URBAN GREENERY AS A COMPONENT OF REAL ESTATE VALUE

Agnieszka Szczepańska, PhD

*The Faculty of Geodesy, Geospatial and Civil Engineering
University of Warmia and Mazury in Olsztyn
e-mail: aszczep@uwm.edu.pl*

Iwona Krzywnicka, PhD

*The Faculty of Geodesy, Geospatial and Civil Engineering
University of Warmia and Mazury in Olsztyn
e-mail: iwona.krzywnicka@uwm.edu.pl*

Grzegorz Lemański, M. Sc.

*Starostwo Powiatowe w Malborku
e-mail: leman269@gmail.com*

Abstract

Due to the specific characteristics of cities, such as the intensity of the use of space, the supply of green areas is limited. These areas are subjected to constant pressure (demand for new transportation or construction functions), which usually results in their reduction. As a consequence of this, green areas have become a limited asset in urban environments. City dwellers, seeking a high quality of life in the urban environment, pay attention to the proximity of greenery to their place of residence. This is, therefore, a factor that greatly influences market prices of residential real estate. In the study, the dependency of transaction prices of residential premises on the vicinity of urban greenery was subjected to analysis. Additionally, questionnaire studies were conducted with respect to the evaluation of the significance of environmental factors when choosing a place to live, which translates over to the decisions made by consumers on the real estate market.

Key words: green areas, real estate value, city.

JEL Classification: C21, Q51, R32.

Citation: Szczepańska A., Krzywnicka I., Lemański L., 2016, *Urban Greenery as a Component of Real Estate Value*, Real Estate Management and Valuation, vol. 24, no. 4, pp. 79-87.

DOI: 10.1515/remav-2016-0032

1. Introduction

The natural environment influences the life of society in urban space. It exerts a great impact on the comfort of individuals dwelling in it, and constitutes a source of elements which are indispensable in the life and economic activity of man; it is also the recipient of dangers resulting from such activity (ŻYLICZ 2004). Numerous studies confirm the significance of the natural environment in the urban space (WALMSLEY 1995, MAAS 2006, WOLCH 2007, SZUMACHER 2011, COHEN et al. 2012, KOSMALA and BŁASZCZYK, 2012, MARKEVYCH et al. 2014, WOLCH et al. 2014). NIEMELÄ (2014) claims that the significance of urban ecology as a discipline combining natural and social sciences and examining the interactions between man and the environment is continuously increasing. Environmental factors, apart from influencing the inhabitants' quality of life, also play a significant role in shaping the values of residential real estate. Such factors most often include: landscape values, vicinity of green areas,

intensity of noise, level of sun exposure and air pollution (RUDAWA 2006, WACHTER and WONG 2008, NIKOLAOS et al. 2011, CELLMER et al. 2012, SZULCZEWSKA et al. 2014, YOSHIDA and SUGIURA 2015).

2. Green Areas in Cities and Their Functions

Green areas are defined in legal provisions as well as in various academic studies (JIM and CHEN 2003, HABER and URBAŃSKI 2005, SUTKOWSKA 2006, BOŻĘTKA 2008, WOLCH et al. 2014, *Nature Conservation Law*). They function in colloquial language as “green areas” or “open areas.” *The Nature Conservation Law of 16 April 2004* (Journal of Laws of 2015 item 1651, Art. 5.21) specifies that these are: developed areas with technical infrastructure and buildings functionally related to them, covered with greenery, performing public functions and, in particular parks, gardens, promenades, boulevards, botanical gardens, zoological gardens, game parks, historical parks, cemeteries, greenery accompanying roads in developed areas, squares, historical fortifications, buildings, storage sites, airports, railway stations and industrial facilities. The group can also include insulating greenery and municipal forests, as well as tourist and leisure areas. Green areas perform a number of functions that are experienced both on a global and local scale. The most important functions, listed in a number of studies (MAAS et al. 2006, SUTKOWSKA E. 2006, WOLCH 2007, SITARSKI 2011, SZUMACHER 2011, COHEN et al. 2012, KOSMALA and BŁASZCZYK 2012, BOTCHWEY et al. 2014, KEMPERMAN and TIMMERMANS 2014) include:

