A TOURISTIC CONCEPT OF LAND MANAGEMENT OF ZAKLIKÓW'S RESERVOIR BASED ON ITS NATURAL VALUES (SOUTH-EASTERN POLAND)

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ABSTRACT

The aim of the study was to determine actions towards enrichment of natural aspects of the water reservoir in Zaklików, with consideration of nature protection and social needs. For this purpose, physical and chemical parameters of the reservoir, floristic and physiognomic characteristics of the area, cartographic analysis of land use, natural and touristic valorisation, and the concept of tourism development of the area were considered. The reservoir, based on the ESMI index, rated as moderate ecological status. The highest natural and tourist values, as well as the highest intensity of conflict between them, were located in the north-eastern and central part of the study area. Based on all analyzes, a concept of development of the study area was created, consistent with the local development plan.

RÉSUMÉN: Un concepto turístico de manejo de tierras en el reservorio Zaklikow, en el contexto de valores naturales (sureste de Polonia).

El objetivo de este estudio fue determinar acciones para enriquecer de forma natural las aguas del reservorio Zaklików, tomando en cuenta la protección a la naturaleza y las necesidades sociales. Para tal fin, se muestrearon parámetros físicos y químicos en el reservorio, se midieron características florísticas y fisionómicas del área, se llevaron a cabo análisis cartográficos y de uso de suelo, se realizaron valoraciones turísticas y del capital natural así como también estudios del desarrollo turístico del área. Sobre la base del índice ESMI, el reservorio se catalogó con un grado de impacto ecológico moderado. Los valores más altos de capital natural y turístico, así como la más alta intensidad de conflictos, se localizaron en las partes noreste y central del área de estudio. De acuerdo con los análisis se logró crear el concepto de desarrollo en el área de estudio, el cual es consistente con los planes locales de desarrollo.

REZUMAT: Un concept turistic de gestionare a terenurilor din zona lacului de acumulare Zaklików din punctul de vedere al valorilor sale naturale (sud-estul Poloniei).

Scopul studiului a fost acela de a elabora măsurile care să ducă la îmbogățirea naturală a lacului de acumulare Zaklików, luând în considerare protecţia naturii şi nevoile sociale. În acest sens, au fost evaluaţi parametrii fizici şi chimici ai lacului, caracteristicile floristice şi fizionomice ale zonei, analiza cartografică de utilizare a terenului, evaluarea elementelor naturale şi turistice, precum şi conceptul de dezvoltare turistică a zonei. Pe baza indicelui ESMI s-a stabilit o stare ecologică moderată a lacului de acumulare. Cele mai mari valori atât naturale cât şi turistice, precum şi conflictul cu cea mai mare intensitate s-au constat în partea de nord-est şi centrală a zonei de studiu. Pe baza tuturor analizelor, a fost creat conceptul de dezvoltare a zonei de studiu, în concordanţă cu planul de dezvoltare locală.

INTRODUCTION

Water is one of the most important components of the natural environment. Its suitable availability and quality is essential for the proper functioning of all organisms on the Earth (Poskrobko et al., 2007).

Poland is a country poorly resourced in water; its average abundance of surface waters is 62 km³. This indicator is three times smaller than the average value for the European Union and almost five times less than the average value of the world. In connection with the development of agriculture, industry, and other sectors of the economy, the demand for water has rapidly increased, while a very large part of it was contaminated. (Poskrobko et al., 2007)

According to the recommendation of the Water Framework Directive, the state and ecological potential of waters are defined by three basic criteria: biological (the composition and abundance of aquatic flora, benthic invertebrate fauna and composition, abundance and age structure of fish fauna), hydromorphological (hydrological system, the continuity of the watercourse, morphological conditions) and physico-chemical (salinity, state acidification, thermal conditions, biogenic, oxygenation, and pollution of priority substances identified as being discharged into water bodies, and contamination by other substances identified as being discharged in significant quantities water bodies) (Water Framework Directive 2000/60/EC, 2000).

In determination of the class of ecological potential of the water reservoirs, the importance of the lowest classified part of their quality obtained in the evaluation procedure is taken into account and accepted as the ultimate result (Water Framework Directive 2000/60/EC, 2000). Assessment of the state and ecological potential of waters allows activities to improve the quality of surface waters. It also allows their rational management, which is a key element in the struggle against the deterioration of water quality (Poskrobko et al., 2007).

Besides satisfying the needs of production and consumption, water is also used in tourism. Nowadays, properly arranged reservoirs represent one of the most commonly visited places by tourists (Kożuchowski, 2005).

Touristic values are specific elements and features of the geographical environment or various types of expressions of human activity – which are actual, available attractions for tourists (Bieńczyk, 2003). Their concentration is unequally distributed in the area (Migoń, 2012). The basic condition for discretion of an object or phenomenon as a touristic value, apart from having the characteristics of stimulating interest and permanent or temporary access for tourists, is its clarity in the landscape that allows for sensory perceptions.

The most important division of tourist values deemed to be their differentiation based on the origin. In this way, they are divided on natural values: created by nature and man-made created by human (anthropogenic). They complement, overlap, and depend on each other, and during their use it is quite difficult to distinguish between natural and anthropogenic components of space tourist's resources (Kożuchowski, 2005).

In tourism, natural values are features of elements of the environment that are assessed by tourists, arousing their interest and attracting them to a particular place (Boud-Bovy, 1985; Gaworecki, 2007; Lijewski et al., 2008). The size and direction of tourism are primarily shaped by natural values, constituting a major factor in attracting tourists. A diversified terrain, a mild climate, a presence of surface waters, and a presence of rich vegetation have a particular importance. However, the highest attractiveness is guaranteed by the contrast of natural landscape, treated as a set of these factors (Kowalczyk, 2000).

