

VEGETATION OF THE CATCHMENT AREAS OF THE LAKES IN POLESIE NATIONAL PARK. CURRENT STATE AND CHANGES

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A b s t r a c t. Spatial structure and distribution of the vegetation complexes in the catchment areas of the lakes in Polesie National Park were analysed. Tendencies of their changes were determined by comparison of their state in 1952 with the present situation (end of the 90s). The greatest transformations occurred in the share of peat-bog and forest vegetation complexes. At present the former complex, makes up from a few to a dozen percent of the catchment areas, while in the 50s their share reached 50%. The loss of the peat-bog area took place because of an increase in the forest territory. Somewhat smaller changes occurred in the share of the remaining complexes.

K e y w o r d s: vegetation complex, catchment area of the lakes, Polesie National Park.

INTRODUCTION

Freshwater and wetland ecosystems are rated as especially susceptible to unfavourable influence of anthropopression. All kinds of human activities (land improvement, fertilisation, forest management) in the catchment areas with the above mentioned ecosystems affect them directly or indirectly. Improper forest management can intensify the process of water dystrophication leading to torrestial supply of humic acids to the water reservoirs [10]. A change in the spatial structure of biocenoses can lead to disturbances in the balance of the whole water-terrestrial system [8,9].

The catchment areas of many lakes were exposed to intensive drainage and deterioration processes of peat-bogs [4]. Together with an increase in the scale of catchment transformations, eutrophication of water basins was intensified. The smallest lakes are most sensitive to these changes [6]. An expansion of the phyto-

plankton in many water reservoirs escalates together with an increase in their trophic level. A decrease of open peat-bog areas and proceeding succession of shrub communities was observed [2-5,7,12,13,15,17]. The area of natural vegetation decreased as a result of human activity on low peat-bogs. Moreover their structure was also changed. Secondary plant communities without peat accumulation ability appeared [11]. Anthropogenic transformation of the high peat-bog vegetation led to their degeneration or even disappearance [15]. Observation of these processes and knowledge of their negative effect on the environment, show the need for research, with a goal of finding out and monitoring one of the most precious ecological systems such as lakes and peat-bogs.

INVESTIGATED AREA AND METHODS

The lakes in the Polesie National Park are usually shallow with flat basins covered by a thick layer of organic deposits. In the majority of lakes, thickness of the deposits exceeds several times the water depth; in the Moszne Lake, it reaches 10.5 m [1]. All lakes in the Park are elements of the large area peat-bog complexes which fill broad hollows.

Analysis of vegetation changes in the catchment areas of the lakes in Polesie National Park was carried out on the basis of aerial photographs from 1952 (scale 1:25000), 1958 (scale 1:10000), 1997 (scale 1:25000) and topographic maps. A detailed analysis of the photographic materials and generalisation of the water vegetation maps in the lakes Karaśne [17], Moszne [18], Długie [19], Łukie [16], followed a field inspection. They allowed to distinguish nine complexes of plant communities. A definition of a vegetation complex is provided by Matuszkiewicz [14]. The distribution maps of the above mentioned units from 1952 and 1997 are results of the research work. They cover all catchment areas of the lakes Karaśne, Długie, Moszne and in the case of the Łukie Lake also the territory adjoining the reservoir.

RESULTS

Forests definitely are predominant in the present structure of plant communities in the catchment areas of the lakes in Polesie National Park. Their percentage varies from 31.2 to 75.1% (Table 1, Fig. 1) and it is the highest in the case of the Długie Lake. Forest plant communities increased their area more than any other complexes distinguished, during the above mentioned period. Their share did not exceed 10% in the beginning of the 50 s. The most extensive changes took place in

Table 1. Changes in the share of plant community complexes in the catchment areas of lakes in the Polesie National Park in the period 1952-1997 (in %)

Plant community complexes	Karaśne			Moszne			Długie			Łukie		
	1952	1997	change	1952	1997	change	1952	1997	change	1952	1997	change
Emergent macrophytes (class <i>Potamogetonetea</i>) and rushes (<i>alliances Phragmition</i> and <i>Magnocaricion</i>)	1.9	1.1	-0.8	0.2	0.8	+0.6	1.4	1.9	+0.5	6.3	27.5	+21.2
Communities of peat-bog vegetation without shrubs	16.7	2.5	-14.2	19.1	4.7	-14.4	20.8	2.5	-18.3	2.4	-	-2.4
Communities of peat-bog vegetation with a low share of shrubs	9.1	1.6	-7.5	3.8	2.4	-1.4	18.7	1.5	-17.2	6.5	-	-6.5
Peat-bog vegetation in the initial stage of shrubs succession	4.9	-	-4.9	25.1	7.5	-17.6	13.4	-	-13.4	6.8	1.9	-4.9
Meadow vegetation (class <i>Molinio-Arrhenatheretea</i>)	27.5	-	-27.5	10.1	2.2	-7.9	4.9	1.0	-3.9	20.3	0.7	-19.6
Shrub vegetation (class <i>Alnetea glutinosae</i>)	-	2.1	+2.1	4.0	14.5	+10.5	13.7	5.0	-8.7	4.9	1.8	-3.1
Forest vegetation	-	31.2	+31.2	6.9	53.7	+46.8	7.2	75.1	+67.9	1.4	33.3	+31.9
Field, pastures and wastelands	37.0	60.2	+23.3	28.6	12.6	-16.0	13.3	7.7	-5.6	6.7	12.2	+5.5
Surface of water without water vegetation	2.9	1.3	-1.6	2.2	1.6	-0.6	6.6	5.3	-1.3	44.7	22.5	-22.2

