DIVERSITY OF AQUATIC ECOSYSTEMS IN URBAN AREAS - PUBLIC EXPECTATIONS

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ABSTRACT

In urban ecosystems, typically created by humans, it is very difficult to balance the needs of all its inhabitants. Significance of nature in the cities has been perceived since the ancient times. In the city there are many problems associated with the lack or sometimes excess of water, as well as poor quality. In times of water resources decline and their progressive degradation, each aquatic ecosystem should be investigated because of its values. Among the aquatic ecosystems occurring in the cities, there are: river valleys, natural lakes, water reservoirs, as well as small bodies of water. The aim of this study is to raise public awareness about the role of aquatic ecosystems in cities with different sizes and with a varying number of inhabitants. All respondents in each type of city felt the need of water presence in their surroundings and treated it as a necessary part of the proper functioning, as well as a place for rest and recreation. However, lack of management and a poor ecological status of them were noticed.

RÉSUMÉ: La diversité des écosystèmes aquatiques dans les zones urbaines - les attentes du public.

Dans les écosystèmes urbains, généralement créés par l'homme, il est difficile d'évaluer les besoins de tous les habitants. L'importance de la nature dans les villes a été perçu depuis les temps anciens. En ville, il existe des problèmes liés à l'absence et parfois l'excès d'eau, ainsi que sa mauvaise qualité. En période de déclin des ressources en eau et de leur dégradation progressive, chaque écosystème aquatique devrait être étudié en raison de sa valeur. Parmi les écosystèmes aquatiques présents dans les villes, il y a des vallées fluviales, des lacs naturels, des réservoirs d'eau, ainsi que de petits plans d'eau. L'objectif de l'étude était de déterminer la sensibilité du public aux écosystèmes aquatiques dans des villes de taille et de nombre d'habitants différents. Toutes les personnes interrogées provenant de chaque type de ville ont fait part de leur besoin de présence d'eau dans leur environnement, perçu comme un élément nécessaire à son bon fonctionnement. Les sites aquatiques constitues également des lieux de repos et de loisirs. Cependant, la mauvaise gestion de l'eau et le mauvais état écologique des eaux ont été soulignés.

REZUMAT: Diversitatea ecosistemelor acvatice în zone urbane - aşteptările publicului.

În ecosistemele acvatice urbane, în general create de om, este foarte dificil să se echilibreze necesităţile tuturor locuitorilor. Importanţa prezenţei naturii în oraşe a fost recepţionată din timpuri străvechi. În oraş există multe probleme legate de absenţa, câteodată de excesul dar şi de calitatea proastă a apelor. În perioadele de declin ale resurselor de apă şi degradarea lor progresivă este necesară studierea valorii fiecărui ecosistem acvatic. Între ecosistemele acvatice din oraş există atât văi fluviale, lacuri naturale, rezervoare de apă, cât şi corpuri mici de apă. Obiectivul acestui studiu a fost determinarea sensibilizării publicului cu privire la rolul ecosistemelor acvatice din oraşe diferenţiate în funcţie de mărime şi număr de locuitori. Toţi cei interogaţi din fiecare tip de oraş au simţit necesitatea prezenţei apei în împrejurimile lor, văzând-o ca un element necesar pentru buna funcţionare, dar în aceeaşi măsură şi ca loc de odihnă şi de agrement. În acelaşi timp a fost remarcat modul deficitar de gestionare a apelor şi starea lor ecologică de calitate redusă.

INTRODUCTION

In urban ecosystems, typically created by humans, it is very difficult to balance the needs of all its inhabitants. Significance of nature in the cities was perceived from the ancient times (Barthel et al., 2010; Damurski, 2012). In the city there are many problems associated with the lack or sometimes the excess of water, as well as poor quality of water. The progressive course of civilization significantly transformed that unique element. Water in the environment is a priceless treasure, and it is usually a limited resource in certain cities. The development of the city, by impairing a hydrological regime, limits its ability to provide essential basic services: supplying and regulation (Fig. 1).

The problem of water shortage is usually associated with areas of warm temperatures. However, Poland is among the countries with a very serious poverty of water resources. On one hand, there are climatic conditions and on the other is an adverse action to reduce the small retention. Such situations aggravate water deficit in the country, as well as affect the occurrence of negative phenomena. The measure of rising problems with water management in Poland is progressing steppe of large areas of the country and threatening areas by rising water deficit. Among these places are Lublin and its surrounding areas.

