

Scots pine is one of the most important forest forming tree species of great ecological, economic and social importance in Europe and Asia. In Poland, it is the main utilitarian species covering over 5.5 million hectares and accounting for the largest tree stock of standing wood (over 60% of gross grand total timber) among all other forest tree species. Populations of the species from different environments show specific features of heritable phenotypic and physiological variation and form, so called 'local ecotypes' best adapted to given environmental conditions. Such well-defined ecotypes of Scots pine were distinguished in Poland including, for instance: 'Bolewicka pine', 'Rychtalska pine', 'Gubińska pine', 'Taborska pine', 'Piska pine', 'Białowieska pine', 'Augustowska pine and others. Climate change predictions indicate that local ecotypes will suffer a fitness deficit, if observed trends in surface temperature and precipitation patterns continue. Such fitness loss will impact productivity and mortality rates of forest trees and will have very negative effects on other organisms related to forests ecosystems. Therefore, to possibly minimize the negative impacts of environmental changes on forest health and productivity it is important to better understand relationships between patterns of genetic variation of different ecotypes and local environmental gradients. Such knowledge will help to predict performance of populations in changing environments and advance selection of the best reforestation material, considering models of the future environmental changes. The project will study distribution of genetic variation at thousands of genes in the most valuable native Scots pine breeding ecotypes in Poland, and will apply genetic analysis to compare the data with variation of the same genetic markers in the reference populations representative of the species distribution range in Europe and Asia, that might have contributed to development of Polish Scots pine forests after postglacial population migration. The proposed research will take advantage of new genetic markers, state of the art high-throughput SNPs genotyping methods and advanced analytical approaches to conduct comparative studies of genomic, geographical and environmental variation of dozens of Scots pine populations. The project will provide detailed genetic characteristic of existing Scots pine resources in Poland managed under strict seed zone regimes that most likely need serious revision. The project will define processes affecting distribution of genetic variation of phenotypically and ecologically diverged populations and will look at genetic relationships and divergence between them. Better understanding of the distribution of standing genetic variation that correlates with unique features of ecotype divergence is essential for predicting likely responses of populations to changing environments, and for development of effective conservation and management strategies of the species most valuable breeding populations under strong pressure of ongoing environmental changes.