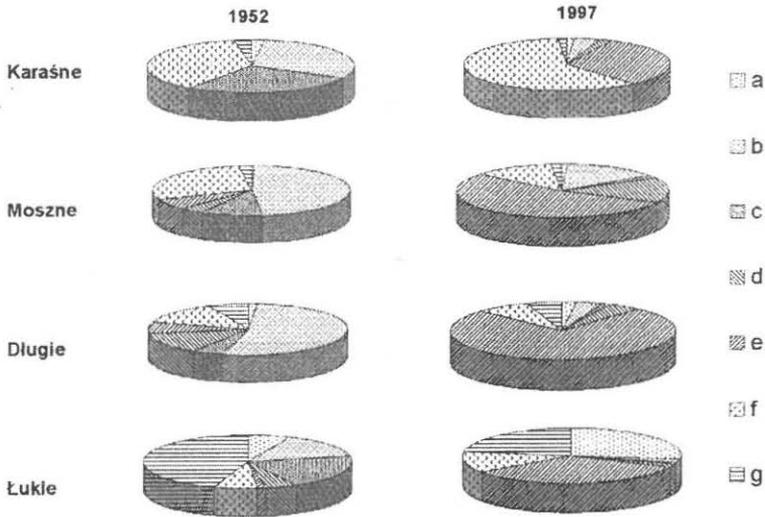


Fig. 1. Share of plant community complexes in the catchment areas of lakes investigated in 1952 and 1997: a – emerged macrophytes and rushes, b – peat-bogs, c – meadow vegetation, d – shrub vegetation, e – forest vegetation, f – fields, pastures and wastelands, g – surface of water without water vegetation

the catchment area of the Długie Lake, where the forest territory increased by 69%. However, in the remaining areas it increased by 31-47%. The majority of forest phytocoenoses represented associations of alder fen forest *Ribo nigri-Alnetum*, swampy birch forest *Betuletum pubescentis*, rare continental swamp/bog pine forest *Vaccinio uliginosi-Pinetum*. Patches of anthropogenic forms of pine-oak mixed forest *Quercus roboris-Pinetum* and substitute communities with pine trees were also common. Due to degradation of the natural hydrologic conditions, many forest patches which used to grow in boggy habitats, evolved into degenerated communities, which were difficult to define syntaxonically.

A spectacular enlargement of the forest territory in the catchment areas took place mainly at the expense of peat-bogs. Wetland communities vegetation, which included the most precious elements of the Park flora and move it valuable in the natural environment at present do not have any significant share in the structure of the plant complexes. It is the highest in the catchment area of the Moszne Lake where it amounted to 14.6%. However, in the remaining areas compared, it did not exceed 5%. This disadvantageous structure was additionally worsened by disproportions between the amount of open peat-bog, without shrubs and peat-bogs at an advanced stage of succession of bush phytocoenoses from the class *Alnetea glut-*

nosae, especially *Salicetum pentandro-cinereae* and *Betulo-Salicetum repentis*. The highest losses of peat-bogs were noted in the catchment areas of the lakes Moszne and Długie where their share decreased by nearly 50%; lower reduction was observed in the catchments of the lakes Karaśne and Łukie.

Similar changes occurred in the meadow communities. At present, phytocoenoses from the class *Molinio-Arrhenatheretea* make up a few percent of the territories described. Only their share is the highest in the catchment area of the Lake Moszne; in the remaining catchments the respective values were lower. The meadow complex took up over one fifth of the territory of the catchment areas of the lakes Karaśne and Łukie in the 50s. The highest losses of meadow vegetation also noted there.

The present share of shrub vegetation (mainly associations of *Salicetum pentandro-cinereae* and *Betulo-Salicetum repentis*) varied in individual catchments in a broad range from 1.8 to 14.5%. Willow and birch bushes make up a significant percentage of the Moszne Lake catchment area; the highest increase in their share was also noted in the above mentioned period. The decrease observed in catchment areas of the lakes: Długie and Łukie, was caused by a transformation of shrub phytocoenoses into forest communities.

