Forests play a crucial ecological role, providing functions such as carbon sequestration, biodiversity conservation, and water protection. However, in recent decades, climate change and increased anthropogenic pressure have negatively impacted their stability and resilience. Particularly valuable are High Conservation Value Forests (HCVFs), which perform a range of important ecological and social functions. These forests are essential for maintaining biodiversity, protecting rare species or threatened ecosystems, preserving water resources, and preventing erosion. In the Polish Carpathians, a region characterized by diverse topography, climate, and tree species composition, numerous HCVFs exist, yet many remain unprotected. Effectively identifying and classifying these forests is especially challenging when relying solely on traditional ground-based inventory methods.

The aim of this project is to develop methods for identifying HCVFs in the Polish Carpathians using open spatial data, such as time series of Sentinel-2 satellite imagery and Airborne Laser Scanning (ALS) data. The research will focus on analyzing indices and metrics derived from Sentinel-2 time series and ALS data to determine key indicators for identifying various types of HCVFs. Additionally, the project will examine changes in HCVFs and their surroundings over the past decade. To achieve these goals, advanced spatial analysis tools, such as R software and Google Earth Engine, will be employed, enabling efficient analysis of large datasets.

The work will include collecting and processing spatial data, creating seasonal composites from Sentinel-2 imagery, and generating canopy height models from ALS data, allowing for detailed analysis of the structure of various types of ecologically valuable forests. Reference data on different HCVF types will be obtained from existing databases (e.g., nature reserves, NATURA 2000 areas) as well as through ground inventory. Various machine learning techniques will be tested for classifying different types of HCVFs and identifying the most important variables.

This project contributes significantly to forest conservation by providing tools for identifying and monitoring HCVFs. The results will also enhance the understanding of processes occurring within these forests and support their protection in the context of environmental and anthropogenic changes. By integrating Sentinel-2 and ALS data, the project offers an innovative approach to HCVF analysis, with the potential for applying these methods in other regions.