In times of water resource's decline and their progressive degradation, each aquatic ecosystem should be investigated because of its values. An important meaning in enriching water resources are the specific types of water bodies; the small ones, as well as bigger sized ones. In addition to the poor quality of surface waters, there are problems associated with the management of many reservoir's surroundings, especially in suburban areas (Chełmicki, 2012). Among aquatic ecosystems occurring in the cities there are river valleys, natural lakes, water reservoirs, as well as small water bodies. Water reservoirs are one of the environmental elements of importance with their valuable function, like water retention for municipalities (Mioduszewski, 2006; Sender and Kułak, 2010). Furthermore, they are perceived as high-value enclaves of the natural environment, as well as objects with recreation function for the rest (Mioduszewski, 1999; Celiński et al., 2001).

Strategy of hydrosphere conservation should be aimed at reducing a deficit through the construction of new intakes, reducing losses in water supply systems and eliminating the exploitation of water resources by industry. In order to improve, the national balance sheet is needed both to increase retention by increasing forest cover and protection, revitalization and creation of new hydrogenic areas. Extremely important in this process is the public awareness.

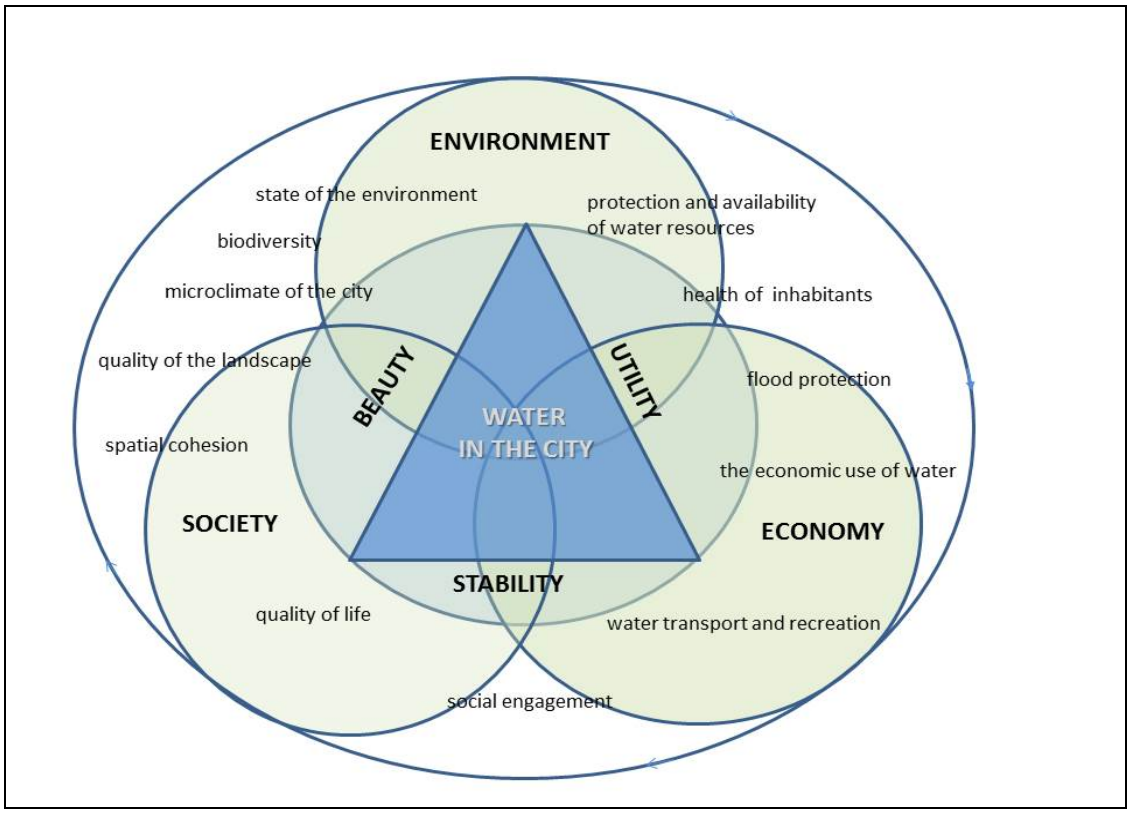


Figure 1: The importance of water in city by Januchta-Szostak, 2011 (revised).