The territories compared differed considerably from one another in the share of fields, pastures and wastelands complex. Percentages were the highest (exceeding 60%), in the catchment area of the Karaśne Lake. In the case of the remaining lakes, the share varied from 12 to 13%. With regard to the state recorded 50 years ago, changes in the areas compared proceeded in different directions. An decrease in the share of the complex mentioned above were observed in the case of the lakes: Długie and Moszne. However, in the remaining lakes the ratio increased by 5.5 and 23.2%.

Beside the above peat-bogs, water and rush vegetation was a characteristic component of the Park nature. Its share in the individual territories was very differentiated and strongly depended on the ratio between the lake size and its catchment area. The complexes considered made up the highest percentage in the surroundings of the Łukie Lake. In the remaining areas, water and rush vegetation took up below 2% of their surface area accurate analysis of aerial photographs was possible. An expansion of rushes and emerged macrophytes during the last 50 years (only in the case of these types of the vegetation) was the highest in the Łukie Lake. This process was slower in the remaining reservoirs. Representation of changes can be slightly deformed because of the territory of the above mentioned type of the vegetation complex related to the size of the whole catchment area, and not to the lake surface. The pace of overgrowing is better reflected by

changes in the water surface share devoid of emergent macrophytes and rushes. Its higher loss occurred in the Łukie Lake.

CONCLUSIONS

In the catchment areas of the lakes in Polesie National Park, 8 types of vegetation complexes were distinguished. Their distribution and structure significantly changed during the last 50 years. General tendencies of transformations were as follows:

- the area and share of the peat-bogs considerably decreased in the territories of all catchments; in the case of the lakes Moszne and Długie, this loss reached nearly 50%;
- the area of meadow communities also decreased, but their reduction was not as extreme as in the peat-bog ecosystems;
- the share of forest vegetation complex significantly increased, in some catchment areas it increased by as much as 50-70%;
- in the catchment areas of the lakes: Moszne and Długie, the territory of fields, pastures and wastelands decreased; in remaining ones, the share of this complex increased;
- the percentage of emerged macrophytes and rushes in the catchment areas increased;
- the original mosaic spatial structure of vegetation complexes was simplified, in consequence, the length of their ecotones decreased.

REFERENCES

1. **Balaga K., Dobrowolski R., Rodzik J.:** Development of Moszne lake-peatbog complex in Polesie National Park (in Polish). In: Water and peat-bog ecosystems in protected areas (Eds S. Radwan, Z. Karbowski, M. Sołtys). PTH, AR, TWWP, PPN, Lublin, 71-76, 1993.
2. **Baryła R., Fijałkowski D.:** Vascular plants of the lakes and peat-bogs in Polesie National Park and its surrounding area (in Polish). In: Protection of the water ecosystems in Polesie National Park and its surrounding area (Ed. S. Radwan). AR, TWWP, Lublin, 79-84, 1995.
3. **Chmielewski T.J.:** Łęczna-Włodawa Lakeland district: transformations of the ecological structure and conditions of the spatial management (in Polish). Monografie Komitetu Inżynierii Środowiska PAN, 4, Lublin, 146 pp, 2001.
4. **Chmielewski T. J., Radwan S.:** Ecological processes in shallow lakes and surrounding peat-bogs in Łęczna-Włodawa Lakeland district (in Polish). In: Functioning of the wetland ecosystems in the protected areas of Polesie region (Ed. S. Radwan). UMCS, Lublin, 31-38, 1996.
5. **Chmielewski T. J., Radwan S., Kowalik W., Kowalczyk C., Wojciechowska W.:** Quantity and quality changes in the biocenoses of the lakes in Polesie National Park and its surrounding area in 1955-1994 years (in Polish). In: Protection of the water ecosystems in Polesie National Park and its surrounding area (Ed. S. Radwan). AR, TWWP, Lublin, 96-107, 1995.

