# DEPARTMENT OF AGRICULTURAL AND ENVIRONMENTAL CHEMISTRY
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# ANTROPOGENIC SOURCES OF NUTRIENTS EMISSION FOR THE BYSTRZYCA RIVER BASIN (PRELIMINARY RESULTS IN FIRST YEAR OF INVESTIGATION)

## Aim, Material and Methods

The Bystrzyca River catchment is an area with a high degree of utilisation of its water resources. The aim of this study is to present a current state of the waters for the Bystrzyca River in terms of its nitrogen and phosphorus content. There will also be an attempt to locate the major sources of these nutrients, as to their focal point and overall area. We will also estimate the influential share for agrocultu-production in the formation of the river waters chemical composition. In addition, we will determine the complete amount of analysed nutrients transported over time in individual test sections of the river, as well as their entry to the estuary of the Wieprz River. This project will provide a theoretical basis for measures aimed at improving the environment in the test basin.

The research area is associated with the Bystrzyca river catchment, covering an area of 1,315.5 km$^2$ located almost entirely in the Lublin Uplands. The Bystrzyca River flows through Lublin (354,000 inhabitants), and has a length of 70.3 km. Its sources are located in Sulów and flows into the Wieprz River. It feeds five tributaries as follows: Kosarzewka, Czerniejówka, Krężniczanka, Ciemięga, and Czechówka. On this river there is a reservoir with an area of 282 ha with a total capacity of 6.34 million m$^3$ (Zemborzycki) - in the southern part of Lublin. It encompasses a 725 km$^2$ part of the catchment area.

The Bystrzyca river catchment is dominated by areas such as: agriculture arable land: 70.7%, meadows and pastures: 4.1%, orchards, 3%, forests 10.8%, built-up areas: 5.2%, standing water: 0.32%, flowing water: 0.22%, roads: 2.6%, rail travel: 0.6%. The river basin is inhabited around 0.5 million people. The largest municipalities are: Lublin 351,000, Bełżyce 6,900, Bychawa 5,400, and on the border of the catchment: Świdnik 40,000 residents.

In order to determine accurately the purity of the river water of the Bystrzyca over its entire length, 14 points were spaced evenly from its source to the estuary. Next, six measurement points were located on downstream sections of the main tributaries, and six additional points were placed after sewage treatment plants, which flood treated sewage into the Bystrzyca (Zakrzówek, Bystrzyca Stara, Piotrowice, Osmolice, Pszczela Wola, Lublin Hajdów). Water samples were collected regularly once a month in two replications for each measuring point. The content of nitrogen from nitrates and ammonium were determined, as well as phosphate phosphorus using colourimetry. To calculate the amount of nutrients that are lost from the Bystrzyca river catchment area, data will be collected from IMGW Institute of Meteorology and Water Management (flow of water taken at the Sobianowice measure point). Based on these data as well as data from the Hydrographic Department in the Maria Curie-Skłodowska University in Lublin, will allow us to calculate the approximate nutrient flows, as well as outflows for the sampling points. In order to calculate the sum of precipitation, data from meteorological stations and posts located in the Bysrzyca river catchment will be used. To assess the anthropogenic burden on the river by sewage, we will use analysed data that is collected by the Regional Inspectorate for Environment Protection in Lublin for operating wastewater treatment plants in the catchment area (the amount of wastewater discharged, the contents of biogenic components in them).

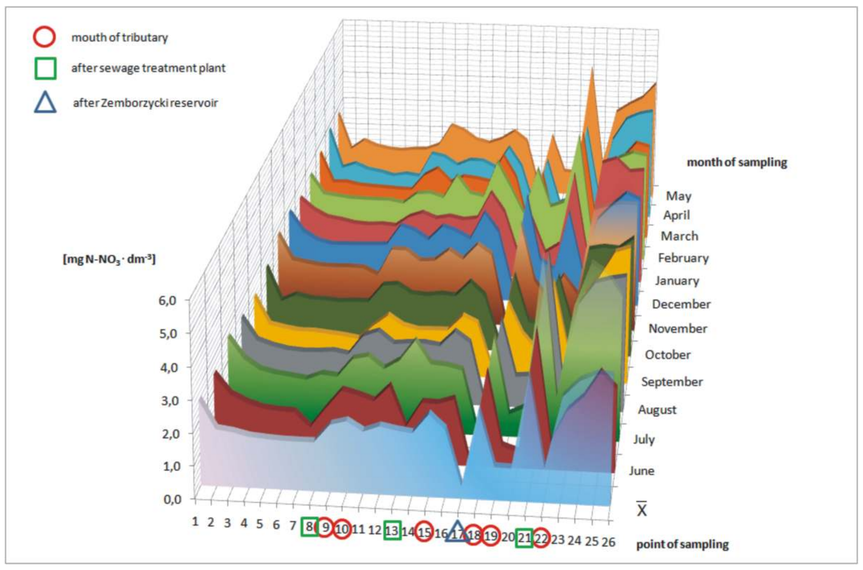


Fig. 1. The content of nitrates nitrogen (N-$NO_3$) in the river waters.

