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Application of a morphological classification of shore features in assessing recreational resources at the lakeshore, as exemplified by Lake Głębokie in Szczecin (Poland)

Abstract: Source literature emphasizes the importance of lakes in the development of tourism-related functions of a given area. These functions are both connected with the lake itself, and with adjacent areas, based on the proximity of the water (Smith, 2003; Choiński and Borkowski, 2008; Duda-Gromada and Potocka, 2010). From the perspective of recreation, access to the lake is an important factor determining the presence of people on its shore. Accessibility of the shore should be understood as free access, with the option to rest, engage in recreation and bathe. This article presents a proposal for a natural and anthropogenic classification of lakeshores. It was employed in assessing the resources and recreational use of Lake Głębokie near Szczecin. The features and parameters of the lakeshore were assessed on the basis of a field survey and the applied valorization procedure. The analysis presented here was based on studies conducted in 2012 and 2017.

Keywords: lakes, recreational value, shore classification, use, degradation

1. Introduction

Issues related to evaluation of elements of the environment for the purposes of tourism are dealt with by numerous researchers (i.a., Sołowiej, 1992; Kruczek, 1996; Krzymowska-Kostrowicka, 1999; Gołębski, 1999; Gaworecki, 2000; Kożuchowski, 2005; Bródka, 2010). Another matter is assessment of the values and use of lakes or their shores for recreation. Evaluation of natural resources for the purposes of tourism or recreation is associated with sub-

jective evaluation (Krzymowska-Kostrowicka, 1999), which provides the basis for constructing comparative scales, known as valorization. Analyses of individual regions, environmental facilities or localities employ various forms of assessment, based on various criteria characterizing the features selected by the researchers (i.a. Bartkowski, 1985; Gołębski, 1999; Gaworecki, 2000; Kowalczyk, 2000; Kurek, 2007; Bródka, 2010).

1.1. Problems of valorization and recreational use of lake reservoirs

Lakes and other inland reservoirs constitute a potential resource for the development of tourism. Even with no additional adaptation of the reservoir, in the absence of any water infrastructure, they are in the area of interest of the recreation seekers. This mainly applies to lakes located in the vicinity of large cities, which are

a place of tourism and weekend recreation, in particular during the entire summer period. In the era of greater mobility, coupled with the desire to rest from work and city life, people are ever more frequently attracted to bodies of water. High intensity of tourist traffic on and around a reservoir results in increased pressure,

understood as degradation and environmental pollution. This pressure is exerted not only on the reservoir itself, but also on the shore area (Skłodowski et al., 2006).

Research on the use of lakes for tourism has been conducted intensively since the mid-1990s. Deja (2001) presented the first fuller attempt to assess lake use for purposes of tourism and recreation. Smith (2003) provided a broad classification into three types of tourism development, based on the reservoir's resources:

- various tourism and recreation activities based on water resources and infrastructure around the lake,
- water tourism developing thanks to access to water,
- forms of tourism developed indirectly at the reservoir, where the lake is only a side element of the environment.

Assessment of attractiveness and utilization of lakes is difficult for several reasons, including seasonality, close relation with the weather, diversity of lakeshore types, bathymetric conditions, and the lake's availability for potential tourists. There are a number of methodological solutions to assess the utility and use of bodies of water for tourism and recreation. Issues concerning lakes can be divided into two broad groups:

- studies related to lake basins, morphology, shoreline development ratio, physico-chemical properties of the water, and bathymetric conditions,
- studies of the lake's shores, their accessibility, development, use, state of nature and issues of environmental aesthetics.

Part of the applied research methods is based on the assessment of water status and physico-geographical features (Zwoliński, 1992; Skłodowski et al., 2006; Krukowska, 2007; Skrzypczak and Witkowska, 2007; Choiński and Borkowski, 2008; Świerk et al., 2010). Other methods center on evaluating the use of lakes and the condition of the shores (Skłodowski et al., 2006; Skrzypczak et al. 2007; Sroczyński, 2007). Some studies have examined the pressure of tourism, degradation and tourist absorption of lakes and

shores (Skłodowski et al., 2006; Cichoń, 2008), still others have focused on the use of lakes and their potential for tourism (Krukowska, 2007; Skrzypczak et al., 2007; Skrzypczak and Witkowska, 2007). Among the assessed characteristics of lakes, such elements are listed as the surface, shoreline development ratio, and depth of the lake – i.e. the so-called morphometric parameters (Choiński and Borkowski, 2008). Much fewer studies have been conducted on tourist use and degradation of the shores. To be able to use the lake itself, it is essential to have access to it. For this reason, we should assess the lake's shore from the perspective of its accessibility for recreation, and its transformations resulting from use. To date, very few attempts have been made to carry out such assessments (i.a., Skłodowski et al., 2006; Skrzypczak et al., 2007; Sroczyński, 2007).

Other approaches to valorization of lake resources are based on assessing the lake's location and development, analyzing its water resources, and experiences of the users themselves (Duda-Gromada and Potocka, 2010). The attractiveness of tourism and recreation of the lake's shore includes values related to aesthetics, landscape, and utility (Sroczyński, 2007).

The functional values of the lake's shore are influenced primarily its shape, height, erosion processes and parameters of the bottom near the shore, including the type of the bottom (Sroczyński, 2007). So far, there has been one classification of a lake shore that captures the relationship between its morphology and its use, from rocky cliffs to flat shores, which are of primary importance for recreation (Sroczyński, 2007). In addition, five classes of shoreline anthropization were proposed separately (Sroczyński, 2007), a key for assessment of shoreline vegetation (Skrzypczak et al., 2007), and an assessment of the degradation of shore vegetation (Skłodowski et al., 2006).

The purpose of this work was to conduct an assessment of tourist use on the basis of the proposed classification of shoreline morphology, which affects other natural and anthropogenic features of the shore's immediate area and its waters.

2. Characteristics of the area

Lake Głębokie (53°28'17 N, 14°29'06 E) is located in the northern part of Szczecin, in Puszcza Wkrzańska, a forest and heath area formed on moraine hills covered with fluvioglacial sands, and in the northern part by old dunes. This area is located on a busy route to Pilchowo and Police, and close to a tram and bus terminus (Fig. 1). Głębokie is a ribbon lake; it has no outflow and is fed by two small watercourses, as well as rainwater. The surface area of the lake is 0.31 square kilometers. Its length is about 1.8 kilometers, the average width is about 0.25 kilometers, and the elongation index λ is six. The shoreline is curvy and its length reaches approximately four km. The maximum depth does not exceed six meters, and the average reaches

2.5 meters. Annual fluctuations in the water table are up to 0.4 meters (my own measurements). Lake Głębokie is the largest reservoir located in the north-western part of the city and the only lake in the area where it is possible to engage in recreation with the use of water equipment. In winter, when the lake is frozen, it is used, among others by ice-skaters. The reservoir is surrounded by mixed and beech forests. Along the shore there are five impressive pedunculate oaks, which are monuments of nature. The wetlands are occupied by alder-ash forests. Pine trees appear on the sandy hills. In several places in clearings there are designated places for camping (Fig. 2). At weekends, Lake Głębokie is readily visited by residents in winter and summer alike.

