

Deforestation is a phenomenon that occurs all over the world. It often happens that the area is deforested for agricultural purposes and after some time it stops being used. Usually it is caused by socioeconomic changes or unprofitable farming. The process of secondary succession begins when arable land is abandoned. It leads to the regeneration of the forest. Physicogeographical conditions in such places are significantly changed due to agricultural activities. For instance, soil fertilization, increased insolation or accelerated soil erosion are factors that provide differences between post-agricultural forest and ancient forests (forest with no mark of agricultural use). In such conditions, meadow species or invasive species win competition against forest (shade-tolerant) species. The older a post-agricultural forest is, the more similar to an ancient forest in species composition it can be found. Such regeneration of the forest can take many centuries, and its rate depends on the distance from the ancient forest (the source of the spread of forest species) and the fertility of the habitat. A lot of research has been done related to forest regeneration in lowlands but it is interesting how this phenomenon proceed in mountains and how it changes depending on the diversity of topoclimatic conditions.

The aim of this project is to determine the influence of topoclimate on the post-agricultural forest regeneration rate in mountains. The area that meets the criteria needed to conduct such research is Eastern Carpathian Mountains in Poland (mesoregions: Western Bieszczady Mountains and Sanocko-Turczańskie Mountains). Before World War II, this area was intensively used for agriculture by Lemkos and Boykos. The displacement of the ukrainian-speaking population of the 1940s caused massive abandonment of arable lands. Today, a very large area of former farmland is overgrown by around 70-year-old post-agricultural forests. The project will be based on determining the species composition of post-agricultural forests and ancient forests in mountains. Then, by comparing these two ecosystems using different measures and statistics analyzes, I will determine the regeneration rate of post-agricultural forests. Finally, by applying modeling I will determine the influence of elevation and aspect (topoclimatic variables) to the forest regeneration rate. To reach the aim, it is necessary to determine the exact range of ancient forests and post-agricultural forests in the Polish Eastern Carpathians. I will use for this purpose Habsburg Empire Maps of Third Military Survey from the 19th century, German aerial photographs from 1939-1945, CORONA satellite imagery from 1960 and 1972 and current satellite imagery. The delineation of ancient and recent forests will be the crucial part of research. Ancient forests will be visible as a forest on each of the listed cartographic materials, and post-agricultural forests, will be visible as arable fields on German aerial photographs (before displacement), and as forest or secondary succession communities in subsequent time sections. The next step will be to draw sample plots for field research within post-agricultural forests and comparative points within ancient forest. The most important task for this project, is to take phytosociological relieves (floristic lists with the abundance and specificity of species occurrence) at each sample plot during field research. The plots will be located far away from the villages what makes access to them challenging. It is anticipated that the field study will require about 2-3 months of intensive daily work.

The results of this project will be answers to questions whether elevation and aspect significantly affect the regeneration rate of post-agricultural forest and how does the regeneration rate change with increasing elevation and changing aspect? As a result of the research, a model will be created, explaining to what extent topoclimatic conditions (measured by aspect and elevation) affect the rate of forest regeneration. There will be made also a map of post-agricultural forests and ancient forests in the Eastern Carpathians with information regarding the regeneration rate. In addition, the list of ancient forest species will be verified in the case of Carpathian beech forest.