sciendo

THE EFFECT OF LOCATION ON THE VALUE OF ORNAMENTAL TREES USING THE EXAMPLE OF A GREEN SPACE IN LUBLIN

Prof. Eugenia Czernyszewicz
The University of Life Sciences in Lublin
e-mail: eugeniacze@gmail.com

Małgorzata Szymańska
Real-Estate Appraiser
e-mail: malgorzata@szymanska-wycena.pl

Beata Żuraw
The University of Life Sciences in Lublin
e-mail: beata.zuraw@up.lublin.pl

Katarzyna Leziak
The University of Life Sciences in Lublin
e-mail: k.leziak@o2.pl

Abstract

This paper examines and identifies, using a specific example, how the location of trees influences their value. For the valuation of trees outside a forest area, appraisers often employ methods recommended for estimating forest stands, which significantly reduces the value of trees and valued properties. The tree-valuation method developed by SZCZEPANOWSKA et al. (2010) was used in our study. First, we compiled an inventory of trees located on plots intended for expropriation. The study covered all specimens with trunk circumferences of over 25 centimetres, which amounted to a total of 76 trees. We considered the value of the trees in the conditions of the actual location, which means that our calculations included house gardens in the city and the values of the same trees in hypothetical growth conditions: tree stands in rural and urban areas, green spaces in urban and rural areas, housing estates, roads and streets (both urban and rural), and historic areas, health resorts and health-resort protection zones.

Our study has shown that the tree valuation method based on differentiating coefficients is a very useful tool for establishing the value of trees in outlying areas.

Key words: *value of trees, ornamental trees, location, valuation*.

JEL Classification: *Q51, Q56, Q26, Q19, O18, O13, D71*.

Citation: Czernyszewicz E., Szymańska M., Żuraw B., Leziak K., 2019, *The Effect of Location on the Value of Ornamental Trees Using the Example of a Green Space in Lublin*, Real Estate Management and Valuation, vol. 27, No 4, pp. 53-61.

DOI: 10.2478/remav-2019-0035

1. Introduction

There is no life without greenery, and trees are its most important element. They constitute a natural feature in the surroundings of man. The role of trees for the good of humanity is unquestionable. Trees serve environmental, economic and recreational functions, support biological diversity (AKBAR et al. 2014; LARA et al. 2017; SALISBURY et al. 2017), and constitute a permanent element of the environment in and outside urban areas. We encounter them in forests, gardens and public spaces. Old trees provide habitats for rare plants and animals (MILTON et al. 2015), and complement and consolidate urbanized space, allowing for the development of additional plans, architectural markers and landmark features, smoothing out the edges of built features, and due to the seasonal changes in colours and forms, give squares and streets a new character. The smell of flowers stimulates our sense of smell; it is calming and relaxing. Plants are an indicator of air pollution, particularly in highly urbanized areas, as biomonitors and effective accumulators of heavy metals, and can be used for the improvement of air quality in cities (UKPEBOR 2010; GUERRERO-LEIVA et al. 2016). Next to the development of vehicle transport, growing air pollution, and the progressing greenhouse effect, the climate- and health-related role of plants is very important. Greenery provides a natural shelter against wind, and, due to the intensification of convection movements, it facilitates the exchange of air masses, retains precipitation waters, increases humidity and oxygen levels in the air, reduces the amplitude of temperatures in the surroundings, captures dust, reduces noise levels, and provides living habitats for animals (SZOPIŃSKA, ZYGMUNT-RUBASZEK 2009). NOTARO and DE SALVO (2010) studied ornamental trees from the species *Cupressus sempervirens* L (evergreen cypress), found in the area of Lake Garda (North Italy) and constituting part of an unforgettable landscape. The trees are threatened by pathogens, the costs of counteracting which are very high. In effect, they involve substantial expenditures related to maintenance and the potential replacement of trees with resistant cultivars. For the purposes of assessing the social benefits, the researchers applied the conditional-valuation method, conducting interviews with randomly selected tourists. The survey showed that the public was able to financially contribute to research expenditures and measures aimed at the preservation of cypress trees.

