6. У Вільхівському парку відбулася фітоценотична деградація насаджень, зміна його ландшафтної структури.

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Проанализирован исторический опыт создания парковых насаждений, особенности современного состояния дендрофлоры, изучен таксономический состав старинного парка, построен план насаждений и ландшафтный план.

Парк-памятник садово-паркового искусства, таксономический состав, план насаждения, ландшафтный план.

The authors analyzed the historical experience of parklands, features modern state dendroflora, studied taxonomic composition of the old park, built plan plantings and landscaping plan.

Park memorial garden art, taxonomic composition, planting plan, landscape plan.

TREES PROTECTED BY LAW IN POLAND ON THE EXAMPLE OF WROCŁAW CITY

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Trees are the basic element of each landscape: natural as well as urban. There are less and less greenery in continually growing cities and high buildings appeared in place of trees. Wrocław is one of the biggest cities in

Poland situated in south west part of the country. The area has the longest vegetation season and mildest winter period in the whole land. This enables cultivation of plants that originate from warmer climate areas. There are 174 nature monuments registered as single trees, tree groups and tree alleys in Wrocław. They belong to 28 species out of which 11 are native and 17 are introduced. The most common tree between the monument in Wrocław is common oak (Quercus robur). This species and plane tree are the thickest and circumference of trunk same of them was bigger than 500 cm. The article present also occurrence of monument trees in Wroclaw districts.

Nature monument, district, single tree, alley, trees group, circumference of trunk.

1 Introduction

Currently the role of urban greenery is “one of the challenges of this century, not only of the human interest, but it is one more necessary step towards a more sustainable future towards our cities” [10]. Nature monuments as well as other trees turned out to be an important element of urban landscape. It is known that green areas within a city have positive impact on aesthetic appeal as well as on air quality. Simultaneously this relation works both ways: air pollution influences the tree wellbeing. High sulphur dioxide concentration is the main negative factor influencing green plants photosynthesis process. The "Environmental Care Law" bill passed in 2001 incorporated the EU standards in the local law in terms of air quality examination and management. Based upon that fact during the past few years one could observe atmospheric pollution decrease with average annual sulphur dioxide concentration and air dust in particular [1]. “Effective land use planning needs transparent information regarding both objective and subjective significance of landscape and other environmental values” [2]. Every green areas “are some of the means to reach urban sustainability, since they make possible the incorporation of self-sufficient and regenerative natural processes” [8]. The oldest trees, apart from playing an important ecological role in an urban terrain, are also a living proof of the original nature environment which has been changed by human presence. In the pas the big trees was a religious worship, nowadays the wayside or tree shrine accompany them. It is possible to see one tree shrine hanged on plane tree in the centre of the city. They have also a symbolic worship: *tilia* is the symbol of peace and health, *taxus* – protection and immortality, *ulmus* – relationship, *quercus* – power, *platanus* – balance, *fagus* – understanding. Monuments trees in Poland are categorized as follows: single trees, trees groups and alleys [3]. A tree can become a nature monument based on its age, size or historical event that is linked with it. The aim of the article is to present the oldest trees in Wrocław area.

2 Characteristics of the site

Wrocław is the capital city of the Lower Silesia region situated in south west of Poland. The main river inside the city limits is Odra and it has

numerous tributaries which divide the city's districts. Wrocław is situated within 290 km^2 out of which 16000 ha is classified as green areas, arable land and grassland. They are arranged in a ray-concentric web [3]. Based upon the data from the 1945–1980 period predominant winds blow from north and north west direction, mainly during summer time [4]. The frequency of westerly winds results in mild winters and more humid summer in comparison to other regions of Poland. Wroclaw, as well as the whole Lower Silesia region belongs to the warmest areas in Poland [5]. The highest average monthly air temperature 17,8 °C and occurs in July, correspondingly the lowest occurs in January with -1,9 °C [4]. Climatic conditions of Wroclaw, due to the mildest winter in the country, enable cultivation of plant originated typical for warmer regions.

