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DEVELOPMENT AND STRUCTURE OF THE GOCZAŁKOWICE RESERVOIR ECOSYSTEM II. CHARACTERISTICS OF THE CATCHMENT AREA

ABSTRACT: The Goczałkowice dam-reservoir catchment area is described on the basis of existing literature data. Characteristics of the morphology, geological and soil structure, hydrology and development of the catchment area are presented.

KEY WORDS: Reservoir, ecosystem, catchment area, morphology, climate, development.

1. INTRODUCTION

The Goczałkowice dam reservoir arose as a result of the construction of an earth dam across the Vistula valley at the 67th km of the course of the river. It serves the Upper-Silesian Industrial Region and the Rybnik Industrial Region as a reservoir of drinking water, being also a storage reservoir impounding flood high-water arising in the upper course of the Vistula. The effect of the catchment area on the quality of the water in the reservoir is very strong due to the input to it of eroded material, transported from the catchment area (B o m b ó w n a 1962, B r a ń s k i 1975), and nutrient components (K a s z a 1977, 1980).

The aim of the present paper is to describe the catchment area of the upper Vistula above the Goczałkowice reservoir.

2. DESCRIPTION OF THE CATCHMENT AREA

2.1. MORPHOLOGY

The Goczałkowice reservoir catchment area is 532 km^2 in surface area (Fig. 1), comprising mountain and piedmont regions of the Beskids (Fig. 2). Waters of surface feeding are discharged into the reservoir by the Vistula and Bajerka rivers.

The Vistula rises on the western slopes of the Barania Góra ridge. The Vistula stream flows at first, as far as Ustroń, by a narrow mountain valley (about 1.5 km in width), receiving on its way water from a number of small streams. At Ustroń it leaves

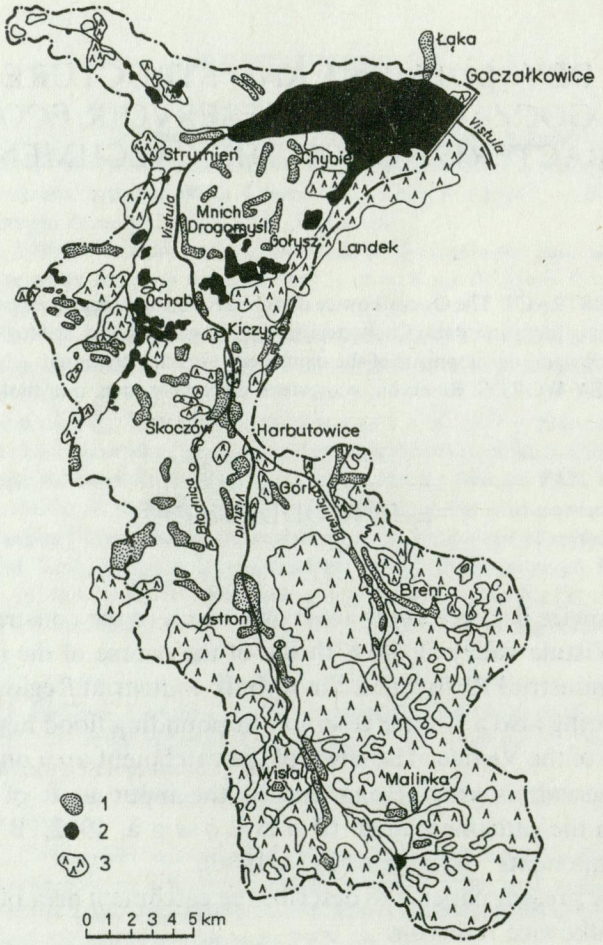

Fig. 1. The Goczałkowice reservoir catchment area
1 – towns and settlements, 2 – waters, 3 – forests

