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Natural values as a factor in the location of residential investments

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Abstract: The natural environment is one of the factors of development activities location. The quality and availability of natural values influences bid prices of flats. The availability of ecosystems of special qualities such as rarity and uniqueness is not a desirable feature for potential buyers. This is due to conservation restrictions, and thus the limited possibilities to use the land for recreational purposes. The most desirable category are the green areas located within the urban structure, which provide the opportunity to combine a sense of communion with nature and relatively unrestricted use of the benefits offered by ecosystems.

Keywords: natural values, housing investments, Poznan agglomeration

1. Introduction

The environment is one of the factors of development investment location. On one hand there are particular terrain qualities on which the investment is to be completed. The environmental parameters such as land surface, soil, geological and hydrological parameters are of importance (Budner 2003, Dąbrowski and Kirejczyk 2001). On the other hand, a completed investment attracts potential buyers with high natural values of the environment. The proximity of green space offers ample opportunities for recreation and relaxation. What is more, it also adds an aesthetic value and prestige to the location (CB Richard Ellis and Murator Expo 2012). Therefore, if the natural values of the area influence developers' decisions on the investment location, as well as the decision of buyers to purchase real estate, the effect should show up in the price of real estate. The question arises: How natural values affect the price of the property? How do particularly high natural qualities, especially land covered by conservation forms of

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protection, influence the price? Do real estate market buyers prefer close proximity to lands of high natural value or rather to lands, which not necessarily are rare or unique but which provide good conditions for rest and recreation?

The aim of this article is to identify the impact of specific natural values on housing prices. The authors attempt to determine what kind of natural qualities and their proximity are particularly preferred by real estate buyers and whether it is reflected in the price of the property. The research was made on Poznan real estate agglomeration market. Therefore analyses were carried out in Polish socio-economic conditions and any generalizations drawn from the reporting apply to these conditions.

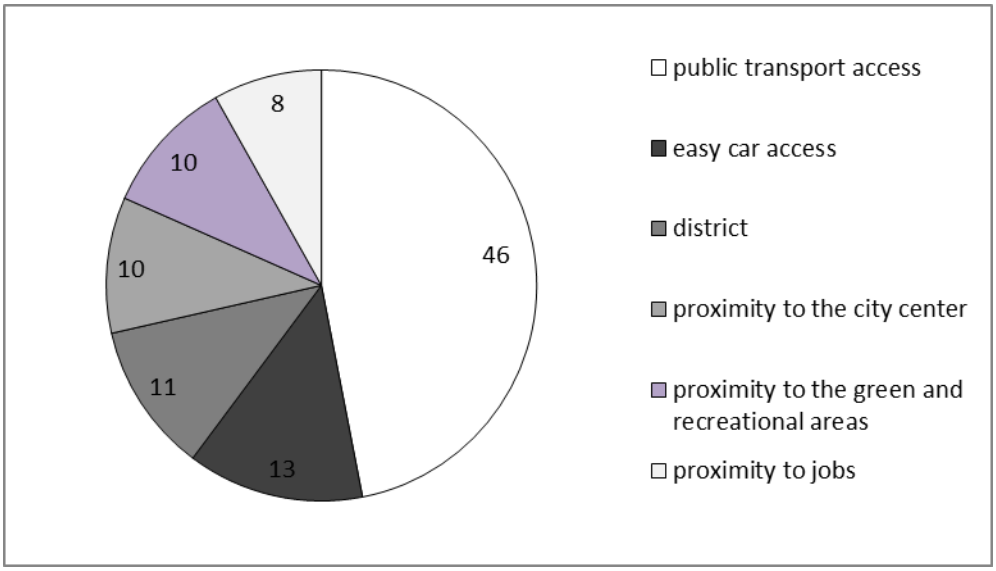
2. The natural environment as a factor of development investment location

Location of economic activities, including the development one, depends on many diverse in their nature factors. The natural environment is often indicated as one of them. Budner (2003: 23) distinguishes three main categories of location factors: natural, non-natural and special. The natural factors are related to environmental conditions prevailing in a given area. The non-natural factors relate to the conditions created by man, especially to infrastructure. The special factors are related to the prevailing economic and social situation. This category also includes all the institutional, political, cost, market and trade modalities.