MILTON et al. (2015) emphasized that, in certain situations, plants in the roadside zone can also have a negative impact. They pointed out the fact that they "attract" of wildlife, resulting in increasingly frequent road kills, the development of corridors for the movement of pests and invasive species, the obscuring of road signs, and damage to road surfaces. BOROWSKI et al. (2012), using the example of planting roadside trees, focused on the importance of selecting nursery material and providing proper care in order to establish a "safe zone". It is also important to sensibly plan the planting of ornamental plants in urban areas because of pollen – the primary factor increasing the content of allergens in the air, which have an adverse effect on human health (CARINANOS 2016; LARA 2017).

According to plant appraisers, the value of vegetation lies in more than just its aesthetic contribution to the landscape, and this value can be estimated. Appraisers deal with a broad spectrum of plant valuation, from a single tree to complex sites, such as afforested residential or recreational areas, industrial parks or tree populations of entire cities (GOODING et al. 2000).

The objective of this study is to determine the effect of location on the value of ornamental trees using the example of trees growing on Raszyńska Street in Lublin, with the application of the coefficient of location based on the tree-valuation method developed by SZCZEPANOWSKA et al. (2010).

2. Literature review

Trees are a component of real estate, and are subject to the valuation process in various legal situations. In practice, appraisers deal with the valuation of land properties featuring ornamental plants, which considerably increase the value of the real estate (ZMARLICKI 2012).

For the purposes of estimating the value of ornamental trees, many countries apply specific parametrical methods. These, however, are based on a subjective choice of parameters, and the ascribing of appropriate weightings (SARDARO et al. 2017). Many studies involved attempts to determine the value of trees in financial terms. SONG et al. (2018) discuss research focussing on the benefits of environmental regulation, and the value of real estate, proffering evidence that the aesthetics of the landscape generate substantial economic benefits. This stance is shared by NOTARO and DE SALVO (2010), who emphasize that benefits in terms of water regulation, and reductions in carbon-dioxide emissions and improved air quality, are usually smaller in comparison to landscape aesthetics. The differences in the level of benefits and costs between the studies are largely associated with the compositions of different species and the age structure of the population of urban trees, as well as with methodological differences.

From the point of view of valuation, it is important that, due to market conditions, the values of the land and its components are determined separately. Pursuant to Article 48 of the Real-Estate Management Act, components of land specifically include buildings and other land fixtures, as well as trees and other plants from the moment of their planting or seeding (the Civil Code Act of 1964). Article 135 (5) of the Act (the Real-Estate Management Act of 1997) lays down a procedure for the determination of the value of forests and tree stands, but it does not consider the value of trees in terms of their environmental function (tree stands outside of forested areas), which is a relevant aspect of ornamental trees. This approach to trees, however, is not reflected in the valuation of trees serving other functions. This has been confirmed by, among others, JUREK (2001), who analyzed a tree valuation approach that focuses on the useful value of trees. Moreover, tree species exist which, depending on their function, can be treated as edible plants, or plants serving an ornamental function for the landscape (YAO, HEYDUCK 2018), as exemplified by *Ziziphus jujuba* (jujube).

The term location refers to the location of the land property, and describes the unique functional and aesthetic contribution of plants to, and the distribution of particular species in, a specific landscape (GOODING et al. 2000).

The paper by Szczepanowska and Latos (2009) provides a tree valuation method that is adapted to Polish conditions, considering the specific qualities of the tree species, the conditions of their growth, and their location-specific functions. Their method applies to single trees, those growing in groups, and to tree stands in non-forested areas, both public and private, irrespective of their origin in the place subject to valuation. The authors of the method considered it necessary to introduce, *inter alia*, the coefficient of location (L) to determine the effect of trees on the value of land property. They did so because, as they emphasised, the value of the tree encompasses the value of the location, and *vice versa* (SZCZEPANOWSKA et al. 2010). According to Dutch studies cited by SZCZEPANOWSKA and LATOS (2009), the value of land properties featuring residential buildings surrounded by attractive landscapes was higher by 4 to 33%.

The high value of trees is appreciated by the public, and has been recognized by court rulings in the USA (SZCZEPANOWSKA, LATOS 2009; GIERGICZNY, KRONENBERG 2012).