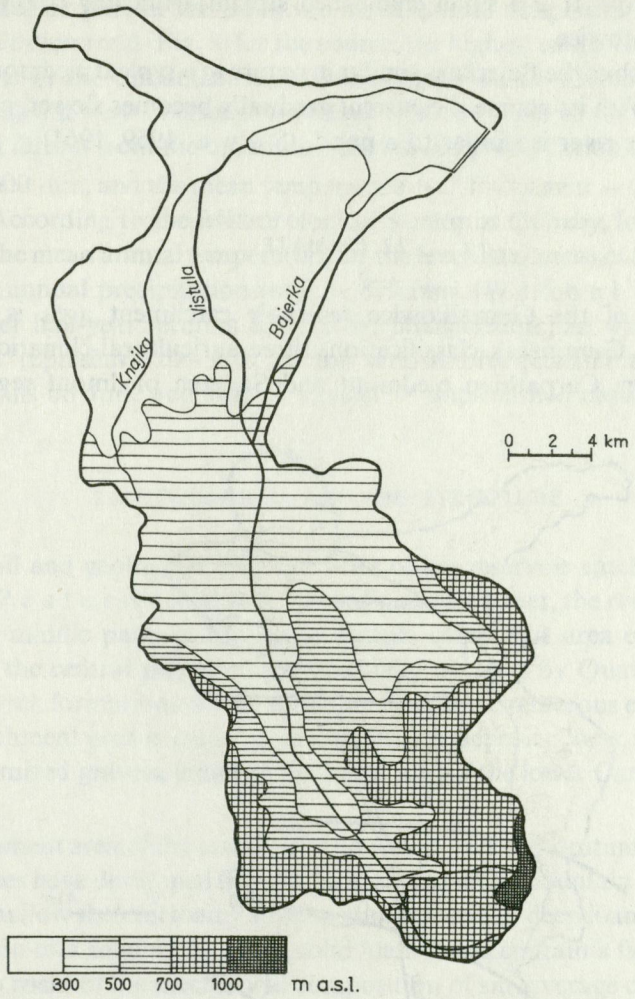

Fig. 2. The relief of the Goczałkowice reservoir catchment area (J. Punzet – unpublished data)

the Silesian Beskid and flows out on to a wide undulating dell that slopes as far as Drogomyśl. At Skoczów two larger tributaries discharge their water into it: the Brennica from the right side, and the Bładnica from the left side. Before the Vistula reaches Strumień it is joined by the Knajka river.

From the sources of the Vistula to Ustroń, and from the source od the Brennica to the vicinity of Skoczów the catchment area is mountainous (Fig. 2). From Ustroń a vast wet plain extends with numerous streams, dissected by many millraces and channels supplying water to ponds (S t a r m a c h 1957).

The Bajerka river flows in the vast Vistula valley, passing the pond complexes of Landek, Gołysz and Mnich situated on its sides. At the end of the 14.7 km of its course

it enters a reservoir. It is a small channelled stream artificially connected with the Vistula at Harbutowice.

The first stretch of the Bajerka is similar in nature to a typical piedmont stream with a swift current. With its course the current gradually becomes slower, and in its near-mouth stretch the river is similar to a pond (S o w a 1959, 1961).

2.2. CLIMATE

The climate of the Goczałkowice reservoir catchment area is not uniform. According to R. Gumiński's classification, three agricultural-climatic regions meet there: Carpathian, Carpathian piedmont and Sudeten piedmont regions (S t a r m a c h 1957).