Among the factors pointed by Dabrowski and Kirejczyk (2001: 40-41) the environmental conditions can also be indicated. They belong to the so called hard factors which can be little influenced by a developer. These factors include the terrain and topographical characteristics of the soil conditions. In addition, there are also factors such as the possibility to connect to municipal infrastructure, the level of services provision, land use structure. Soft factors are the second highlighted category. The developer can influence them to only a little extent and they are most often very subjectively evaluated. To this category belong: the quality of culture, housing and leisure activities. The last category include: socio-economic factors such as: a plan of spatial development, the investment climate, the structure of government.

From the point of view of buyers the location factors are slightly different. Here determinants are slightly different in nature. However, in this case the influence of the natural environment on the decision to purchase the property also reveals. A study by Richard Ellis and Murator Expo (2012) showed that for 10% of real estate buyers in Warsaw, green and recreational areas proximity is the most important factor in choosing the location of an apartment. A similar percentage of responders indicate easy car access, the status of the district, the proximity to the city center and to jobs to be the most important factor. The most important, as declared by 46% of responders factor is, however, the easy access to public transport (Figure 1).

Figure 1. Factors influencing the choice of location of the apartment



Source: (CB Richard Ellis, Murator EXPO, 2012).

In each of the presented typology, from both the supply and demand point of view there are natural environment factors revealed. They are of technical nature (soil and topography conditions). For the manufacturer and for the consumer they are connected to aesthetic and recreational values provided by the natural environment of the place of residence. The influence of the environment on decisions taken by both manufacturers and customers has an impact on the price. The environmental values are reflected in both the value of the land for investment, as well as in the final stage of the investment process – the price of the property.

3. Methodology

For the purpose of the study Poznan investment lands have been categorized in terms of availability of natural values. The following two criteria have been adopted: the natural value of the particular environment element and its distance from the analyzed investments. Five categories have been distinguished as a result (Table1).

The first category includes the areas located in the immediate vicinity of the lands of high natural value: Wielkopolska National Park, Puszcza Zielonka Landscape Park, Rogalin Landscape Park, the Cybina river Valley, and the Warta river Valley. The distance of not more than 1km from these regions is the necessary condition for eligibility of the particular investment in the first category.

Table 1. The categorization of investment areas in relation to natural values quality and their proximity

Category	Features
1. Very high natural values	The immediate vicinity of Wielkopolska National Park, Puszcza Zielonka Landscape Park, Rogalin Landscape Park, the Cybina river valley, the Warta river valley; the distance of these objects is not more than 1km.
2. High natural values	The close proximity of Wielkopolska National Park, Puszcza Zielonka Landscape Park, Rogalin Landscape Park, the Cybina river valley, the Warta river valley; the property distance from these objects is between 1-3km and /or the immediate vicinity of other forest complex, water reservoir or other object/natural area of significant conservation or tourism and recreational value.
3. Moderate natural values	The close proximity of the forest complex, water reservoir or other object/natural area of significant conservation value other than those listed in item 1; the property distance from these objects is between 1-3km and /or the immediate vicinity of a city park, water reservoir, small forest (up to 5 hectares) of a low conservation or tourism and recreational value.
4. Low natural values	A city park, water reservoir, small forest (up to 5 ha) of a low conservation or tourism and recreational value within the distance 1-3km.
5. No natural values	The absence of any objects of conservation values within the distance of 3km.

Source: Authors' own elaboration.

The second category includes the investments neighboring the same areas as in the category 1, but the distance from them is slightly bigger and varies from 1 to 3 km. This category also includes the investments that are in the immediate vicinity (within 1km) of a big forest complexes or water reservoirs of significant natural or tourism and recreational value.