3. Data and methods

The study area is located in the Węglin Północny district of Lublin. Raszyńska Street is on the outskirts of the western part of the city. It is directly connected to exit road No 19. The area features single-family residential housing, designed in a modern but traditional style, and made to a high technical standard, on plots with surface areas of 500-600 m^2. Plans are in place to alter Raszyńska Street due to the necessity of increasing the accessibility of these residential areas to the national road. The construction works are expected to involve the removal of trees along the road, since they lie within the right-of-way area, and their existence conflicts with the planned project.

Remnants of *Tilia cordata Mill.* and *Carpinus betulus* L. alleys are preserved along the road, being successively supplemented with new trees of different species, and also cleared for the purposes of facilitating access to private premises. We made an inventory of a total of 136 specimens of dendroflora, belonging to 14 genera, in the study area. The inventory was compiled in May 2015. Most trees were no older than 50 years. Old trees aged more than 100 years had the smallest representation – only two specimens. The age of trees was determined on the basis of MAJDECKI'S tables (1980-1986). In contrast, their state of health was established in accordance with the recommendations of SZCZEPANOWSKA et al. (2010) in the form of the fitness coefficient (K), expressing the qualitative characteristics of the tree, such as vitality and state of health (including trunk, boughs and branches), as well as any defects and damages affecting the condition of each specimen.

The study covered all species of older trees whose circumference, measured at a height of 1.30 m, was greater than 25 cm, i.e. 76 specimens. The trees grow on registered plots belonging to natural persons, and constitute parts of their house gardens. The following trees covered by the study were subject to inventory in the study area (Table 1).

1) 5 specimens of *Betula pendula* Roth with trunk circumferences from 40 cm to 95 cm, mostly in a good state of health,
2) 2 specimens of *Picea abies* (L.) H.Karst with trunk circumferences of 35 cm and 70 cm, in good and poor states of health, the latter being due to pests,
3) 1 specimen of *Picea pungens* Engelm. with a trunk circumference of 52 cm, in a good state of health,
4) 7 specimens of *Acer negundo* L. with trunk circumferences from 26 cm to 68 cm, in a good state of health,
5) 1 specimen of *Acer platanoides* L. with a trunk circumference of 238 cm, in a good state of health,
6) 9 specimens of *Tilia cordata* Mill. with trunk circumferences from 30 cm to 280 cm, mostly in a good state of health,
7) 39 specimens of *Carpinus betulus* L. with trunk circumferences from 30 cm to 53 cm, in a good state of health,
8) 6 specimens of *Juglans regia* L. with trunk circumferences from 28 cm to 57 cm, in a good state of health,

9) 5 specimens of *Salix babylonica* L. with trunk circumferences from 25 cm to 45 cm, in a good state of health,
10) 1 specimen of *Salix alba* L. with a trunk circumference of 170 cm and strongly tilted trunk.

Table 1

A list of the analysed trees in terms of the rate of growth in tree-trunk thickness

Rate of growth in tree-trunk thickness	Number of trees, including names of species
Slow-growing trees	39 specimens of *Carpinus betulus* L.
Trees with a moderate rate of growth	24 trees of the species *Tilia cordata* Mill., *Juglans regia* L., *Betula pendula* Roth, *Picea abies* L. H.Karst, *Picea pungens* Engelm., *Acer platanoides* L.
Fast-growing trees	13 trees of the species *Acer negundo* L., *Salix babylonica* L., *Salix alba* L.
Very slow-growing trees	Not applicable.
In the above list, 60 trees (80% overall) were in a good state of health, 11 trees in a moderate state of health, 1 in a poor state of health, 3 were dying, and 1 tree was dead.	

Source: authors.

We have provided a comparison of the values for the same trees, but assuming that they are located in different areas, in order to determine the effect of the location of trees on their value, based on their state of health as at the date of compiling the inventory.

In our study we employed the tree valuation method based on differentiating coefficients, developed by SZCZEPANOWSKA et al. (2010). This method of tree valuation, based on the ”price-cost” principle – used in countries with a market economy – takes into account Poland’s economic conditions in terms of costs, quality standards and technical standards and specifications, as well as climatic and environmental conditions reflecting the species diversity of trees and their state of health in urban and rural areas.