A result of the social dialogue is the knowledge of how important for us these things are on a local scale. This form supports, directs, and also reminds, the importance of the issue. In Poland, wide public participation is rarely used. This is due to the lack of knowledge of the legal state and also the lack of tradition and skills in this area (Pawłowska, 2012).

The aim of the study was to determine the public awareness about the role of aquatic ecosystems in cities with different sizes and number of inhabitants.

METHODS

The expectations of inhabitants of chosen communities in relation to aquatic ecosystems in the city were analyzed on the basis of the survey.

The survey was conducted among 152 people in 2013. Questions were shown and answers were written down in a questionnaire. The survey was carried out among people spending time over the water; age groups were not analyzed. Analyzes were conducted in three cities in Lublin Voivodeship, differentiated in terms of population and size: Lublin (348 thousand inhabitants, 147.5 km^2 surface), Janów Lubelski (11,904 thousand inhabitants, 14.80 km^2 surface) and Kock (3,484 thousand inhabitants, 16.78 km^2 surface) (Fig. 2). The survey included 14 questions related to the impact of aquatic ecosystems and their influence on quality of life in the city. The presence and diversity of aquatic ecosystems were one of the main criteria for the selection of cities. In order to obtain statistical verification of received data, a nonparametric statistics χ^2 (Chi square) was used.

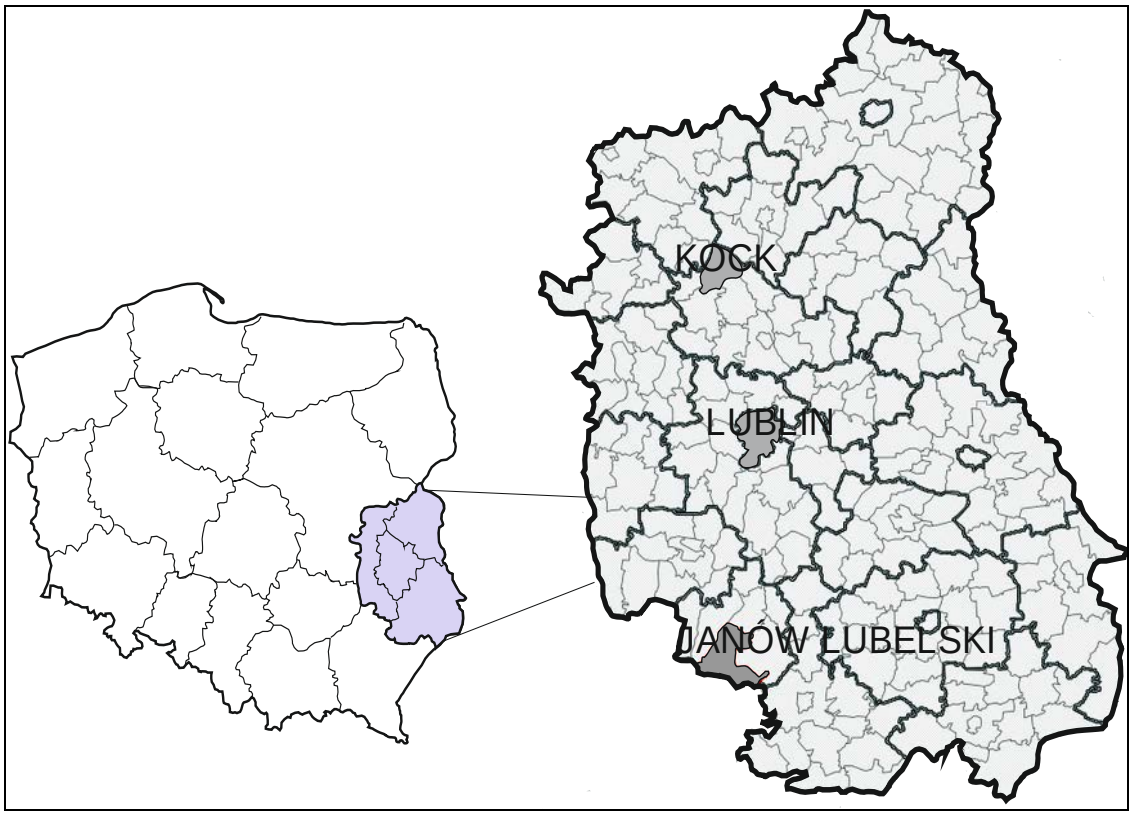


Figure 2: The study area, the location of the designated cities on the background of Lublin Voivodeship.