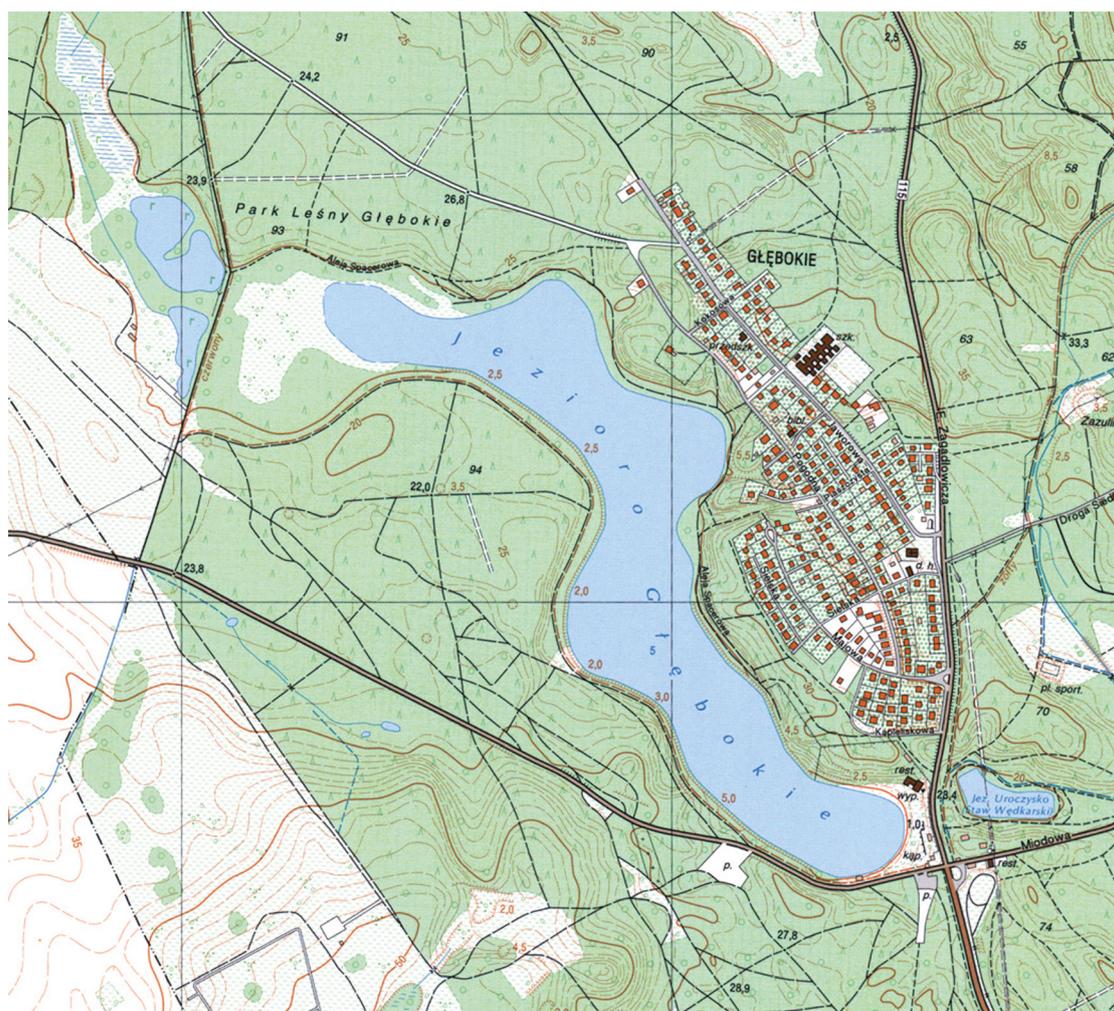


Figure 1. A topographic map of the area around Lake Głębokie (Mapa topograficzna Polski 1:10 000, 2003, Arkuśz Pilchowo)



Figure 2. Examples of the various shore types of Lake Głębokie and of their use. A – manmade beach with recreational infrastructure (section I), B – a picnic area with educational boards (section IV), C – anthropogenic erosion of the high shore (section II), D – inaccessible wetlands, a refuge for birds (section IV) (the author's own archive)

Around the lake there is a walking trail of over 9 km, used by hikers, runners, and cyclists. In summer, a paid swimming and bathing area is available, next to which there is a ropes course which has been in operation for ten years, a canoe rental shop, a pier, and a restaurant.

The lake has been used for recreation by residents of Szczecin since the 19th century. A bathing resort was officially established in the 1920s. In its morphologically diversified landscape, there are among others luxury villas,

located up to two hundred meters from the north-western shore of the lake, near the Szczecin-Police route.

A large part of vacationers, avoiding the fees for the paid swimming and bathing area, or the crowds usually present on the artificial beach, occupy the wild shores located along the entire reservoir. In 2008, to improve the water quality on the lake, an aerator was installed, which oxygenates the water and helps to remove nitrates and phosphates.

3. Methods

While making numerous observations of the recreational use of Lake Głębokie, an attempt was made to assess the lake's shore and its components in terms of valorization for the requirements of tourist use. From 2010 to 2012, in spring and summer, comprehensive field studies were carried out around the lake.

The research was repeated in 2017. The main purpose was applying the prepared classification of morphological features and natural parameters of the lake. In view of growing interest in the lake, an attempt was made to assess the degradation of nature around the lake, and its shore.

The field measurements consisted in taking an inventory of environmental features (among others, according to the proposals made in Lipniacki (1978) and Kruczek (1996). These were classified and presented in a code table. A topographic map on the scale of 1:10 000 was used for the purpose of the study. Morphological measurements were made using a GPS receiver and measuring tapes. The classification along with a part of the results of field studies from 2011-2012 were presented at the Congress of Geographers in Poznań in 2012 (Łabuz, 2012). The present study contains observations and results of the studies repeated in 2017, with reference to those of 2012. The research work was divided into several stages:

Stage I (preliminary) – the purpose and scope of the assessment were determined: features characterizing the lake’s shore and the spatial range of the area up to 100 meters from the shore were determined. Assessments of the suitability of lakes for tourism and recreation often emphasize the significance of shore heights (Sroczyński, 2007) and the type of vegetation on the shore (Skłodowski et al., 2006; Świerk et al., 2010). Based numerous

field surveys and observations of other reservoirs, a classification and a set of criteria for the assessment of morphological parameters, animate nature and anthropogenic procedures (including elements of pressure on the natural environment) were prepared.