The second type of touristic values are the anthropogenic structure – material objects, closely associated with life, work, and human activity, produced by him in the process of historical development and being of interest to tourists. Among these anthropogenic values,

historical monuments of architecture and engineering play the main role (Lijewski et al., 2008). Apart from tourist and natural values, one of the main factors attracting tourists is providing them with appropriate conditions for rest is suitable touristic management (Kowalczyk, 2000; Rogalewski, 1979; Sessa, 1983; Kruczek, 2012).

Surface waters are a very important natural value that affects the tourist attractiveness of an area. In many cases, their occurrence generates a choice of summer holidays by tourists (Młynarczyk and Zajadacz, 2008; Kowalczyk, 2000). Water reservoirs, together with the adjacent areas, create conditions for life of many flora and fauna species not found in terrestrial ecosystems, often under protection. In addition, surface waters are a valuable part of the visual landscape, increasing its aesthetic values (Kożuchowski, 2005).

Due to its tourist attractiveness, water bodies are particularly vulnerable to degradation because of the increase of tourism concentration in their surroundings. Therefore, they are very vacillating ecosystems, sensitive to external impacts. The main reasons of a negative impact of tourism on the water reservoirs are: water pollution by wastewater from touristic houses facilities; the lack of sewers; leaking septic tanks; leaking gasoline and oil from boats; as well as direct littering. The consequence is a whole range of negative effects, which can be divided into indirect and direct. Indirect groups include reducing conditions of aquatic ecosystems, and changing the composition of water and eutrophication. Among the direct effects there is a discernible increase in water turbidity, increasing the amount of nutrients, growth of harmful bacteria and other organisms, change in water quality and an introduction of alien species (Młynarczyk and Zajadacz, 2008).

Limiting the risks associated with the development of tourism requires undertaking actions, among which valorisation of the area is important key. It means evaluating and comparing with each other individual elements of a particular area. The aim of the tourist valorisation is to prepare the basis for finding the optimal method of natural resources use and to ensure the adequate development of land space use for recreational purposes (Cowell, 2007; Chmielewski, 2012). The obtained results approximately allow determining the probable impact of tourist events and tourism traffic on the environment (Kożuchowski, 2005).

The aim of the study was to determine actions to natural enrichment of the water reservoir in Zaklików and changes in the infrastructure and its development, with the consideration of nature protection and social needs. For this purpose, the following research was conducted: physical and chemical parameters of the reservoir; floristic and physiognomic characteristics of the area; cartographic analysis of land use; natural and touristic valorization, as well as the concept of tourism development of the area.

MATERIAL AND METHODS

The study area is located in the most northern part of the Podkarpacie Voivodship and Stalowa Wola District, in the city and municipality named Zaklików (Fig. 1). Due to the hydrological location, it is situated in a basin of the Vistula and the San rivers. In the area under the study, there are no protected areas or natural monuments. At the nearest neighborhood, there is the Natura 2000 called “Janowskie Forests”. It was created to protect and preserve the unique landscape character and is one of the biggest forest complexes in Poland – Solska Primeval.

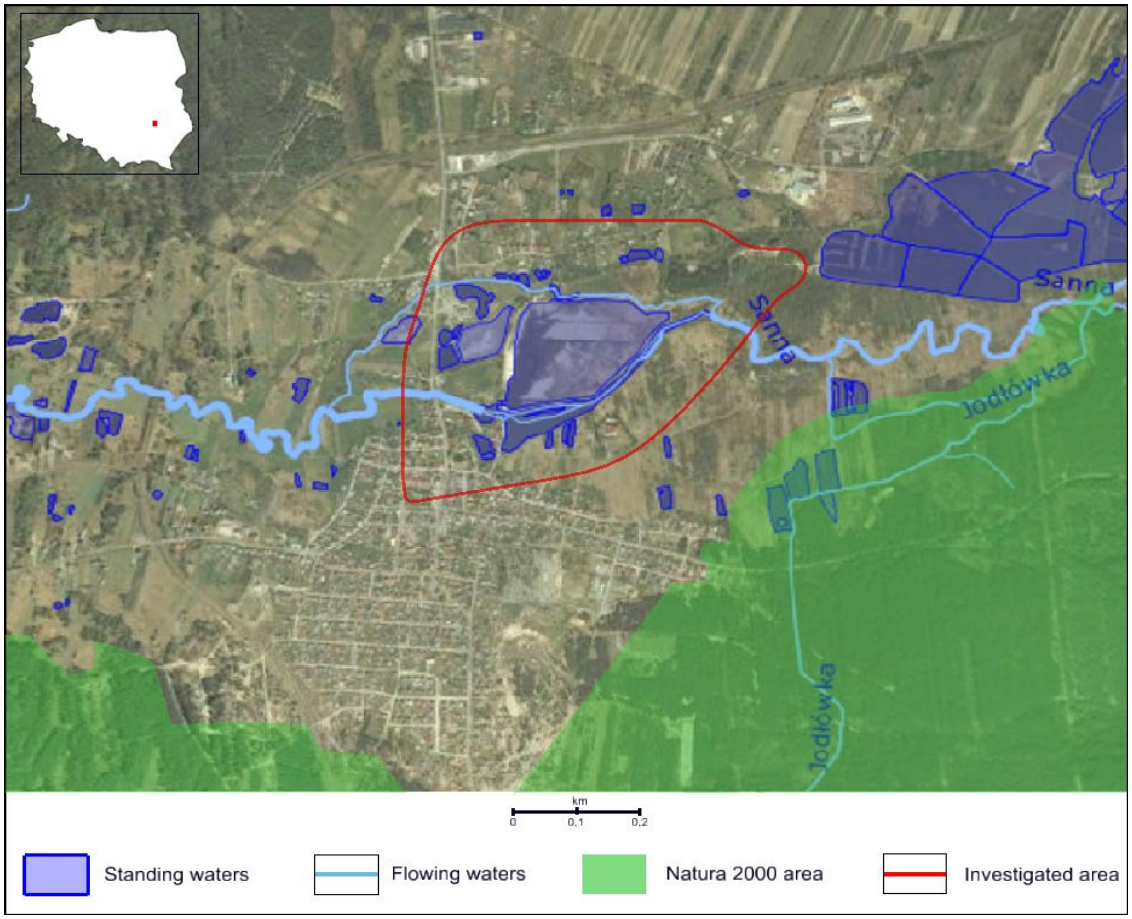

Figure 1: Study area location on the orthophotomap (http://mapy.geoportal.gov.pl/).