- a) protective: warning guards for road signs, masking of strategic military facilities, airports, as well as preventing erosion, and the protection of rare and valuable species of plants and animals,
- b) biological and health-related: protection against dust, ashes, excessive smoke, barriers against strong wind, protection from noise, positive impact on the micro-climate, regulation of air temperature, influence on the quality of air (elimination of carbon dioxide, enrichment with essential oils, fragrances) and soil humidity,
- c) nutritional and economic: greenery, in a broader aspect, encompasses agricultural and forest areas, as well as gardens, i.e. it directly and indirectly influences the growth of production,
- d) social, psychological and educational: places of entertainment, playgrounds for children, leisure, educational role of botanical, zoological and ethnographic gardens,
- e) aesthetic and artistic: color diversification; greenery instils buildings with character, influences the appearance and attractiveness of municipal space,
- f) preventing fire: preventing the spreading of fires in open areas and in dense development.

A definite majority of urban greenery is located in the horizontal plane of the city. However, there are numerous empty vertical spaces, such as walls, where various vines can be introduced. Their advantage is primarily the great surface area which may be covered along with the minimum space necessary for vegetation. Greenery of this type is characterized by great resistance to droughts, frost and dust. It also directly muffles noise. What is more, vines provide additional thermal insulation for buildings and protect walls from rain (LASKOWSKI 1984).

Also noteworthy is greenery located on rooftops; this solution has been gaining popularity (also on account of the construction of sustainable housing) as a basic element of modern housing estates. Greenery located on rooftops has mainly thermal and hydrological properties; it increases fire resistance and muffles noise (SOKOŁOWSKA and KRAJCZYŃSKI 2004). It has a beneficial impact on the structural durability of roofs, as well as protecting them from unfavourable atmospheric conditions.

The role and significance of green areas has been confirmed by various studies. In particular, in intensely urbanized areas, urban greenery constitutes a basic aesthetic value; it has also come to be perceived as an important component of urban space. The significance of biological and health functions is emphasised by BRANAS et al. 2011, KOSMALA and BŁASZCZYK 2012, SITARSKI and PSTRĄGOWSKA 2013, BOTCHWEY et al. 2014, MARKEVYCH et al. 2014, and WOLCH et al. 2014, who discuss the positive impact of greenery on the health and wellbeing of man. On the other hand, KEMPERMAN and TIMMERMANS (2014) note the fact that greenery influences activation and supports social contacts: the more greenery, the more developed and frequent such contacts. In their studies, MCCUNN and GIFFORD (2014) notice the feeling of affiliation to a specific location and the neighbors' involvement triggered by the presence of green areas. Therefore, greenery is an element of space that is of great significance to the functioning of the city organism.

3. Greenery vs. Prices of Residential Properties

The vicinity of greenery is reflected in real estate prices, in particular residential properties. Various studies indicate an increase in real estate prices caused by environmental factors ranging from merely 2% to as much as 62% (RUDAWA 2006, WACHTER and WONG 2008, NIKOLAOS et al. 2011, ZHENG et al. 2012, CELLMER et al. 2012, YOSHIDA and SUGIURA 2015). The surroundings of a real estate exert a significant impact on decisions made by market participants. Studies conducted in recent years in Western European countries show a strong relation between the surroundings of real estate with green areas and their prices. The best example are, in particular, real properties with residential functions; their purchasers attach great importance to the quality of the place of residence. Thence, the land for residential development most sought after by developers is in areas located in “green” residential districts. An attractively located real estate property is characterised by the vicinity of green areas, which greatly increase the quality of the environment of the place of residence and the location’s aesthetics. However, it should be remembered that the proximity of urban greenery is only one of the many factors determining the attractiveness of a location and its price.

4. Impact of Greenery on Real Property Value Exemplified by Olsztyn

The presence of green areas should be considered a feature the prestige and social respect of which offers measurable economic benefits. Thus, the object of the conducted analysis was the assessment of any dependencies between the occurrence of urban greenery in the vicinity of residential properties and transaction prices. Analyses were based on sale transactions from 2014 and 2015 related to residential properties located in the Pojezierze housing estate in Olsztyn.

