SILTING OF THE SIELPIA WATER RESERVOIR IN THE 20TH AND 21ST C. (CENTRAL POLAND)

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Michał Aksamit[2]
Piotr Kusztal[2]
Tomasz Kalicki[1]
Paulina Grzeszczyk[2]
Paweł Przepióra[1]
[1] Institute of Geography, Jan Kochanowski University in Kielce, **Poland**
[2] Student Science Club of Geomorphologists „Złoty Bażant", Jan Kochanowski University in Kielce, **Poland**

ABSTRACT

In the 20th and 21st c. the Sielpia water reservoir was silted several times. The reasons for this were the progressive bed erosion caused by the disappearance of the anthropogenic small-scale water retention system and repeated catastrophic discharges caused by dams destructions. At that time it came to the significant environmental changes.

Keywords: Sielpia water reservoir, flash floods, erosion, silting

INTRODUCTION

The Sielpia water reservoir (55 ha) is located on the Czarna Konecka river (central Poland), which drainage the north-western margin of the Holy Cross Mountains (Fig. 1). It was constructed at the beginning of the 19th century and for about 100 years it was used as an industrial pond of the metallurgical plant [1]. In the 30s of 20th c., the dyke dividing the pond has been destroyed during floods[1]. This destruction may have been due to the neglect of the hydrotechnical infrastructure after the collapse of the local ironworks in 1921 and the progressive silting of the reservoir (water overflow due to reduction of the pond capacity). The disappearance of the anthropogenic small-scale water retention system (small ponds) on the river near Piekło village [2], [3] between 1915 and 1938 [4] may have been conducive to the process of silting of Sielpia water reservoir at that time. The Sielpia water reservoir was rebuilt in the 60s of 20th c. Since that time, it has been silting again as a result of e.g. anthropogenic flash floods caused by breakdowns of dams (Fig. 2) on Czarna Konecka river [5], [6], [7], [8]. In the 80s, part of the muds from the bottom of the pond were replaced by sand (maintenance works)[1]. Obtained ecological condition of reservoir did not last long, because its silting was progressed. Due to the unrepaired dam in Małachów (destruction in 1993) an increase of bank and bed erosion (Fig. 3), rate and size of bedload transport in the river and accumulation in the pond occurred [9]. As a result of these processes, the area and capacity of the Sielpia water reservoir has decreased [8], [10] and it is very shallow (Fig. 4).

[1] http://konecki24.pl/2015/08/02/ps-60263-pikantna-historia-zalewu-w-sielpi-na-wodzie-pisana/

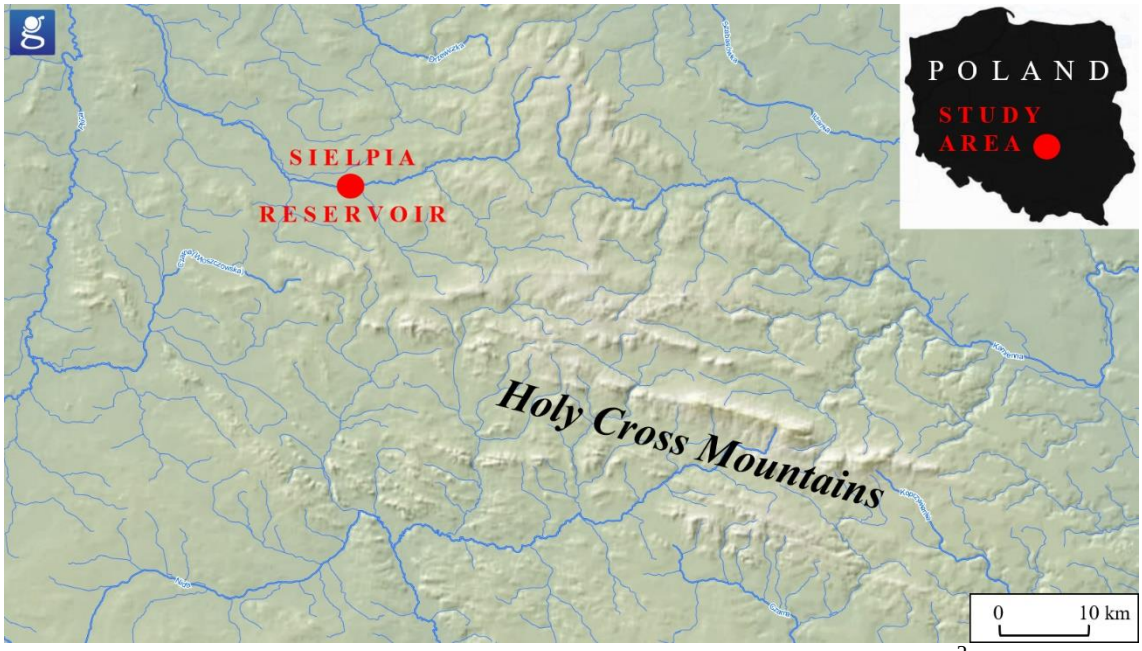

Figure 1. Location of Sielpia water reservoir on Digital Elevation Model[2]

