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MONSUL

„Analysis of factors affecting the ecological status of the Sulejow Reservoir based on continuous monitoring and integrated 3D model of the artificial lake (project MONSUL)”

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Project

MONSUL

Introduction

The water resources supporting the Lodz Region are limited. The care and protection of these resources from degradation should be a main objective of public administration authorities, research centres and all inhabitants of the region. To meet this objective, scientists of Lodz University of Technology and their Norwegian partners undertook a project aimed at the analysis and evaluation of the impact of factors affecting the ecological condition of the Sulejow Reservoir ("Reservoir"). The results of this research will serve as a base to maintain and revitalize the water ecosystem, its ecological potential, improve the water quality and also be used to upgrade the programmes to protect the Reservoir long term.

The Sulejow Reservoir was built in the early 1970s. No big water reservoirs existed in the area at that time and the reservoir was planned for the increase in water demand to support the rapidly expanding Lodz agglomeration. The Reservoir functions are evolving. Starting out as a place to store water to what is now an important place for recreation, water sports and a unique and very complex ecosystem with variety of plant and animal species. The Reservoir evolution strongly impacted the local economy, farming, water retention and microclimatic conditions. The water condition is degrading due to unconstrained volumes of pollutants that are draining into the Reservoir, resulting in the excessive growth of blue-green algae.

Why do we implement the project?

The Sulejow Reservoir is integral to the Lodz area ecosystem, which includes in excess of 100,000 inhabitants. The local ecosystem is endangered by the susceptibility of the water resources to eutrophication caused by local farming, industry and inhabitants, and even changes in the climate. These dangers must be assessed, predicted and minimized.

Scientists from the Faculty of Process and Environmental Engineering, Lodz University of Technology, together with The Norwegian Institute for Water Research (NIVA) from Oslo, plan a comprehensive assessment of the ecological status the Sulejow Reservoir ("Project"). The Project will develop tools and coherent model of the basin water monitoring. Researchers from the Faculty of Geographical Sciences of Lodz University will be involved in developing bathygraphic maps and spatial database of the Sulejow Reservoir. The tools and methods developed in this Project will also be available to the agencies for water management of other reservoirs throughout Poland and internationally.

The Norwegian Financial Mechanism and the Financial Mechanism of European Economic Area (e.g. Norwegian funds and EEA funds) provide the financial support for this project in the amount of PLN 1.7 million.

Partners

The main partner of the project is The Norwegian Institute for Water Research (NIVA), established in 1958 and considered as one of the most renowned European research entities of this type. Norwegians understand that natural resources are critical to their economy. This is especially true for water, what provide critical support for the Norwegian citizens standard of living and hydropower. We will also co-operate with the faculty of Geographical Sciences of Lodz University. One outcome of the project is to generate bathygraphic maps of the reservoir and a spatial database of the area of the artificial lake. The project will use available software for the collection of information about the environment and geographical space. We will also take advantage of recent 3D modeling to visualize the information related to the ecological condition of the reservoir waters.

Vision, aims and effects

The project implemented by the Lodz University of Technology and the Norwegian Institute for Water Research is intended to be inclusive. Therefore, we want to involve other entities in the project – local governments and institutions responsible for hydrological and environmental administration. We will also co-operate with non-governmental organizations, entrepreneurs, and those who are involved in care and management of the Sulejow Landscape Park, angling circles and sailing clubs - acting in the area of the Sulejow Reservoir.

The MONSUL project focus on the following:

- Launching a measurement device used for an evaluation of water quality parameters. The measurement device will be integrated into the ecosystem and efficiently transmit data for real-time analysis. The monitored parameters will include: chlorophyll concentration, content of nitrates and phosphates, water temperature, pH, oxygen concentration, conductivity;
- Developing a database of the area of the Sulejow Reservoir for GIS - Geographic Information System;
- Developing a 3D model of the Sulejow Reservoir. The model will enable calculations for temperature distribution, flow velocities and concentrations of pollutants, as well as the simulation of the ecological condition of the reservoir;
- Disseminating Project results in an open forum, publishing research articles with a focus on international cooperation, conference presentations, workshops and seminars.