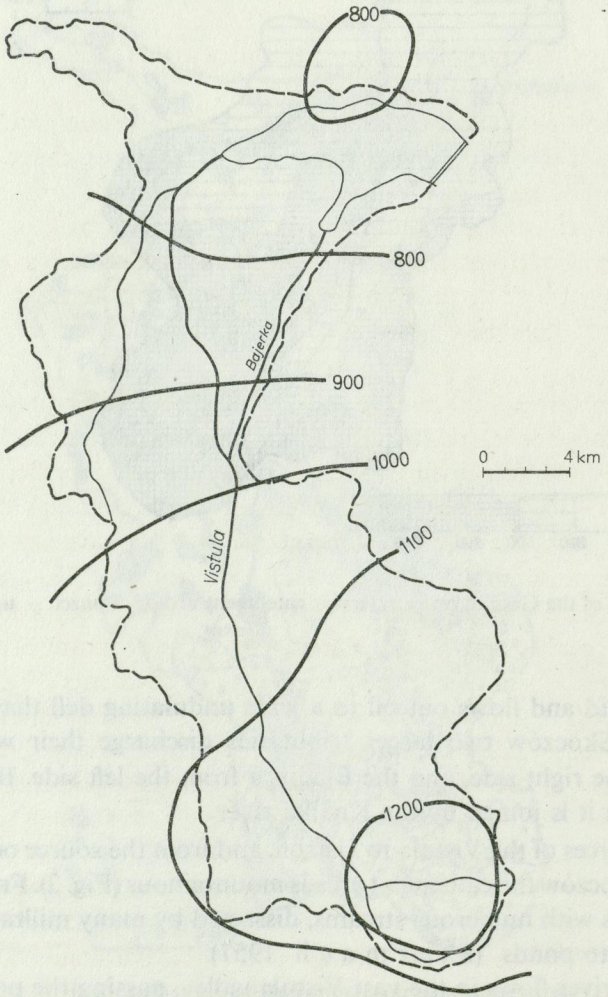

Fig. 3. Course of annual precipitation totals in mm in the Goczałkowice reservoir catchment area (data of the years 1881 – 1930 acc. to Wiszniewski – after J. Punzet – unpublished data)

In the mountain part of the basin the mean annual temperature is about 6.3°C. Annual precipitation total (Fig. 3) for the source, the highest south-eastern parts of the mountain parts of the catchment area, comes up to about 1200 mm. In the lower mountain terrains it varies between 1000 and 1200 mm, and in the remainder of the piedmont area farther from the mountains the annual precipitation total is within the range 800–1000 mm, and the mean temperature – 7.1°C (Lazar – after P a s t e r n a k 1962). According to the Meteorological Station at Ochaby, located 5 km from the reservoir, the mean annual temperature for the level-land areas of the basin is 8.2°C, and the mean annual precipitation total – 879 mm (W r ó b e l 1975).

The summer half-year receives 65% of the precipitation, the winter half-year – 35%. Snowfall represents 20–25% of the annual precipitation total. Maximum precipitation falls on June and July (J. Punzet – unpublished data).

2.3. GEOLOGICAL AND SOIL STRUCTURE

Detailed soil and geological characteristics of the reservoir catchment area were presented by P a s t e r n a k (1962). According to his paper, the rock substratum in the upper and middle parts of the upper Vistula catchment area consists of flysch formations, in the central piedmont part partially overlain by Quaternary deposits. Many of the flysch formations of this area date from the Cretaceous epoch. The lower part of the catchment area is made up of Quaternary deposits: loess, loess-like loams, diluvial sands, mixed gravels, loams of the upper and of the lower Carpathian terraces (Fig. 4).

In the catchment area of the reservoir, with varied rock substratum types and relief, various soil types have developed (Fig. 5). Almost the whole mountain area of the basin is covered by shallow skeletal loamy soils, medium-deep and deep loamy soils and rock soils. In addition to a solid stony body, solid loamy soils contain a fairly large eluvial admixture (top rock) of the mechanical composition of silt, average clay, or mostly of light clay with a large admixture of sands. They are poor soils. The loamy soils are as a rule of the particle-size composition of heavy clayey loams. They are more fertile. Due to a considerable percentage of woodlands (Fig. 1) and nature of the soil deposits, surface erosion here is weak in spite of considerable gradients (Fig. 2).

The central, piedmont part of the catchment area is covered with silt soils, rendzinas (carbonate clay soils) and clay soils. These soils are rich in potassium and medium-rich or poor in phosphorus. Because it is covered with silt soils and rendzinas and has an undulating surface and a low percentage of forest cover, this area is subject to a strong surface erosion and a considerable linear erosion.

In the level part of the catchment area of the reservoir loess, peaty soils and small tracts of clay soils are found, whereas in the valley of the Vistula and its tributaries alluvial soils occur. These soils contain little assimilable potassium and small amounts of phosphorus. In spite of its silty soils, the level terrain is very little affected by erosion.