Additionally, preferences of potential purchasers with respect to environmental factors in the vicinity of the real estate properties were subjected to analysis. To this aim, a questionnaire study was carried out among persons professionally involved in the real estate market.

4.1. Description of Study Object: Pojezierze Housing Estate

The Pojezierze housing estate is located in the central and eastern part of Olsztyn (Fig. 1). In spite of the fact that it occupies a relatively small surface area (2.39 km²), it is among the most populated districts (7.4% of Olsztyn’s population). This also translates to population density which amounts to almost 5,000 people per km² (*Report on the Condition of the City of Olsztyn in the Years 2012-2013*). The housing estate features Kusociński Park - the largest park in Olsztyn; its surface area amounts to approx. 10.5 ha. The area of the park, apart from numerous greenery layouts, also encompasses two small anthropogenic lakes, playgrounds for children and a skate park (*Land Use Plan of the City of Olsztyn*). Residential areas of the housing estate are managed by the Pojezierze Housing Cooperative. Buildings where the analyzed residential premises are located are in the central part of the Pojezierze Housing Estate, north of Kusociński Park.

Fig. 1. Study area. Source: author’s own study on the basis of: <http://msipmo.olsztyn.eu/imap/>

4.2. Dependency Between the Quality of Greenery and Prices of Residential Properties

The pool of data adopted for the study regarding residential properties (53 transactions) was largely uniform on account of the factors listed below:

- the period when the transactions were concluded, i.e. years 2014-2015 (stagnation on the real estate market, time trend on the level of 0%);
- uniform residential substance (prefab large panel technology, similar years of construction, similar renovation and thermal insulation practices translating to a similar degree of technical and functional wear and tear);
- single real estate manager – Pojezierze Housing Cooperative;
- dense general location within the area of the set out housing estate;
- demand on a similar level.

The assessment of the quality of green areas had the form of a point bonitation method and took into account such features as: the dominant type of greenery (areas covered with forests, individual trees, parks and green areas), spatial formation (spot, linear, area), condition (decaying, ageing – old trees, maturing and mature, young forest – in line with the development stages of trees), height (bushes, low trees – up to 5 meters, medium trees from 5 to 15 m, and tall trees – above 15 m), distance from a building (directly next to a building, at a moderate and significant distance).

To examine the dependency between the quality of greenery adjoining a building and the unit price, the *r*-Pearson linear correlation coefficient was used (Table 1). The obtained result of 0.395 means the occurrence of a positive correlation, i.e. dependency between the analyzed variables. This in turn means that unit prices of real properties grow along with an increase in the quality of greenery located near a building.

Table 1

Linear correlation between unit price of residential properties with respect to the quality of greenery

Variable	Pearson's linear correlation coefficient			
	Marked correlation coefficients are significant at $p < 0.5000$ N=53 (absence of data was removed on a case to case basis)			
	Average	Standard deviation	Quality of greenery	Unit price [PLN/m ²]
Quality of greenery	12.28	2.27	1.00	0.40
Unit price [PLN/m ²]	4293.29	443.31	0.40	1.00

Source: author's own study.

This dependency is illustrated by the distribution of unit prices of residential properties with respect to the quality of green areas presented in Fig. 2. The trend line is clearly growing. The increase in the quality of greenery by one valuation point is accompanied by a 77.00 PLN increase in the unit prices of residential properties.

5. Preferences of Potential Purchasers – Analysis of Results of Questionnaire Studies

Preferences of potential purchasers of residential properties were defined by means of questionnaire studies conducted among persons professionally involved in the real estate market in Olsztyn. The study was performed on a 50-person group of real estate agents. The survey contained questions related to environmental factors, their role and impact on real estate prices. The first question referred to the interest of potential purchasers in environmental factors when selecting a residential property (Fig. 3).

The answers “definitely yes” and “I suppose so” were provided by as many as 75% of the respondents, which means the clients of real estate agencies pay attention to environmental factors when purchasing residential premises. In response to the question about the purchasers' readiness to pay more for apartments located in the vicinity of green areas, as many as 54% of the respondents gave a positive answer. Environmental factors with a positive and negative impact which the potential purchasers pay attention to are shown in Fig. 4.