RESULTS AND DISCUSSIONS

In all studied cities, regardless of size, inhabitants felt the need of the water presence in their surroundings and treated it as a necessary part of the proper functioning. But what is more interesting is that this need increased significantly with the size of the city (Fig. 3). These differences were statistically significant ($\chi^2(1) = 0.003.76$; $p < 0.05$). We surmised that in small cities people are more used to surrounding nature than in bigger cities. This may be due to their greater openness to nature.

All respondents confirmed the need for the occurrence of recreational reservoirs in the city; whereas among the existing ones it was said about insufficient and often inappropriate use of their coasts. The answer was justified yet mismatched the current land use to the needs (Fig. 4).

Among all respondents, only in opinion of inhabitants of the big city there is a right way of management in river valley. The smaller city, the less people think that land use management is proper. The highest number of respondents spoke about the lack of any development in a small town.

Fluvial water ecosystems provided citizens with an important role too (Fig. 4), although the question was about threats from water, rivers were especially indicated (Tab. 1). The need for river regulations in the city was supported by the great majority of respondents (from 94% in the large cities to 51% in the small cities). The answer was justified that in this way it improved the appearance of the city.

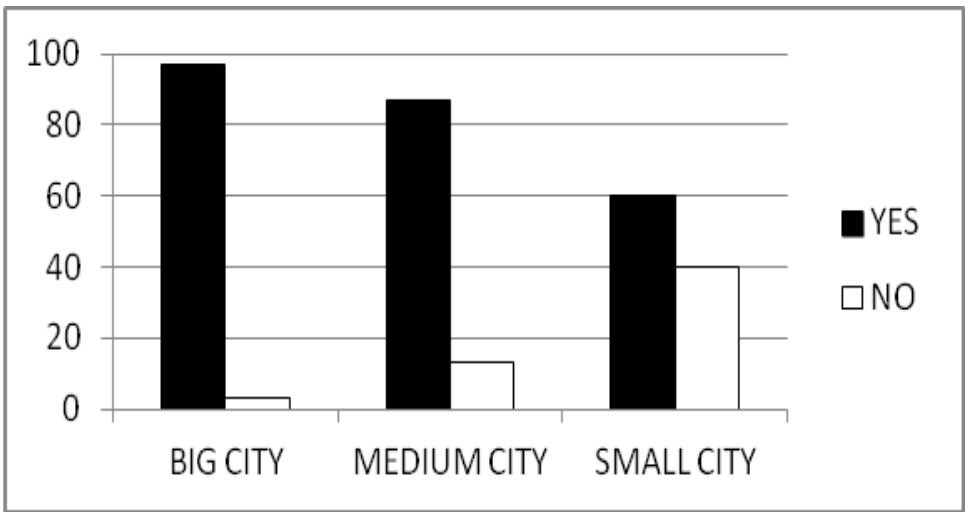


Figure 3: Answer to the question: "Is the water (lake, river, pond, etc.) an important element in the functioning of the city?" (n = 152).