Within the analyzed area, the largest water reservoir is the one in Zaklików (Fig. 2), whose surface is approximately 20 ha. The reservoir was built in 1935 as a recreational object. Currently, its main function is retention – operation of flood control and recreation. The second tank is a fishing water body of approximately four ha, called by the inhabitants as the Giant Ferris Pond, because its waters supply a small private hydroelectric power. At the beginning of the XX century, it fuelled the local mill, as well as provided energy for the street lighting of Zaklików locality. Both the water reservoir and the fishing water body are powered by the Sanna River. The study included a buffer zone of the reservoir, amounting to 500 m zone around the reservoir.

Studied area was classified as area with favourable environmental conditions, slightly transformed by man. Among the risks is the lack of sewers and sewage treatment plants in the municipality, causing diffuse pollution of both water and soil through incorrect exploitation of septic reservoirs. Another is the lack of organizing and regularity in the collection and export of municipal waste from across the whole municipality. The consequence is the formation of illegal dumps affecting negatively on the whole environment. A negative phenomenon is also the illegal exploitation of sand dunes near the reservoirs. This results in the devastation of land and irrational management of resources. In the spring and autumn, there is a significant increase in the level of groundwater, rivers, as well as reservoirs, which in 2012 year contributed to the breaking of the dam and flooded parts of the city (Fig. 2) (Gurdak et al., 2013).

Figure 2: Burst dam on a fish pond in Zaklików in 2012 (http://wiadomosci.onet.pl/Kielce).

The study of physical and chemical properties of water and floral research were conducted in 2015 at four research sites located in two reservoirs in Zaklików. Research sites were taken: from fishing pond (1), whereas the other three from water reservoir: sequentially from the beach side (2), from the old Sanna riverbed (3) and at the mouth of the river to the reservoir (4) (Fig. 3). The selection of these research sites was according to variety of habitats and surroundings usage.

From each research site, water in quantities of about 100 ml was taken. Parameters that were analyzed: potential of hydrogen (pH); electrolytic conductivity (µS/cm), total hardness of water (mg $CaCO_3/dm^3$); and phosphate (mg P-PO_4/dm^3) and nitrates content (mg N-NO_3/dm^3). In addition, visibility of studied water using Secchi disc was investigated.

Vegetation studies were carried out in horizontal transects extending from the shoreline to the maximum depth of their occurrence (Sender, 2012a, b). Plant communities were examined and identified on the basis of the phytosociological method of Braun-Blanquet (Dzwonko, 2007). The syntaksonomic system was adopted from Matuszkiewicz (2013). The phytolittoral surface and the length of the shoreline inhabited by macrophytes were determined on the basis of real vegetation maps of the lakes created by the software Macrostation, version 8. Assessment of the ecological status of lakes was made based on Polish Ecological State Macrophyte Index ESMI officially recognized and accepted the task to monitor the stagnant reservoirs in Poland (Ciecierska et al, 2010):

$ESMI = 1 - exp\frac{-H*Z}{H_{max}}$, where:

H – plant diversity index;

H_{max} – maximum plant diversity;

Z – colonization index.

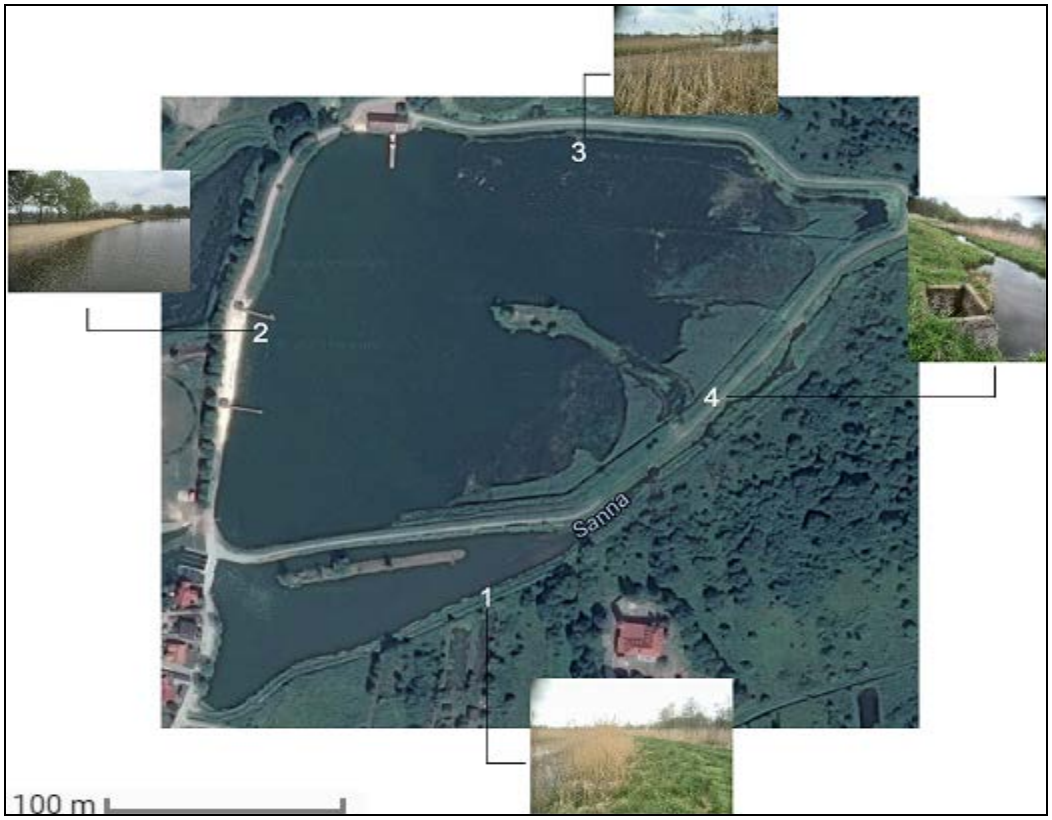

Figure 3: Distribution of investigated sites.