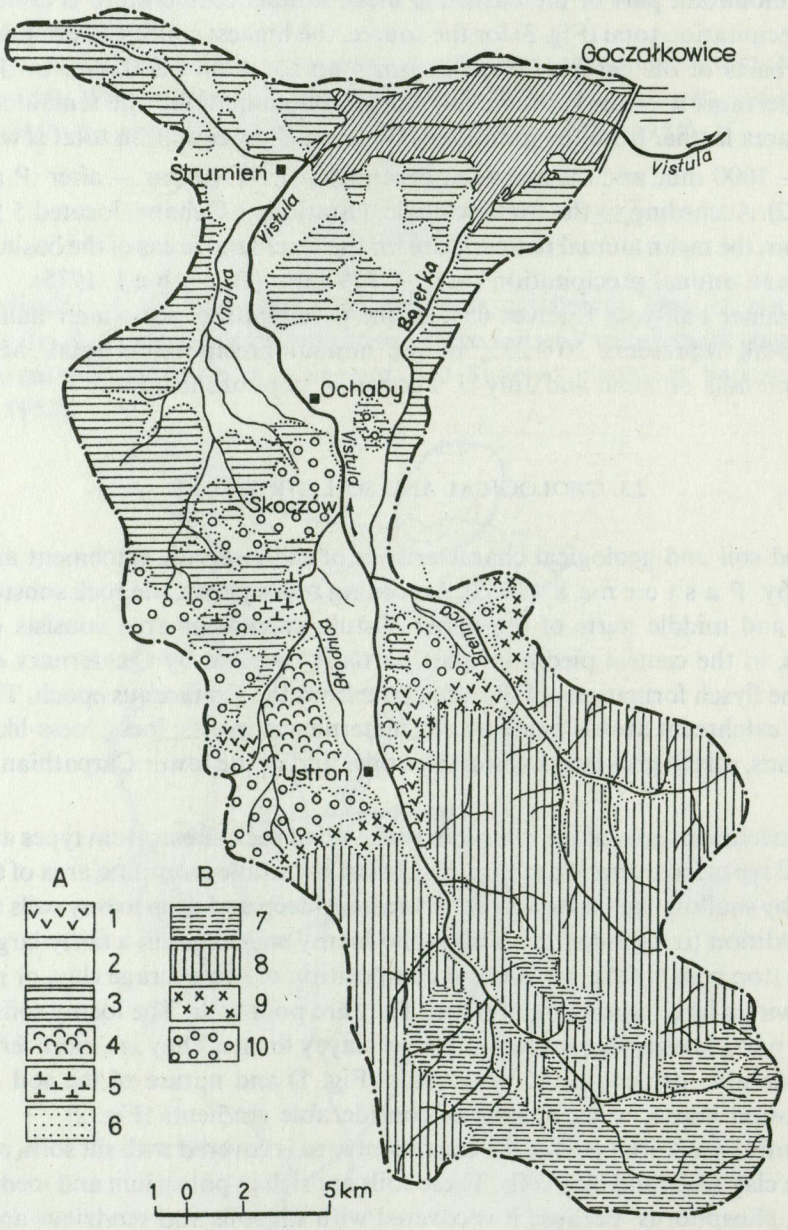

Fig. 4. Geological map of the catchment area of the reservoir at Goczałkowice (Burtanówna et al. – according to P a s t e r n a k 1962)

A: Quaternary: 1 – breccia and loams from pre-Quaternary weathering of older rocks, 2 – gravel sands and loams of the lower Carpathian terraces, 3 – loess and loess-like loam, 4 – breccia and loams of the upper Carpathian terraces, 5 – mixed gravels, 6 – sand of ice-age accumulation, B: Cretaceous (Ailesian) series: 7 – Istebna sandstone, shales and conglomerates, 8 – Godula sandstone and shales, 9 – Lgota sandstone and shales and Wierzowa shales, 10 – Cieszyn shales and limestones with small outcrops of cieszynites (igneous)

