

## LAND-USE CHANGE SCENARIOS OF CHOSEN SMALL WATER BODY – PUBLIC PARTICIPATION FOR A NEW REALITY

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### ABSTRACT

The object of this study was a small water body adjacent to the Zemborzycki Reservoir. The aim of the study was to find an optimal way of management of the small water body's surroundings based on scenario building and public participation. The three following scenarios of the small water body's surroundings' management with a leading role were used: a) ecological and educational, b) representative and recreational, and c) left in its current form. As a result of the public participation conducted in 2011, it was shown that the ecological and educational scenario is the most optimal for the respondents; and in 2012, implementation had been undertaken. In the decision-making process, a public participation seems to play an important role because actions are accepted, thus fulfilling needs of most users and allowing for identification of the society within a given place.

**RESUMEN:** Escenarios de cambio de uso de suelo en un pequeño cuerpo de agua – participación ciudadana en la creación de una nueva realidad.

El objeto de este estudio fue el pequeño cuerpo de agua adyacente al embalse de Zemborzycki. El objetivo fue elegir el tipo óptimo de manejo de dicho cuerpo, basado en la construcción de escenarios y la participación ciudadana. Los tres escenarios más significativos de manejo del entorno del cuerpo de agua son: a) ecológico y educativo; b) representativo y recreativo; y c) como se encuentra y se usa actualmente. Como resultado de la participación ciudadana llevada a cabo en 2011, el escenario ecológico y educativo resultó ser óptimo para los encuestados, mismo que se implementó en 2012. En el proceso de la toma de decisiones, la participación ciudadana parece desempeñar un papel importante, porque gracias a ésta se aceptaron las medidas adoptadas, se cubrieron las necesidades de la mayoría de los usuarios y se identificó un lugar específico para la sociedad en el proceso de manejo.

**REZUMAT:** Scenariile privind schimbarea utilizării terenurilor a corpurilor mici de apă – participarea cetățenească la crearea unei noi realități.

Obiectul acestui studiu a fost corpul mic de apă adiacent la rezervorul Zemborzycki. Scopul studiului a fost alegerea optimă de gestionare a mediului corpului mic de apă, pe baza elaborării de scenarii și participarea cetățenească. Cele trei scenarii diferite mai semnificative de gestionarea a mediului corpului mic de apă sunt: a) ecologic și educațional, b) reprezentativ și recreativ, c) așa cum se găsește și se folosește în prezent. Ca urmare a participării cetățenești care a avut loc în anul 2011, scenariul ecologic și educațional s-au dovedit a fi cea mai optimă pentru respondenți, și în anul 2012 punerea în aplicare a fost efectuată. Participarea cetățenească la procesul de luare a deciziilor pare să joace un rol important, datorită acestui fapt sunt acceptate măsurile adoptate, nevoile majorității utilizatorilor sunt acoperite și se permite identificarea societății cu un anumit loc.

## INTRODUCTION

In times of declining water resources and their progressive degradation, each aquatic ecosystem should be investigated because of its values. An important meaning in enriching water resources have small water bodies (Hajdu and Kelemen, 2009), often missed in research. In addition to the poor quality of surface waters, there are problems associated with the management of many reservoirs' surroundings, especially in suburban areas (Chełmicki, 2012).

Water reservoirs are one of the environmental elements of importance with their valuable function, like water retention for municipalities (Mioduszeński, 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 (Mioduszeński, 1999; Celiński et al., 2001). Small water bodies are an integral part of the rural and urban landscape, significantly enriching their biodiversity (Szpakowska and Życzyńska-Bałoniak, 1994; Hłyńczak et al., 1995; Patro and Zubala, 2010), as well as in the river valleys (Kopeć, 2007).

Because of small size, small water bodies, more often than other reservoirs, are exposed to drying and eutrophication processes that cause disturbances in the species' composition and their degradation (Kalbarczyk, 2003; Kuczera and Misztal, 2007).

The meaning of research methods based on scenario building is increasing (Verburg et al., 2006), particularly in times of global warming and climate change monitoring and modelling landscape dynamics gained in significance (Houet et al., 2010). Visualization of scenarios is a great way to discover and predict inhabitants' needs. Gibon et al. (2010) illustrates the need of integration and participation that considers socio-ecological processes in the modelling and elaboration of scenarios.

