HEALTH STATE, HABITAT QUALITY AND LANDSCAPE SIGNIFICANCE OF MONUMENTAL TREES IN THE TOWN OF OPOLE

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ABSTRACT: The paper presents research results which are aimed at assessing the health, habitat quality and landscape significance of monumental trees in the boundaries of the town of Opole (south-west part of Poland). As a result of conducted analyses it was found that the examined trees represent 9 species. The dominant were: *Platanus ×hispanica* 'Acerifolia'. The remaining ones were: *Quercus robur, Ulmus laevis, Fagus sylvatica, Fraxinus excelsior, Acer campestre, Tilia cordata, Ginkgo biloba* and *Liriodendron tulipifera*. The vast majority of trees are angiosperms. The representative of gymnosperms was only one species - *Ginkgo biloba*. More than a half of the objects represented species foreign to our flora. These were: *Platanus ×hispanica* 'Acerifolia', *Ginkgo biloba* and *Liriodendron tulipifera*. Generally, the health of the trees analysed was good, however, habitat quality was average and high. The most numerous group were trees not distinctive in a landscape. There were slightly fewer distinctive trees. Whereas monumental trees, which lacked decorative features for the majority of observers, represented the smallest number.

KEY WORDS: dendrology, health, monumental tree, habitat, landscape.

Introduction

"Huge, majestic, old trees are subject to legal protection as nature monuments. They sometimes have their own names, sometimes a story reminding us of old events, an interesting legend making us recollect our past. Old trees are not only our nature monuments, but also our culture. It is worth protecting them, it is worth looking at them, it is worth knowing about them" (Andrzejewski 1994).

Poland belongs to few European countries, where many old trees are still preserved (Pacyniak 1992). Location and number of monumental trees are inversely proportional to the degree of environmental transformation (Kasprzak 2005). The biggest number of

them does not grow in the woodlands but in field and roadside plantings, by the houses and farms, in towns. Most of them grow in monumental parks and post-manor gardens (Harabin 1996). Majestic trees have always played an important part in man's life. In the past they mostly had a cultural meaning, today we also notice their aesthetic value, biocenotic and scientific function (Gołąbek and Aleksandrowicz 2004). Many of the old trees are remnants of natural environment. We should take care of them not only because of the role they play, but especially because of the rise of next generation of majestic trees in present conditions will be hindered (Buliński 1999).

Among nature monuments, definitely the most numerous category (94.4%) constitute trees – single, groups, avenues (GUS 2008). However, we do not know much about their health or about conditions of their habitat. This information is necessary to elaborate a complex programme of trees cultivation and protection (Höster 1993).

A factor distinguishing older trees from younger ones are energy resources. Young individuals have a high assimilation coefficient, due to greater leaf surface compared to a whole biomass. Therefore, they produce a lot of assimilants so they have considerable energy resources which cause not only intensive growth but also a higher tolerance to various changes (Szczepanowska 2001). In older trees the proportion of root mass and mass of above-ground parts of a tree decreases, therefore the trees react very strongly to all kinds of impacts that influence the functions of the root system.

It is impossible to determine precisely the tree's life expectancy. Within trees of the same species, a period in which a tree starts to show signs of ageing and withering may differ depending on widely understood environmental conditions (Łukasiewicz 2008).

Trees belong to most precious city plants. We have to wait tens of years, for these huge, very attractive objects therefore it is important to take care of them.

The advantages of the presence of trees in a city are commonly known. "Nature effect" of the presence of great and healthy trees (e.g. softening of widely understood urban microclimate) noticeably reflects calculable savings in economic balance both for individual households, and for whole cities (Łukasiewicz 2008).

As a rule urban trees are influenced not only by one but by a whole group of stress factors, which do not appear in natural conditions. However, it is possible to ascertain, that growth, vitality and the longevity of urban trees is strongly influenced by widely understood deformation of soil habitat. Here is the hierarchy of harmful factors that threaten trees – starting from the most significant ones:

- excessive soil density,
- too little soil capacity as compared to root system,
- soil salinity,
- water stress (Łukasiewicz 2008).