Moderate natural value of investment areas is the third category. The neighborhood of the forest complex, a water reservoir and another object or area of significant conservation value within the distance of 1 to 3 km is the eligible factor of this category. The direct vicinity of a city park, a water reservoir or a small forest (up to 5 ha) of a low conservation or tourism and recreational value is another marker of the said category. If these objects are located farther than 1-3 km then they belong to the category 4.

The last category includes the investment areas without any natural values. There is no valuable form of green within a radius of 3km from the investment.

The classification of investments was also made in terms of distance from the city center. There are five zones. The first includes the investments localized within the distance of 3 km from the city center. The second – real estate located within a distance of 3-6km from the city center. The third one includes objects located within 6-9 km, the following one 9-15 km and the last one 15-23 km from the city center.

In the next step, each of the implemented investments in Poznan agglomeration area was assigned to the appropriate category of access to the area of natural values and to the particular distance from the city center category.

The most important information in the perspective of this study was the bid price of 1m2 of the real estate built within investments. The price fixing made it possible to investigate the relationship between the value of natural land to the price of 1m2 of the real estate and the distance from the city center to the price of 1m2 of the real estate. As a result it helped to determine the impact of the availability of special natural values on the property value.

4. Development investments in Poznan agglomeration

Poznan agglomeration is one of the most important elements of contemporary Polish settlement system. It belongs together with Warsaw, Cracow, Lodz, Wroclaw, Gdansk and Upper Silesia conurbation to the group of the seven strongest urban areas of the country (Kaczmarek and Mikula, 2010: 3-6).

There are several different concepts of Poznan agglomeration area delimitation (Swianiewicz and Klimska, 2005: 53-56; Parysek, 2008; 38, GUS). According to the delimitation used by the Adam Mickiewicz University Centre for Metropolitan Research, Poznan agglomeration constitutes 11% of the Wielkopolska region. It is composed of 23 municipalities forming a system of two rings surrounding the central city. The agglomeration population is over 950 thousand and the average population density is 350 people per km2. The residents of the agglomeration constitute 28% of the Wielkopolska region population, and 2,5% of the population of the whole country. The metropolitan area has a mono-centric nature – the majority of the population (58%) is concentrated in the center – Poznan. The agglomeration is distinguished by such features as: the strong intensity of the process of suburbanization, a large municipal administrative integration, dynamic spatial development, a high level of economic, entrepreneurship and innovation development (Strategia, 2011; 28)

Warta and Cybina valleys and the forests of Puszcza Zielonka Landscape Park are the key elements of the agglomeration surroundings.

The agglomeration has a number of valuable natural assets. They are subject to various forms of nature conservation. There are: Wielkopolska National Park along with 18 areas of strict protection, 16 nature reserves, 5 natural parks, 13 protected landscape areas, 27 ecological areas, 2 landscape-nature protected complex, 603 natural monuments (Mizgajski, 2010: 103-104). Many of these areas became part of the 11 metropolitan areas of Natura 2000.

Forest cover of the agglomeration is 21,2%, which is slightly smaller than the forest cover of Wielkopolska region (25,6%. The spatial distribution of the forest is dominated by large forests of Puszcza Zielonka and Wielkopolska National Park (Jaszczyk at al., 2010: 36-39).

Lakes area situated in the metropolitan area is 2500 ha, which constitutes 1% of the lake ratio (Strategia, 2011: 50).

Many city parks located in the city center are important elements of Poznan agglomeration natural environment. The largest of these are: the Citadel Park, Sołacki Park, Wilson Park, Debina and Marcelinski forest woods.

In the course of this study there were 48, significant in terms of scale, development investments carried out within the Poznan agglomeration area. Most of them were concentrated in the central part of the city. Many were located along the Warta River and around city parks. Relatively few new apartment complexes were built near or within the objects of the highest natural value such as: Wielkopolska National Park, Puszcza Zielonka Landscape Park or Rogalinski Landscape Park (Table 2).