3 The results

There are 174 monuments trees at the Register of Nature Monuments in Wrocław (tab.), two among them are inanimate plants components. They are fossils part of trunk which are situated in the Botanical Garden. The nature monuments in Wrocław presents all category of them. Most of all there is a single trees, in number 81 plants which is 82,65% monuments objects, much less is group of trees (15,35%), and alley constitute only 2% Wrocław's nature monuments (fig. 1). The most rich in them district is Śródmieście, where is according to Register of Nature Monuments 2007, 85 trees (fig. 2) collected in 39 objects protected by low (2 alleys, 8 group of trees and 29 single trees).

List of monument trees in Wroclaw (according to Register of Nature Monuments, Council of Wroclaw, 2007)

Lp.	District	Species	Circumference of trunk (cm)	Category
1	2	3	4	5
1	Fabryczna	*Fagus sylvatica*	334	Single tree
2		*Liriodendron tulipfera*	376	Single tree
3		*Platanus ×acerifolia*	433	Single tree
4		*Platanus ×acerifolia*	485	Single tree
5		*Platanus ×acerifolia*	432	Single tree
6		*Platanus ×acerifolia*	450	Single tree
7		*Platanus ×acerifolia*	410	Single tree
8		*Quercus palustris*	290	Single tree
9		*Quercus robur*	411	Single tree
10		*Quercus robur*	440	
11		*Quercus robur*	365	
12		*Quercus robur*	355	
13		*Quercus robur*	351	Group of trees
14		*Quercus robur*	535	
15		*Quercus robur*	350	
16		*Quercus robur*	387	
17		*Quercus robur*	360	
18		*Quercus robur*	437	Single tree
19		*Quercus robur*	534	Single tree
20		*Quercus robur*	435	Single tree

21		*Quercus robur*	410	Single tree
22		*Quercus robur*	506	Single tree
23		*Quercus robur*	455	Single tree
24		*Quercus robur*	404	Group of trees
25		*Quercus robur*	421	
26		*Quercus robur*	495	
27		*Quercus robur*	466	Group of trees
28		*Quercus robur*	461	
29		*Quercus robur*	452	Single tree
30		*Quercus robur*	404	Single tree
31		*Taxodium distichum*	267	Single tree
32		*Tilia platyphyllos*	376	Single tree
33		*Ulmus laevis*	314	Single tree
34		*Ulmus laevis*	493	Single tree
35		*Ulmus laevis*	322	
36		*Ulmus laevis*	380	Group of trees
37		*Ulmus laevis*	363	
38		*Ulmus laevis*	350	
39		*Quercus robur*	400	Single tree
40		*Quercus robur*	461	Single tree
41		*Quercus robur*	419	Single tree
42	Krzyki	*Talus baccata*	215	Single tree
43		*Tuja occidentalis*	128+55	Single tree
44		*Tilia cordata*	396	Single tree
45		*Tilia maximowicziana*	320	Single tree
46		*Tilia platyphyllos*	344	Single tree
47		*Ulmus laevis*	347	Single tree
48		*Aesculus hippocastanum*	370	Single tree
49		*Carpinus betulus*	239	Single tree
50		*Chamaecyparis lawsoniana*	138	Single tree
51		*Fraxinus excelsior*	334	Single tree
52		*Platanus ×acerifolia*	465	Single tree
53		*Platanus ×acerifolia*	412	Single tree
54		*Quercus robur*	728	Single tree
55		*Quercus robur*	404	
56		*Quercus robur*	337	
57		*Quercus robur*	328	
58		*Quercus robur*	469	Group of trees
59		*Quercus robur*	417	
60	Psie Pole	*Quercus robur*	678	
61		*Quercus robur*	456	
62		*Quercus robur*	449	
63		*Quercus robur*	375	Single tree
64		*Quercus robur*	522	Group of trees
65		*Quercus robur*	420	
66		*Quercus robur*	403	Single tree
67		*Quercus robur*	384	Single tree
68		*Quercus robur*	389	Single tree
69		*Quercus robur*	413	Single tree
70		*Quercus robur*	384	Single tree