METHODS AND AIM OF STUDY

Historical data, cartographic materials, field measurements (morphometric, bathymetric) and laboratory research (sediment grain-size analysis by sieve method, Folk and Ward's distribution parameters counting and graphic presentation by GRANULOM program of A. Walanus [11], [12]) made it possible to determine the causes, a conditions and a rate of silting of the Sielpia water reservoir (Polish Uplands) in 20th and 21st centuries.

RESULTS

The effects of progressive headward erosion and catastrophic discharges from the 2nd half of the 20th century were inventoried in the section of the Czarna Konecka valley floor downstream of Janów (Fig. 2): undercuts of river banks, an incision of the riverbed, confined meanders (Fig. 3), transformation of some floodplain section into a terrace, erosion forms on the floodplain, very coarse deposits of cut-and-fill and alluvial covers in the valley floor [6], [7], [8]. They document the disappearance of a significant part of the sediments in the riverbed zone. The river probably transported the missing deposits to the estuary section (downstream of Piekło village) and to the pond at Sielpia (Fig. 2). This is indicated by bathymetric measurement results, which show that near river mouth into the reservoir depth of lake usually doesn't exceed 50 cm and there are shallows (Fig. 4). An inland delta was created there [7], [8], consist of sandy material, which is also in river bank undercuts profiles upstream of Sielpia.

[2] http://mapy.geoportal.gov.pl/imap/

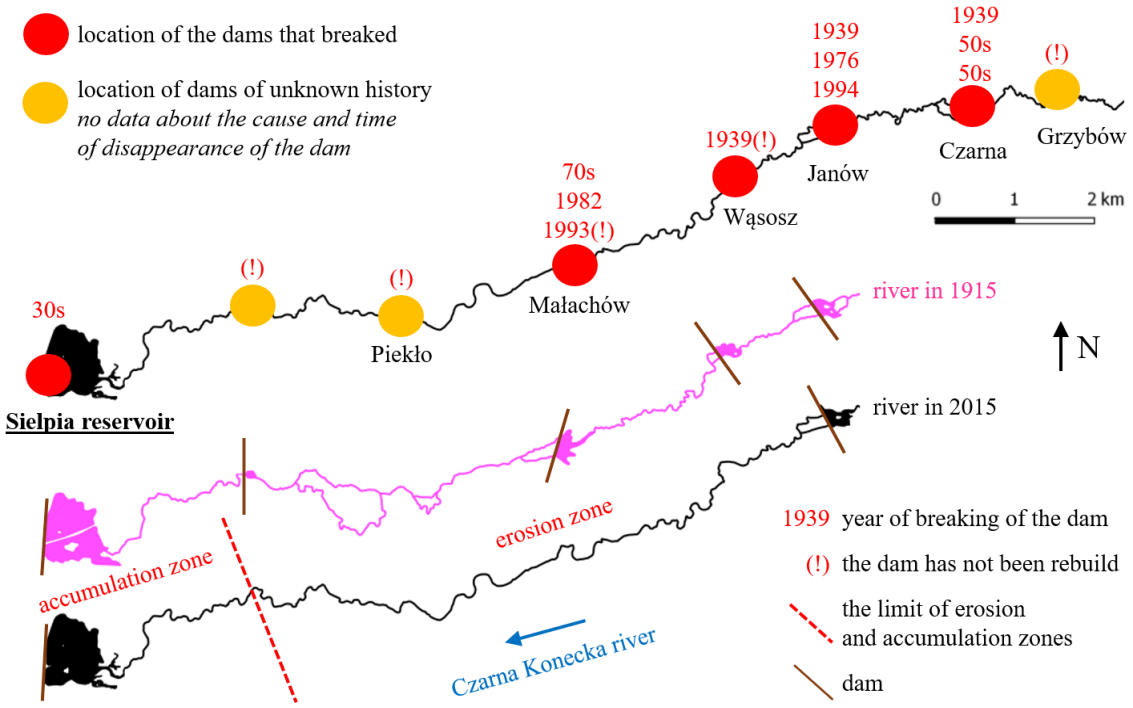

Figure 2. Destructions of dams on the 13 km section of the Czarna Konecka river valley upstream of the Sielpia reservoir and effects of the disappearance of the anthropogenic small-scale water retention system (Janów-Sielpia section) in the 20th c.