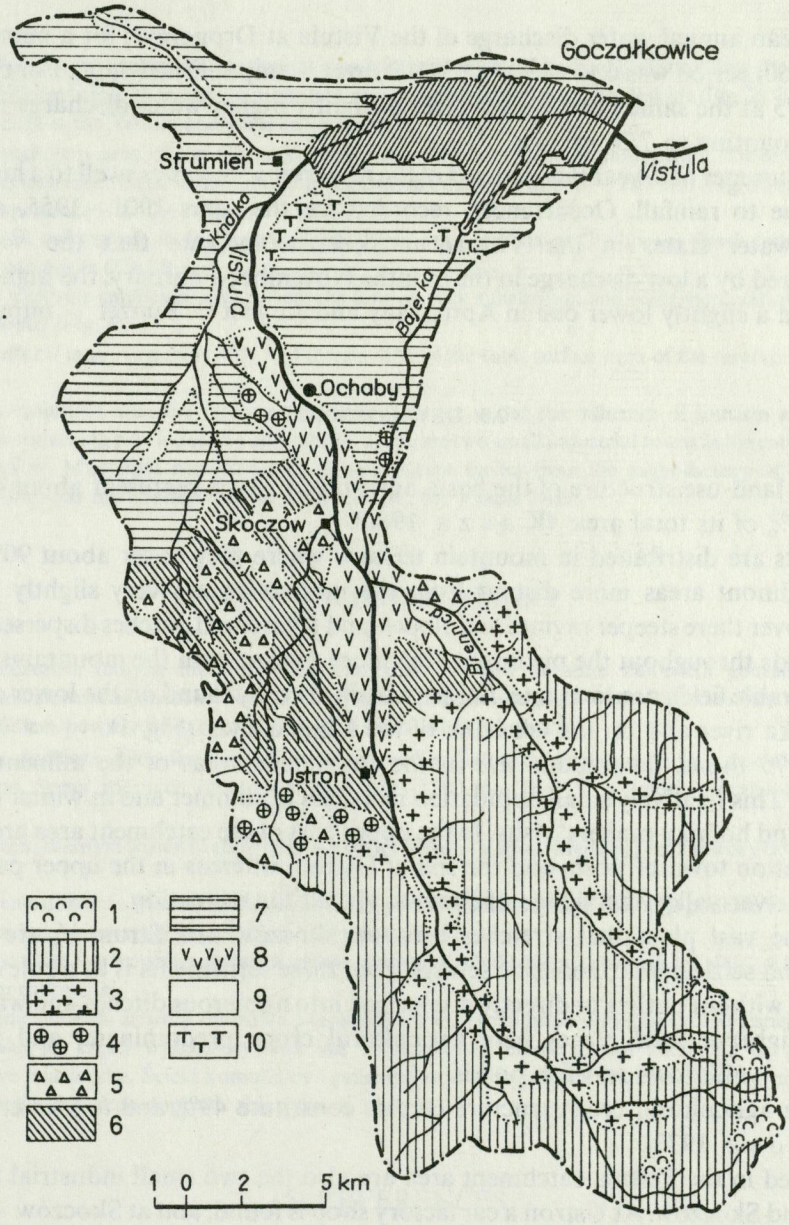

Fig. 5. Map of the soils of the Goczałkowice reservoir catchment area (Lazar – according to Pasternak 1962)

1 – rocky soils, 2 – skeletal loam soils, 3 – loam soils, 4 – clay soils, 5 – rendzinas (carbonate clay soils), 6 – silt soils: formed out of brecciated flysch, 7 – silt soils formed out of lessoid sediments, 8 – light alluvial soils, medium alluvial soils, and heavy alluvial soils of mountainous areas (with stones), 9 – light, medium and heavy alluvial soils of level areas, 10 – silty bog soils and peaty soils

2.4. HYDROLOGY

The mean annual water discharge of the Vistula at Drogomyśl for a many-years' (1901 – 1960) period was 6.15 $m^3 \cdot sec.^{-1}$ (J. Punzet – unpublished data). For the years 1973 – 1975 at the same point on the river a slightly higher water discharge rate was found, amounting to 7.24 $m^3 \cdot sec.^{-1}$.

In the summer half-year the affluents of the reservoir sometimes swell to a high level, usually due to rainfall. Occurrences, recorded for the years 1901 – 1955, of mean monthly water states in the Vistula at Skoczów indicate that the Vistula is characterized by a low discharge in the months November-February, the highest state in July and a slightly lower one in April, May and August (J. Punzet – unpublished data).

2.5. DEVELOPMENT

In the land-use structure of the basin agricultural lands represent about 46% and forests 40% of its total area (K a s z a 1980).

Forests are distributed in mountain terrains where they cover about 90% of the area. Piedmont areas more distant from the mountains are very slightly forested. Woods cover there steeper ravines and slopes, and form small patches dispersed amidst arable fields throughout the piedmont area more distant from the mountains. In level terrains arable fields predominate. Larger woods are only found on the lower course of the Bajerka river and on the left bank of the Knajka river (Fig. 1).