The morphology and dynamics of the shore determine the lake’s usability, and show the natural tendencies evident in its transformations, also under the influence of intensive use (e.g. erosion patterns). The shore’s morphology, including its height above the level of the surface, affects the type of vegetation and the possibilities of using the reservoir. The main element of the classification is the height of the shore, assessed within 10 meters from the water line (Fig. 3). The following shore types were distinguished: low shore (N), up to 5 meters, and high shore, over 5 meters, either falling straight into the lake (W) or terraced (T).

This classification includes depths of up to 1 meter at the edge (P) as a factor determining safe bathing, as well as deeper zones marked as (G). All common combinations of shore features can be captured by this classification. It is supplemented by the possibility

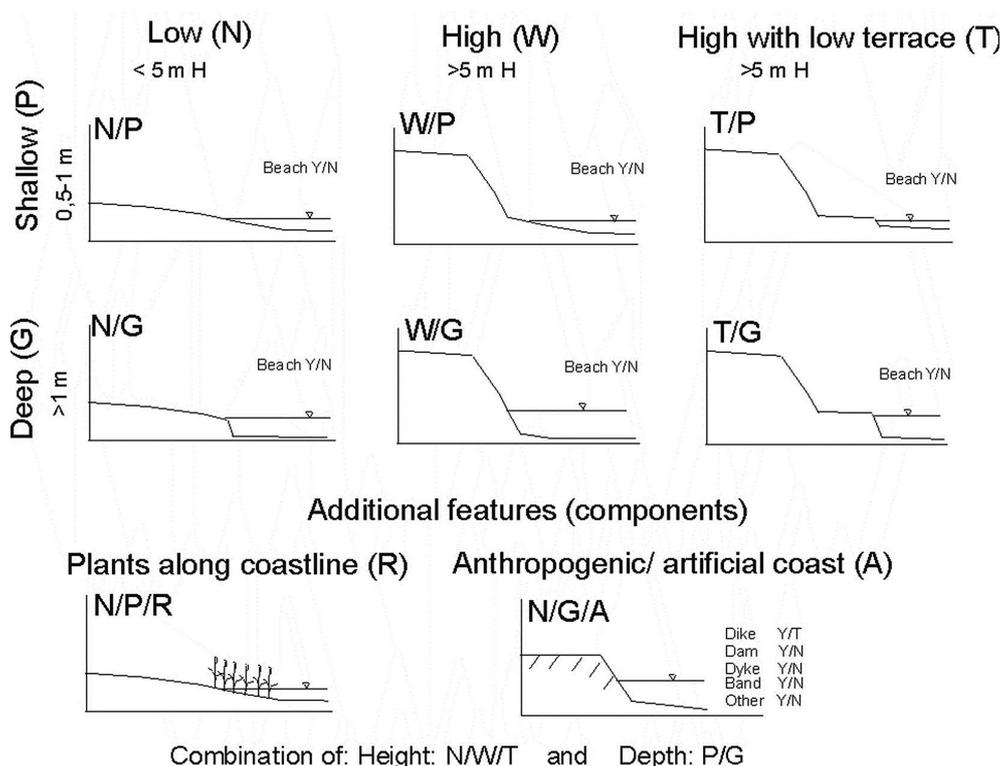


Figure 3. Morphological classification of the lake’s shores, taking into account vegetation and anthropogenic impact (the author’s own study)

of marking the vegetation (R), anthropogenic (manmade) shore (A), consisting of a flood-bank for example, an embankment, dam, or

wall for controlling erosion. Other morphological features of the shore are proposed in Table 1.

Table 1. Classification of the morphological features of a lake's shore and littoral zone (the author's own study)

Morphological features of the shore	Criteria			
Shore height (within 10 m from the water's edge)	low > 5m		high < 5m	
Shore height differences	<1.5m	1.5-3m	<3m	
Shore moisture conditions	dry	periodically flooded	permanent wetland	
Presence of a sandy beach	yes		no	
Shore morphodynamics	erosion (parameters)		accumulation (overgrowth)	
Erosion (description of the scale for the parameter)	along the shore a wave-cut notch under a cliff > 0.2 m and retracting land		spot retraction, small coves 1x1 meter along the shore	
Bottom type	silt	sand	gravel	other
Bottom depth at the shore (up to 5 meters from the edge of the water)	low 0.5-1m		high > 1m	
Objects on the bottom (do 15 meters)	none; clear bottom		tree branches and trunks submerged	
Bottom visibility	yes		no	
Others	present		none	

In a separate classification, the respective components of nature and criteria for taking its inventory were distinguished (Table 2). They include, among others, plant habitats on the shore within the strip up to one hundred meters wide and reed beds and rushes of the

water ecotone, which affect ease of access to the reservoir. Further distinguished were the categories and types of afforestation, the presence of glades favorable to recreation, as well as the density of vegetation affecting the perception of the landscape and the use of the littoral zone.

Table 2. Classification of the vegetation of the lake's shore and littoral zone (the author's own study)

Vegetation features	Criteria				
Presence of vegetation	yes			no	
Type of vegetation at the shore	floating	low rush	rush	wetlands	
Rush density in the strip of land encompassing the shore	0-25%	25-50%	50-75%	>75%	
Vegetation habitats on the shore	meadow, grass	clearing surrounded by forest	forest (coniferous, deciduous)	bog woodland, peat bog	
Forest type	deciduous	coniferous	mixed	riparian	other
Forest density	low <25%	average 25-75 %		high >75%	
Forms of environmental protection	present (specify which)			none	
Other	Present			None	

In addition, a list of infrastructure facilities and anthropogenic activities was proposed in the vicinity of the lake's shore (Table 3). Until now, only Sroczyński (2007) described the degree of anthropogenic influence on lake

shores. Anthropogenic activities visible in the strip encompassing the shore were divided into less and more important from the point of view of usability. No tourist infrastructure was distinguished other than the elements necessary

to use the shore and the littoral zone of the reservoir. A separate category includes is the negative anthropogenic features, understood as evidence and effects of degradation, including destroyed vegetation, the degree and per-

sistence of littering and damage to the shore. This allowed identifying areas containing usable infrastructure and places affected by the greatest pressures and most severe degradation of the natural environment.