The determination of the actual value of tress was based on the product of the base value, the coefficient of growth value, the coefficient of species value, the coefficient of the state of health, and the coefficient of location, according to the following formula

$$WR = WP * P * G * K * LWR = WP * P * G * K * L \tag{1}$$

where:

WR – actual value (PLN),
WP – base value (PLN),
P – coefficient of growth value,
G – coefficient of species value,
K – coefficient of state of health,
L – coefficient of location.

According to SZCZEPANOWSKA et al. (2010), the base value expressed in PLN reflects the rate of growth of tree-trunk width. On the basis of this rate, fast, moderately and very slow-growing species can be distinguished. They were ascribed the following values: PLN 840 for fast-growing trees, PLN 1,120 PLN for trees with a moderate growth rate, PLN 1,349 for slow-growing trees, and PLN 1,550 for very slow-growing trees. The growth value coefficient was calculated for four groups of trees with varying growth rates and trunk circumferences ranging from 25 cm to 505 cm, with the lowest values being ascribed to fast-growing trees, and the highest values to very slow-growing trees. The base value is adjusted by the coefficient of species value for trees exhibiting a specific dendrological value, or an adaptation capacity, divided into four groups: trees with a very high dendrological value, a high dendrological value and a small adaptation capacity (coefficient 1.3); trees with a high dendrological value and a high and highest adaptation capacity (coefficient 1.1); trees with an average dendrological value and a low and high adaptation capacity (coefficient 1); and trees with an average dendrological value and the highest adaptation capacity (coefficient 0.9). The coefficient of the state of health allows for the assessment of the state of health of a tree considering its qualitative parameters, such as damage to and deformations of leaves, dead shoots, gaps in the crown, and horizontal damage to the trunk surface. The coefficient ranges from 1.0, which is a very good assessment, to 0.0, meaning that the tree is dead.

According to SZCZEPANOWSKA et al. (2010), the coefficient of location (L) allows for the determination of the effect of the tree on the value of the area in which the tree is growing. It relies on the basic economic principles in order to increase the objectivity of the determination. The value of the tree is considered in conjunction with its local function, and with the effect of the place and its surroundings on the value of the tree, amounting to

- 0.4 for tree stands in urban and rural areas,
- 0.7 for built-up rural areas, and house gardens in urban and rural areas,
- 1.0 for green spaces in urban and rural areas, and for residential districts,
- 1.5 for right-of-way areas in urban and rural areas,
- 2.0 for historic areas, areas of health resorts and health-resort protection zones.

The coefficient of location in the applied valuation method is relatively easy to determine, unlike in the case of determining the state of trees, particularly when the inventory is compiled in the period outside the vegetative period. According to the authors of the tree valuation method, the categories specified in the Land and Buildings Register Regulation are helpful in determining the coefficient of location. An the example of why it is reasonable to incur higher costs to plant trees in problematic locations is given by a comparison of the conditions of tree growth on paved roads with those prevailing in plant assemblages. We also considered the sizes of trees for particular locations, assuming that trees with lower size parameters planted in better environmental conditions would develop very well and would catch up in growth with trees that were larger at the time of planting, becoming, over time, equal in visual and ecological terms (SZCZEPANOWSKA et al. 2009).

4. Empirical results

We estimated the value of all the trees using a "new tree valuation method based on differentiating coefficients", taking into account the species, trunk circumference, and state of health. As mentioned above, the base value was adjusted by the coefficient of growth (P), the coefficient of species (G) and coefficient of location (L), starting from the actual location, i.e. house gardens in cities (equation 1).

Table 2

The values of different tree species (in PLN) depending on the actual (1) and hypothetical coefficient of location (2, 3, 4, 5), and the current state of health of the trees

Species	1	2	3	4	5
Betula pendula Roth	10,399	5,942	14,854	22,281	29,708
Picea abies (L.) H.Karst	3,773	2,156	5,391	8,086	10,781
Picea pungens Engelm.	2,572	1,469	3,674	5,510	7,347
Acer negundo L.	4,860	2,777	6,943	10,415	13,886
Acer platanoides L.	10,093	5,768	14,419	21,628	28,838
Tilia cordata Mill.	50,472	28,841	72,103	108,155	144,207
Carpinus betulus L.	169,498	96,856	242,140	363,210	484,280
Juglans regia L.	12,667	7,238	18,095	27,143	36,190
Salix babylonica L.	3,905	2,232	5,579	8,369	11,159
Salix alba L.	1,136	649	1,622	2,434	3,245
Total	**269,375**	**153,928**	**384,820**	**577,231**	**769,641**

1. Rural built-up areas, and house gardens in urban and rural areas.
2. Tree stands in urban and rural areas.
3. Green spaces in urban and rural areas, and residential districts.
4. Roads and streets in urban and rural areas (right-of-way areas).
5. Historic areas, areas of health resorts, and health-resort protection zones.