71		*Quercus robur*	421	Single tree
72		*Quercus robur*	414	Single tree
73		*Ulmus glabra*	336	Single tree
74		*Ginko biloba*	290	Single tree
75		*Ginko biloba*	256	Single tree
76		*Ginko biloba*	255	Single tree
77		*Celtis occidentalis*	297	Single tree
78		*Platanus ×acerifolia*	388	
79		*Platanus ×acerifolia*	365	
80	Stare Miasto	*Platanus ×acerifolia*	302	
81		*Platanus ×acerifolia*	401	
82		*Platanus ×acerifolia*	392	Group of trees
83		*Platanus ×acerifolia*	397	
84		*Platanus ×acerifolia*	309	
85		*Platanus ×acerifolia*	355	
86		*Platanus ×acerifolia*	273	
87		*Platanus ×acerifolia*	405	
88		*Platanus ×acerifolia*	672	Single tree
89		*Platanus ×acerifolia*	527	Single tree
90		*Chamaecyparis lawsoniana*	127	Single tree
91		*Castaneda sativa*	243	Single tree
92		*Carya ovata*	239	Single tree
93		*Chamaecyparis pisifera* 'Squarrosa'	124	Single tree
94		*Daxylon schrolionum*	20-60	
95		*Dadoxylon rhodesnum*	210	
96		*Fagus sylvatica*	349	
97		*Fagus sylvatica*	264	Group of trees
98		*Fagus sylvatica*	274	
99		*Fagus sylvatica*	244	
100		*Fagus sylvatica*	358	
101		*Fagus sylvatica*	325+252+125	Group of trees
102	Śródmieście	*Fagus sylvatica*	318	
103		*Fagus sylvatica*	307	
104		*Ginko biloba*	255	Group of trees
105		*Ginko biloba*	272	
106		*Ginko biloba*	284	Single tree
107		*Hedera helix*	54 + 77	Climbing plant
108		*Hedera helix*	fi 42	Climbing plant
109		*Liriodendron tulipifera*	282	Single tree
110		*Pinus nigra*	171	Group of trees
111		*Pinus nigra*	197	
112		*Platanus ×acerifolia*	495	Single tree
113		*Platanus ×acerifolia*	434	Single tree
114		*Platanus ×acerifolia*	519	Single tree
115		*Platanus ×acerifolia*	436	Single tree
116		*Pterocarya fraxinifolia*	207+274+303	Single tree
117		*Quercus palustris*	313	Single tree
118		*Quercus robur* „Jan Dzierżoń”	652	Single tree
119		*Quercus robur*	387	Group of trees

120		*Quercus robur*	306	
121		*Quercus robur*	271	
122		*Quercus robur*	386	
123		*Quercus robur*	456	
124		*Quercus robur*	337	
125		*Quercus robur*	333	
126		*Quercus robur*	314	
127		*Quercus robur*	268	
128		*Quercus robur*	274	Alley
129		*Quercus robur*	252	
130		*Quercus robur*	250	
131		*Quercus robur*	271	
132		*Quercus robur*	279	
133		*Quercus robur*	347	
134		*Quercus robur*	245	
135		*Quercus robur*	266	
136		*Quercus robur*	235	
137		*Quercus robur*	359	
138		*Quercus robur*	257	
139		*Quercus robur*	358	
140		*Quercus robur*	345 + 305	
141		*Quercus robur*	413	
142		*Quercus robur*	365	Group of trees
143		*Quercus robur*	293	
144		*Quercus robur*	410	Single tree
145		*Quercus robur*	436	Single tree
146		*Quercus robur*	500	Single tree
147		*Quercus robur*	444	Single tree
148		*Quercus robur*	424	Single tree
149		*Quercus robur*	479	Single tree
150		*Quercus robur*	393	Single tree
151		*Quercus robur*	629	Single tree
152		*Quercus robur*	354	Single tree
153		*Quercus robur*	393	
154		*Quercus robur*	317	
155		*Quercus robur*	332	
156		*Quercus robur*	484	
157	Śródmieście	*Quercus robur*	363	Alley
158		*Quercus robur*	413	
159		*Quercus robur*	459	
160		*Quercus robur*	520	
161		*Quercus robur*	404	
162		*Quercus robur*	338	
163		*Sorbus torminalis*	92	Single tree
164		*Taxus baccata*	204	Group of trees
165		*Taxus baccata*	164	
166		*Taxus baccata*	103	
167		*Taxus baccata*	164+104+36	
168		*Taxus baccata*	71+47+28	
169		*Taxus baccata*	132	

170	*Taxus baccata*	117	
171	*Taxus baccata*	128	
172	*Taxus baccata*	114+78+62+110	Single tree
173	*Tuja occidentalis*	207	Single tree
174	*Tilia tomentosa*	389	Single tree

