If we learnt more about the ecosystem restoration processes by which it is possible to effectively restore ecological functions to sites transformed by the industry, we could globally recover about 1% of the land which would serve the environment and offer ecosystem services for people. As indicated by the results of the research conducted so far show, post-industrial sites including spoil heaps from coal mining which is the still main energy source in many region of the world are perceived as elements disturbing the landscape and negatively affecting the natural environment and people's quality of life. At the same time, they hold a significant natural potential which may greatly support the ecosystem services provided to humans. To give spoil heaps their environmental functions, their reclaim is carried out by introducing trees, grasses or leaving these sites to natural processes to be inhabited by organisms with different morphological, physiological and behavioural characteristics. Plant and animal species must adapt to the very difficult habitat conditions that prevail in the spoil heaps. Hence, a lot of research has been devoted to the reaction and investigation of the suitability for reclamation of various groups of plant species. Reclamation is an element of interference in the process of succession of plant and animal communities, while succession takes place spontaneously. The resulting diversity of species, their traits and functions in post-industrial ecosystems are the basis for providing key ecosystem services, especially in the era of climate and environmental changes. The most important of these are carbon sequestration and water retention along with biodiversity. Carbon sequestration is undoubtedly important for mitigating climate change, biodiversity and functional diversity are the basic elements of preserving or developing the resistance of ecosystems to changes in environmental conditions, while water retention becomes particularly important in the era of increasing drought and water deficit (Poland is at 26 position in Europe in consideration in available water resource per capita). It may be said that spoil heaps have regional impact - but regional impact translates into a global balance, and the local living environments of human populations in highly industrialized regions are of great importance to people. In view of the above, we have posed a specific research question: **how the reclamation technology used, the type of vegetation cover and the resulting species diversity, as well as the functional diversity of plants and soil fauna and microorganisms, affect carbon sequestration and water retention in novel ecosystems developing in post-mining sites which mitigate the effects of transforming the environment and provide services for human population.** So far, many studies have focused on the technology of reclaim itself, the study of individual biotic elements and abiotic ecosystems, but there is still no comprehensive study in this field. This research is also important in the context of the growing amount of greenhouse gases, including CO_2 in the Earth's atmosphere, and shrinking water resources. **Therefore, the aim of our project is to comprehensively determine the impact of various reclaim scenarios and types of vegetation on carbon sequestration and water retention of novel ecosystems along with the functional diversity of plants, microorganisms and soil fauna in mining spoil heaps.**

A comprehensive analysis of the diversity of plant, soil fauna, fungi and bacteria functional traits along with their enzymatic activity will allow to find out about correlations between them as reflected by the amount of bound C and the water retained within them. With the use of geoinformation tools, spatial correlation between the applied reclamation scenarios of a selected post-industrial site with the potential of living organisms and the parameters of the substrate will be worked out. The obtained results will allow to learn about the determinants of carbon binding and water retention in spoil heaps which are very numerous in areas that are currently undergoing social and economic transformations, in line with the concept of green deal. Gaps will also be filled in what is known about the mechanisms determining the circulation of carbon and water within anthropogenic ecosystems, while the correlations between the functional diversity of organisms in new ecosystems as exemplified by spoil heaps, and the services they provide will be determined. In the laboratory, the role of dominant plant species in initiating and conducting C-binding and water retention processes will be investigated. The significance of co-occurrence with other species possessing different functional traits and used in reclamation processes on C-binding and water retention and their impact on the analysed ecosystem services will be studied. Finding the answer to the question about **the course of carbon sequestration and water retention processes in novel ecosystems** will allow to work out of general balance of carbon and water at various spatial scales of sites transformed by mining. The results of the project will also form the basis for further research in an extremely important field, including climate change mitigation and implementation of water policies. The obtained research results will be disseminated in publications in specialist journals on restoration ecology, climate change, applied ecology, soil science, but also in the process of teaching and in measures popularizing the achievements of science to the society.