If the impact of alders transformed technogenic substrates which are extremely difficult to reclaim, such as ashes and barren sands, in such a way so that they could adopt ecological functions of soil – this would solve the problem of biological stabilisation and reclaim of hundreds of thousands of hectares of soilless areas (e.g. all kinds of furnace waste landfills, extremally poor sand mine cast, and more) on the global scale – this is quite clear from recent publications about global problems with restoration of these areas. On the basis of research it is already known that alders survive for sometime under these conditions, but the question is whether they sufficiently activate, and if so, to what extent, and what mechanism they apply to transform technogenic substrates into soil.

In view of the above, the aim of this project is to assess the impact of the alders (Alnus sp.) on the biogeochemical transformation and biological activation of technogenic substrates in soilless areas in extreme habitat conditions and to determine the extent to which these substrates can obtain similar biological properties and functions of natural soils, defined as possessing the ability to provide mineral nutrition for plants. The main criteria for evaluating the effects of the phytomelioration impact of alders and adopted soil functions will be biological activation of substrates (biological properties complex), accumulation and mineralisation of organic matter, and as well as the accumulation and rate of nitrogen mineralisation, which is the minimum factor in technogenic habitats. Technogenic substrates of soilless areas, i.e. furnace wastes from the combustion of lignite and barren sands from post-mining excavations will be used as extreme conditions for life and growth of plants, whereas biological properties of soils in natural alder habitats will be taken as the reference point.

From the standpoint of Soil Science, furnace waste non-selectively deposited in landfills is characterised by a number of unfavourable physical and chemical properties highly variable in horizontal and vertical cross-section (including high susceptibility to cementation, poor air-to-water ratios, excessively alkaline reaction and salinity). These characteristics of the deposited waste unfavourable for plant growth with high spatial variability and vulnerability to wind and water erosion, together with unfavourable climatic conditions of the region (little precipitation) mean that the difficulty in the reclaim of furnace waste is very high. It makes forest reclamation by conventional afforestation methods virtually impossible. Similarly, the basic difficulty in reclamation of remarkably barren sands in post-mining excavations is the shortage of organic matter and nutrients, especially nitrogen. Hence the basic problem and the fundamental question emerge: how to initiate a dynamic process of soil formation, accumulation of organic matter and nitrogen and transformation of biological properties of the technogenic substrates to adopt ecological functions of soils and whether this is at all possible.

Based on previous experience, we know that alders, despite their specific requirements in terms of natural habitats (high humidity, soil fertility) are able to adapt and survive for up to several years in extreme conditions of post-industrial areas - **but we do not know the mechanism and the effect of biological impact on technogenic substrates, which is the key issue in assessing the possibility and advisability of the use of the soilless method** where the substrate impacted by phytomelioration can take over the ecological functions of the soil - t**he answer to that question is sought by this research project**.