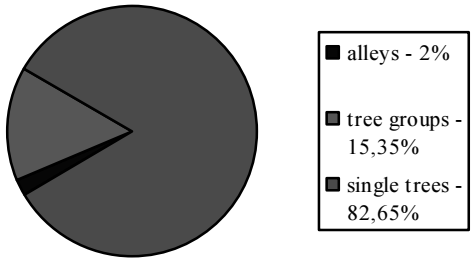

Fig. 1. The form of nature monuments in Wrocław

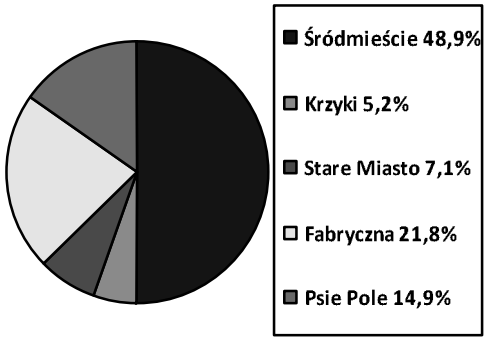

Fig. 2. Percentage of nature monuments in Wrocławs districts

There is 45 common oaks (*Quercus robur*) with circumference of trunks from 235 cm to 652 cm. Twenty six of them is part of both alleys, 9 trees form two groups of trees (6 and 3 exemplars), the rest of common oaks in that district are single trees. Next species, taken the quantity into consideration is yew tree (*Taxsus baccata*) with circumference of trunks from 28 cm (one trunk of the many-trunks tree) to 204cm. All of them (9 plants) grows in the Botanical Garden and they are registered as one group of trees. Almost the same number of trees (8 pieces) belongs to beech tree (*Fagus sylvatica*). The circumference of trunks that species fit between 125 cm (the thinnest trunk in three- trunks tree) and 349 cm. All beech trees make two group of four trees each of them. There is four plane trees (*Platanus* ×*acerifolia*) in Śródmieście district with circumference of trunks from 434 cm to519 cm three ginkgo tree (*Ginkgo biloba*) with circumference of trunks from 255 cm to 284 cm. There are two conjoined ginkgo which are registered as one, probably because they still grow into each other in a grate height. One can find in that, district also two black pine tree (*Pinus nigra*) as well as two ivy (*Hedera helix*). Both pine make a group of trees which has a circumference of trunks 171 cm and 197 cm. Ivy are registered as a single trees. One of them has two trunks (54 and 77cm circumference), and the second one has measured diameter instead of circumference (42 cm). The rest of trees are represented by singular species: *Chamaecyparis lawsoniana* with circumference of trunks 127 cm, *Chamaecyparis lawsoniana* 'Squarosa' – 124 cm, *Castanea sativa* – 243 cm, *Carya ovata* – 239 cm, *Liriodendron tulipifera* – 282 cm, three trunk *Pterocarya fraxinifolia* – 207, 274 and 303 cm, *Quercus palustris* – 313 cm, *Tuja occidentalis* – 207 cm and *Tilia tomentosa* – 389 cm. Plants from *Daxylon* and *Dadoxylon* genus needs separate discuss because they are inanimate nature monuments. First of them (*Daxylon schrolionum*) it is group of 20 trunks fossils

fragments witch circumference is between 20 and 60cm, the second (*Dadoxylon rhodesnum*) is 210 cm high fossils trunk fragment.

From the own observations results that there are not in the Register of Nature Monuments in Wrocław one common oak growing in the Botanical Garden, while there is still one beech tree as a part of group of trees also in the Botanical Garden. This plant was felled several years ago because it was infected by pathogenic fungi and it was dangerous for the visitors.

The second district taking the nature monuments quantity into consideration is Fabryczna, where is growing 38 trees protected by low. As well as in Śródmieście in that city area the most common monument tree is *Quercus robur* – 22 plants with circumference of trunks from 350 cm to 535 cm. That species here is register as a single tree and groups of trees formed of 2, 3 and 8 exemplars. There is another monuments group of trees in Fabryczna, composed of four European white elm (*Ulmus laevis*), all of them is 6 in that part of city with circumference of trunks from 314 cm to 493 cm. Not many less is plane trees in here – 5 specimens witch circumference of trunks that species fit between 410 cm and 485 cm. The rest of species in that district are represented by following species: *Fagus sylvatica* –circumference of trunk 334 cm, *Liriodendron tulipifera* – 376 cm, *Quercus palustris* – 290 cm, *Taxodium distichum* – 267 cm and *Tilia platyphyllos* – 376 cm.