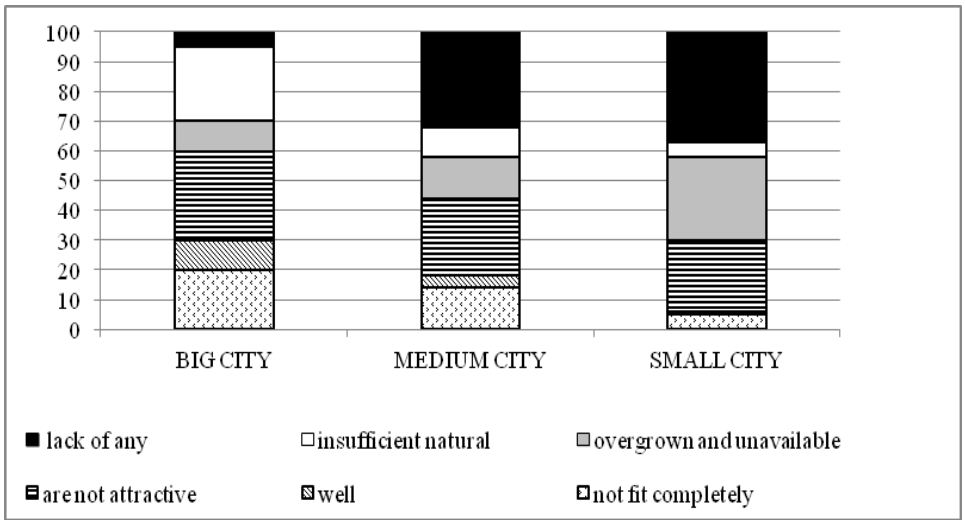


Figure 4: Answer to the question: "Is the development of river (lake) banks adequate?" (n = 152).

The great majority of respondents considered aquatic ecosystems in the city as a place for rest and recreation, just like inhabitants of other cities in Poland and in the world (Mroczek and Kostecka, 2008; Kułak and Chmielewski, 2010).

City size is also important in understanding them as environmentally valuable places. Natural role of waters in the cities was more important for the residents of small towns. These differences were statistically significant ($\chi^2(1) = 0.01$; $p < 0.05$) (Fig. 5).

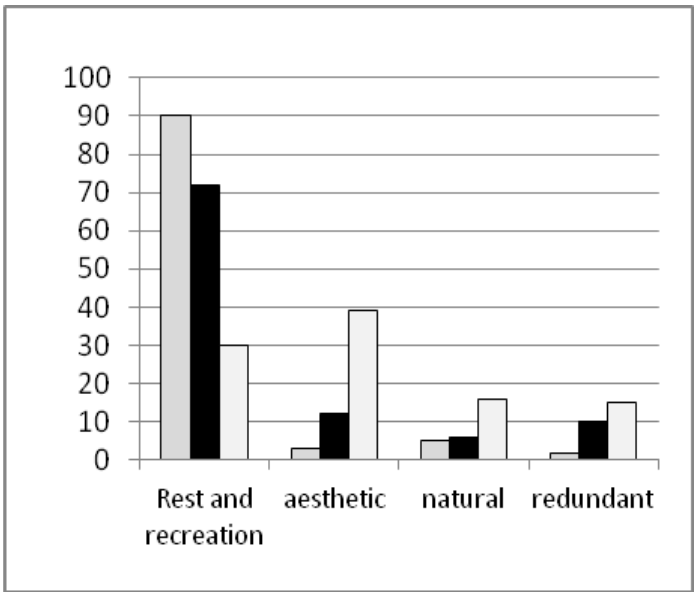


Figure 5 a: Answer to the question: "Specify the importance a) river, b) water reservoir in your city?" (n = 152).

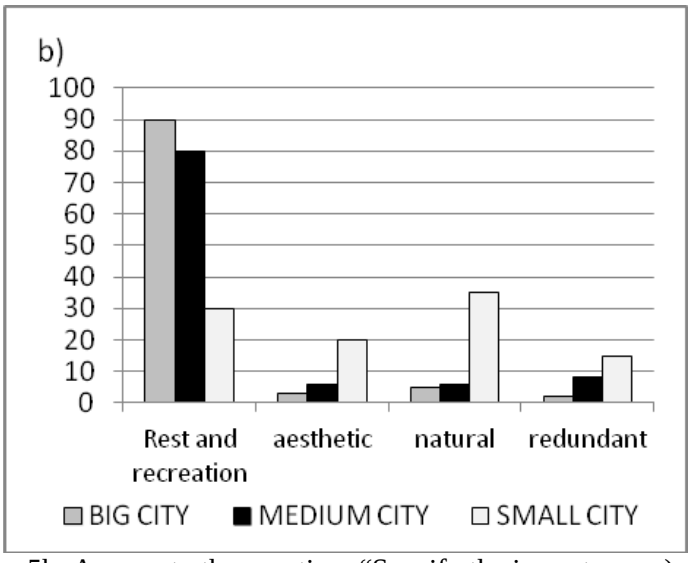


Figure 5b: Answer to the question: "Specify the importance a) river, b) water reservoir in your city?" (n = 152).