Table 3. Classification of the anthropogenic features of the lake's shore and littoral zone (the author's own study)

Anthropogenic features	Criteria			
	very important		less important	
Shore type	artificial beach	reinforced shore, e.g. concrete	flood embankment	Dam, sluice, other elements
Bathing and swimming area	Separated or fenced off area of water Designated area along the shore		Designated zone along the shore, or absence of special demarcations	
Small water infrastructure facilities on	recreation piers	jetties, marinas	footbridges on the shore	mooring dolphins
Small infrastructure facilities on the shore	arbors	bonfire sites	benches, trash cans	other (specialist structures)
Access to water equipment: kayaks, paddle boats and others	present (specify)		none	
Information/ education	thematic information boards		warning and prohibition signs	
Negative	Very important		Less important	
Littering on the shore	heavy, persistent; litter from previous seasons visible		individual packages, left periodically	
Trampled turf, erosion on the shore	surface layer missing, area erosion, along the shore		narrow paths, linear erosion or spot erosion	
Damaged tree stand and bushes	young trees cut out, branches broken off		individual spots of damage to branches	
Littering of the littoral zone	clearly visible on the bottom, old artifacts, including e.g. broken bottles		Individual old artifacts e.g. floating	
Damaged vegetation of the littoral zone	Reeds cut out, destroyed floating vegetation within a given section		Small periodic damage to the content of the habitats	

Stage II proper – inventory-based – the inventory method was adapted to the needs of the study, based on the methodology used in local history (Lipniacki, 1978; Kruczek, 1996; Sołowiej, 1992; Bieńczyk, 2003). The inventory included the following elements: morphological elements of the shore and shallow bottom based on the classification above, vegetation, tourism-related development and detected threats to nature. The essential field work consisted in determining the lake shore types based on the accepted morphological classification (Fig. 4). In addition, the inclination of the slope and the depth of the bottom at the shore within 10 m from the waterline were determined (Fig. 5), along with the type of bottom and transparency of the water (using a Secchi disc), in different seasons of the year (including fall). Changes

in the height of the water table in relation to the shore were also recorded in different seasons.

During the year, these changes were not sufficiently sizeable to be classified in this assessment. The sections and points of the shore offering convenient access to the lake were identified, e.g. for bathing purposes. Areas of beaches were defined; beaches being understood here as exposed sandy surfaces and grassy surfaces suitable for resting. Due to their occurrence in spots rather than in lengthwise sections, neither their percentage share in the length of the shoreline nor the size of their area were calculated. Eleven sediment samples from places used by tourists and recreation seekers were collected for analyses of the lake's bottom. After drying, the samples were sifted on sieves with a mesh diameter of 0.25 mm. In this way,

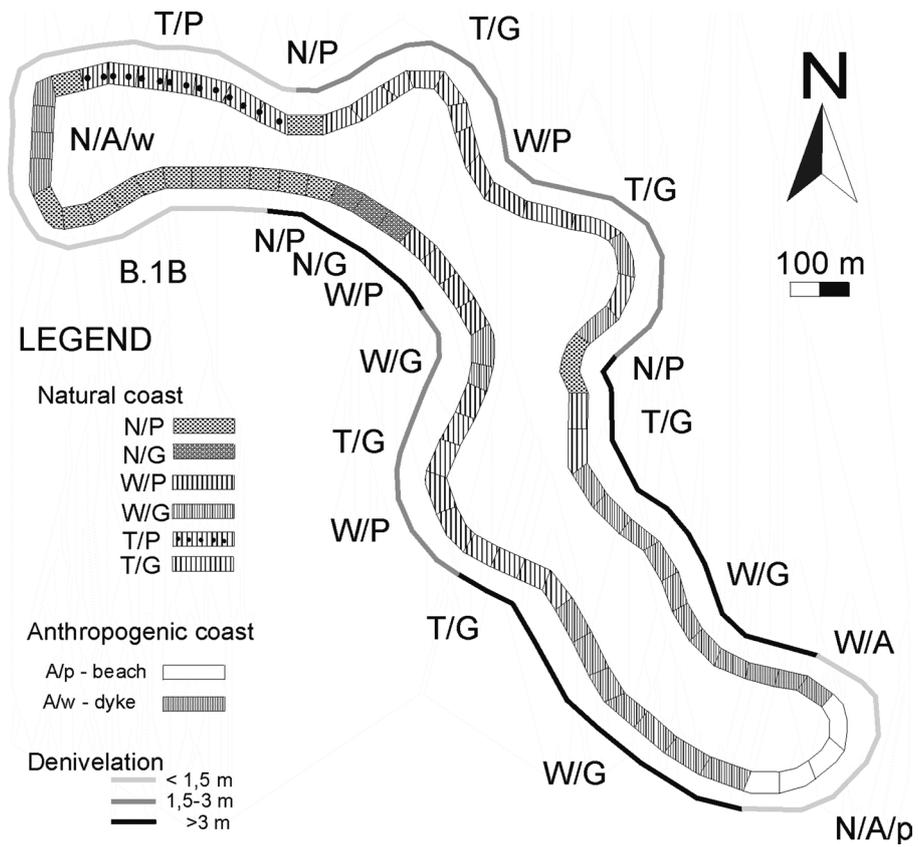


Figure 4. Morphological valorization of the shore of Lake Głębokie (the author's own study)

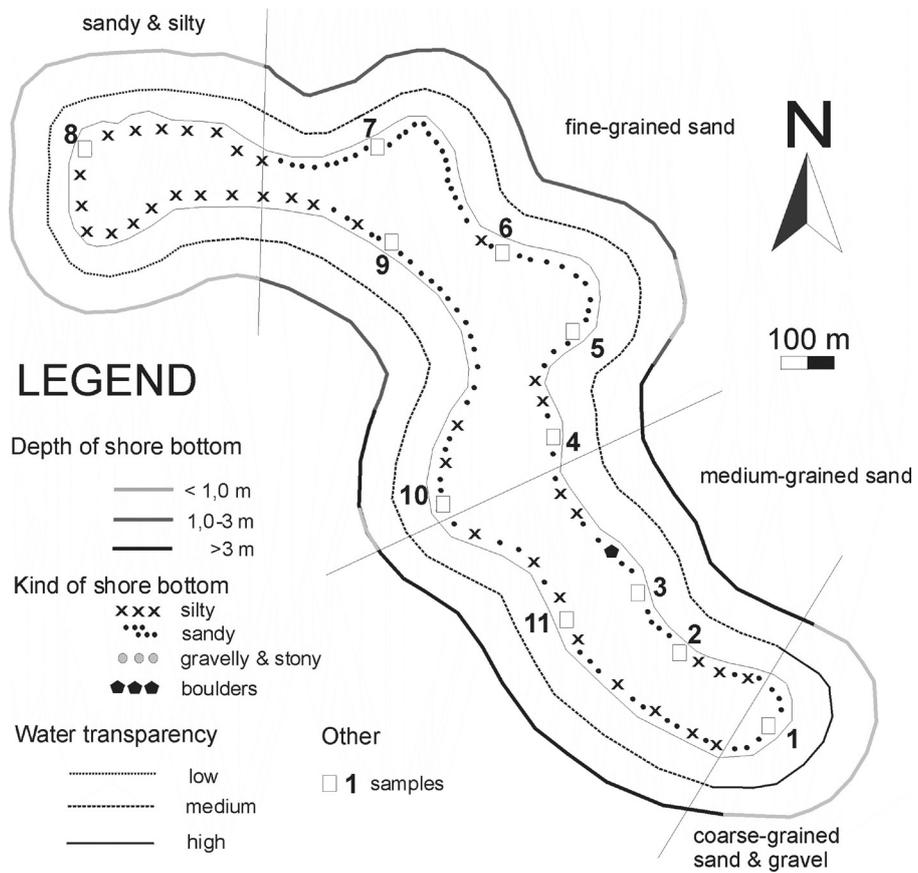


Figure 5. Valorization of the features of the bottom at the shore of Lake Głębokie (the author's own study)

the type of the bottom and the mechanical composition of the sediment (gravel, sand or mud) were assessed. These elements are suggestive of

the comfort of use and indicative of the process of accumulation (fine sediment) or erosion of the bottom (thicker sediment), (Fig. 6).