The aim of this study was the choice of an optimal way of management of the small water body's surroundings based on scenario building and public participation.

## MATERIAL AND METHODS

### Study area

A small water body being researched is located in the administrative boundaries of the Lublin city, in the surroundings of the Zemborzycki Reservoir with leading recreational functions. This area belongs to the Bystrzyca River valley (Fig. 1). In the area development plan, this area was designed as a green area, whereas local plans of spatial development did not include it.

In 2007, after the construction of the bike and walk path on a substantial section of the western shore of the Zemborzycki Reservoir, a separate small water body was created in the immediate vicinity of the reservoir as a result of cutting off one of its bays after the construction works of the embankment; but it is still staying connected with the reservoir by a concrete culvert.

Instead of localization of the small water body in the city and fields, it is intensively used as an agricultural constitute for a significant part of the catchment.

From the east, a single-family housing is a dominant way of land use, and on the eastern part there is the Zemborzycki Reservoir.

The small water body has only 0.13 hectares and is a land depression constantly filled with water. Up until 2010, it acted as a receiver of pollutants and was also used as an illegal dumping ground. In that state it did not have any natural and landscape values.



Figure 1: Localization of small water body under study.

### Sampling analysis and measurements

In the concept development process of the small water body's management, several studies were conducted; because of this, it was possible to carefully study the specificity of the area and create an optimal solution important to the interests of nature and landscape conservation (Sender and Kułak, 2010; Kułak et al., 2011).

Different scenarios of management and functioning of the small water body area, as well as its surroundings, were based on earlier questionnaire surveys carried out in the surrounding area of the Zemborzycki Reservoir, regarding the needs and recreation preferences over water areas (Kułak and Waryszak, 2010; Kułak, 2013).

A public consultation that was carried out by a questionnaire of 80 people resting nearby the object under the study was the next step of our research. We wanted to find out the demands of the people visiting the study area and involved its users.

The questionnaire consisted of two parts. The first part included a graphic presentation (photographs) and descriptions of the object, concerning its current status, functioning and use, as well as values and problems. In the second part, three scenarios of different ways of management were presented to respondents: a) ecological and educational, b) representative and recreational, c) left in its current form. For each scenario, the descriptive functional and spatial program (Fig. 2) a location plan (a top view) and four 3D visualizations were presented.

Next, people were asked to tell us which of the presented scenarios is preferred by them and if it would be of worth to conduct the implementation. In case the respondents did not agree with any of the presented options, they had also a possibility of not pointing out any particular scenario, as well as the ability to free expression. Choice was written down in each questionnaire given to the respondents.