In the Psie Pole district there are 26 nature monuments, and between of them the most numerous is again common oak – 19 trees with circumference of trunks from 328 cm to 728 cm. They are mainly single trees, but also two groups of trees (2 and 8 items). Two single tree *Platanus* × *acerifolia* are growing here as well (circumference – 412 cm and 465 cm). Next trees represents a species each as following: *Aesculus hippocastanum* – 370 cm, *Carpinus betulus* – 239 cm, *Chamaecyparis lawsoniana* – 138 cm, *Fraxinus excelsior* 334 cm and *Ulmus gabra* – 336 cm.

There is register 16 nature monuments in the Stare Miasto area and all belongs to the introduced species. Twelve of them are *Platanus* ×*acerifolia* with circumference of trunks from 302 cm to 672 cm, 10 between this trees makes only groups of trees in that district. It possible to find here three *Ginkgo biloba* with circumference of trunks from 255 cm to 290 cm, and one *Celtis occidentalis* witch has 297 cm circumference of trunk.

The lowest number of tree monuments is located in the Krzyki district, even though it is commonly known as "green district" with a couple of public parks. Probably it is thanks to relatively young trees stand which is not a subject to legal protection. There are 9 specimens register as a single tree. Between them are 3 common oaks witch circumference of trunks fit between 400cm and 461cm. In Krzyki district grows also *Taxus baccata* (215cm of circumference), *Tuja plicata* (128 and 55cm) register as *Tuja occidentalis*, lime (396cm) register as small-leaved lime (*Tilia cordata*), *Tilia maximowicziana* – 320cm, *Tilia platyphyllos* – 344cm and *Ulmus laevis* – 347cm circumference of trunk.

Between all of tree monuments the highest number is the genus of *Quercus* (fig. 3), there are 89 indigenous species *Quercus robur* and 2

Quercus palustris. The second highest is *Platanus* ×*acerifolia* (23 specimens). In terms of angiosperms plant group there are *Fagus sylvatica* (9 species), 8 elm trees (7 *Ulmus laevis* and one *U. glabra*) and 6 lime belonged to 4 different species. The gymnosperms flora is represented in high numbers by an indigenous species – *Taxus baccata* with the amount of 10. Next one is an Asian species *Ginkgo biloba* in total of 6 species. The rest of native and introduced species is represented maximum by three plants, all of them are 20 trees.

Considering the genus occurrence in Wrocław's districts, there is only Krzyki and Stare Miasto where *Quercus robur* is not a dominated species (fig. 4). In Krzyki district area the most quantity genus is *Tilia* (4 examples) but they belong to the three different species, however there are 3 *Quercus robur.* The most quantity species group in the Stare Miasto district is *Platanus* ×*acerifolia* while there are not common oaks as the monument trees. The biggest diversity species is observed in Śródmieście district, where one can found every species growing in the other districts. There are also 15 trees belonging to 9 different genus which are categorized for group named "others".

Monuments trees usually have a very thick trunk comparing to the others examples from the same species or genus. The most of Wrocław's monuments trees (59 examples) trunk circumference is fit between 301cm and 400cm (fig. 5). Little less plants (51 ex.) is in the group with circumference of trunk from 401cm to 500cm. The least there are trees thicker than 500cm, only two species: *Quercus robur* and *Platanus* ×*acerifolia*.