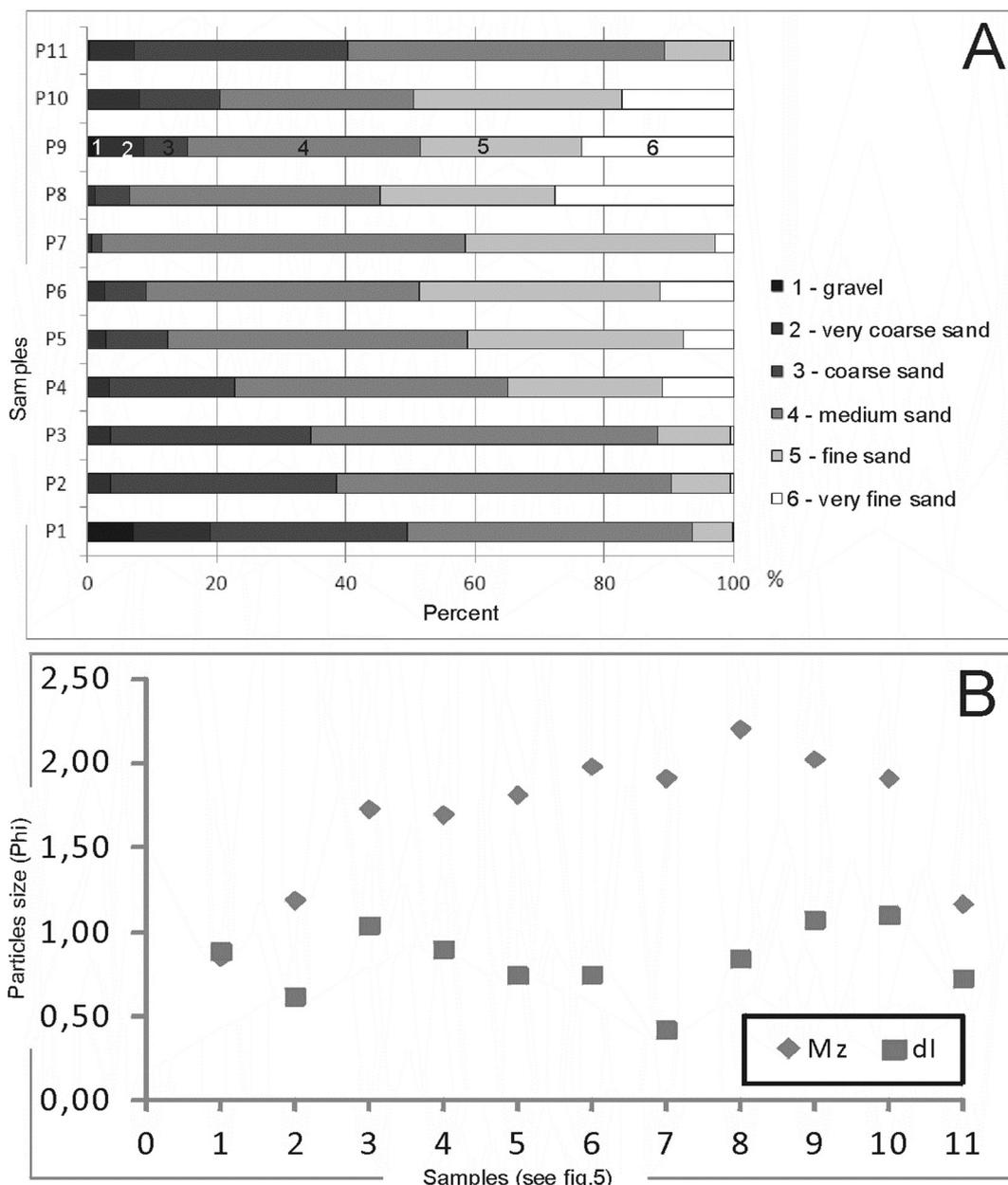


Figure 6. Mechanical composition of the sediment on the lake’s bottom near the shore a) granulometric composition of the sediment b) average grain size (phi) and sorting of the sediment. Location of taking the samples – cf. Fig. 5 (the author’s own study)

The inventory of the living elements of the shore’s natural environment lists the occurrence and type of vegetation growing on the shore, as well as the presence of large trees (Fig. 7). The inventory of tourism development lists places with camping tables and benches, places for bonfires, rubbish bins, toilets and information boards concerning elements of animate nature

(devoted, among others, to life in the lake, mammals, birds, trees and herbaceous plants).

In order to make a correct assessment, the inventory included threats to the elements of nature and values under assessment, which include littering, anthropogenic erosion of the shore (trampled turf) and the resulting depressions on the edge of the reservoir. All

