Adaptation and plasticity of European beech in response to changing climate

The aim of this project is to understand and analyze the responsiveness, vulnerability and plasticity of European beech populations to climate change and to assess their adaptive capacity. European beech (*Fagus sylvatica* L.) is a widespread tree species and an important component of forests in Western and Central Europe. Current and projected climate change poses several risks to beech in the future. In a warmer and drier climate, populations at the southern edge of the species' range may suffer from droughts leading to tree mortality, whereas the northward expansion of the species' range is likely to be limited by both frosts and droughts. Climate is one of the factors that determine growing conditions for tree populations. Local populations within the species often differ in their ability to adapt to new climatic conditions. However, assessment of this variation in local environments does not allow investigation of the genetic component of this response. This is only possible in the common garden (provenance) experiments, where variation in traits among multiple populations planted together under the uniform site conditions can be studied in response to the environment.

In this project we will focus our research on a set of beech populations covering a large part of the natural range of the species. These populations are planted at different sites of common garden experiments, representing various climatic conditions, and specifically the sites at the eastern limit of the species distribution range. We will measure tree diameter and height growth, and assess the responsiveness of beech populations to climate change by analyzing the relationship between annual tree-ring widths and climatic conditions at various locations in Europe. We will also analyze wood anatomy of individual tree rings as well as their stable carbon isotope composition to gain an insight into the foundations of growth in relation to climatic fluctuations, especially to drought events. The analysis of variation in genomic regions related to stress response and phenology will give us an insight into adaptive potential of populations. We will also model the growth responses of beech populations to climate change based on sensitivity of their radial growth to climate transfer in a series of common garden experimental sites.

The outcomes of our project will be crucial for understanding the response of beech populations and their potential to adapt to future climate. We expect to provide the basis for selecting seed origins that can be considered as sources of populations that are better adapted to future climatic conditions. Our goal is to provide scientific support for the projections of the species' fate and the management of its genetic resources following the ongoing environmental changes.