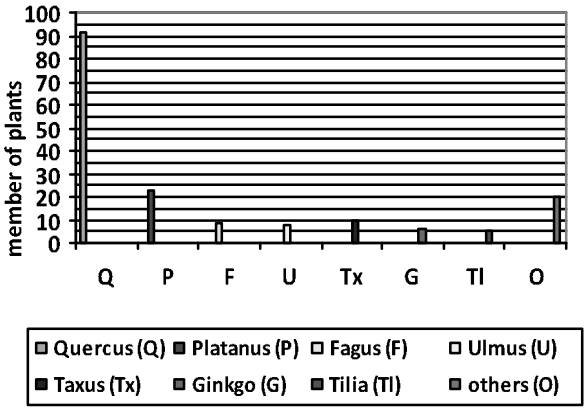

Fig. 3. Alive genus protected by low in Wrocław

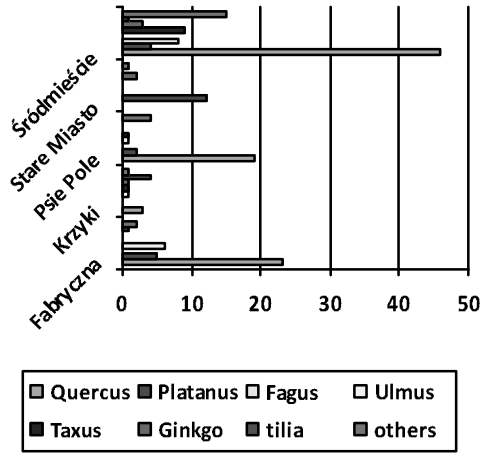

Fig. 4. Protected by low genus in the Wrocław's Districts

4 Conclusions

There are 104 498 trees in Poland which are registered and protected as nature monuments, out of which 2830 is located in Lower Silesia and 174 in Wrocław itself. All Wrocław specimens belong to 28 species out of which 11 are indigenous and 17 are of different origin. Between trees protected by low there is the most of common oak even the Lower Silesia is the region where there is the last quantity of that species [9]. According to proposed by Hrynkiewicz-Sudnik and Siewniak (1998) as well as Symonides (2008)

circumference of trunk for the monument tree, only in Stare Miasto it should be about 100 tree protected by low (Weber-Siwirska, Bąbelewski typescript). It would be much more if take the category from Czekalski and Klimaszewska (2003). These authors suggest the each foreign tree with circumference bigger than 220cm. should be nature monument, besides *Robinia pseudoacacia* and *Populus americana*.

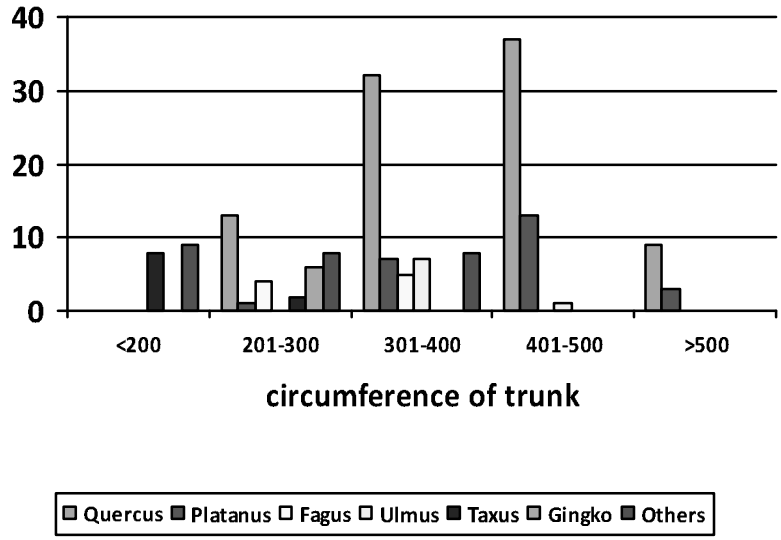

Fig. 5. Number of the trees in relation to thickness of the trunk

It would be good to verify the Register of Nature Monuments in Wrocław taking list of species and they quantity into account. Many misstatement in publication about the thickest *Acer pseudoplatanus* in Poland discover Borkowski (2004). Sometimes the circumference of single tree was the sum of several trunk tree circumferences or it was measure much below 130cm.

Even it turns out that most of the tree monument is in good condition, it would be good to check they texture inside. It is necessary in case of specimens with bird hollows, rotten trunks and reduced canopy. Damages causes by virus or pathogens are one of the main elements provoking falling down trees [7]. Somme authors [4] separate additional group of danger factors important for trees growing in urban areas: defective care (incorrect irrigation and cutting branch, removing of surrounding trees). Precision database about monument trees is need to survey necessary care treatment, and also to preclude invalid cancel of trees which could grow long time if they correctly care.

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