6. **Chmielewski T. J., Radwan S., Sielewicz B.:** Changes in ecological relationships in a group of eight shallow lakes in the Polesie Lubelskie region (Eastern Poland) over forty years. *Hydrobiologia*, 342/343, 285-295, 1997.
7. **Chmielewski T., J., Sielewicz B.:** Changes of the landscape ecological structure in Polesie National Park during last 40 years (in Polish). *Przegląd Przyrodniczy*, 8/4, 3-10, 1997.
8. **Górniak A.:** Humic substances and their role in functioning of the freshwater ecosystems (in Polish). Uniwersytet Warszawski, Filia w Białymstoku. *Rozprawy* 448, 151 pp, 1996.
9. **Hillbricht-Ilkowska A., Zdanowski B.:** Directions of the protection of the lakes in Wigry National Park and manners of their protection against further eutrophication and degradation (in Polish). In: *Lakes in Wigry National Park. Eutrophication and directions of the protection* (Ed. B. Zdanowski). *Zeszyty Naukowe Człowiek i Środowisko PAN, Ossolineum, Wrocław-Warszawa-Kraków*, 191-198, 1992.
10. **Kraska M., Piotrowicz R.:** The vegetation of chosen lobelia lakes on the background of physical and chemical conditions of their waters (in Polish). In: *Lobelia lakes. Characteristics, functioning and protection* (Ed. M. Kraska). *Idee ekologiczne* 6, ser. *Szkice*, 4, 67-83, 1994.
11. **Kucharski L., Michalska-Hejduk D.:** State and protection of notforest vegetation in the reserves of Łódź region (in Polish). *Parki nar. Rez. przyr., Białowieża*, 19.2, 19-29, 2000.
12. **Lorens B., Sugier P.:** Changes of water and riparian vegetation of the Łukie Lake in 1952-1998 years (in Polish). In: *Problems of the active protection of water and peat-bog ecosystems in Polish national parks* (Eds S. Radwan, R. Kornijów). *UMCS*, 203-209, 1999.
13. **Lorens B., Sugier P.:** Transformations of the vegetation in the catchment area of the Długie Lake in the second half of XX century (in Polish). In: *Problems of the protection and management of the rural areas with high nature values* (Eds S. Radwan, Z. Lorkiewicz). *UMCS, Lublin*, 87-93, 2000.
14. **Matuszkiewicz A.:** Landscape-vegetation complexes as a special kind of ecological units (in Polish). *Ochrona i kształtowanie środowiska naturalnego. Cz II*, 22, *SGGW-AR CPBP*, 04.10. Warszawa, 58-64, 1990.
15. **Pisarek W., Kucharski L.:** Rush and peat-bog vegetation of the Bolimowski Landscape Park (in Polish). *Monographiae Botanicae*, 85, 101-137, 1999.
16. **Sugier P., Lorens B.:** Plant communities of the Łukie Lake in Polesie National Park (in Polish). *Parki nar. Rez. przyr., Białowieża*, 19.2, 3-18, 2000.
17. **Sugier P., Popiołek Z.:** Rush and riparian vegetation of the lakes in Polesie National Park on the background of environmental conditions. *Karaśne Lake* (in Polish). *Ann. Univ. Mariae Curie-Skłodowska, C*, 50, 55-69, 1995.
18. **Sugier P., Popiołek Z.:** Rush and riparian vegetation of the Moszne Lake in Polesie National Park (in Polish). *Ann. Univ. Mariae Curie-Skłodowska, C*, 53, 185-200, 1998.
19. **Sugier P., Popiołek P.:** Differentiation of the aquatic and riparian vegetation of the Długie Lake in Polesie National Park (in Polish). *Parki nar. Rez. przyr.*, 18.2, 61-79, 1999.

ROŚLINNOŚĆ ZLEWNI JEZIOR POLESKIEGO PARKU NARODOWEGO STAN AKTUALNY I ZMIANY

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S t r e s z c z e n i e. W pracy przedstawiono rezultaty analizy struktury przestrzennej i rozmieszczenia kompleksów roślinności w zlewniach jezior Poleskiego Parku Narodowego. Określono także tendencje ich zmian, porównując stan z lat 50. z aktualnym układem kompleksów roślinnych. Wyróżniono 8 wspomnianych jednostek w zlewniach jezior Karaśne, Moszne, Długie i Łukie. Największy udział powierzchniowy posiadają obecnie fitocenozy leśne. Na niektórych z porównywanych obszarów sięga on 75%, podczas gdy w latach 50. nie przekraczał 10%. Wzrost powierzchni lasów nastąpił kosztem ograniczenia arealu torfowisk. Ubytek powierzchni tych ekosystemów wynosi od 13,8 do 48,9% i jest największy w zlewni jeziora Długie. Ograniczeniu uległ także areal zbiorowisk łąkowych, przy czym spadek ten nie był tak drastyczny jak w przypadku torfowisk. W zlewniach jezior Moszne i Długie zmniejszyła się powierzchnia pól, użytków zielonych i nieużytków, na pozostałych obszarach wzrósł udział roślinności tego kompleksu. Postępuje także proces zarastania powierzchni jezior przez makrofitę wynurzoną i szuwarę, lecz jego tempo jest zróżnicowane i w głównej mierze uzależnione od głębokości zbiorników. Pierwotna mozaikowa struktura przestrzenna kompleksów roślinności uległa uproszczeniu.

S ł o w a k l u c z o w e: kompleks roślinności, zlewnie jezior, Poleski Park Narodowy