The analysis of physiognomy and land cover was based on field observations and interpretation of cartographic studies. On the basis of the way these maps were created they carried out the valorisation of the study area, where the system of Chmielewski's (2012) methodological assumptions was adopted. On the basis of the borders of land cover and terrain, the area was divided into natural-landscape units. Each of units was subjected to natural and touristic valorisation.

A natural valorisation was based on an assessment of:

- Ecosystem diversity. For each natural ecosystem, one point was added; for semi natural – 0.5 point (water reservoirs, wet meadows) and 0.25 point (drained meadows). If any ecosystem covered more than 50% area of unit, its points were doubled.
- Species diversity. For each flora and fauna point, the unit has one point.
- Threats like roads, agriculture, industrial objects. For each such object – one point was added.

The total sum points formed the basis of the environmental and tourism assessment. These values gave a basis to the calculation of the intensity of the conflict within each individual unit with the following formula:

$$K = \frac{(WP+WT)+1}{(WP-WT)+1}$$

where: K – intensity of the conflict; WP – sum points obtained from environmental valorization; WT – sum points obtained from tourism valorization.

The grading scale of the conflict's intensity:

From – 7 to – 3.8 – one point – very low;
From – 3.7 to – 0.6 – two points – low;
From – 0.5 to 2.6 – three points – moderate;
From 2.8 to 5.8 – four points – high;
From 5.9 to nine – five points – very high.

The next step was touristic valorization of all structural units of the investigated area, in which a five-point scale classification was prepared to rated them in categories such as:

- The diversity of terrain. Within each separated unit horizontal and vertical lines were designated. Then the sum of their intersections with the contour lines was calculated and their length in centimeters. These data are substituted into:

$$\frac{sum\ of\ intersections}{sum\ of\ length}$$

- Presence of standing waters. Each unit having within its borders received one point. If they occupied more than 50% of the unit area, the number of points was doubled.
- Presence of forests. Each unit having within its borders received one point. If they occupied more than 50% of the unit area, the number of points was doubled.
- Presence of cultural objects. Each object gave one point to the unit.
- Cultural objects. Each object gave one point to the unit.
- Viewpoints. Each object gave one point to the unit.
- Touristic management (accommodation and gastronomy objects, touristic routes). Each object gave one point to the unit.
- Destructive objects (roads, high voltage lines, agriculture, industrial objects). Each such an object gave one point to the unit.

Each assessment, presented as a map with different intensities of color, showed a richness of the data values of the analyzed area.

The next step was the calculation of intensity of conflict between them. After comparison of the results obtained for the individual structural units and the analysis of the zoning plan (Gurdak et al., 2013), in aim of organizing spatial structure, a division of the study area into functional zones have been made: nature protection zones, natural enrichment zones, and development of natural infrastructure zones. All analysis allowed the concept of tourism development of the study area.

RESULTS

Analysis of physico-chemical parameters allowed clearer determination of the seasonal changes in examined indicators (Tab. 1). Most of them increased in the autumn. The exception was nitrates, whose concentration in three research sites was much higher in the summer. The reason for this was mainly the impact of the intensity of precipitation, and hence runoff, variability of plants, and the varying intensity of the development area. By comparing the results of all the research sites, it could be noted that the high values for most indicators showed the fishing pond, which could be due to the close proximity to dense building, as well as intensive use of the pond for fishing purposes and energy targets. Other research sites located on the big reservoir were characterized by similar values, but the highest were noted in the site number 4, located at the mouth of the river to the reservoir. This suggested that the river was a carrier of many impurities, what was evidenced by the high degree of electrolytic conductivity at this site, it was also a carrier of nutrients, in particular nitrates. The best physico-chemical conditions were found in water taken from areas located below the beach. In these parts, the value of the pH of water excited close to neutral, low level of impurities, total hardness, nutrients, as well as the highest visibility of water. It could suggest that this was due to the wide angle of that place of water intake from the river mouth to the reservoir. Before water reached the other side of the reservoir, pollutants and nutrients were accumulated in large quantity by the plants in the tank. It proved the self-cleaning capacity of the tank. Water at both reservoirs had low values of total hardness, so their characters were very soft, probably influenced by the absence of chalky substrate.

Table 1: Results of physico-chemical analysis of water of Zaklików's reservoirs (S – summer, A – autumn).

Parametres	water reaction (pH)		electrolytic conductivity (µS/cm)		total hardness of water (mg $CaCO_3/dm^3$)		Phosphate (mg $P\text{-}PO_4/dm^3$)		Nitrates (mg $N\text{-}NO_3/dm^3$)	
Season / site	S	A	S	A	S	A	S	A	S	A
1	7.1	7.4	361.2	358.4	8.3	7.7	0.03	0.69	1.10	0.74
2	6.8	7.3	339.0	367.9	3.4	7.6	0.12	0.14	1.10	0.47
3	6.6	7.3	343.7	385.6	4.3	7.5	0.52	0.56	0.10	0.32
4	6.9	7.3	356.2	380.0	5.0	7.6	0.09	0.37	1.08	0.64

In the study area, there was a high variety of plant species (Tab. 2). They primarily constituted cosmopolitan plants, rush and aquatic vegetation, as well as woody water vegetation.