Source: authors.

The total value of trees for the house garden location was PLN 269,374, considerably higher (by PLN 115,446, i.e. 1.75 times) than the value of trees hypothetically assumed to be part of tree stands in urban and rural areas – PLN 153,928 (Table 2). This means that the value of the trees growing in house gardens in urban areas was more than twice that of the same trees assumed to be part of tree stands located in urban and rural areas.

The highest value – PLN 769,641 – would be ascribed to trees growing in historic areas, areas of health resorts and health-resort protection zones. This is five times the corresponding value of tree stands in urban and rural areas, and 2.8 times the value of trees located in house gardens in urban and rural areas (Table 2).

The value of trees in right-of-way areas (PLN 577,231) constituted 75% of the value of the trees located in historic areas (PLN 769,641) and 375% of the value of trees assumed to be part of tree stands in urban and rural areas (PLN 153,928 PLN). The median value was found for trees located in green spaces in urban and rural areas, and residential districts (PLN 384,820).

We found that the location of trees had a strong effect on the value of the trees. When grouped by rate of growth in thickness, the value of the trees, irrespective of their number in particular groups, was strongly correlated with the value of the areas in which they were growing. Hornbeams constituted the most abundant group. At PLN 484,280, the highest value was found for historic areas, areas of health resorts, and health-resort protection areas. The lowest value of PLN 5,658 was found for the scarcest group of trees – tree stands in urban and rural areas. This value is 85.59 times lower than the highest (Table 3).

Table 3

A comparison of values of the analyzed trees in terms of rate of growth in thickness in different locations

Rate of growth of trunk thickness	Number of trees by species	Value of trees (PLN) in location 1	Value of trees (PLN) in location 2	Value of trees (PLN) in location 3	Value of trees (PLN) in location 4	Value of trees (PLN) in location 5
Slow-growing trees	39 specimens of *Carpinus betulus* L.	169,498	96,856	242,140	363,210	484,280
Trees with a moderate rate of growth	24 trees of the species *Tilia cordata* Mill., *Juglans regia* L., *Betula pendula* Roth, *Picea abies* L. H.Karst, *Picea pungens* Engelm., *Acer platanoides* L.	89,976	51,414	128,536	192,803	257,071
Fast-growing trees	13 trees of the species *Acer negundo* L., *Salix babylonica* L., *Salix alba* L.	9,901	5,658	14,145	21,217	28,290
Very slow-growing trees	Not applicable	-	-	-	-	-
Total	Value of trees in location 1 =100	269,375 100	153,928 57.14	384,821 142.86	577,230 214.28	769,641 285.71

1. Rural built-up areas, and house gardens in urban and rural areas.
2. Tree stands in urban and rural areas.
3. Green spaces in urban and rural areas, and residential districts.
4. Roads and streets in urban and rural areas (right-of-way areas).
5. Historic areas, areas of health resorts, and health-resort protection zones.

Source: authors.

In the comparison of trees with the largest circumferences in their species groups (Table 4), trees with moderate growth rates were represented the most abundantly – 7 specimens. In this group, the Norway maple was the most valuable tree, irrespective of location – from PLN 5,768 (tree stands in urban and rural areas) to PLN 28,838 per tree (historic areas, areas of health resorts, and health-resort protection zones). In the group of slow-growing trees – the common hornbeam was valued at PLN 8,407 (tree stands in urban and rural areas) to PLN 42,035 per tree (historic areas, areas of health resorts and health-resort protection zones). Among trees with fast growth rates, ash-leafed maple was the most valuable. Its value varied from PLN 843 (tree stands in urban and rural areas) PLN 4,215 (historic areas, areas of health resorts and health-resort-protection zones). The value of each of the analyzed trees, irrespective of the value of the species, was five times higher in historic areas than in tree stands in urban and rural areas.