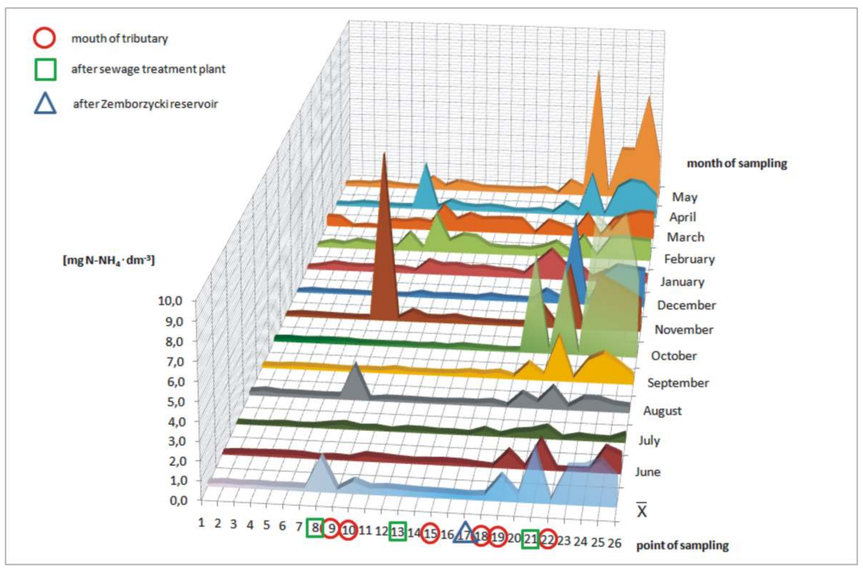


Fig. 2. The content of ammonium nitrogen (N-$NH_4$) in the river waters.

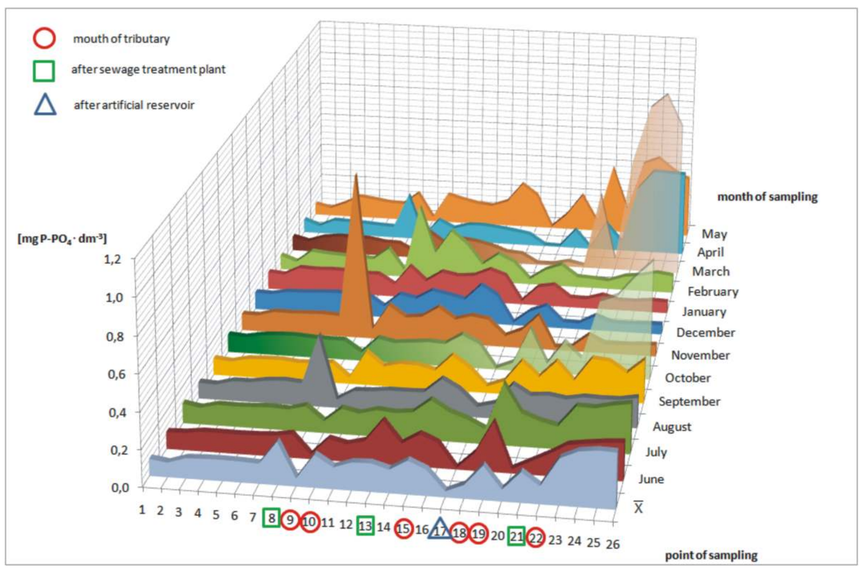


Fig. 3. The content of phosphorus (P-$PO_4$) in the river waters.

## Summary


The aim of this study is to present the current water conditions of the Bystrzyca River, with a special focus on phosphorus and nitrogen concentrations. We will try to locate the largest amount of nutrient sources in the river basin, and to estimate the influence of agriculture on the chemical composition of the river's water. We need this information to find effective methods for the reduction emission of pollutants.

The experiment consists of twenty-six checkpoints in the Bystrzyca river basin. River water samples will be taken each month for three years. The samples will be analysed for P-$PO_4$, N-$NO_3$ and N-$NH_4$ content. Hydrological data and information about site sources of nutrients (from sewage treatment works) will be also collected and calculated in this experiment.

The paper presents preliminary results in first year of investigation.


## Conclusions

1. Point sources of nutrients (e.g. sewage treatment works, polluted tributaries) clearly influences on the content of nitrogen and phosphorus in the river water.
2. Zemborzycki reservoir strongly reduces the content of nitrogen and phosphorus in the river water. Unfortunately it takes place with high level of eutrophication effect, every season for last 20 years. Average annual load of nutrients to Zemborzycki reservoir is about 125 t of N and 5 t of P.
3. Localisation of Critical Source Areas (CSA) seems to be difficult now due to the strong influence of point sources. Improvement actions must therefore first address to reduce emissions from point sources.
4. For deeper analysis localisation of CSA we need additional hydrological data to calculate the complete amount of analysed nutrients transported over time in individual test sections of the river, as well as entered its estuary.


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