The ultimate goal of the project is to develop a universal tool that enables critical and balanced decisions that concern environmental protection and planning related to the environment of the reservoir waters.

The model will be easily adapted to use for the other water reservoirs in Poland. The equipment bought for the project will continue to have value after completion of the project in at least the following areas:

- The GIS database of the reservoir area will be used for educational and research purposes and as a tool supporting the management of water resources and space management in the reservoir area;
- The 3D model of the reservoir will become an instrument supporting the management of the waters of the Sulejow Reservoir, enabling an upgrade of existing water protection programmes;
- The beneficiaries of the project will be the authorities of The State Environmental Monitoring, responsible for the monitoring and dissemination of environmental data; the local authorities will complete and upgrade the data concerning the water quality in the Sulejow Reservoir;
- The GIS system data and the 3D model of the reservoir can be used by The Regional Water Management Authority in Warsaw, as a tool to support management of the reservoir, including an upgrade of water management plans for the region. The Regional Directorate for Environmental Protection in Lodz will be able to use the tools to upgrade environmental protection programmes developed for the reservoir area.

The creation of a universal and complex tool for the evaluation of the quality condition of a large water reservoir provides a base for further scientific and educational research. Environmental awareness will be increased and attention will be drawn to complex water monitoring. The model developed in this project will be the most reliable and available control system of water ecosystem condition in the EU.

The Sulejów Reservoir

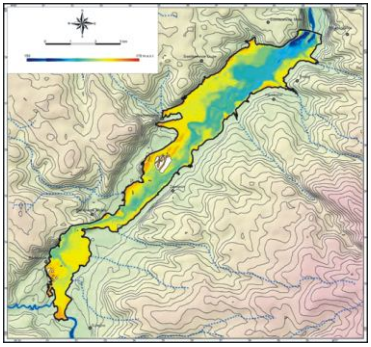
The Sulejów Reservoir is a typical, shallow lowland reservoir, taking up a large area.

- The Reservoir was created in 1969-1973 as a result of damming the Pilica river near the village called Smardzewice. A concrete and soil dam with the length of 1200 m and the height of 16 m was constructed on the 139th kilometer from the mouth and resulted in the creation of a reservoir with the surface area of 2700 ha.

- The reservoir water supply comes mainly from two rivers: Pilica and Luciąża.

- Basic description of the Sulejów Reservoir:

- length 17.1 km,
- maximum width 2.1 km,
- average width 1.5 km,
- average depth 3.3 m,
- maximum depth 11 m,
- shoreline length 58 km,
- surface area approx. 27 km^2,
- usable volume 61 mio. m^3,
- maximum volume 75 mio. m^3,
- catchment area 4900 km^2.



The Sulejów Reservoir is particularly susceptible to eutrophication, caused mostly by long water retention (40 days), low average depth, inflow of waste waters from the direct catchment area and the supply rivers: Pilica and Luciąża. The eutrophic character of the waters is caused by excessive load of biogenic substances, especially phosphorus, fed

into the reservoir from both local and area sources. The most disadvantageous manifestation of the increased water fertility are toxic cyanobacterial blooms in the vegetation period. The presence of algae disqualifies the reservoir as a source of potable water but also limits its recreational functionalities. Contact with cyanobacteria in water may cause allergic reaction, both dermatological and gastric. Consumption of even small amounts of cyanobacteria toxins in water for prolonged periods of time may result in liver or colon cancer.

The quality of water in the reservoir depends mostly on the level of the supply rivers. 64% of the areas around the reservoir are used for farming purposes, there are no factories or large industrial plants in close proximity causing direct pollution. All in all, for many years the reason for the unsatisfactory condition of the environment have been surface run-off from agricultural areas, sewage from leaking septic tanks and areas without a central sewage system, resulting in the loss of biodiversity and the reduction of the environmental value of the local ecosystem.

Photo: Jacek Szabela, Michał Pieczara