Table 2: identified plant species.

No.	species	quantity
1.	*Plantago major* L.	+
2.	*Heracleum sphondylium* L.	+
3.	*Heracleum sosnowskyi* Manden.	+
4.	*Hedera helix* L.	2
5.	*Geranium pratense* L.	2
6.	*Artemisia dracunculus* L.	1
7.	*Artemisia vulgaris* L.	3
8.	*Chelidonium majus* L.	1
9.	*Nuphar lutea* L.	1
10.	*Sambucus nigra* L.	2
11.	*Crataegus oxyacantha* L.	3
12.	*Carpinus betulus* L	1
13.	*Malus* Mill.	+
14.	*Acer platanoides* L.	+
15.	*Trifolium repens* L.	1
16.	*Oenanthe aquatica* (L.) Poir.	+
17.	*Lythrum salicaria* L.	+
18.	*Arctium* L.	1
19.	*Glyceria maxima* (Hartm.) Holmb.	2
20.	*Sonchus oleraceus* L.	2
21.	*Elodea canadensis* Michx.	1
22.	*Alnus* Mill.	2
23.	*Cirsium arvense* (L.) Scop.	+
24.	*Juglans regia* L.	+
25.	*Typha* L.	3
26.	*Tussilago farfara* L.	+
27.	*Aegopodium podagraria* L.	+
28.	*Urtica dioica* L.	2
29.	*Convolvulus arvensis* L.	2
30.	*Potamogeton natans*	2
31.	*Robinia pseudoacacia* L.	+
32.	*Eupatorium cannabinum* L.	+
33.	*Equisetum arvense* L.	+
34.	*Rumex hydrolapathum* Huds.	+
35.	*Ulmus minor* Mill.	+
36.	*Salix alba* L.	+
37.	*Salix alba* L.	+
38.	*Chamaenerion palustre* Scop.	+
39.	*Carex limosa* L.	+
40.	*Phragmites australis* (Cav.) Trin. ex Steud	4

Water vegetation did not create typical for lake distribution. The main component of water vegetation was rushes; submerged plants occurred sporadically (Fig. 4).

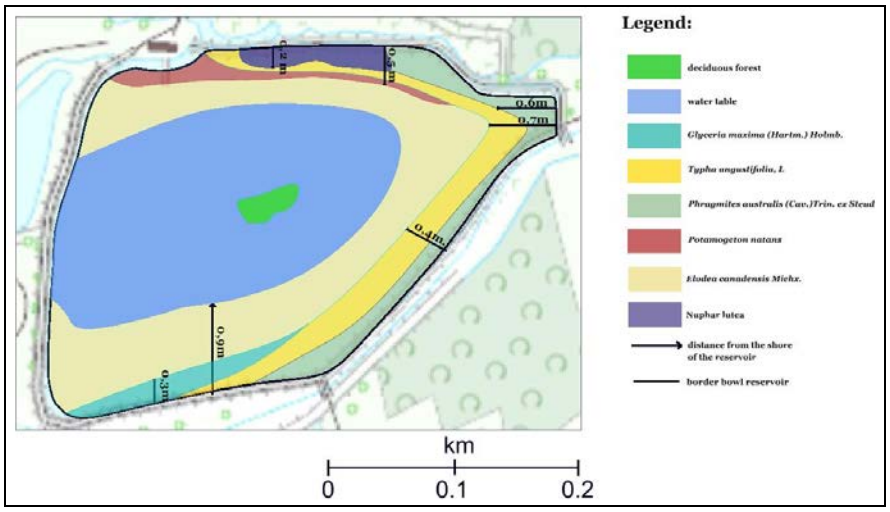

Figure 4: Distribution of plant vegetation in Zaklików Reservoir.

The ecological status of waters on the basis of ESMI ratio has been assessed as moderate. It means that the structure of the vegetation in the reservoir can be under rapid degradation, if any adverse factors will affect.

$$ESMI = 1 - exp\frac{-1{,}337 * 0{,}8075}{1{,}792} = 0{,}103$$

According to Chmielewski (2012), the research area was divided into 33 natural – landscape units. Within the units, based on the documentation (Gurdak et al., 2013) and field observations, the sites of protected species occurrence of fauna and flora were delimitated (Fig. 5).

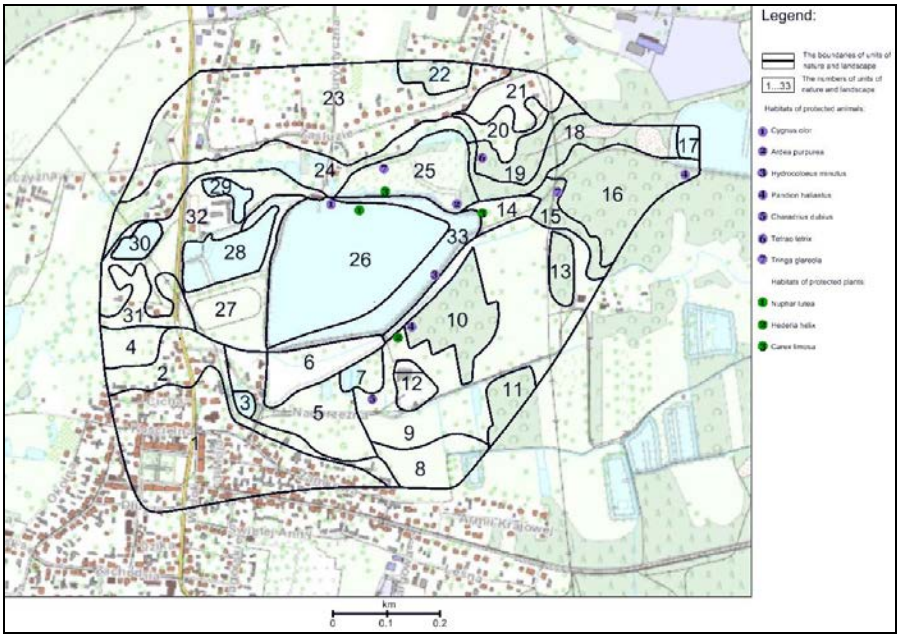

Figure 5: Protected flora and fauna species occurrence within borders of landscape units.