Methods

All the trees – nature monuments (24 objects) located in the area of the town of Opole (south-west part of Poland) were subject to research (in 2007).

Tree health was determined using 5-grade scale elaborated by Pacyniak and Smólski (Pacyniak 1992), in which:
1. – trees fully healthy, without any losses or tree pests;
2. – trees with partially withering thin branches in the top parts of a tree crown, with pest (both fauna and flora) in a slight degree (single cases);

3. – trees which have 50% withered crown and trunk, but also fiercely attacked by pests;
4. – trees with 70% of a withering crown and trunk and big xylem losses;
5. – trees having over 70% of a withered crown and trunk with numerous hollows including withered trees.

Evaluation of habitat quality was conducted based on a method of partial grades based on observation and measurements (Jendrzejczak et al. 2006). The grades were given in ten categories. There applied a 5-grade scale, however, a 5th grade denotes the best state for tree.

Below presented grade categories:

A. Access of tree in an area
- 5   very good access, easy to localise in an area
- 4   good access, relatively easy to localise in an area
- 3   access moderately good, possible to localise
- 2   access difficult, difficult to localise
- 1   lack of access

B. Habitat type as a kind of area
- 5   natural habitat, no buildings
- 4   habitat close to natural, with features of human activity (green areas, deserted gardens)
- 3   habitats created by a man that function as green areas (parks, squares)
- 2   habitat with dispersed development (housing development with green areas)
- 1   habitat with compact development that lack natural features

C. Buildings proximity
- 5   no buildings nearby
- 4   buildings within over 15 metres from a tree
- 3   buildings within 7 - 15 meters from a tree
- 2   buildings within less than 7 metres, branches touch or may touch walls
- 1   buildings very close to a tree trunk

D. Distance of a tree from the streets
- 5   area reserved for pedestrians
- 4   area not used by vehicles, but located not far away from the street
- 3   area directly located by the street with little traffic
- 2   area directly located by the street frequently used by cars, mostly passenger cars
- 1   area directly located by the street constantly used by vehicles, including heavy ones

E. Water permeability of the ground
- 5   soil free from any facing
- 4   soil free up to a crown girth or covered with single belts of facing
- 3   soil free up to the middle of a crown girth or only one side of a tree
- 2   ground not covered with facing only in the close distance from a tree trunk
- 1   whole ground around a tree trunk covered with facing

F. Vicinity of industrial electric power lines
    5   no electric power lines
    4   object located within over 20 metres from interconnection power lines
    3   object located within less than 20 metres from interconnection power lines, but there is a cover limiting their possible negative impact on a tree
    2   object located less than 20 metres far from interconnection power lines
    1   a tree touches interconnection power lines or may touch them in the nearest years

G. Surroundings hygiene
    5   neat and clean area most part of a year
    4   neat area, periodical cleaning works
    3   area relatively clean, mostly natural contaminations
    2   low hygiene level, natural and anthropogenic contaminations
    1   area very polluted and neglected

H. Present state of tree care
    5   very good (cleanness, irrigation, improvement cutting, care of accompanying vegetation)
    4   good (cleanness, improvement cutting)
    3   care limited to regular care of environment hygiene and possible necessary crown corrections
    2   care is limited to periodic cleaning of an area
    1   total lack of care, possible signs of devastation

I. Other forms of protection
    5   various forms of protection (bird nest boxes, bird feeders, area fencing)
    4   conducted two of mentioned forms of protection
    3   conducted one of mentioned forms of protection
    2   lack of any protection form of this type, to some extent compensated by natural conditions
    1   lack of any traces of action of this type

J. Condition of accompanying vegetation
    5   very good
    4   good
    3   care of accompanying vegetation is limited only to hygiene works on a given area
    2   accompanying vegetation neglected
    1   accompanying vegetation strongly neglected, with possible signs of devastation

The authors used mean value of partial grades in particular categories to determine habitat quality.

The landscape significance of a tree was graded according to the following scale: (Jendrzejczak et al. 2006):
    5   dominant tree in a landscape
    4   tree distinctive in a landscape
    3   tree is not distinctive in a landscape
    2   tree does lacks decorative features for majority observers
    1   decorative value of a tree is minimal

Results

The achieved research results are placed in tables 1 – 2.