Figure 3. Effects of progressive erosion and catastrophic discharges in the riverbed
1 - river level lowering relative to the ruins of the former dam at Małachów,
2 - confined meanders downstream of Janów

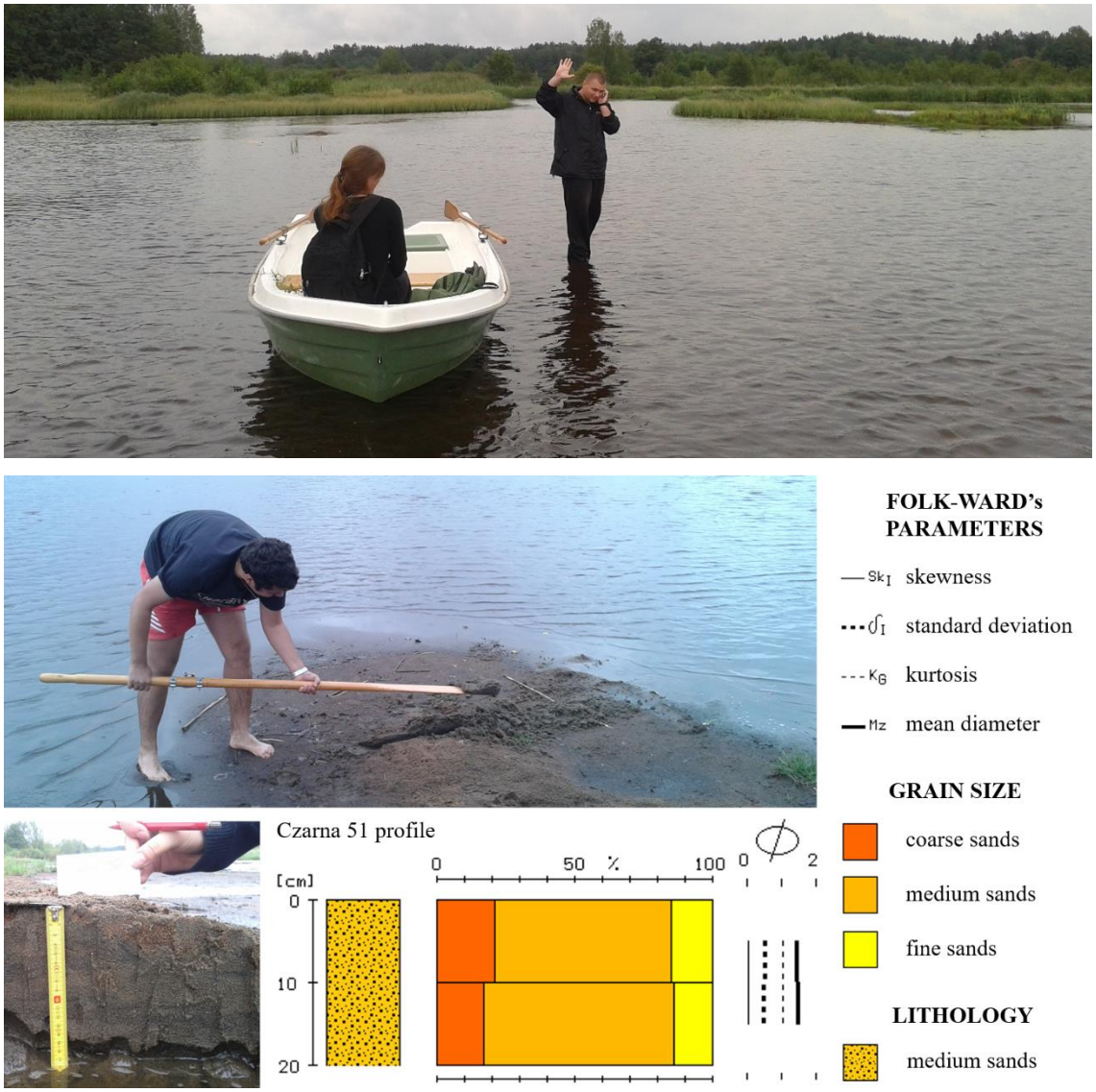

Figure 4. Shallow of the reservoir near the river mouth and the grain size and Folk-Ward's distribution parameters of the top sediments of the inland delta

CONCLUSIONS

In the 20th and 21st centuries the Sielpia water reservoir was silted several times (probably in 1930s, 1980s and after 1993). The reasons for this were the progressive bed erosion caused by the disappearance of the anthropogenic small-scale water retention system in the sections of Małachów-Sielpia (probably in the 20-30s of 20th c.) and Janów-Sielpia (in 1993) and repeated short-time episodes of intensive transformation of the valley floor (catastrophic discharges) caused by dams destructions (at least 11 events). The rate of pond silting increased when in 1993 the length of river section without dams almost doubled. Since that time, there have been very clear changes of the riverbed morphology typical for environments with higher energy of relief.

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