In terms of the occurrence of natural values, the most diverse unit was unit number 25, which is mostly, occupied by old the river Sanna bed (Fig. 6). This type of ecosystem favored the occurrence of many flora and fauna habitats. High natural values occurred in units with the following numbers: 10, 15, 16, 18, 19, 26 and 33, in the coverage of which dominated mainly forests, standing water, and rushes. The lowest natural values occurred in units' no. 1, 2, 20, 21, 23, 27 and 32. The main reason was low diversity, as well as the significant share of the various threats affecting negatively on the environment, such as roads or industrial objects.

The highest tourist values occurred in units' no. 18 and 19 (Fig. 7). This was due to steep slopes covered with forests, attractive for tourists and valuable points of presence of protected birds. High values were also characterized units with the numbers 5, 12 and 24, which were influenced by location within the elements of tourist infrastructure and diversity of the terrain. The lowest touristic values were characterized units number 20, 21 and 23, located in the north of the studied area. This affected the occurrence of unbalanced building, roads, agriculture and the absence of protected species, low diversity terrain, and a number of tourist infrastructure's elements.

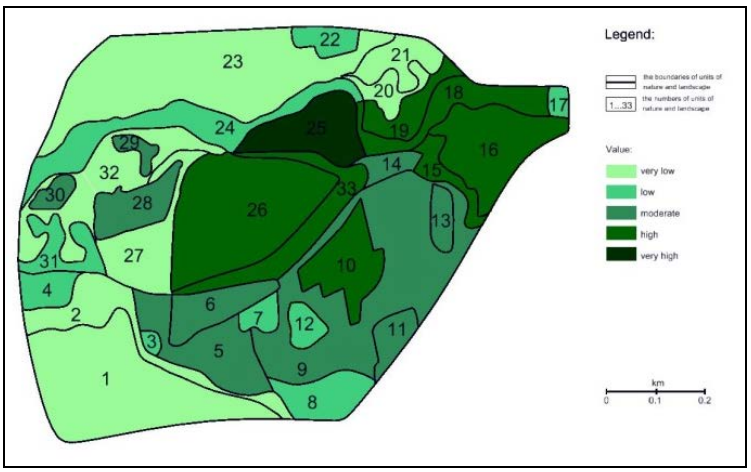

Figure 6: Natural valorization of area under the study.

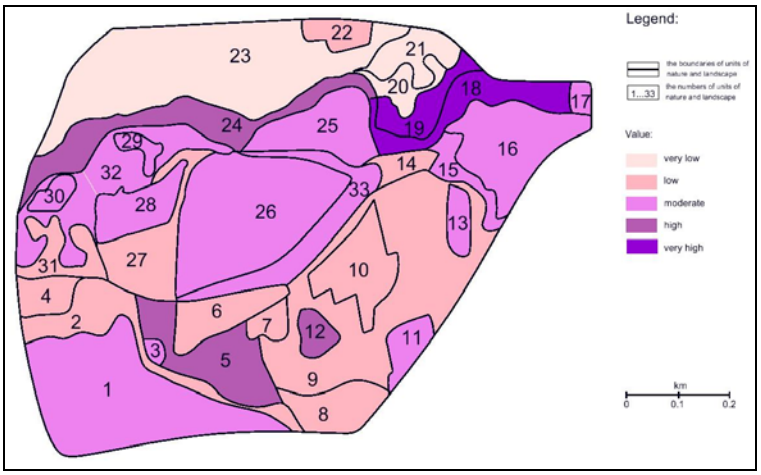

Figure 7: Touristic valorization of investigated area.

The highest intensity of a conflict was characterized by unit numbers 10, 15, 16, 26 and 33 (Fig. 8, Tab. 3), due to the presence in their borders valuable natural ecosystems and occurrence of protected plants and animals, as well as very high tourism values, encouraging people to visit these areas. A high intensity of conflict occurred also within the units with the numbers 6, 8, 14, 20, 21, 28, 29, and 30. They were characterized by comparable value of both nature and tourism. The lowest intensity of conflict appeared in the unit numbers 3, 5, 9, and 13, where the number of tourist attractions prevailed over the amount of natural values.

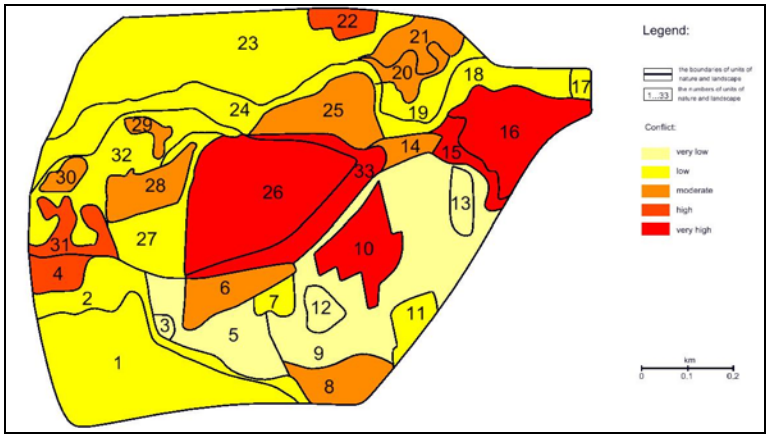

Figure 8: The intensity of the conflict between natural and touristic values of investigated area.