Table 4

The actual value of trees with the largest circumferences in their species groups, depending on location

Species	Base value (WP) - PLN	Coefficient of location (L) 1*	Actual value (WR) - PLN	Coefficient of location (L) 2*	Actual value (WR) - PLN	Coefficient of location (L) 3*	Actual value (WR) - PLN	Coefficient of location (L) 4*	Actual value (WR) - PLN	Coefficient of location (L) 5*	Actual value (WR) - PLN
Betula pendula Roth	1,120	0.7	4,339	0.4	2,480	1	6,199	1.5	9,299	2	12,398
Picea abies (L.) H.Karst	1,120	0.7	3,600	0.4	2,057	1	5,143	1.5	7,715	2	10,286
Picea pungens Engelm.	1,120	0,7	2,571	0.4	1,469	1	3,674	1.5	5,510	2	7,347
Acer negundo L.	840	0.7	1,475	0.4	843	1	2,108	1.5	3,162	2	4,215
Acer platanoides L.	1,120	0.7	10,093	0.4	5,768	1	14,419	1.5	21,628	2	28,838
Tilia cordata Mill.	1,120	0.7	9,576	0.4	5,472	1	13,680	1.5	20,519	2	27,359
Carpinus betulus L.	1,349	0.7	14,712	0.4	8,407	1	21,017	1.5	31,526	2	42,035
Juglans regia L.	1,120	0.7	3,761	0.4	2,149	1	5,373	1.5	8,059	2	10,745
Salix babylonica L.	840	0.7	1,215	0.4	694	1	1,736	1.5	2,604	2	3,472
Salix alba L.	840	0.7	1,136	0.4	649	1	1,622	1.5	2,434	2	3,245

* Symbols as in Table 3.

Source: authors.

5. Discussion and conclusions

GOODING et al. (2000) claim that the value of plants, regardless of whether they constitute a single specimen, or a group of plants growing in a recreational or residential area, goes significantly beyond their aesthetic landscape qualities. What is more, SONG et al. (2018), NOTARO and DE SALVO (2010) have demonstrated that landscape aesthetics bring significant economic benefits, although these vary, largely depending on the species' composition and the age structure of tree populations, as well as on the methodological approaches. Our study confirmed this, showing that, regardless of location, the value of trees of different species varied significantly (Table 4). The value of trees should be considered in relation to the function they serve in a given location, and to the influence of the location and its surroundings. Hence, location is an important factor differentiating the value of trees of the same species. In our study we included five locations of trees: rural built-up areas, house gardens in urban and rural areas, tree stands in urban and rural areas, green spaces in urban and rural areas, and residential districts, roads and streets in urban and rural areas, and historic areas, and areas of health

resorts and health-resort protection zones. The highest value was found for trees growing in historic areas, and areas of health resorts and health-resort protection zones. This was five times the value of trees in urban and rural areas. The value of trees in house gardens was 1.75 times the value of trees hypothetically assumed to be part of tree stands in rural and urban areas. The conclusion is that, when doing tree valuation, it is important to correctly define the location of trees. This was also the assumption underlying the development of the tree valuation method based on differentiating coefficients (SZCZEPANOWSKA, LATOS 2009; SZCZEPANOWSKA et al. 2009; SZCZEPANOWSKA et al. 2010). Provisions in local development plans and findings from real-estate inspections might be useful in this regard.
We have drawn the following conclusions from our study:

1. The applied tree valuation method based on differentiating coefficients is a simple and logical approach to tree valuation in non-forested areas, but it is not applicable to trees whose primary function is the provision of fruit or wood, or trees recognized as natural monuments.
2. The location of trees is highly significant for the process of real-estate appraisal. In the area of our study the values of the same trees varied. In the hypothetically assumed historic areas, areas of health resorts, and health-resort protection zones, it was five times the value of those in tree stands in urban and rural areas (PLN 769,641 PLN – the most valuable location, and PLN 153,928 – the least valuable location). The value of trees in house gardens, i.e. the actual location of the analyzed trees, was PLN 269,374, and was 1.75 times the value of trees hypothetically treated as being part of tree stands in urban and rural areas.
3. When doing tree valuation, it is very important to accurately define the location of trees, as it affects the final value of the components. For instance, the value of a specimen of the Norway spruce in tree stands is estimated at PLN 2,156, while in house gardens in urban and rural areas its estimated value increases to PLN 3,773, and in green spaces of residential areas to PLN 5,391, on roads and streets to PLN 8,086, and in historic areas to PLN 10,781.
4. According to the authors of the tree valuation method, the categories included in the Land and Buildings Register Regulation are helpful in the determination of the coefficient of location (SZCZEPANOWSKA et al. 2010). From the appraiser's point of view, the provisions of local development plans could also prove to be useful for this purpose, and in a lack thereof, the provisions of the master plan and property inspection findings could serve as a reference.

6. References

AKBAR K. F., ASHRAF I., SHAKOOR S., 2014, *Analysis of urban forest structure, distribution and amenity value: a case study*, Journal of Animal and Plant Sciences, vol. 24, ed. 6, pp. 1636-1642.

BOROWSKI J., BARIDON D., DWORNICZAK Ł., KUŹMICZ Ł., SUCHOCKA M., STOLARCZYK J., SZCZEPANOWSKA B. H., SZMIGIEL-FRANZ A., TYSZKO-CHMIELOWIEC P., WITKOŚ K., ZIEMIAŃSKA M., 2012, *Aleje podręcznik użytkownika. Jak dbać o drzewa, żeby nam służyły?*, Fundacja EkoRozwoju, (*User's guide. How do you take care of trees so they serve us?*; Foundation for Sustainable Development), Wrocław.

CARINANOS P., ADINOLFI C., DE LA GUARDIA C.D., DE LINARES C., CASARES-PORCEL M., 2016, *Characterization of Allergen Emission Sources in Urban Areas,* Journal of Environmental Quality, vol. 45, ed. 1, pp. 244-252.

GIERGICZNY M., KRONENBERG J., 2012, *Jak wycenić wartość przyrody w mieście? Wycena drzew przyulicznych w centrum Łodzi*, Zrównoważony Rozwój – Zastosowania, nr 3, (*How to estimate the value of the natural environment in urban areas. The valuation of trees along roads in the centre of Łódź*) pp. 73-89.

GOODING R.F., INGRAM J.B., URBAN J.R., BLOCH L.B., STEIGERWALDT W.M., HARRIS R.W., ALLEN E.N., 2000, *Guide for Plant Appraisal*, 9th Edition, International Society of Arboriculture Champaign, Illinois.

GUERRERO-LEIVA N., CASTRO S.A., RUBIO M.A., ORTIZ-CALDERON C., 2016, *Retention of Atmospheric Particulate by Three Woody Ornamental Species in Santiago, Chile*, Water Air and Soil Pollution, vol. 227, ed. 12, art. no 435.

JUREK J., 2001, *Wycena zadrzewień ogrodów przydomowych*, Nieruchomości 9(37), wrzesień 2001 https://nieruchomości. beck.pl/ [accessed on 20 Sept. 2018], *(The valuation of tree stands in house gardens)* September 2001, https://nieruchomości. beck.pl/ [accessed on 20 Sept. 2018]*).*

LARA B., ROJO J., BLANCO J.J., CARDADOR C., SERRANO J.I., SORIANO D., PEREZ-BADIA R., 2017, *Ornamental Flora and Allergenic Potential in Urban Green Spaces. Comparison in Parks of the Town of Toledo*, Revista De Salud Ambiental, vol. 17, ed. 2, pp. 176-186.

MAJDECKI L., 1980-1986, *Tabela wiekowa drzew*. Rkps, Oddział Architektury Krajobrazu, SGGW, (*An age table of trees*. Rkps, Department of Landscape Architecture, Central College of Agriculture) Warsaw.

MILTON S.J., DEAN W.R.J., SIELECKI L.E., VAN DER REE R., 2015, *The function and management of roadside vegetation*, Handbook of Road Ecology, Edited by: VanderRee R., Smith D.J., Grilo C., pp. 373-381.