Asking about the role of river valleys, especially as ecological corridors, frequent answers in large cities were "not sure" (from 45 to 55%), while a consistent "yes" in a small town -70% (Fig. 6). It suggested a lack of proper ecological knowledge in bigger cities, or not focusing on this issue at all.

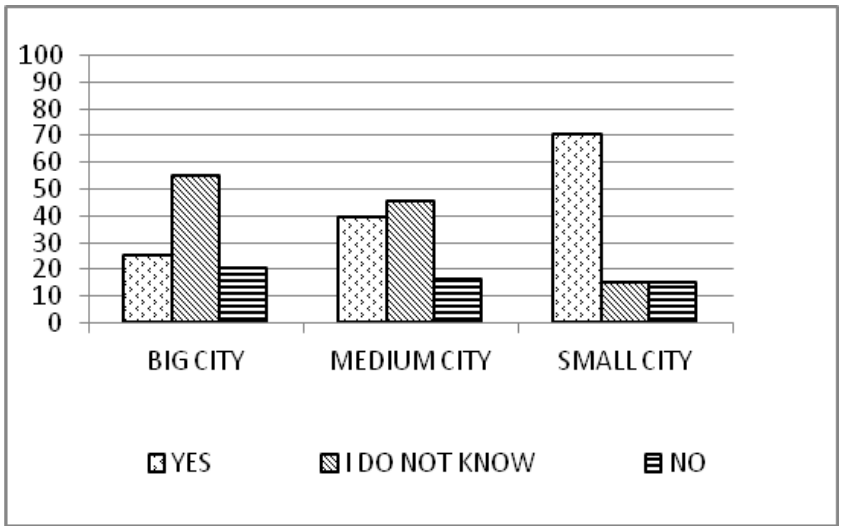


Figure 6: Answer to the question: "Does the water serve as an ecological corridor in the city?" (n = 152).

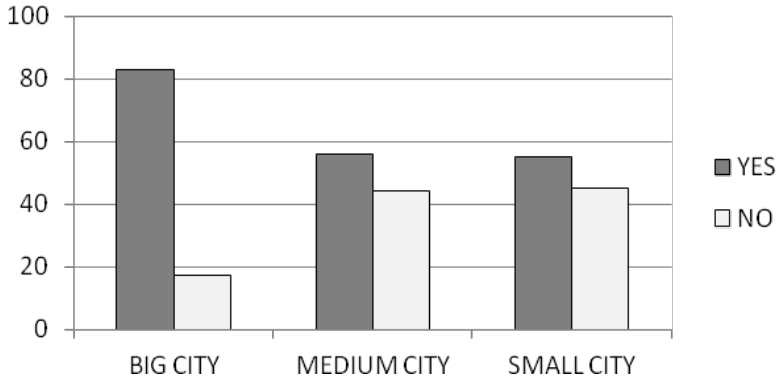


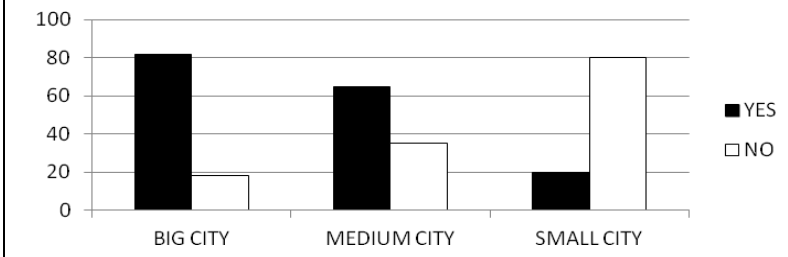
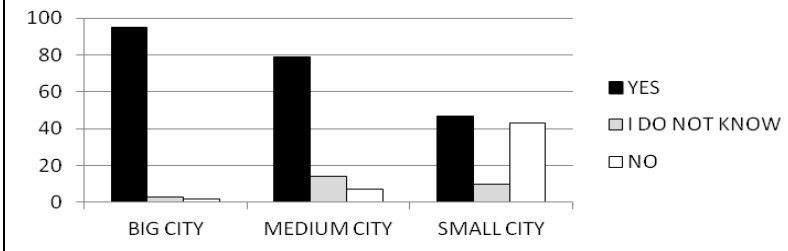
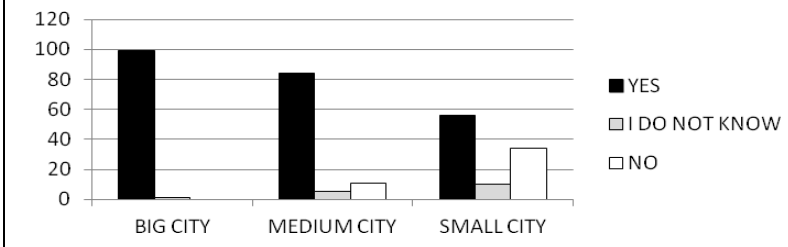
Figure 7: Answer to the question: "Are fountains/ponds in the city required?" (n = 152).