Table 3: The intensity of the conflict between natural and touristic values.

Number of unit	Natural valorisation	Touristic valorisation	Conflict	Scale bonitation
1	– 2	3	– 0.5	2
2	– 1	1	– 1	2
3	1	3	– 5	1
4	1	1	3	4
5	1.75	4	– 5.4	1
6	2	1	2	3
7	0	2	– 3	2
8	0.25	1	9	5
9	0.25	2	– 1.18	2
10	3	3	7	5
11	2	3	0	2
12	0.25	5	– 1.4	1
13	2	4	– 7	1
14	2.25	1	1.9	3
15	3	3	7	5
16	3	3	7	5
17	0.5	3	– 2.3	2
18	3	7	– 3.7	2
19	3	7	– 3.7	2
20	– 1	0	0	3
21	– 2	– 1	0	3

Table 3 (continued): The intensity of the conflict between natural and touristic values.

Number of unit	Natural valorisation	Touristic valorisation	Conflict	Scale bonitation
23	– 1.5	– 1	– 3	2
24	0.5	5	– 1.9	2
25	6	3	2.5	3
26	3	3	7	5
27	– 0.5	2	– 1.7	2
28	2	3	0	3
29	2	3	0	3
30	2	3	0	3
31	0.5	1	5	4
32	– 0.5	3	– 1.4	2
33	3	3	7	5

On the basis of the conflict intensity's analysis, one zone for the protection of nature, located in the north-eastern part of the study area, was delimitated (Fig. 9). Zones of enrichment of nature were separated in north-eastern and north-western part of the area. The other two areas were classified as areas dedicated to the development of tourism infrastructure.

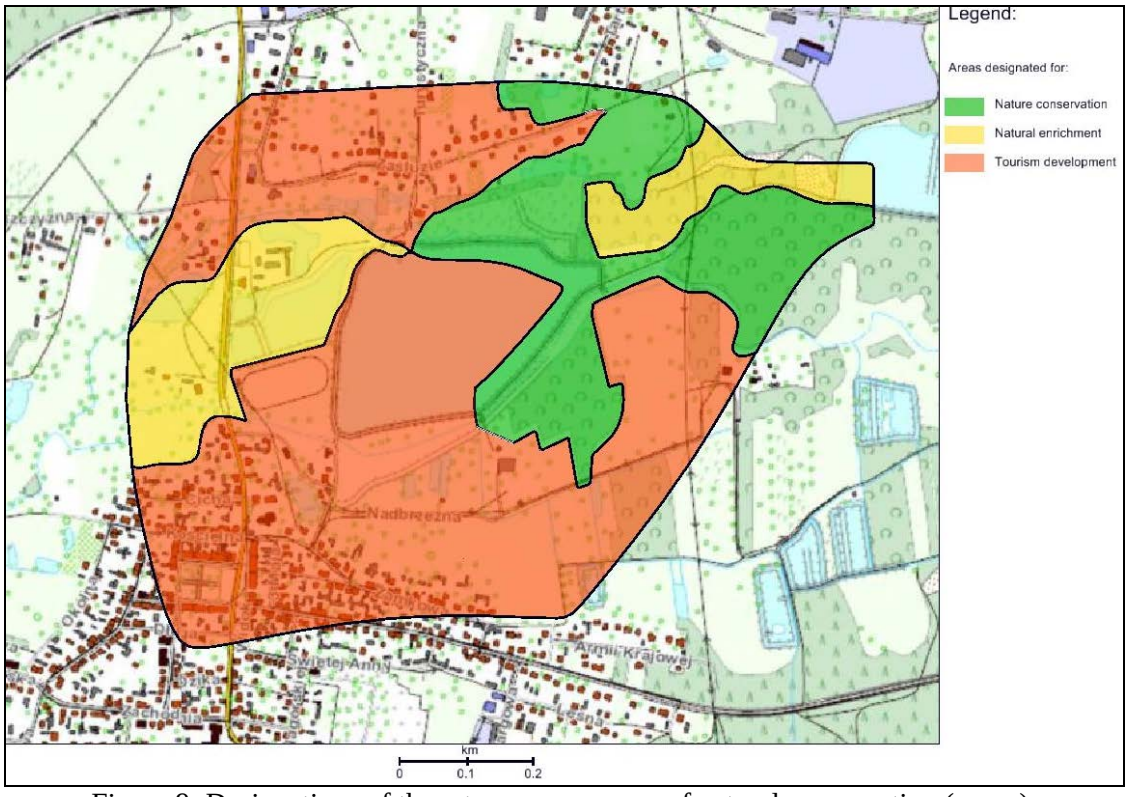

Figure 9: Designations of three type zones: zone of natural conservation (green), natural enrichment (yellow) and tourism development (orange).

On the basis of designated zones, as well as documentations (Gurdak et al., 2013), the concept of study area's development was developed (Fig. 10).