Fig. 2. Diagram of variance of unit prices of residential premises with respect to the quality of greenery. *Source:* author's own study.

Fig. 3. Interest of potential purchasers of residential properties in environmental factors *Source:* author's own study

Fig. 4. Evaluation of the significance of environmental factors during the selection of residential properties. *Source:* author's own study

These factors are: the vicinity of parks, recreational areas, reservoirs and sun exposure. Significant environmental threats primarily include noise and the vicinity of industrial plants. The subsequent question referred to the vicinity of residential properties that is desired by the clients (Fig. 5).

Fig. 5.- Desirable areas and facilities in the vicinity of residential properties *Source:* author's own study.

As many as 20% of the respondents confirmed that clients consider green areas as the preferred vicinity of the premises that they intend to purchase. Bearing in mind that the broad definition of green areas encompasses forests, undeveloped areas, playgrounds and recreational areas, it can be said that almost 80% of potential clients look for a place of residence in the vicinity of such areas. This is also confirmed by answers to the question regarding the features of the property which clients pay special attention to (Fig. 6). Most respondents indicated that the purchasers were guided by the technical condition of the building, construction technology and development of the area when choosing the premises; the provided answers also include incorporation of the property into greenery.

Fig. 6. Preferred features of residential properties. *Source:* author's own study.

The significance of factors determining the choice of a residential property was the topic of the last question in the questionnaire. The respondents indicated that the vicinity of green areas is a significant factor for the majority of purchasers (Fig. 6) – as many as 82% of the answers indicated that the vicinity of green areas is important or very important to buyers when choosing residential properties.

Fig. 6. Evaluation of the significance of selected factors determining the choice of residential properties. *Source:* author's own study.

On the basis of the conducted study, it may be concluded that environmental factors influence the demand for and the value of residential properties, which also confirms the results of other studies (e.g. WACHTER and WONG 2008, NIKOLAOS et al. 2011, CELLMER et al. 2012, ZHENG et al. 2012, SZCZEPAŃSKA et al. 2015, YOSHIDA and SUGIURA 2015). The questionnaires conducted among real estate agents operating in the area of the city of Olsztyn showed that almost 75% of clients who use the services of a real estate agency take environmental factors into account when choosing a place to live. What is more, over a half (54%) of the respondents provided a positive answer to the question about their willingness to pay a higher price for a property located in the vicinity of green areas, which the purchasers consider to be the most important environmental factor. The results of the study regarding the determination of the preferred vicinity of residential properties mainly testify to the fact (which seems obvious and predictable) that the most desirable areas in the vicinity of residential properties include: lakes, forests and undeveloped areas, as well as green areas and recreational areas. Such a distribution of results testifies to the rationality of decisions made by the real estate market participants looking for a high quality living environment.

6. Summary

A decrease in the surface area of greenery in housing estates has become noticeable in the recent years. New housing estates use the area for development to a maximum already at the design stage. In older housing estates, green areas are under investment pressure to satisfy transportation needs (parking sites). This is happening in spite of the fact that the beneficial impact of green areas on the functioning of a city confirmed by numerous studies, both in Poland and abroad. Their biological, protective, economic, health-related, social, educational and aesthetic functions have all been listed. The vicinity of green areas determines the level of the quality of life and aesthetics of a given place. The multiplicity of positive impacts and the limited number of such areas has resulted in them becoming very desirable assets in cities. This fact, combined with a growing environmental awareness of society, makes the presence of green areas an important aspect for people to consider when choosing a dwelling location, which is reflected in the preferences of potential purchasers of residential properties. This, in turn, also affects property value.