NOTARO S., DE SALVO M., 2010, *Estimating the economic benefits of the landscape function of ornamental trees in a sub-Mediterranean area, Urban Forestry & Urban Greening,* vol. 9, ed. 2, pp. 71-81.

SALISBURY A., AL-BEIDH S., ARMITAGE J., BIRD S., BOSTOCK H., PLATONI A., TATCHELL. M, THOMPSO K., PERRY J., 2017, *Enhancing gardens as habitats for plant-associated invertebrates: should we plant native or exotic species?* Biodiversity and Conservation, vol. 26, ed. 11, pp. 2657-2673.

SARDARO R., PANIO D., FUCILLI V., BOZZO F., ACCIANI C., 2017, *Il valore ornamentale dell'albero: proposta metodologica per un nuovo percorso valutativo*, Aestimum, vol. 70, pp. 75-95.

SONG X.P., TAN P.Y., EDWARDS P., RICHARDS D., 2018, *The economic benefits and costs of trees in urban forest stewardship: A systematic review*, Urban Forestry & Urban Greening, vol. 29, pp. 162-170.

SZCZEPANOWSKA H.B., LATOS A., 2009, *Synteza badań i założenia merytoryczne metody wyceny wartości drzew dla warunków polskich (A synthesis of studies on and assumptions for the tree valuation method for Polish conditions)*, IGPiM, Warsaw.

SZCZEPANOWSKA H.B, OLIZAR J., BOROWSKI J., SITARSKI M., SUCHOCKA M., SZADKOWSKA E., CHOJNACKA I., KUBUS M., BIAŁECKA-KORNATOWSKA B., KOSIBA E., PSTRĄGOWSKA M., KORDUS A., 2010, *Opracowanie nowej metody określania wartości drzew wraz ze współczynnikami różnicującymi oraz merytorycznym uzasadnieniem metody i zasadnością jej wprowadzenia do obiegu prawnego (The development of a new method of determining the value of trees based on differentiating coefficients, and the substantive rationale of the method and its introduction to the legislation)*, IGPiM, Warsaw.

SZCZEPANOWSKA B., SITARSKI M., SUCHOCKA M., 2009, *Wyznaczanie współczynników lokalizacji wykorzystanych do metody wyceny drzew na terenach zurbanizowanych (The determination of location coefficients as used in the method for the valuation of trees in urbanised areas)*, IGPiM, Warsaw.

SZOPIŃSKA E., ZYGMUNT-RUBASZEK, 2009, *Rozwiązania techniczne w projektowaniu i realizacji zieleni wysokiej w krajobrazie zurbanizowanym,* Oficyna Wydawnicza Państwowej Wyższej Szkoły Zawodowej w Sulechowie. Sulechów. *(Technical solutions in the design and implementation of high-growing vegetation in urbanised landscapes,* the Publishing House of the State Higher Vocational School in Sulechów, Sulechów*)*.

UKPEBOR E.E., UKPEBOR J.E., AIGBOKHAN E., GOJI I., ONOJEGHUO A.O., OKONKWO A.C., 2010, *Delonix regia and Casuarina equisetifolia as passive biomonitors and as bioaccumulators of atmospheric trace metals*, Journal Of Environmental Sciences, vol. 22, ed. 7, pp. 1073-1079.

Ustawa z dnia 21 sierpnia 1997 r. *o gospodarce nieruchomościami*, tekst jednolity Dz. U. 2018 poz. 121. (The Real-Estate Management Act of 21 August 1997, consolidated text, Journal of Laws, 1997, item 121).

Ustawa z dnia 23 kwietnia 1964 r. *Kodeks cywilny*, tekst jednolity Dz.U. 2018 poz. 1025. (The Civil Code Act of 23 April 1964, consolidated text, Journal of Laws, 2018, item 1025).

YAO S., HEYDUCK R., 2018, *Ornamental Jujube Cultivar Evaluation in the Southwestern United States*, Horttechnology, vol. 28, ed. 4, pp. 557-561.

ZMARLICKI K., 2012, *Określanie wartości plantacji kultur wieloletnich,* Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych, Warsaw *(Determining the value of multiannual culture plantations,* Polish Federation of Valuers Associations, Warsaw).