Everyone recognized the problem of poor water quality among urban water ecosystems, but not everyone was familiar with the methods and possibilities of its improvement. This problem concerned especially small towns. People did not see the need for drains in those towns (Tab. 1).

Natural ecosystems in large and medium cities attracted less attention than those created by human. Generally they were characterized by smaller, natural values and poorer ecological condition (Kuczyńska-Kippen et al., 2004). Residents of large cities had greater need for the occurrence of ecosystems created by man (Fig. 7).

Urban planning in our times should undeniably be sustainable with water management in the region. On one hand it should ensure good quality of urban water, and on the other, it should revitalize the area according to their natural destiny. Each kind of urban water, both natural and artificial, enrich biodiversity (Sender and Kułak, 2010). Human needs are inextricably linked to its natural surroundings. Water in the city improves the quality of urban space by making it more stable, and also provides a range of services (Januchta-Szostak, 2013).

Table 1: Significance of aquatic ecosystems in the city - the characteristics of answers (percentage share).

	Size of city / Answer	Big city	Medium city	Small city
Does the water in the city cause any fear?				
Is river regulation necessary in the city?	Yes	97	67	51
	No	3	33	49
Is land development of river banks (lakes) correct?	Yes	55	60	70
	I do not know	25	14	15
	No	20	26	15
Is rainwater management appropriate?	Yes	20	30	31
	I do not know	23	24	40
	No	57	46	29
Is the water quality good?	Yes	9	18	25
	I do not know	11	20	16
	No	80	62	59
Is sewerage needed in the city?				
Is the water supply needed in the city?				
Does the sewage treatment adversely affect urban landscape?	Yes	16	27	25
	I do not know	5	3	9
	No	79	70	66

CONCLUSIONS

Complete public awareness about the quantity and quality of water is extremely valuable in carrying out any action to balance any losses and state improvement. Unfortunately, conducted research did not confirm willingness of the society to make significant compromises. However, studies have highlighted that there is a problem of water in cities. Everyone recognized the problem of poor water quality among urban water ecosystems, but not everyone was familiar with the methods and possibilities of its improvement.

One of the solutions could be an increase of ecological education, not only among children, but also among adults. In Western Europe it has been observed as a special "care" of man over almost every water body, especially in urban areas, where tanks "are conducted" in harmony with nature (Kułak and Chmielewski, 2011).

Another, can be promoting small retention as an activity increasing water resources in urban and suburban areas.

The most significant role and tools have urban planning and conservation units that should play integral part of sustainable management of water covering the whole catchment area. That's the way of land use and the type of activity in the catchment area's influence on the quality of water (Radwan and Sender, 2008) and the occurrence of flood risks.

Regardless of the city size and the number of the cities residents, respondents recognized the necessity of the occurrence of an aquatic ecosystems' variety in their immediate vicinity.

In large cities, recreation was the main function which water should serve, whereas in smaller ones, water was important because of its natural meaning.

Residents of large cities had a greater need for the occurrence of ecosystems created by man.

City size and the number of residents was irrelevant in the case of indication of the ecological status of these ecosystems, which was defined as unsatisfactory. However, the need to improve the ecological status of waters was assessed unequally. Such possibilities were not pointed out in small towns.

The way of river valley's management and reservoir embankments was inadequate, especially in big cities.

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