

In the face of growing pressure from global changes, forests play a crucial role in mitigating climate change and protecting biodiversity. Understanding the interdependencies between these two functions is essential for developing effective ecological and political solutions to address current environmental challenges. As part of an international research project, the goal is to understand the relationship between carbon storage in forest ecosystems and biodiversity, while also filling knowledge gaps regarding the impact of natural disturbances and human activities on these relationships. The project focuses on studying how different forest management practices and the natural dynamics of forests influence species richness, population size, and changes in carbon resources. Our research will cover biodiversity across a wide range of habitats—from primary forests, through forests that were once used but are now under protection, to managed ones. To assess the long-term effects of human activity and natural disturbances, our studies will integrate various data sources, including multi-species community data and dendrochronology (tree age studies). An innovative element of this project will also be the analysis of soil biodiversity, as soil microorganisms may respond differently to changes in carbon resources compared to above-ground organisms. The research will also examine various types of disturbances in forests, considering both their frequency and intensity, by analyzing forests at different stages of development and with various age classes. The project will focus specifically on two of the most important forest types in Europe: beech and spruce mountain forests, with a particular emphasis on the primary forests of the Carpathians. These primary forests will serve as reference points, allowing us to evaluate changes occurring in forests subjected to economic activities. Our studies will include an analysis of the historical dynamics of forests and the effects of conservation efforts, investigating changes in carbon resources and biodiversity. Through our approach, we aim to better understand how different forest management and conservation methods can contribute to combating climate change and protecting biodiversity. The results will help develop improved forest management solutions that can provide numerous ecological benefits while minimizing potential trade-offs.