Invasive species are considered one of the greatest threats to native forest ecosystems. Their negative impact is mainly related to the decline in biodiversity and economic losses. Removing invasive trees is a very time-consuming, expensive process, and often leads to the deterioration of the situation. Many methods, e.g., chemical ones, are not neutral to the natural environment and can negatively affect other organisms occurring there. The vast majority of previous studies on the impacts of invasive species on various ecosystem services are based on observations in stands inhabited by only one invasive tree species. The subject of co-invasions, focusing on the tree-tree relationship, is very rarely assessed in the literature. In this project, I will focus on two model tree species: black locust and black cherry. Both species will take advantage of climate change and will become more widespread in our forests. The invasive species I have studied differ in terms of biology and ecology. Black locust is a pioneer species, capable of fixing nitrogen, can reach large sizes, and often occurs in the main canopy stand layer. Black cherry is a shrub or short tree, a typical mid-successional species. Unlike black locust, this species cannot fix atmospheric nitrogen and occurs mainly in the understory or the subcanopy stand layer. Both species can change the soil and light conditions in invaded stands. Especially in forest habitats, transformations can lead to drastic changes in the species composition of vegetation. By introducing a large amount of nitrogen into the soil, nitrophilous species, such as common nettle, will benefit from the presence of them. Black locust can significantly increase the soil pH, which will lead to a decline of acidophilic vascular plants, such as blueberry, or many bryophyte species. As a result of the presence of invasive trees in individual layers of the stand, light conditions change, which affects the species composition and competition between individual plants in forest strata.

The main aim of the project is to investigate the impact of tree co-invasion on soil and light condition transformations, biodiversity, and the functioning of Scots pine forests. Co-invasion is the co-occurrence of two or more invasive species in a particular area. Sometimes, co-invasion leads to cascading, extreme changes in the functioning of ecosystems, ecosystem transformation, and the intensification of subsequent biological invasions, leading to invasional meltdown. In my project, I will investigate how black locust and black cherry mutually affect their above-ground biomass increments. Due to that, I will check whether in their case the competition phenomena are more dominant, or maybe facilitation based on the complementarity of resource use. I will also determine the densities of tree and shrub natural regeneration. Forest natural regeneration ensures an uninterrupted alternation of generations in forests. Natural regeneration is a key element of natural forests and managed forests based on the model of close-to-nature multifunctional forests. It is an increasingly popular alternative to artificial tree planting. An important element of the project is to enrich the widely used surveys of understory vegetation biodiversity with an inventory of tree-related microhabitats. The latter can serve as an excellent measure of the potential biodiversity of forest ecosystems. Usually, for an accurate assessment of biodiversity, we need numerous specialists, such as botanists, zoologists, and mycologists. Tree-related microhabitats are potential ecological niches for various organisms. Assuming that the greater the richness of tree-related microhabitats, the greater the potential biodiversity, such an assessment can be made by a person who can distinguish tree species and is familiar with catalogues of tree-related microhabitats.

My research project will result in quantitative recognition of co-invasion effects, necessary for the development of management strategies for stands simultaneously inhabited by two invasive tree species. Most guidelines and recommendations are formulated only for a single invasive tree species. Usually, the element of co-invasion is omitted in them. The invasive trees I am studying inhabit various niches and forest strata, which should additionally require more thoughtful actions on the part of foresters and other specialists managing forests with different conservation regimes. Thanks to a holistic study of the impacts of co-invasion on various ecosystem services, we will have a broad view of the real threat associated with tree co-invasion, but also what positive effects of tree co-invasion we can expect. This will allow us to improve silviculture and conservation plans, as well as to better predict the effects of global environmental changes.