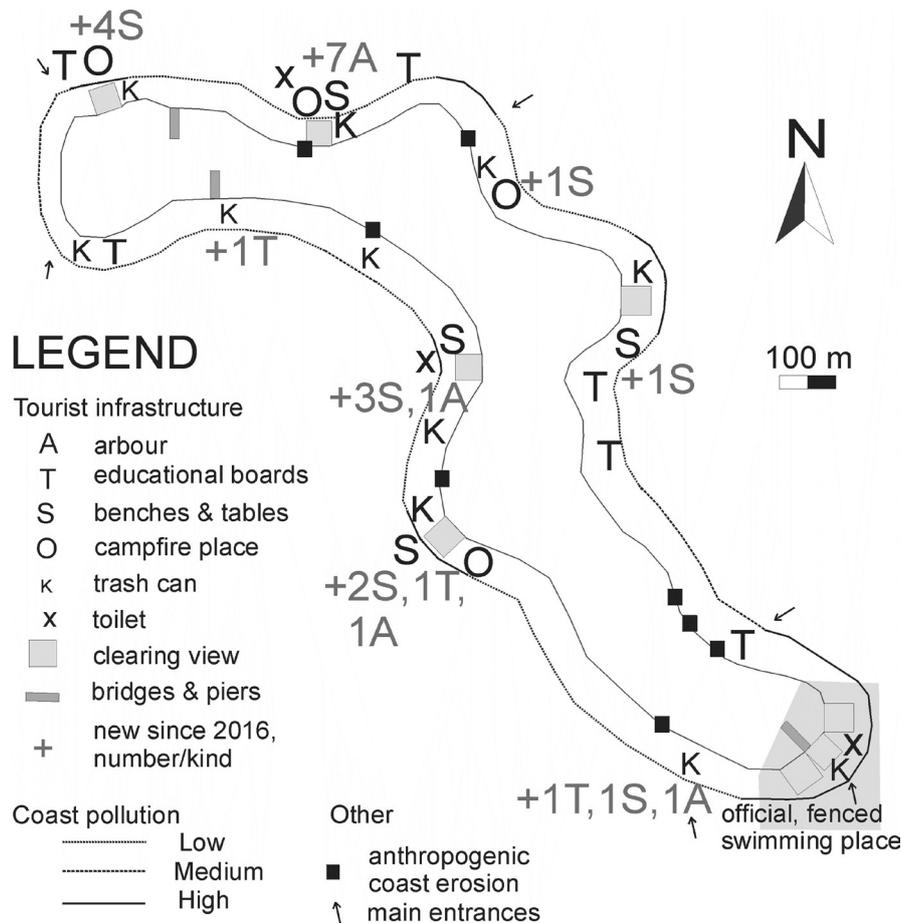


Figure 7. Valorization of the vegetation on the shore of Lake Głębokie (the author's own study)

of the inventoried items were included in the classification table. During the inventory, photographic documentation was made.

Stage III proper – the items from the inventory were grouped into the appropriate classes according to the adopted criteria. The development of the classification was based on existing guidelines (e.g.: Sołowiej, 1992; Gołembski, 1999). It was assumed that the shores available for tourism and recreation are ones with a small inclination and an extensive platform used for recreation (as in Sroczyński, 2007). The features that improve the quality of the environment include variations in terrain relief, a low depth at the edge, sandy bottom and the presence of clearings, increasing the use of the shore and the aesthetic attractiveness of the landscape. The elements that positively impact aesthetics include varied vegetation, the presence of large and old trees (mostly oaks) and a medium forest density. Beaches, formed within the erosive platform of the shore and the absence of reed beds were classified as elements conducive to rest and recreation. However, thickets of the ash-alder riparian forest and reed beds

inhabited by numerous species of birds, visible mainly from the lake, also represented positive tourist and natural values. The current development was assessed as positive for the lake's recreational and tourist values. The elements decreasing these values include permanent littering in this area, especially within the clearings, and erosion of the shores.

From the perspective of developing various tourist functions, it was assumed that the inventoried elements should be summed up in their respective classes: natural elements, anthropogenic elements (development), and existing elements that decrease the value of the environment. These elements were subjected to point bonitation by assigning them the appropriate value in points, and their sum was converted into one hundred percent of the features that positively affect the use of the shore. The source literature emphasizes the difficulty of applying bonitation, where we assess diverse types of elements, e.g. qualitative and quantitative ones (Kozuchowski, 2005). Thus, our own bonitation criteria were specified in order to achieve the purpose of the work underway.

Stage IV – synthesis – on the basis of the results, synthesizing tables were developed, along with their graphic representations. Based on this, the classification criteria for shorelines were divided into six areas with distinctive features (numbered I-VI). Each of these was

assigned a percentage value of the assets in the entirety the objects inventoried in the study. Attractiveness, divided into three classes, takes into account both the number of values, and the condition of the environment deteriorated by the negative elements.

4. Test results

Based on the differentiated results of the shore's features from 2012 and 2017, six different shore sections were distinguished (Fig. 9). The main criterion for assessing the shore was its morphological type (Fig. 4). The highest share, of more than over 60 percent, has high edges, over five meters above the water level. A part of the high shore area is preceded by a terrace, with a width ranging from five to ten meters and more. The high shore is most often associated with a greater depth of water. In these places one meets only individual swimmers or anglers. The low shores, most often with shallow water, are adjacent to clearings, which are intensively used for recreation and relaxation. The bottom

near the shore shows the granularity of the material becoming finer from the south to the north, along the western and southern shores (Fig. 5). The southwestern shore descends into the water abruptly, and it is therefore not used by tourists (section VI), despite the location of a large forest car park with camping places in its direct vicinity.

The high eastern shore separates the low terrace from which there is better access to the water. Both natural and human-related erosion proceed here. Growing depressions were observed here, causing artificial lowering of the terrain and formation of small coves of low depth, where the bottom is covered by medium

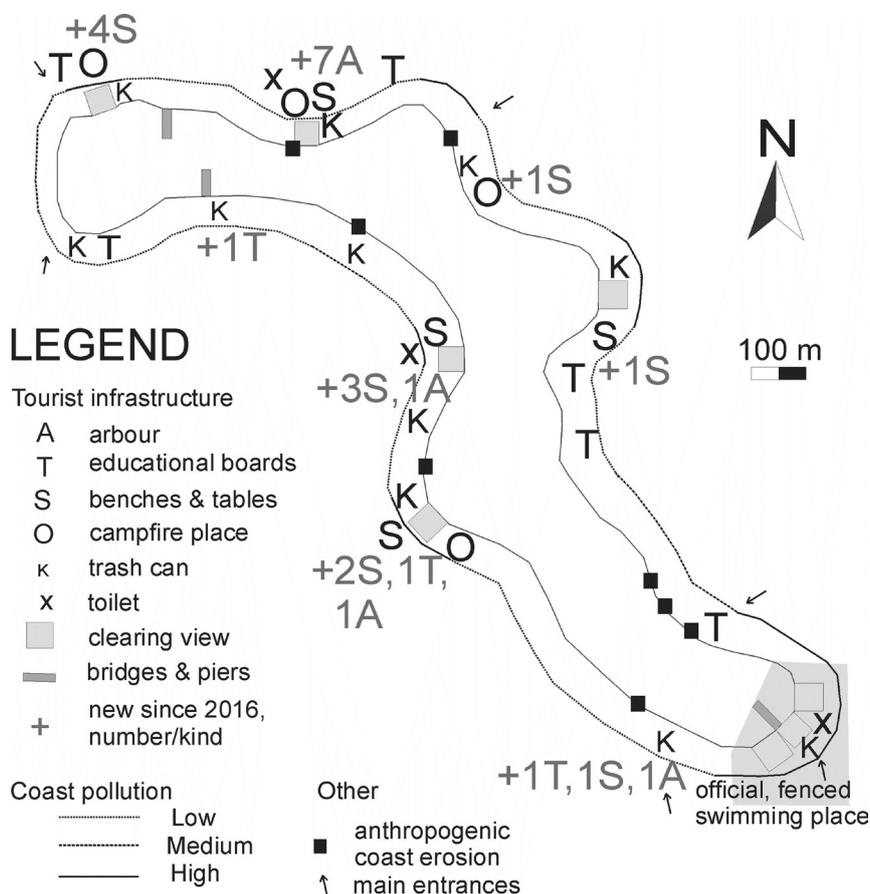


Figure 8. Development on the shore of Lake Głębokie and its anthropogenic erosion (the author's own study)

and fine-grained sand, with coarse-grained mixed in (section II).