There were 7 development investments carried out in the areas classified as category 1 when it comes to the access to high natural value areas. Most of them were located in the immediate vicinity of the Warta River and Cybina river valleys. Another 11 investments were classified as category 2 that is those slightly more distant from the Warta River, Wielkopolski National Park areas and those adjacent to such facilities as Rusalka Lake, Kornickie Lake and Strzeszynskie Lake. Most investments have been classified as category 3. Those houses and apartments are located near city parks and woodlands. The fourth category includes 10 investments. They are located close to the category 3 lands and areas but they are more distant to them. The last 6 investments belonged to category 5. They do not have any significant natural values in their neighborhood within recognized as important distance.

In terms of distance from the city center, there are 13 investments in zone 1. 14 currently ongoing construction projects were identified in zone 2. The smallest number of investments that is 6 was found in zone 3. Zones 5 and 6 were only a little more numerous, respectively, 7 and 8 ongoing projects.

It is worth to note the lack of the investment areas regularity of particular natural value categories in the following proximity zones. For example, category 1 sites are located in the 1, 2, 4 and 5 proximity zone and the Category 2 in the 1, 2, 3 and 5 zone. In each of the proximity zones the development investments may be located in any natural value availability category.

Table 2. Development investments made in Poznan agglomeration in 2012 according to the availability of particular natural categories

Cat.	Name of the investment	Investor	Location (place, street)	Natural value area availability	Zone	price /m^2
1	Osiedle Parkowe	Jakon	Mosina, Krotowskiego St.	Wielkopolski National Park, Rogalinski Landscape Park	5	4 369
	-	Mar- Gut	Stęszew, Narutowicza St.	Wielkopolski National Park, Debno Lake	5	4 000
	Tumski Park	SGI	Poznań, Zawady St.	The Cybina River Valley, Malta Lake	1	5 600
	Osiedle na Smolnej	Budimex	Poznań, Smolna St.	The Warta River Valley	1	5 140
	Osiedle Leśna	SM w Koziegłowach	Koziegłowy, Leśna St.	Puszcza Zielonka Landscape Park	2	4 104
	Osiedle nas Wartą	Wechta	Poznan, Szyperska St.	The Warta River Valley	1	7 422
	Os. Leśne V	Family House	Czapury, Gromadzka St	The Warta River Valley, forest	4	3 576
2	Tarasy Warty	Trico Investment	Poznań, Na miasteczku St.	The Warta River Valley	1	6 600
	Osiedle Olszynka	Czerwona torebka	Krosno	Wielkopolski National Park, Rogaliński Landscape Park	5	3 500
	Wschodnia	Immo-Invest	Luboń, Wschodnia St.	Dębina Park	3	4 000
	Ogrody Różane	Konimpex Invest	Poznań, Jasna Rola St.	Żurawiniec Nature Reserve	2	4 999
	Osiedle Karpia	Gant Development S.A.	Poznań, Karpia St.	Żurawiniec Nature Reserve, The Warta River Valley	2	5 499
	Osiedle Ecoria	PGB Erigo	Poznań, Karpia St.	Żurawiniec Nature Reserve, The Warta River Valley	2	5 569
	Na skraju lasu	OKRE Development	Poznań, Jasna Rola St.	Żurawiniec Nature Reserve	2	5 150
	Nowe Ogrody	Real Management	Poznań, 5 Stycznia St.	Botanical Garden, Rusałka Lake	2	6 360
	-	Future	Kórnik	Kórnickie Lake	5	4 000
	Osiedle Natura	Jakśbud	Biedrusko	Natura 2000 Biedrusko	5	3 914
	Strzeszyn Literacki	JAL A.MENKE	Poznań, ul. Koszalińska St.	Strzeszyńskie Lake	3	5 120
3	Osiedle Zacisze	PlastBud Developer	Mrowina	Forest	5	3 600
	Słowiańska Nova	Masterm Investment	Poznań, Słowiańska 36 St.	CytadelaPark	1	6 054
	Nowy Grunwald	SJM	Poznań, Bułgarska St.	Botanical Garden, Rusalka Lake, Marcelinski Wood	2	6 500
	Mieszkania na Sokoła	Monday Development	Poznań, Sokoła St.	Sołacki Park, Wodziczki Park	1	7 400