7. References

- BOTCHWEY N. D., TROWBRIDGE M., FISHER, T., 2014, *Green Health Urban Planning and the Development of Healthy and Sustainable Neighborhoods and Schools*, Journal of Planning Education and Research, Vol. 34, No. 2, pp. 113-122.
- BOŻĘTKA B., 2014. *Systemy zieleni miejskiej w Polsce–evolucja i problemy kształtowania*. (Systems of Urban Greenery in Poland: Evolution and Development Problems), Problemy Ekologii Krajobrazu (The Problems of Landscape Ecology), Vol. XXII, pp. 49-63.
- BRANAS C. C., CHENEY R. A., MACDONALD J. M., TAM V. W., JACKSON T. D., TEN HAVE T. R., 2011, *A Difference-in-Differences Analysis of Health, Safety, and Greening Vacant Urban Space*, American Journal of Epidemiology, Vol. 174, No. 11, pp.1296-1306.
- CELLMER R., SENETRA A., SZCZEPAŃSKA A., 2012, *Land Value Maps of Naturally Valuable Areas*, Geomatics and Environmental Engineering, Vol. 6 No. 3, pp. 15-24.
- COHEN P., POTCHTER O., MATZARAKIS A., 2012. *Daily and Seasonal Climatic Conditions of Green Urban Open Spaces in the Mediterranean Climate and their Impact on Human Comfort*. Building and Environment, Vol. 51, pp. 285-295.
- HABER Z., URBAŃSKI P., 2005. *Kształtowanie terenów zieleni z elementami ekologii*. (Development of Green Areas with Elements of Ecology), Wydawnictwo Akademii Rolniczej w Poznaniu (Agricultural University in Poznań Publishing), Poznań.
- JIM C.Y., CHEN S.S., 2003. *Comprehensive Greenspace Planning Based on Landscape Ecology Principles in Compact Nanjing City, China*. Landscape and Urban Planning, Vol. 65, pp. 95-116.
- KEMPERMAN A., TIMMERMANS H., 2014, *Green Spaces in the Direct Living Environment and Social Contacts of the Aging Population*, Landscape and Urban Planning, Vol. 129, pp. 44-54.
- KOSMALA M., BŁASZCZYK M., 2012, *Społeczny wymiar zieleni i jej wpływ na jakość życia mieszkańców miast*, (Social Dimension of Greenery and its Impact on the Quality of Life of City Residents, Selected Aspects from City Physics) Przegląd Komunalny (Municipal Review), Vol. 8, pp. 51-57.
- LASKOWSKI L., 1987, *Wybrane zagadnienia z fizyki miasta*. (Selected Aspects from City Physics), Wydawnictwo COIB (COIB Publishing), Warszawa.
- MAAS J., VERHEIJ R. A., GROENEWEGEN P. P., DE VRIES S., SPREEUWENBERG P., 2006. *Green Space, Urbanity, and Health: How Strong is the Relation?*. Journal of Epidemiology and Community Health, Vol. 60, No. 7, pp. 587-592.
- MARKEVYCH I., TIESLER C. M., FUERTES E., ROMANOS M., DADVAND P., NIEUWENHUIJSEN M. J., BERDEL D., KOLETZKO S., HEINRICH J., 2014, *Access to Urban Green Spaces and Behavioural Problems in Children: Results from the GINplus and LISApplus Studies*, Environment International, Vol. 71, pp. 29-35.
- MCCUNN L. J., GIFFORD R., 2014, *Interrelations Between Sense of Place, Organizational Commitment, and Green Neighborhoods*, Cities, Vol. 41, pp. 20-29.
- NIKOLAOS K., DIMITRA V., AGAPI X., 2011, *Real Estate Values and Environment: A Case Study on the Effect of the Environment on Residential Real Estate Values*, International Journal of Academic Research, Vol. 3, No. 1, pp. 861-868.
- NIEMELÄ J., 2014, *Ecology of Urban Green Spaces: The Way Forward in Answering Major Research Questions*, Landscape and Urban Planning, Vol. 125, pp. 298-303.
- Raport o stanie miasta Olsztyn za lata 2012-2013
http://bip.olsztyn.eu/bip/folder/3636/raporty_o_stanie_miasta/, accessed 12.04.2016.
- RUDAWA D., 2006, *Projektowanie nie „zazielnianie”* (Designing vs. “Covering with Greenery”), Facility Manager, Vol. 2, No. 19, pp. 50-53.
- SITARSKI M., 2011. *Dlaczego należy zmienić definicję „zadrzewień” i „terenów zieleni” w ustawie o ochronie przyrody*. (Why is it Necessary to Change the Definition of “Tree Patches” and “Green Areas” in the Nature Conservation Law?), Człowiek i Środowisko (Man and Environment), Vol. 35, No. 1-2, pp. 93-106.
- SITARSKI M., PSTRAĞOWSKA M., 2013, *Tereny i obiekty zieleni na wybranym obszarze Pragi, dzielnicy Warszawy*. (Areas and Green Facilities in a Selected Area of Pragu, a District of Warsaw), Człowiek i Środowisko (Man and Environment), Vol. 37, No. 4, pp. 25-50.
- SOKOŁOWSKA B., KRAJCZYŃSKI M., 2004, *Stropodachy. Projektowanie i wykonawstwo*. (Flat Roofs. Design and Execution), Wydawnictwo Politechniki Koszalińskiej (Koszalin University of Technology Publishing), Koszalin.