Table 1. Health state of monumental trees of the town of Opole.

Tree number	Species	Location	Health state
1.	*Tilia cordata*	Opole – Grotowice	3
2.	*Acer campestre*	In front of the building of Opole Voivodship Office	2
3.	*Fagus sylvatica*	20 Piastowska St.	2
4.	*Ginkgo biloba*	5 Strzelców Bytomskich St.	2
5.	*Liriodendron tulipifera*	20 Piastowska St.	2
6.	*Fraxinus excelsior*	20 Piastowska St.	2
7.	*Ulmus laevis*	Mozarta St. – Żwirki i Wigury St.	2
8.	*Ulmus laevis*	9 Oleska St.	2
9.	*Quercus robur*	Bolko Island Park	2
10.	*Quercus robur*	1 Strzelców Bytomskich St.	1
11.	*Quercus robur*	18 Strzelców Bytomskich St.	2
12.	*Quercus robur*	at N. Barlickiego St.	2
13.	*Quercus robur*	Pasieka Park	3
14.	*Platanus ×hispanica* 'Acerifolia'	6 Niedziałkowskiego St.	1
15.	*Platanus ×hispanica* 'Acerifolia'	17 Piastowska St.	2
16.	*Platanus ×hispanica* 'Acerifolia'	Wolności Square	2
17.	*Platanus ×hispanica* 'Acerifolia'	Wolności Square	2
18.	*Platanus ×hispanica* 'Acerifolia'	2 Barlickiego St.	3
19.	*Platanus ×hispanica* 'Acerifolia'	2 Barlickiego St.	2
20.	*Platanus ×hispanica* 'Acerifolia'	1 Korfantego St.	2
21.	*Platanus ×hispanica* 'Acerifolia'	Wrocławska St. at school premises	2
22.	*Platanus ×hispanica* 'Acerifolia'	Wrocławska St. at school premises	2
23.	*Platanus ×hispanica* 'Acerifolia'	Wrocławska St. at school premises	2
24.	*Platanus ×hispanica* 'Acerifolia'	2 Odrowążów St.	2

Table 2. Habitat quality and landscape significance of monumental trees in the town of Opole.

Tree number	Partial grading in given categories										Grading of habitat quality	Landscape significance
	A	B	C	D	E	F	G	H	I	J		
1.	4	1	2	2	2	1	4	4	2	4	2.6	3
2.	4	3	4	4	4	5	5	3	2	5	3.9	4
3.	4	3	4	5	5	5	5	4	2	5	4.2	4
4.	3	1	2	3	3	5	2	3	2	5	2.9	3
5.	3	3	4	5	4	5	4	4	2	5	3.9	3
6.	3	3	2	5	3	5	5	4	1	5	3.6	3
7.	5	1	1	4	2	5	5	5	3	5	3.6	4
8.	4	1	1	3	2	5	2	3	2	3	2.6	3
9.	4	4	4	5	4	5	4	4	3	3	4.0	3
10.	4	3	2	4	4	5	5	4	2	5	3.8	3
11.	4	2	2	3	3	5	5	4	2	5	3.5	3
12.	4	3	4	4	2	5	4	5	2	4	3.7	4
13.	3	4	4	4	4	4	4	3	1	4	3.5	2
14.	4	3	4	3	4	5	5	5	2	5	4.0	4
15.	4	1	2	2	2	5	4	4	2	5	3.1	4
16.	5	3	4	2	4	5	5	4	2	3	3.7	4
17.	5	3	4	2	4	5	5	4	2	3	3.7	4
18.	5	2	4	3	3	5	4	4	3	4	3.7	4
19.	4	2	2	4	3	5	4	4	2	4	3.4	3
20.	5	3	3	4	3	4	5	3	2	5	3.7	4
21.	4	2	1	3	2	5	4	4	2	5	3.2	3
22.	4	2	3	3	2	5	4	4	2	5	3.4	3
23.	4	2	3	3	2	5	4	4	2	5	3.4	3
24.	4	2	2	3	2	5	4	4	2	5	3.3	3

Among the examined monuments there existed 9 species. The greatest share (45.7%) was *Platanus ×hispanica* 'Acerifolia'. It is a tree which grows very well in Central European conditions. It grows here up to over 35 m high and 10 m in the girth (Tomusiak and Zarzyński 2008). It grows very well in urban and industrial area conditions. It has a long life-span and is immune to dry air and air pollution. However, it requires a lot of space to grow a wide crown (Seneta and Dolatowski 2008).

