Geophysical research in the pilot area – water intake Świerczków in Tarnów / photo: Sławomir Sitek

RECOVERING RAINWATER

The newest data provided by NASA satellites, which measure water beneath the Earth's surface by making use of the force of gravity, provide information about the rapid decline of groundwater resources. It could seem that the results of measurements of resources, which are invisible to the naked eye, are of interest only to specialists. However, in such a country as Poland, for example, about 75% of tap water comes from groundwater resources.

Additional groundwater supply from the Dunajec River through a infiltration trench in Tarnów / photo: Grzegorz Wojtal

Climate change is exacerbating the water deficit, and the Earth is threatened by drought, so hydrogeologists on all continents concentrate their research on the improvement of methods for providing additional groundwater supply. A real solution is the accumulation of excess surface water, i.e. using heavy rainfall, which can be stored in aquifers and resorted to when drought comes. Additional controlled groundwater supplies are possible thanks to Managed Aquifer Recharge (MAR) systems.

No continent is safe. Europe struggles with water shortages, too. An international team including scientists from the University of Silesia is preparing to develop solutions for additional artificial groundwater supplies in Central European countries by using rainwater. Partners from five countries – Poland, Hungary, Slovakia, Croatia, and Germany – also participate in the DEEPWATER-CE project. The team of hydrogeologists from the Institute of Earth Sciences at the Faculty of Natural Sciences of the University of Silesia is headed by Dr. Sławomir Sitek. The project began in May 2019 and is to end in April 2022.

The ongoing climate changes in Central Europe have had a considerable and negative impact on the level of groundwater resources. The region has to face rising average air temperatures and an increasing number of extreme weather events such as droughts, heat waves, floods, and violent thunderstorms. The quantity and distribution of precipitation varies over time, which leads to extreme fluctuations in river flows and limits access to water resources in industry and agriculture, but also for private consumers.

At the beginning of July 2019, the Polish Institute of Meteorology and Water Management issued a heat warning for the Silesian Voivodeship due to a threat of water shortage. At the end of the same month, record rainfall was recorded in Katowice, the capital of this region. Within an hour, a total of 74 liters of water per 1 m^2 fell, which was over 10% of the annual rainfall.

– If such an amount of water is not utilized even in a small percentage, we will lose it, since the surface run-off will direct it to the river, and subsequently it will flow into the Baltic Sea. The main issue, therefore, is to store excess water after heavy rainfall or snow and to use it in times of drought, explains Dr. Sławomir Sitek.

The most frequently used solution are intakes with filtering i.e. the construction of underground water intakes along river banks. Water drawn from such intakes is used, among others, by the inhabitants of Bielsko-Biała and Cieszyn in the Silesian Voivodeship. Rainfall water can also be directed by means of geological boreholes and pumps, with the help of filter ponds. This option is much cheaper than the construction of huge retention reservoirs. Countries which have been struggling with water shortages for many years have implemented such solutions. Spain and Australia are pioneers with regard to the application of methods for additional groundwater supply, however, the implementation of these technologies in Central Europe requires an adaptation of this method to geological and hydrological conditions. The DEEPWATER-CE project has been drawn up in order to review and identify the most effective options to be used in Central Europe, taking into account the area's exposure to climate change according to climate model projections. An analysis of climate scenarios for the Central European region will identify areas that could particularly benefit from additional groundwater recharge due to an increased risk of water shortage and drought.

The research area of the pilot project by the Polish scientific team is a groundwater intake in Tarnów, Lesser Poland, which supplies about 100,000 inhabitants with drinking water. As the scientists explains, the choice of this location was not accidental. Tarnów is a model example because it has some of the largest nitrogen plants in Europe, which may pose a potential threat to the groundwater intakes located there. For this reason, the hydrogeologists from the University of Silesia intend not only to adapt an appropriate method of increasing groundwater resources, but also aim to develop an early warning monitoring system that will ensure safety and good quality water for the city's inhabitants. Using the intake in Tarnów as an example, the scientists want to prove that additional water supplies can also be used in areas threatened by deterioration of groundwater quality due to neighboring industrial plants.

text: Maria Sztuka

Dr. Sławomir Sitek
Institute of Earth Sciences
Faculty of Natural Sciences
at the Univesity of Silesia
slawomir.s.sitek@us.edu.pl