- Studium uwarunkowań i kierunków zagospodarowania przestrzennego miasta Olsztyna. (Land Use Plan of the City of Olsztyn)* Uchwała nr XXXVII/660/13 z 15-05-2013 (Resolution no XXXVII/660/13 of 15 May 2013)
- SUTKOWSKA E. 2006., *Współczesny kształt i znaczenie zieleni miejskiej jako zielonej przestrzeni publicznej w strukturze miasta-przestrzeń dla kreacji. (Modern Shape and Significance of Urban Greenery as Green Public Space in the Structure of a City: a Space for Creation.)* Teka Komisji Architektury, Urbanistyki i Studiów Krajobrazowych (Commission of Architecture, Urban Planning and Landscape Studies), Vol. 2, pp.184-192.
- SZCZEPAŃSKA A., SENETRA A., WASILEWICZ-PSZCZÓŁKOWSKA M., 2015. *The Effect of Road Traffic Noise on the Prices of Residential Property – A Case Study of the Polish City of Olsztyn.* Transportation Research Part D: Transport and Environment, Vol. 36, pp. 167-177.
- SZULCZEWSKA B., GIEDYCH R., BOROWSKI J., KUCHCIK M., SIKORSKI P., MAZURKIEWICZ A., STAŃCZYK T., 2014. How much Green is Needed for a Vital Neighbourhood? In Search for Empirical Evidence. Land Use Policy, Vol. 38, pp. 330-345.
- SZUMACHER I., 2011. *Funkcje terenów zieleni miejskiej a świadczenia ekosystemów. (Functions of Urban Greenery Areas vs. Eco-System Services)*, Prace i Studia Geograficzne (Studies in Geography), 46, 169-176.
- Ustawa z dnia 16 kwietnia 2004 r. o ochronie przyrody, (Nature Conservation Law of 16 April 2004), Dziennik Ustaw z 2015 r. poz. 1651 z późn. zm. (Journal of Laws, 2015, item 1651, as amended)
- WACHTER S. M., WONG G., 2008, *What Is a Tree Worth? Green-City Strategies, Signaling and Housing Prices*, Real Estate Economics, Vol. 36, No. 2, pp. 213-239.
- WALMSLEY A., 1995. *Greenways and the Making of Urban Form.* Landscape and Urban Planning, Vol. 33, No. 1, pp. 81-127.
- WOLCH, J., 2007. *Green Urban Worlds.* Annals of the Association of American Geographers, Vol. 97, No. 2, pp. 373-384.
- WOLCH J. R., BYRNE J., NEWELL J. P., 2014, *Urban Green Space, Public Health, and Environmental Justice: The Challenge of Making Cities 'Just Green Enough*, Landscape and Urban Planning, Vol. 125, pp. 234-244.
- YOSHIDA J., SUGIURA A., 2015, *The Effects of Multiple Green Factors on Condominium Prices*, The Journal of Real Estate Finance and Economics, Vol. 50, No. 3, pp. 412-437.
- ZHENG S., WU J., KAHN M. E., DENG Y., 2012, *The Nascent Market for "Green" Real Estate in Beijing*, European Economic Review, Vol. 56, No. 5, pp. 974-984.
- ŻYLICZ T., 2004, *Ekonomia środowiska i zasobów naturalnych, (Economy of the Environment and Natural Resources)*, Polskie Wydawnictwo Ekonomiczne (Polish Economic Publishing House), Warszawa.