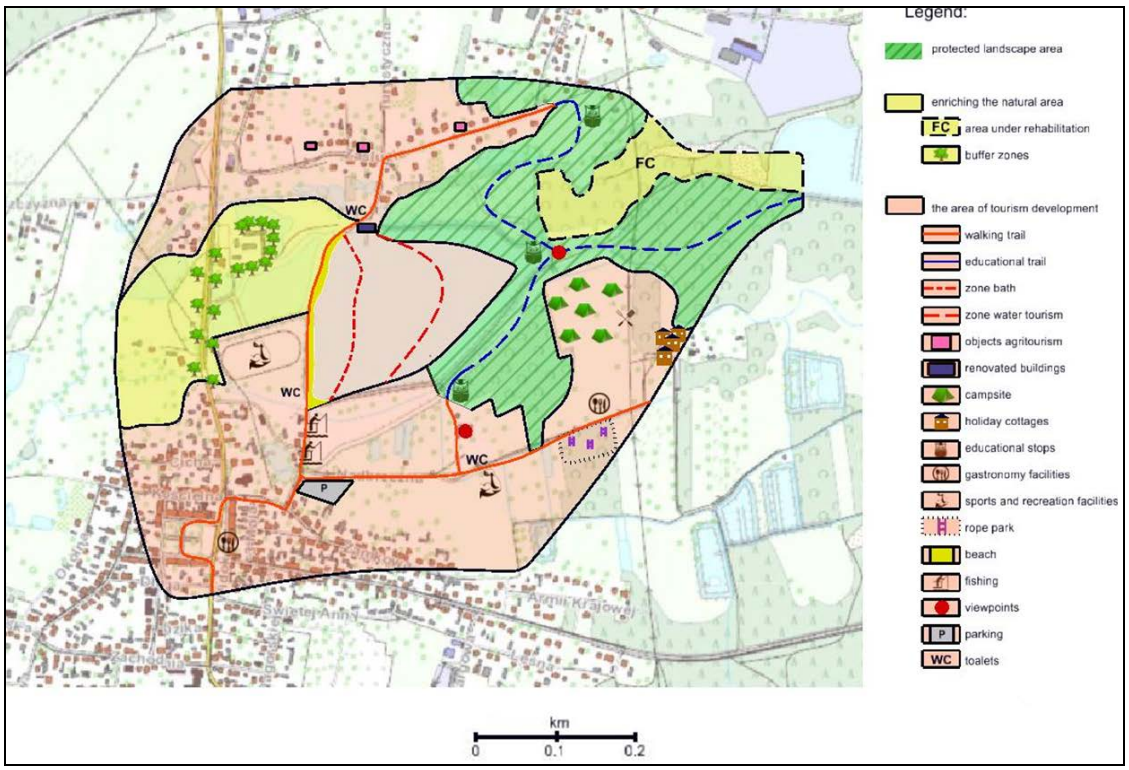

Figure 10: The concept of study area's development.

The natural protection zones comprised mainly of the eastern part of the study area, where deciduous forests, mixed forests, old river Sanna bed, rushes in the bowl of the tank, as well as peat excavations on the waterlogged meadows with the surrounding vegetation, occurred. These valuable ecosystems conducive to the occurrence of many plant habitats, as well as habitats of protected nesting birds. Due to the very high natural value, this part of the site should be taken under the legal protection. According to the study (Gurdak et al., 2013), it could be a protected landscape area. In order to satisfy social needs related to this area, it is suggested to appoint the nature path with educational stops and viewpoints, which would provide the association of residents and tourists with the local nature. The path would combine rich natural values of studied area with the nature reserve named "Łęka", localized in the "Janów Forests" Landscape Park.

Zones of natural enrichment concerned mainly areas with high and moderate natural values. In the eastern part of the area, they covered mixed forest, sand dunes, and part of the water tank. Due to the exploitation of sand, this area should be subjected to reclamation. In the western part, these zones were delimitated in the area including wet meadows, peat excavations with the surrounding vegetation and small water reservoirs. Also, an industrial object and the main road leading to the Zaklików city are in such zone. It was suggested to use plant vegetable protective belts as buffer zones to reduce pollution inputs into surface water, as well as the protection of natural habitats of wet meadows.

The development of a tourism infrastructure was recommended for the rest of the region. In the northern part, the agrotourism development was suggested where a compact farm and distributed buildings were located, which would constitute the base both to catering and accommodation facilities of the area. It was recommended to preserve green areas, pits peat land and small water bodies, affecting not only positively on the environment, but also enhancing its aesthetic value of observers. The zone designated for tourist development also included the reservoir, which would constitute the basis for the development of tourism of the whole analyzed area.

Due to their natural values, waters of the Sanna River that inflows into the reservoir and carries many contaminants, should be primarily clean. On the surface of the reservoir, it was recommended to separate zones for active tourism. Around the reservoir, it was suggested to make a path for tourists (walking, cycling, etc.). At the eastern shore, it is recommended to pour sand in order to expand the provided beach; a resort object located on the reservoir should be renovated and equipped with equipment for water sports. It would also be a good idea to research availability located near the sports field for tourists. In areas located in the southern part of the area (city Zaklików), it was recommended to create greenery areas and objects of small architecture. In the south eastern part of the study area, according to documentation (Gurdak et al., 2013), construction of another water reservoir was suggested. However, in our opinion, this is not a good idea because it requires felling approximately 10 hectares of deciduous forests and takes a large area of meadows. A better solution would be the construction of summer cottages, campsites, catering facilities and sanitation objects, which were in a little quantity over the study area. Also, it was recommended to create objects and sports and recreational facilities such as an outdoor gym or ropes course, as well as the construction of the parking near the reservoir.

CONCLUSIONS

Analysis of physical and chemical parameters showed clear seasonality of studied parameters.

The highest concentration of physic-chemical parameters shows the water in the fish pond, and the lowest, water from the site surrounded by meadows.

Floristic studies showed a large variety of vegetation, especially in the buffer zone. However, the reservoir, based on the ESMI index, rated as moderate ecological status.

On the analyzed area, there were many valuable habitats of plant and breeding birds. There were also a lot of unique morphological forms, as well as several interesting elements of tourist infrastructure.

The highest both natural and tourist values were located in the north-eastern and central part of the study area, the lowest in the north and south.

The highest intensity of the conflict occurred in the area with high tourist and natural values. They were located in the central and south-eastern part of the area. The lowest intensity of the conflicts occurred within the unit, where the tourist values prevailed over the natural values. They were distributed mainly in the southeastern part of the area.

Based on all analyzes, the developmental concept of the study area is consistent with the local development plan. A contentious issue is the construction of an artificial reservoir in the southeastern part of the area.

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