Over 75 thous. inhabitants live in the catchment areas of the affluents of the reservoir. This relatively small population increases in summer and in winter owing to tourists' and holiday-makers' visits. In the upper part of the catchment area are located the recreation town of Wisła and the spa of Ustroń, whereas in the upper part of the Brennica river valley the village of Brenna, visited for recreation.

On the vast plain that stretches between Skoczów and Strumień are situated villages and settlements. Domestic sewage from these settlements is as a rule stored in cesspools without outlets or directly discharged into numerous ditches and watercourses. In higher-located places here agricultural crops predominate, and in lower localities – meadows and fish ponds.

In the agricultural crop structure cereals constitute 49% and fodder crops 25% (G o r g o s z 1973).

Located in the Vistula catchment area are also the two small industrial towns of Ustroń and Skoczów. At Ustroń a car factory shop is found, and at Skoczów – a large linen and felt factory, a tannary, a fruit-processing factory and a foundry.

In the immediate catchment area of the reservoir lies the little town of Chybie where there is a sugar-factory. Wastes from the industrial plants and municipal sewage are discharged into the Vistula, and only wastes from the sugar-factory of Chybie are carried by a pipeline and discharged below the reservoir. At some of the pollution sources sewage-treatment plants have been built.

3. SUMMARY

The Goczałkowice reservoir catchment area is described on the basis of literature data. Its surface area equals to 532 km^2 (Fig. 1), including mountain and piedmont regions of the Beskids (Fig. 2). The source of surface feeding is the Vistula and Bajerka rivers.

The catchment area of the Goczałkowice reservoir is not uniform climatically. Three agricultural-climatic regions meet there. Total annual precipitation comes up to 800 – 1200 mm (Fig. 3), and the mean annual temperature is of the range 6.3 – 8.2°C.

The rock substratum in the reservoir catchment area consists of Cretaceous flysch formations and Quaternary deposits (Fig. 4).

In the reservoir catchment area, where the kind of rock substratum and relief vary, various soil types have developed (Fig. 5).

Agricultural land represents 46% and forests 40% of the total surface area of the reservoir catchment area.

In the mountain area the reservoir catchment area is under the influence of tourism and forestry, whereas the remaining part is used by agriculture. There are two small industrial towns in the catchment area of the reservoir. Municipal and industrial sewage, except wastes from the sugar-factory of Chybie, are discharged into the main affluent of the reservoir, i.e., the Vistula river.

4. POLISH SUMMARY

Na podstawie danych literaturowych scharakteryzowano dorzecze zbiornika goczałkowickiego. Powierzchnia zlewni zbiornika wynosi 532 km^2 (rys. 1), obejmując górskie i podgórskie obszary Beskidów (rys. 2). Źródłem powierzchniowego zasilania są rzeki Wisła i Bajerka.

Klimat dorzecza zbiornika goczałkowickiego nie jest jednolity. Zbiegają się tu 3 dzielnice rolniczo-klimatyczne. Suma rocznych opadów wynosi 800 – 1200 mm (rys. 3), a średnia roczna temperatura 6,3 – 8,2°C.

Podłożem skalnym w zlewni zbiornika są utwory fliszowe z epoki kredowej oraz utwory czwartorzędowe (rys. 4).

Na terenie dorzecza zbiornika, zróżnicowanym pod względem rodzaju skalnego podłoża i ukształtowania powierzchni, wytworzyły się rozmaite gleby (rys. 5).

W strukturze użytkowania gruntów zlewni zbiornika użytki rolne stanowią ok. 46%, a lasy 40% jej powierzchni całkowitej.

W terenie górskim zlewnia zbiornika pozostaje pod wpływem turystyki i gospodarki leśnej, natomiast na pozostałej jej części wykorzystywana jest rolniczo. Na terenie zlewni zbiornika są położone 2 przemysłowe miasteczka. Ścieki komunalne i przemysłowe, za wyjątkiem ścieków z cukrowni Chybie, są wpuszczane do głównego dopływu zbiornika, tj. rzeki Wisły.

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