

Popular science project summary

Global changes, which include climate change (global warming) and increasing nitrogen deposition, are one of the greatest scientific problems nowadays. For decades, ecologists have made every effort to study the impact of a changing environment on forest ecosystems. Particularly important in observing changes is comparing the condition of historical plots with current ones. Such comparisons are mainly made for plots not affected by severe disturbances such as windbreaks, dieback caused by insect outbreaks, avalanches, floods or any other natural phenomena that overturn trees and replace dense stands. In fact, there are no forests that have not been subjected to various types of disturbance. This is especially the case today, when, as a result of global changes, the frequency and scale of natural disturbances are increasing. Natural disturbances are a topic as much studied by ecologists as global change, but to the best of our knowledge little is known about the joint effects of climate warming and stand-replacing disturbances on temperate forest vegetation.

The aim of this project is to analyse both the individual and joint effects of global change and natural disturbances on forest vegetation in mountain temperate forests. We propose a methodology combining so-called 'twin plots', vegetation resurveys on historical plots and tracing the recent history of natural disturbances based on aerial photographs. As a research area, we chose the Tatra National Park, which thanks to a long series of meteorological studies has good documentation of climatic changes, e.g. temperature or length of the growing season. Additionally, pioneering phytosociological studies were carried out in the Tatra Mts., which provide a unique opportunity to trace changes in vegetation.

Particularly important in the proposed research is the methodological aspect, which sheds new light on the use of historical data. The idea of establishing permanent study plots was developed a few decades ago (~40). Our data is about a century old, so we would like to use *quasi*-permanent, not marked in the field plots. Thanks to methodological development and several scientific papers on this subject, we know that data from such plots are as valuable as those collected from permanent plots. The error resulting from the displacement of the plots with a methodological regime or an appropriate sample size can be eliminated. Thanks to that we are able to use such unique data as those from the Tatra Mts and resurvey them with high accuracy. In addition, the forests of the Tatra Mts affected by strong natural disturbances are now a mosaic of old-growth forests, regeneration stages and decay stands. Thanks to good documentation of aerial photographs from a period of more than 20 years, we are able to determine the extent, type and time of disturbances. Comparison of historical and current data with their microclimate conditions in stands and on recently disturbed plots could determine the impact of global changes and indicate the directions of these changes.

While the study aims to gain new knowledge on how forest vegetation functions in times of climate change, it may also be of great practical importance. The study area is located in the Tatra National Park. The results of this study may help to correctly determine the protective tasks and possible conservation measures, and also serve as a model for other mountain areas in the temperate zone. In addition, the collected data will be very valuable to follow the dynamics of forest ecosystems as a result of changes in the natural environment. It should be emphasised that the proposed project aims to analyse vegetation changes over the last 100 years, which is unprecedented in studies using vegetation comparisons across this kind of research.