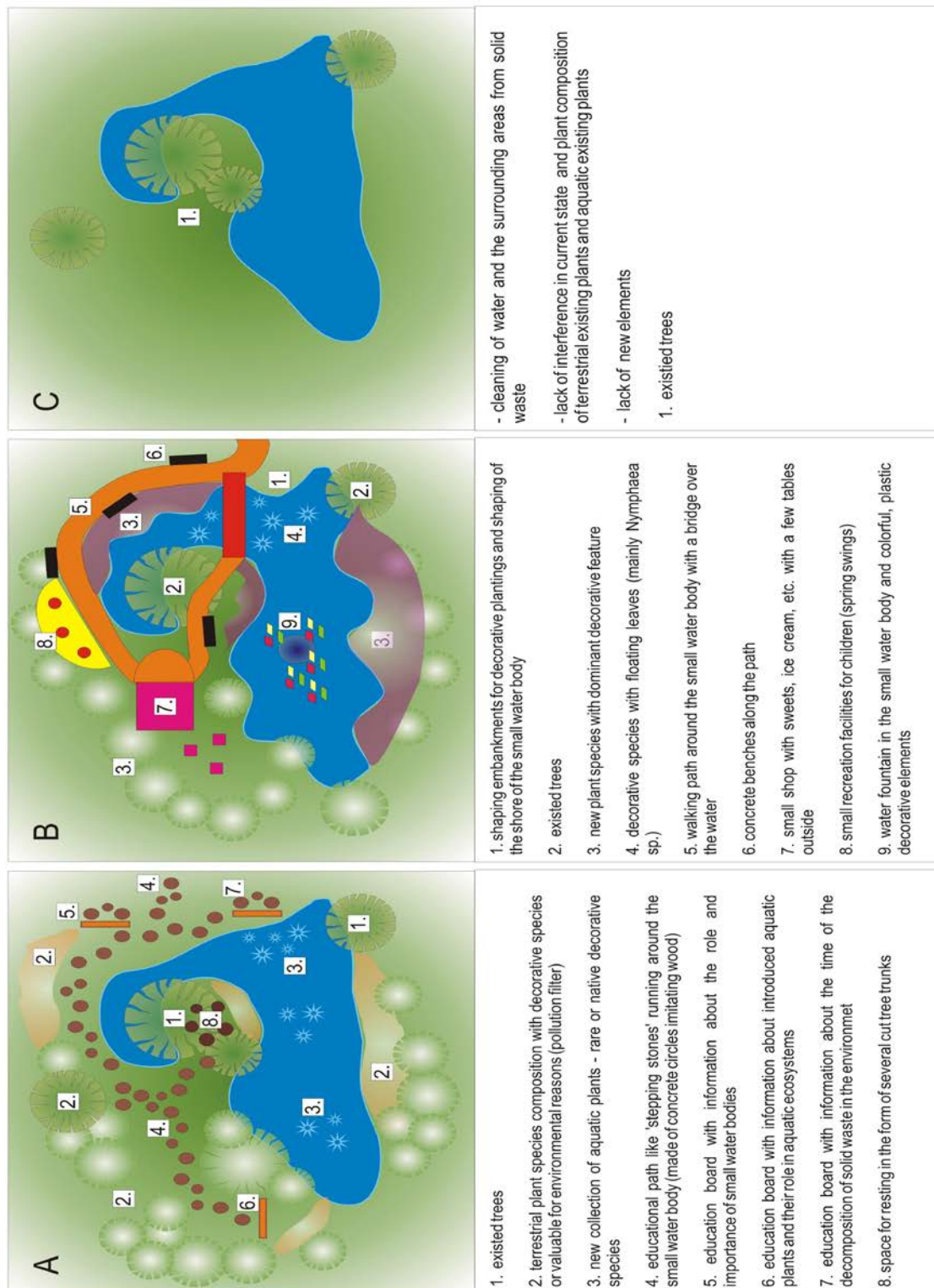


Figure 2: Visualization of three different scenarios of the small water body.

Each concept included five categories of information about the following: land use around the small water body vegetation, elements of infrastructure, materials used, and a target group (Tab. 1).

Table 1: Three scenarios of different ways of management: a) ecological and educational, b) representative and recreational, c) left in its current form.

	The concept of expanded ecological and educational function	The concept of expanded representative and recreational function	The concept of leaving its current form
Area	<p>Assumptions:</p> <ul style="list-style-type: none"> <li>• cleaning of water and the surrounding areas from solid waste;</li> <li>• stabilization of the water level in the small water body (valve on the conduit);</li> <li>• a small interference with the natural terrain and shores of the small water body, including necessary levelling for the introduction of a walk and bike path.</li> </ul>	<p>Assumptions:</p> <ul style="list-style-type: none"> <li>• cleaning of water and the surrounding areas from solid waste;</li> <li>• stabilization of the water level in the small water body (valve on the conduit);</li> <li>• a great interference with the natural terrain and shores of the small water body, including levelling of the ground, shaping embankments for decorative plantings and shaping of the shore of the small water body according to the project.</li> </ul>	<p>Assumptions:</p> <ul style="list-style-type: none"> <li>• cleaning of water and the surrounding areas from solid waste;</li> <li>• lack of water level stabilization in the small water body (possible periodic drying);</li> <li>• lack of interference with the natural terrain and shores of the small water body.</li> </ul>
Vegetation	<ul style="list-style-type: none"> <li>• a small interference in the current state and plant composition of existed vegetation;</li> <li>• removal of a small amount of plants that obstruct or prevent the free use of land;</li> <li>• enrichment of terrestrial plant species' composition of decorative species or value for environmental reasons (pollution filter);</li> <li>• leaving most of the existing aquatic plants and the implementation of a new collection of aquatic plants – rare or native decorative species.</li> </ul>	<ul style="list-style-type: none"> <li>• a great interference in current state and plant composition of existed vegetation;</li> <li>• 80% removal of existing vegetation;</li> <li>• planting new plant species with dominant decorative feature;</li> <li>• removal part of existing aquatic plants (especially underwater);</li> <li>• planting of decorative species with floating leaves (mainly <i>Nymphaea</i> sp.).</li> </ul>	<ul style="list-style-type: none"> <li>• lack of interference in the current state and plant composition of existing terrestrial plants;</li> <li>• lack of interference in the current state and plant composition of existing aquatic plants.</li> </ul>

Table 1 (continued): Three scenarios of different way of management: a) ecological and educational, b) representative and recreational, c) left in its current form.

