti.

Keďže porasty sú prevažne domáceho pôvodu a tento charakter aj vďaka záujmom štátnej ochrany prírody je žiaduce zachovať, ako aj kvôli zatraktívneniu parku, všetky dopĺňujúce výsadby drevín navrhujeme z tvarových, farebných a vzrastových foriem iba autochtónnych (domácich) druhov drevín.



Qualitative and quantitative valuation of woody plants and stands in Brusno – SPA Park – Plan of park
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