	Nowe Kamienice Jeżyckie	Constructa Plus	Poznań, Mylna St./ Kościelna St.	Sołacki Park	1	4 950
	Osiedle pod Platanami	Wechta	Poznań, Saperska St.	Dębina Park	2	5 100
	Za Cytadelą	Wechta	Poznań, Za Cytadelą St.	Cytadela Park	1	8 814
	Leśna Polana	Linea	Dąbrówka	Forest	4	4 600
	Malta Fountain	Grupa Haniewicz	Poznań, Milczańska, St.	Malta Lake	1	6 300
	Osiedle Platanowe	BGR BAU	Suchy Las	Meteoryt Morasko Nature Reserve	3	4 600
	Osiedle Zacisze	Budnex	Swarzędz, Radosna St.	Forest	4	4 500
	Swarzędz Południe	Agrobex	Swarzędz, Mokra St.	Forest	4	4 600
	Mieszkania Dębiec	Red Park	Poznań, 28 czerwca St.	Dębina Park	3	5 350
	Osiedle na Wzgórzach	GGW Development	Poznań, Morasko	Meteoryt Morasko Nature Reserve	3	4 520
4	Osiedle Bajkowe	Masterm city	Poznań, Barwicka St.	Marceliński Wood	2	5 900
	Hevelia	Monday Development	Poznań, Heweliusza St.	Marceliński Wood	2	6 300
	-	SM Grunwald	Poznań, Rynarzewska St.	Fr. Józef Jasiński Park	2	5 616
	Kasztanowa Aleja	Echo Investment	Poznań, Wojskowa St.	Kasprowicza Park, Manitiusa Park	1	5 923
	Osiedle Podolany II	Pryzma Developer	Poznań, Strzeszyńska St.	Rusałka Lake, Strzeszyńskie Lake	2	5 150
	Tarasy Malty	Trico Investment	Poznań, Chartowo St.	Malta Lake	1	6 500
	Towarowa 41	Ataner	Poznań, Towarowa St.	Marcinkowskiego Park	1	7 500
	Perła	Family House	Poznań, Kosińskiego St.	Dębina Park	1	5 200
	-	Future	Komorniki, Młyńska St.	Forest	4	4 000
	Zielone Wzgórze	SM w Murowanej Goślinie	Murowana Goślina	Raduszyńskie Lake	5	3 600
5	Osiedle Wiśniowe	Twoje M	Plewiska, Fabianowska St.	-	4	4 000

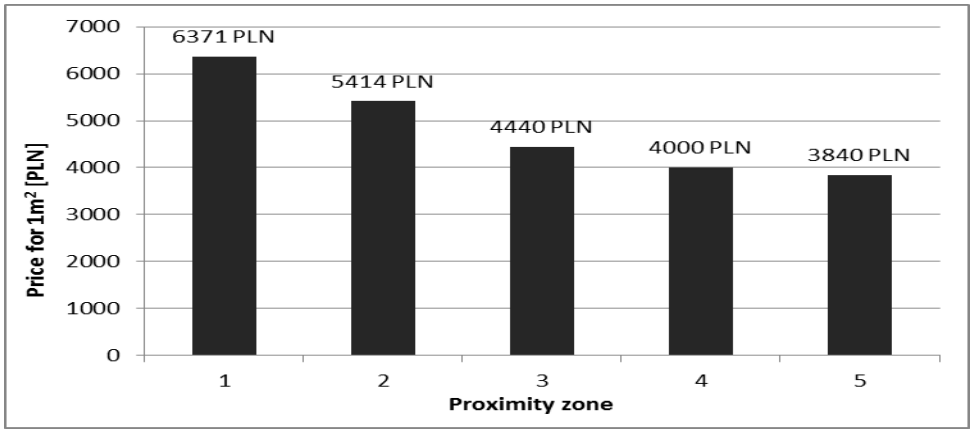
	Topaz	Family House	Poznań, Bosa St.	-	2	4 900
	Koralik	Family House	Poznań, Czeremchowa St.	-	2	4 500
	Osiedle Tarnowo Centrum	Jakon	Tarnowo Podgórne, Szkolna St.	-	5	4 700
	Osiedle przy ul. Buczka	Akropol Inwestycje	Luboń, Buczka St.	-	3	3 350
	Osiedle Parkowe	Poz Invest	Komorniki	-	4	3 500