Over five years, the rate of erosion reached as much as 0.2 m per year. The results included destruction of turf on a fairly steep slope, and large beeches falling into the water (Fig. 10). Towards the north, the shore is lowered (with a wider accumulation terrace). There are numerous coves and wetlands. In this area, some camping sites are located, including a clearing adapted for recreation, with places for bonfires. There is also anthropogenic erosion of the lake's grass-covered shore (section III). This part of the shore is also heavily used, and tourists often leave scattered litter. In the spring of 2012, a mobile toilet was thrown into the lake.

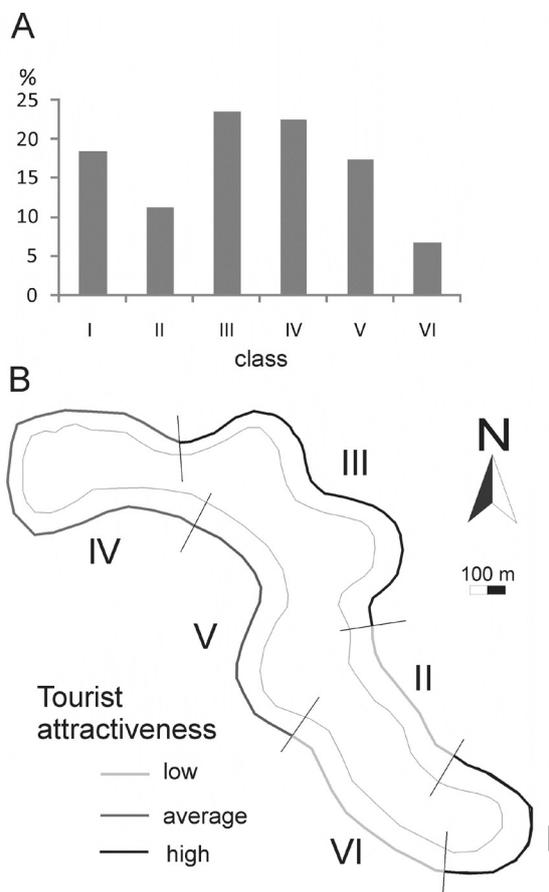


Figure 9. Attractiveness of Lake Głębokie for tourism and recreation, a) percentage share of tourist values within the designated sections, b) tourism-related attractiveness of the designated sections (I-VI the sections designated) (the author's own study)

On the opposite side of the lake, the western shore is similarly used (section V). It is dominated by greater differences in altitude close to the water line, for this reason there are fewer places intensively used outside of

two clearings, one of which has wooden tables and a place for a bonfire. Intense anthropogenic shore erosion was also visible here. The southern part of the lake, adjacent to the tram terminus (section I), is the most anthropogenically transformed section. Within a fenced-off area, there is an artificial beach here, with designated swimming and bathing areas, and a pier that extends into the lake (Fig. 2A). The bottom is of medium depth, sandy with an admixture of gravel. There is a sports equipment rental shop, changing rooms, benches, a playground and food outlets. In the northern part of this section, a ropes obstacle course and a water slide are located within the fenced area. Least transformed is the northern, shallow and overgrown stretch of the lake. Here, an artificial causeway with a road, and sluices dividing the lake into two separate reservoirs (section IV). The shore here is low but covered with rushes, reeds and marshy plants (Fig. 2D). In the northernmost part of the lake at the confluence of paths and trails there is another clearing with infrastructure for recreation and an information board, including the rules and regulations regarding the use of the forest above the reservoir (Fig. 2B). In this section the shore is overgrown the most, and most birds can be observed here, for example from a canoe or a small boat. Forests around the lake are primarily mixed forests, in several places wide-spreading perennial pines and beeches were marked, including monuments of nature.

Based on the selected classification, it was found that sections III and IV hold the most recreational values, about 23 percent in the total sum (Fig. 9). The lowest number of items is found in section VI, around 6 percent. Despite significant anthropogenic pressure, the highest attractiveness understood as the sum of values and the state of the environment is found in sections III and I. They are periodically cleaned, which does not lower their aesthetic value. Section IV has a good deal of natural values, however, it is not suitable for recreation understood as permanent use, based on its infrastructure. The shore here is inaccessible, and the presence of birds should continue to rule out future development.

Based on the inventory carried out in 2017 and its comparison to 2012, the following changes in the development were found (Fig. 8):

- fresh and renewed educational boards (nine different ones along the path surrounding the lake),
- roofed arbors and new benches,
- refurbished bonfire sites,
- more baskets and benches along the path.

During this time, erosion in section V and the clearings of sections III and IV intensified

(Fig. 10). A new phenomenon is the appearance of erosion in section VI. Objectively, there is also greater destruction of the young groves within a radius of up to 100 meters in the areas designated for bonfires. It is a fairly new habit of foresters to leave brushwood firewood at the bonfire sites, but the quantities are insufficient with respect to the demand. In addition, around the logs, especially after the weekend, significant amounts of rubbish are left, e.g. empty bottles.

