

Soil is a very important element of the environment and primary production in ecosystems depends on it. In recent years, the role of soil as a carbon store, which helps in the fight against global warming, has been emphasized more and more often. Recently, forest fires have become an increasingly frequent phenomenon. About 4% of the Earth's vegetation area is burned annually. Another transformation of landscape, that requires attention, is the areas reclaimed after mining activities. Human intervention after such large-scale transformations may consist of afforestation of areas with various species of trees. The introduction of vegetation initiates soil formation (post-mining soil) and accelerates the process of soil regeneration (post-fire soil). Providing organic matter, e.g. by afforestation, at the beginning of soil restoration increases the activity of soil microorganisms; in the next stage soil fauna appears, which promotes better growth of trees and initiates the soil formation process.

This project aims to determine the role of soil organisms in the development of forest soils containing pyrogenic carbon (leftover from incomplete plant combustion) as well as geogenic carbon (fossil carbon residues). We will focus on the soil-forming and carbon accumulation processes in the conditions of regenerated and reconstructed forest ecosystems. Research plots will be located in the areas covered by forest reclamation after lignite mining (Bełchatów), after sand extraction (Szczakowa) and after a large-scale fire (which took place in 1992 in the Rudy Raciborskie forest district). In the above-mentioned places, pine, larch, birch or oak were afforested. Forest stands with the same tree species found on natural soils will serve as a reference. To meet the main goal of the project, numerous projects will be carried out, from basic soil science, such as the description of the soil profile, to more advanced, for example, micromorphological preparations that will allow the observation of the soil in an unchanged form at a microscopic level (e.g. observation of microaggregates, the degree of decomposition of organic matter). An indispensable element of the research is to determine the activity and biodiversity of soil microorganisms, fungi and representatives of soil fauna, i.e. enchytraeids and earthworms.

This planned research is multidimensional, with important potential impacts in soil science, soil biology and forest ecosystem restoration, as well as improving knowledge of the mechanisms responsible for soil carbon storage in soil disturbed by human activity. The results of this research will significantly improve the understanding of the mechanisms and dynamics of soil-forming processes in the three types of degraded areas in various afforestation scenarios. The regrowth of forests following past large-scale disturbances is expected to be crucial in slowing the rate of carbon dioxide in the atmosphere. However, the drivers of this carbon pools in soil from varied succession scenarios with additional carbon remain poorly characterized. Moreover, the research deals with issues that are relevant both in Poland and in the world.