Source: Author's own elaboration based on developer materials.

4. The availability of natural values as a factor affecting prices in the real estate market

The investment proximity to the city center is the main factor affecting the price of apartments. The highest real estate prices in the primary market can be observed only in the first zone (Figure 2). This amounts to 6371 PLN. This price significantly decreases in the following zones. It amounts to 5414 PLN in the second zone, and respectively 4000 PLN and 3840 PLN in the following ones. There is almost 40% value difference between zone 1 and zone 5. The observation confirms the correlation using Pearson`s coefficient. The result is at a very high level -0.95, which indicates a strong link between variables and their inverse relationship.

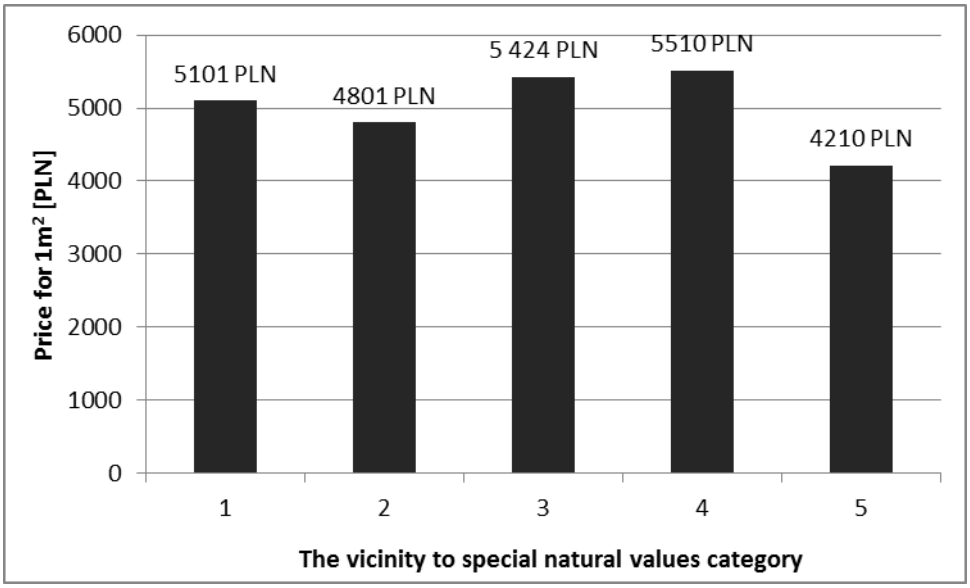
Figure 2. The average apartment price for 1m^2 in particular city center proximity zone



Source: Author's own elaboration based on developer materials.

Housing prices show some variation depending on their position towards the areas of special natural values. The highest housing prices show up in category 4 (the average price for $1m^2$ - 5510 PLN) and 3 (5424 PLN). The investments located in the immediate vicinity of particularly high conservation value areas are on the third position (5101 PLN). The investments classified as category 5, characterized by a lack of access to any natural values areas reach the lowest price per 1 m^2. This amounts to 4210 PLN. It is worth to note a huge disparity in average prices per 1 m^2 of real estate between category 4 and 5. The difference between the category where the highest prices are revealed and the category in which the prices are the lowest is as high as 1300 PLN, which is over 20% (Figure 3)

Figure 3. Price of apartments in different availability to special natural values categories



Source: Author's own elaboration based on developer materials.