In a group of analysed objects there also existed:

- *Quercus robur* – 20.8%;
- *Ulmus laevis* – 8.3%;
- *Fagus sylvatica*, *Fraxinus excelsior*, *Acer campestre*, *Tilia cordata*, *Ginkgo biloba* and *Liriodendron tulipifera* – each 4.2%.

Vast majority – 95.8% (8 species), are angiosperms. Gymnosperms represented only one species, namely *Ginkgo biloba*. It is a tree immune to air pollution and has a long life-span – it lives up to 2000 years (Seneta, Dolatowski 2008). It grows in Poland up to 31 m high and 400 cm in the girth (Pacyniak 1992). As many as 13 objects (54.2%) represented species foreign to our flora. These were: *Platanus ×hispanica* 'Acerifolia', *Ginkgo biloba* and *Liriodendron tulipifera*. The last one grows in Poland up to 33 m high and has a girth of over 400 cm. It grows quickly and is one of the most beautiful park trees (Pacyniak 1992).

Generally, the health state of the analysed trees was good. As much as 79.2% of the trees were in good (health state 2), 12.5% in average (health state 3) and 8.3% in very good health (health state 1). *Tilia cordata* in Grotowice, *Quercus robur* in the area of Pasieka Park and *Platanus ×hispanica* 'Acerifolia' at 2 Barlickiego St. were in the worst condition. Monuments in a very healthy state were: *Quercus robur* at 1 Strzelców Bytomskich St. and *Platanus ×hispanica* 'Acerifolia' at 6 Niedziałkowskiego St.

Grades of habitat quality of the analysed trees were between 2.6 and 4.2. It may be therefore assumed that the habitat quality of monumental trees in Opole is average and high. The lowest habitat quality (2.6) noted at *Tilia cordata* in Grotowice (one of three trees in the worst health) and at *Ulmus laevis* at 9 Oleska St. The highest habitat quality (4.2) there noted at *Fagus sylvatica* at 20 Piastowska St. The habitat quality of the trees in the best health state (no 10 and 14) was also high and amounted respectively to 3.8 and 4.0.

Among the analysed monuments the biggest group – 54.1% constitute trees not distinctive in a landscape. A little less – 41.7% were distinctive trees and only 4.2% of monuments lacked any decorative features for majority of observers. Neither trees dominant in a landscape nor trees with minimal decorative value were found.

Conclusions

The examined monumental trees represent 9 species. The biggest share (45.7%) constituted *Platanus ×hispanica* 'Acerifolia'. The remaining are: *Quercus robur*, *Ulmus laevis*, *Fagus sylvatica*, *Fraxinus excelsior*, *Acer campestre*, *Tilia cordata*, *Ginkgo biloba* and *Liriodendron tulipifera*.

The vast majority – 95.8% (8 species) were angiosperms. The gymnosperms represent only one species, namely *Ginkgo biloba*. As many as 13 trees (54.2%) represented species foreign to polish flora. These were: *Platanus ×hispanica* 'Acerifolia', *Ginkgo biloba* and *Liriodendron tulipifera*.

Generally health state of the analysed trees was good. As many as 79.2% of the objects presented good, 12.5% average and 8.3% very good health state.

The research proved that the habitat quality of monumental trees in Opole is average and high (grades of habitat quality were between 2.6 and 4.2).

Among the analysed monuments the biggest group – 54.1% constituted trees not distinctive in a landscape. There were a little less – 41.7% of distinctive trees and only 4.2% of monuments which lack decorative features for the majority of observers.

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