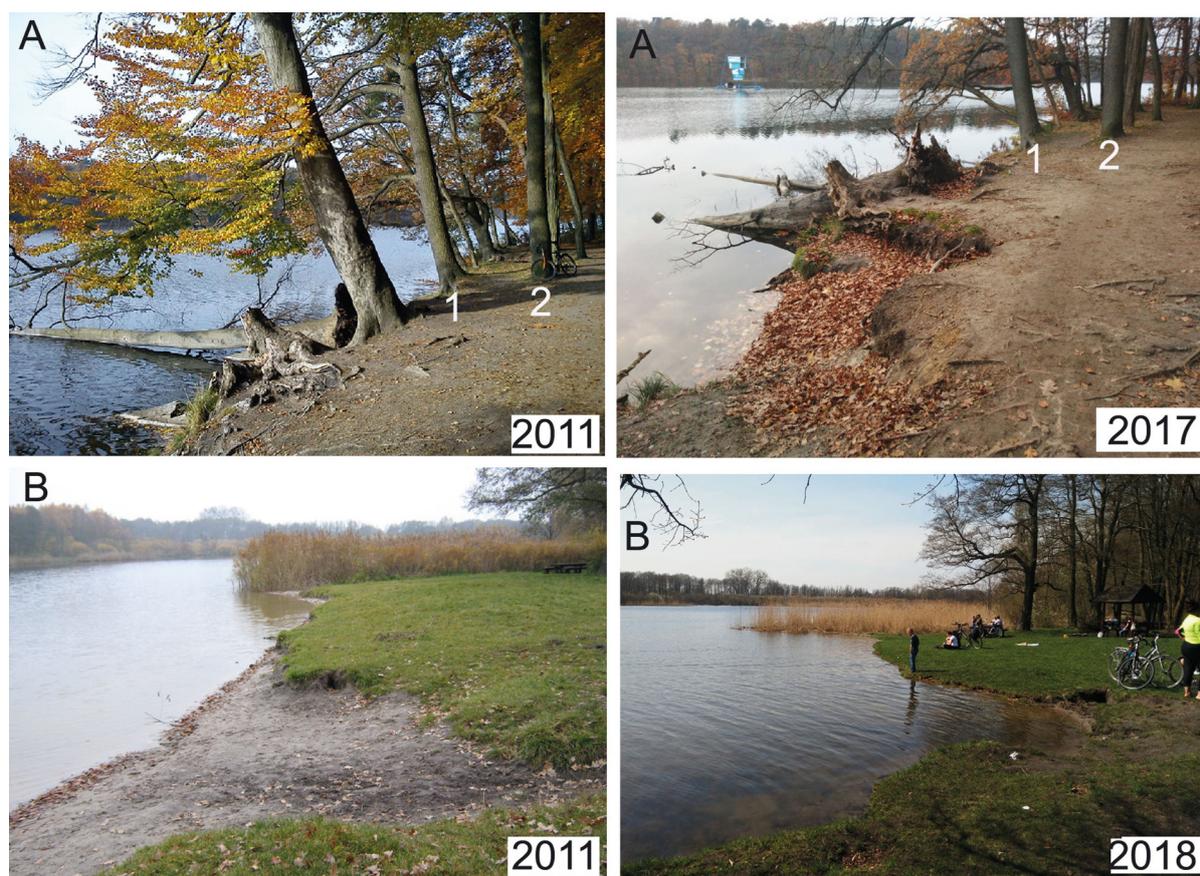


Figure 10. Examples of shore erosion effects. A – high shore with a usable terrace: due to its recession, two beech trees have been destroyed, 1-2 beech trees further away. B – low shore with a clearing, heavily used, erosion up to one meter and indentations in the shoreline (the author's own archive)

5. Discussion

The highest impact on the use of the littoral zone and the shore is related to the topography of the area, including accessibility of water (Sroczyński, 2007; Świerk et al., 2010). Users select only those sections of the shore that offer advantages related to easy access to the lake, pleasurable qualities of the landscape or of the components of the natural world and their arrangement. Therefore, the analysis of the

shore's morphology is crucial in assessing the recreational utility of a lake, as demonstrated by Sroczyński (2007). Utility values of lakes are reduced by the presence of vegetation in the littoral zone (Deja, 2001) and other obstacles on the shore (Skrzypczak et al., 2007). The outlet or outflow of watercourses from a given reservoir may influence the attractiveness of a given section of the shore. One should not forget

about the physical and chemical parameters of the water near the shore. The quality of water, its purity, and transparency are important factors determining the value of water recreation (Cichoń, 2008).

The present work proposes a classification of all significant elements from the point of view of developing usage-related functions of the parts of lakes adjacent to the shore. So far these elements have been assessed separately, as vegetation and its degradation (Skłodowski et al., 2006), access to the lake resulting from the formation of the shore (Sroczyński, 2007), or infrastructure increasing or decreasing the lake's utility value (Skrzypczak et al., 2007; Skrzypczak and Witkowska, 2007; Sroczyński, 2007). Another issue is the need to both protect the area in order to preserve its values for further use, and limit improper behaviors of recreation seekers.

The greatest recreation-related load on lake shores is found in the areas with beaches (Skrzypczak and Witkowska, 2007). On the other hand, the main advantages offered by the shore result in increased use and creation of potential threats to the environment (Skrzypczak and Witkowska 2007). Damage inflicted by users includes littering, burnt-out bonfires, damaged trees, trampled vegetation on the ground, which was also indicated Skłodowski et al. (2006). Other types of damage include destroyed water vegetation, shore erosion and cut-down trees.

According to research, over 65 percent of respondents penetrate the section up to one hundred meters from the shore of the lake (Skłodowski et al., 2006). The same belt was studied in the present work. During the 5-year study around the Lake Głębokie, we observed an increase in soil erosion and trampling of vegetation on the shore in intensively used places, as well as heavy pollution with litter thrown into the water or into the nearby forest. Skłodowski et al. (2006) suggest that prohibi-

tions are not sufficient; more emphasis should be put on education, because approximately every three hundred meters along the lakeside there are traces of destruction of nature.

Changes to the natural world on the shore depend not only on absorption of tourists but also on weather conditions (Cichoń, 2008). Weekend tourism is the cause of the greatest pressures on the environment of the area studied. These can be temporary changes related to more intensive periodic use consisting in trampling of the grass, which can, after all, regenerate. Observing changes in the morphology of the shore and vegetation in the clearings around Lake Głębokie in the years 2012-2017, one may conclude that in time the degradation is progressing, especially where the sites are used extensively. In place of turf, beaches are formed, which also attract for the youngest users. Recreation seekers do not seem to notice these changes; they also do not seem to be bothered by the litter lying around. This fact should be taken into account in designating new areas for rest and recreation around lakes.

As mentioned above, in time the pressures increase not only on the reservoir itself, but also on the area around the shore (Skłodowski et al., 2006). The capacity of the natural environment for absorption needs to be considered comprehensively, taking into account physical, as well as ecological and socio-psychological aspects (Cichoń, 2008). New piers and designated bathing and swimming areas will generate losses in the surrounding nature. A solution should be found for the problems of damage to vegetation and littering. At the reservoir studied, twice as many garbage bins were placed over five years, while wood and brushwood is periodically laid out at the places designated for bonfires. Next to the boards showcasing the values of local nature, there should be signs warning about littering or destruction of the natural environment.

6. Summary

Point bonitation is one of the better methods of assessing environmental elements for purposes of tourism. It should be performed on a group of comparable facilities, both on the

scale of individual cities, regions, or even entire countries. A certain dose of subjectivity is an inseparable element of the methodology. It should therefore be performed by people with

extensive experience with the subject. Inventory works with a critical assessment of usage possibilities are the only appropriate source of knowledge about a given area.

The research conducted in the present study indicates that inventories of natural values and inventories of values related to human activity should be taken separately. At the stage of valorization, it is not appropriate to lump the natural values, which are valuable for nature-related tourism, together with elements of infrastructure, which increase the values for recreational tourism or even qualified tourism

with elements of sports. The values themselves and the need to use them for such diversified purposes are often mutually exclusive. One cannot, for example, play sports in areas that are protected or valuable for ecological and educational tourism. Such an approach would yield only averaged-out results. Understanding attractiveness for tourism and recreation in this way is mistaken. The author's own classification of lakeshore morphology can be used to analyze the resources of other reservoirs located in moraine areas with varying shore heights.

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