Sustainable nitrogen fertilization for agricultural crops developed based on open lab and field experiments and integrated hydrological modelling in near-real-time

In an era when population constantly growth and the demands for food, water and energy still increase, agricultural production faces a challenge on which the security of future generations depends. Sustaining constant development, we are reaching barriers of the raw material reserves our planet offers us. In an effort to support continuous growth, we optimize food production processes to increase the production as much as possible. As a result, we disrupt sustainable development by forgetting about the environment around us because here and now we have to meet the population's demand for food. Farmers, in order to meet these challenges, are forced to fertilize their crops, protect them from various diseases and prolonged droughts. Unfortunately, such activities have a negative effect on the environment which leads to the disruption of local ecosystems to such an extent that the results of these changes are often irreversible.

The goal of the project is to develop a model that operates at the agricultural catchment scale to support farmers in the decision-making process. The model will predict in near real time the spread of nutrients such as nitrogen in environment . Nitrogen is one of the basic macroelements that is necessary for plant growth, but after the fertilization it is often washed out from the fields and feeds surface and groundwater causing degradation of local environment.

In order to mitigate the negative effects of fertilization, the project will focus on developing a methodology for sustainable crop fertilizing that will take into account the weather conditions, such as prolonged drought or heavy rain, and help to keep as many nutrients as possible in the soil, significantly reducing the environmental degradation caused by crop production.

The end result of the work will be novel methodology of sustainable crop fertilization which will be supported with near-real-time modelling. Results will present actual state and quality of water bodies and meteorological conditions. In addition, results will be visualized in web application that provides predictions, based on chosen fertilization scenarios and indicating risks and benefits related to the selected scenario. The proposed scenario will ensure sustainable fertilization to achieve high yields without degradation of the local water environment.