The investments of the highest housing prices are (category 3 and 4) located in close proximity to city parks or small woodlands such as the Citadel Park, Solacki Park, Debinski Wood or suburban forests.

These results indicate that the choice of the apartment location does not essentially depend on the particularly valuable ecosystems availability. More desirable properties are located lose to green areas which are situated in the urban structure. Their environmental value is not essential. Then there is the possibility of combining the advantages of urban area with the green areas benefits. Small and medium-sized urban parks provide the residents with the opportunities for recreation, leisure and entertainment. This is confirmed by the fact that most of its investments were located in the third availability category. It should be noted, however, that the lack of access to any natural value areas determine significantly lower property prices. This is confirmed by the average price of housing within category 5 of availability and a huge disparity in prices between this category and all the others.

The regression analysis indicates a small impact of natural values availability on the apartment price per $1m^2$. A multiple linear regression has been carried out according to the formula:

$$y = a + b_1x_1 + b_2x_2$$

where: y - dependent variable

x – independent variable

a – absolute term

b – regression coefficient

The price per $1m^2$ is the dependent variable. The proximity to the city center and the natural values availability are independent variables. The regression takes the form:

$$y = 6922{,}6 - 22{,}1x_1 - 662{,}2x_2$$

where: x_1- natural values availability category

x_2- proximity to the city center zone

The regression indicates the dominant role of the proximity to the city in shaping the real estate prices (ratio 662,2). Here the natural values areas availability plays a minor role (ratio 22,1). In this case the proximity to the city center has almost 38 times stronger impact on the real estate price than the availability of green areas. The coefficient of determination of the presented model stands at 0,57.

5. Conclusions

The natural values availability is not a significant factor shaping the price of housing. Their influence is negligible especially when compared with the most important factor, which is the distance from the city center. It should be recognized that development investments are not a significant threat to the areas of significant natural value. They usually are located outside the urban structure and they are not the most desirable location for both the developers and future residents. Rare and unique ecosystems with a huge environmental value seldom are the most attractive investment location for developers. Safety restrictions prevailing in these areas, the lack of adaptation to the recreational use and most of all a significant distance from the city center influence their relatively low attractiveness. Statistical analysis indicates that the said distance from the city center is the main factor affecting the price of 1 m^2 of housing. Compared with it, the impact of natural values access is not very important.

The above results suggest that development activities should not be a significant threat to the important natural values. They are not particularly interesting to real estate buyers. They do not require their proximity to the real estate. What they appreciate more is the proximity of urban green areas, which are fully accessible and have the recreational infrastructure within the city area. These areas provide a safety buffer for valuable natural areas located in close proximity to the city.

The results of the research are preliminary ones and need to be continued. The study was based on the basis of bid prices. To confirm these results further analysis based on transaction prices or consumer preferences need to be done. The obtained results relate only to the primary market. The secondary market needs similar analysis. It would also be interesting to extend the study to other Polish cities and regions and to compare them to the possible results obtained in other countries.

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Natural values as a factor in the location of residential investments

Streszczenie

Środowisko naturalne stanowi jeden z czynników rozwoju aktywności lokalnej. Jakość oraz dostępność walorów naturalnych warunkuje wysokość oferowanych cen mieszkań. Dostępność ekosystemów o specjalnych walorach, takich jak rzadkość i wyjątkowość nie jest pożądaną cechą dla potencjalnych nabywców. Wynika to z wymogów konserwacyjnych, a zatem ograniczonych możliwości wykorzystywania terenu w celach rekreacyjnych. Najbardziej pożądaną kategorię stanowią tereny zielone położone na obszarach miejskich, co zapewnia sposobność połączenia poczucia wspólnoty z naturą, a także relatywnie nieograniczonym czerpaniem korzyści z ekosystemów.

Słowa kluczowe: walory naturalne, inwestycje mieszkaniowe, aglomeracja poznańska