Infrastructure elements	<ul style="list-style-type: none"> <li>• creation of an educational path like “stepping stones” running around the small water body (made of concrete circles imitating wood);</li> <li>• the placing of three education boards located at the educational path. The first with information about the role and importance of small water bodies. The second with information about introduced aquatic plants and their role in aquatic ecosystems. The third board is designed for the youngest users, made up of rotating elements that will contain information about the time of the decomposition of solid waste in the environment;</li> <li>• creation of space for resting in the form of several cut tree trunks, set under the largest tree</li> </ul>	<ul style="list-style-type: none"> <li>• creation of paved walking path around the small water body with a bridge over the water;</li> <li>• setting concrete benches along the path;</li> <li>• location of a small shop with sweets, ice cream, etc. with a few tables outside;</li> <li>• setting up a small recreation facility for children (spring swings);</li> <li>• introduction of a water fountain into the small water body and colorful, plastic decorative elements.</li> </ul>	<ul style="list-style-type: none"> <li>• lack of new elements.</li> </ul>
Materials	<ul style="list-style-type: none"> <li>• natural or imitating natural – wood, stone, gravel, bark, concrete with wood-effect, etc.;</li> <li>• no color contrast, low-key, natural.</li> </ul>	<ul style="list-style-type: none"> <li>• metal or artificial – plastic, resin, gum;</li> <li>• contrast colours.</li> </ul>	<ul style="list-style-type: none"> <li>• lack of putting new elements.</li> </ul>
Target group	Each age group.	Each age group with the main children function.	Difficult access – limited use.

## RESULTS AND DISCUSSION

Visualizations of three land use management scenarios were prepared to collect information about users' needs (Fig. 2).

The interviews were suitable to obtain information about standards of the way of spending free time. The action was received positively, respondents willingly took part in the survey, expressing the joy of interest in this place that was up to now quite neglected. They appreciated the fact that their opinion is important for designers and will have a significant impact on the development of a concrete implementation.

Of the basic conducted questionnaire survey, the vast majority of respondents chose the first scenario that was chosen by 62% of respondents (Fig. 3.)

