Description for general public

The ecosystem is an ecological system composed of animate and inanimate (abiotic) parts, creating a biotenosis for biocenosis. Among the abiotic factors an important group are those associated with the climate, including temperature, light, humidity, rock and water composition. The unusual rate of climate change recorded today is transforming local living conditions to which plant growth and development were adapted. These changes can modify the composition of biocenosis and significantly affect interactions between the plant and the environment, as well as complex networks of species relationships. In this context, it is particularly interesting to pay attention to what is hidden underground - the functioning of the roots. On a daily basis, we do not notice or appreciate them, and the underground part, although much less known, is no less important than the above-ground one. It seems crucial to find answers to questions about its response to changes in the environment, the relationship between the construction of the root system and the climate-modified availability of various elements, considerations regarding changes in the environment of interaction of roots and fungi, and above all to determine whether possible root modifications (and adaptation of whole plants) are able to "keep up" with extremely rapid climate change.

Trees growing in the boreal zone adapted their root system to efficiently collect elements in the conditions of their limited availability. One of these adaptations is to increase the biomass of the smallest roots and thus create a larger area for the development of mycorrhizas. It has been shown on pine that trees from the boreal zone sown in warmer climates grow trees with the same root characteristics as those in the north. It is not known, however, which of the root features "remember" their origin and do not change after transferring to new environmental conditions. Will the changed root features affect the soil environment? Tree roots are responsible for the supply of water and minerals. It is known that mycorrhizal fungi and other soil microorganisms (including saprotrophic fungi and bacteria) play an important role in increasing the availability of macro- and microelements. On the other hand, the development of microorganism communities and their relationships depends on the carbohydrates and other compounds secreted by the roots and the "availability" of the roots themselves to soil partners, namely their morphology and anatomy.

The project focuses on these issues based on common-garden experience (trees of different origin grow on the same surface, under the same environmental and habitat conditions). The goals of the project are: i) to investigate whether trees from northern Europe will be characterized by greater accumulation of carbon in small roots than trees from the south, ii) to determine what metabolites are released by the roots into the soil, iii) whether the pool of metabolites affects interdependencies between microorganisms and between them and the roots, and thus making available to the tree important elements, iv) whether and how the root structure is related to the origin of the trees.

Research will be carried out on the Scots pine (*Pinus sylvestris* L.), which is a species with a huge natural range, growing in different climatic conditions, and at the same time very economically important. We will use soil and root samples taken from trees growing on the experimental research area in Lithuania. Research on such material will create the basis for understanding how the origin of Scots pine can affect root features, underground processes and composition of soil microorganisms, and the availability of elements needed by plants. The opportunity to learn about the reactions of trees growing in different conditions than the stands in which the seeds were collected will bring us closer to understanding the consequences of environmental changes for the physiology and ecology of forest trees. We assume that the results obtained will be a significant contribution to understanding to what extent the predicted climate change may affect the functioning of the economically and environmentally important species which is Scots pine, and this aspect, although particularly important in the modern era, is still little known. Based on preliminary research, we assume that changes in both the structure of roots and communities of microorganisms associated with Scots pine roots can play a role in modifying plant responses to changing climatic conditions.