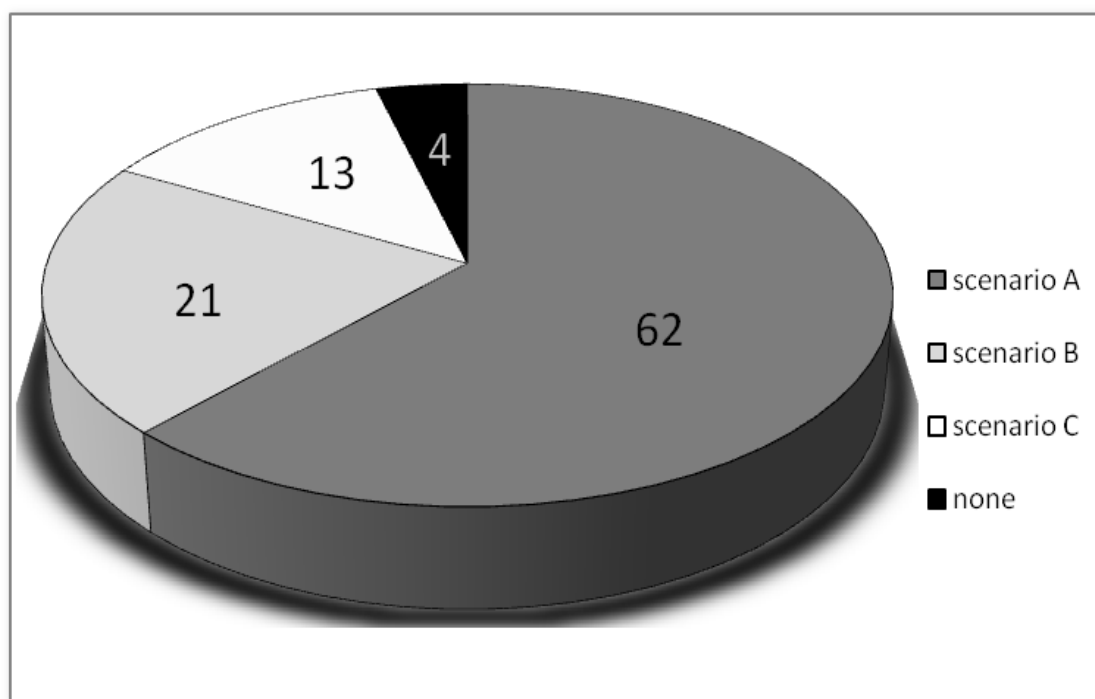


Figure 3: Percentage share of chosen by respondents' scenarios.

The representative and recreational scenario was chosen by 21% of respondents, whereas 13% chose leaving the current state of the area. Only 4% of asked people were not interested in any future works in this area. The results revealed the importance of a piece of nature in suburban areas. Chosen by respondents, the ecological and educational scenario of the small water body management was implemented in 2012 (Figs. 4a-d). Results showed that the project of revitalization of the small water body was very important for interviewees. The area surrounding the small water body belongs to the Lublin city, and that is why the work was supported by the Department of Natural Protection in the Municipality Lublin.





Figure 4a: Area under the study before (2011).



Figure 4b: Area under the study before (2011).





Figure 4c: Area after the revitalization (2012).



Figure 4d: Area after the revitalization (2012).

## DISCUSSION

Small water bodies have a great biological function. Together with the surrounding vegetation and soils, they constitute an ecological system for wild flora and fauna species (Goławski and Kasprzykowski, 2007). Simultaneously, they provide an increased biodiversity of the surrounding area (Kalbarczyk, 2003). Furthermore, small water bodies affect the level of groundwater and soil water management of the surroundings areas (Fiedler, 1997). They constitute suitable habitats for the development of aquatic vegetation – macrophytes (Hartog and Segal, 1964; Cook, 1983; Wołek, 1996; Maślanko et al., 2011). Macrophytes in the small water body shape abiotic and biotic conditions, influencing mainly on the fertility of the waters, plants and animals species composition, provide a place of feeding, breeding and refuge for many aquatic invertebrates and fish; as well as habitats for avifauna (Kornijów and Radwan, 2000). Moreover, they can act as a barrier in the form of capturing and neutralizing a filter of elements flowing from the catchment (Wiater, 2005). Probably because of planting, many different submerged and emergent macrophytes species, the biodiversity of the small water body under the study will increase.

For landscape architects, it is crucial to understand peoples' needs and expectations, because they are responsible for creating a new reality. The best way to understand them is to allow people to express their opinions. Buchecker et al. (2003) found that direct participation in the landscape changes raises residents' responsibility for their living environment, creates basis for sustainable development and enables social and cultural integration as the consequence of higher interest in regional and national politics. Participation in environmental activities has been acknowledged to play a role in increasing scientific literacy in a broader sense (Conrad and Hilchey, 2010), as helping to promote a reconnection between people and nature (Devictor et al., 2010; Hobbs and White, 2012), as well as raising awareness of environmental issues (Brossard et al., 2005; Jones-Walters and Cil, 2011). The local space users are usually addressed by interviews made in the field (Hinterberger et al., 2000; Volk, 1992). To obtain general valid information, a high number of interviews need to be conducted (Janovsky and Becker, 2003). In the decision-making process, a public participation seem to play an important role, because thanks to it, taken actions are accepted, thus fulfilling needs of most users and allowing for identification of the society with a given place. Thanks to a public participation, a new and improved reality, balancing the needs of society and nature conservation can be shaped.

A concept of revitalization of small water bodies in suburban areas is an example of creating "green areas" in the city. It provides possibilities of outdoor recreations for Lublin inhabitants. Designing of this kind of recreation should be accomplished so that the sustainability of these areas is preserved and it should provide the future generation with the opportunity to enjoy the natural values of the outdoor recreation at an even higher level (Bell, 2007). Natural attractions in suburban areas are one of the recreational resources in ecotourism and these attractions are located in most of rural areas in the world. Conducted research pointed out that ecological and educational types of scenarios are needed. We concluded that probably the Zemborzycki Reservoir fulfils an intensive type of recreation in Lublin city, whereas people also need some enclaves of nature close to their homes.

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