

Invasions of alien species are considered one of the major problems of nature conservation. The massive proliferation of alien plants carries with it a serious threat to the preservation and maintenance of native ecosystems. Invasive species, through intense competition and modifying of local habitats, lead to declines in biodiversity and may pose threats to many native and endangered species, including fungi.

Studies of invasive herbaceous plant species such as *Alliaria petiolata* and *Impatiens glandulifera* indicate a significant negative impact of herbaceous plant invasions on abundance and diversity of ectomycorrhizal fungal species on the roots of both mature trees and seedlings, as well as significant impacts on soil communities of saprotrophic and pathogenic fungi. The impact of invasive tree species on fungi in native forest ecosystems remains largely unstudied.

Thus, the main goal of this project is to recognize the effects of invasive tree species on soil fungi communities of different trophic groups, especially ectomycorrhizal fungi, in native forests. To assess how invasive tree species would affect the mycobiota of native forest ecosystems, three tree species invasive to Europe: black locust (*Robinia pseudoacacia* L.), black cherry (*Prunus serotina* Ehrh.) and northern red oak (*Quercus rubra* L.) were selected. These species represent various forms of mutualistic symbiosis between plants and microorganisms (arbuscular mycorrhizal, ectomycorrhiza, nitrogen-fixing symbiotic bacteria), various functional trait strategies (acquisitive and conservative), and belong to the most invasive and widespread alien tree species in Europe. This study will be used to answer the following research questions:

1: How do invasive tree species affect the species richness and diversity of soil fungi in native forests, with particular attention to ectomycorrhizal fungi?

2: How do impacts of invasive tree species on soil fungal communities change with the functional traits specific to individual species (forms of symbiosis and competitive strategy) and density of invasive tree species?

3: Are the development of native tree species and associated ectomycorrhizal symbiotic associations modified when growing in soil pressured by invasive tree species, and if so how?

To answer these research questions, laboratory analyses of environmental samples and an experimental setup will be used. The environmental samples will be studied on an invasive tree species abundance gradient (non-invaded, semi-invaded and invasive-dominated study plots). Soil fungal communities will be analyzed by a metagenomic molecular approach with next-generation sequencing (NGS) technology. NGS allows for identification and quantification of all fungi present in the soil, regardless of their trophic status (mycorrhizal, saprotrophic, pathogenic), based on the DNA isolated from environmental soil samples.

The pot experiment will be prepared using seedlings of native trees (*Pinus sylvestris* and *Quercus robur*), commonly growing in the surroundings of the invasive tree species studied, *R. pseudoacacia*, *P. serotina* and *Q. rubra*. The seeds of oak and pine will be sowed in four variants of soil: soil unaffected by the invasive trees (1), soil collected in the invasive tree-dominated stands (2), sterilized soil collected in the invasive tree-dominated stands (3) and native soil mixed with plant litter from under invasive trees (4). Seedlings of native tree species will be regularly observed and their germination and morphological characteristics recorded over the two-year experiment. Two years after seed sowing, the morphology of seedlings will be measured including ectomycorrhizal root colonization, abundance and species richness of ectomycorrhizae, leaf area, aboveground and belowground dry biomass. The experimental part examines how the soil and litter modified by the invasive tree species affect the development of native tree regeneration.

The soil used for laboratory and experimental parts of the study will be collected from the same study plots, thus the results of both study parts will correspond to each other. Moreover, chemical analysis (nutrient contents, pH) of soil used in the study will be prepared, both before and after the 2-year experiment.

The results allow us to determine, how studied invasive tree species affect soil fungi in native forests, which play a key role in the proper development and functioning of forest ecosystems, and will provide the knowledge necessary for effective protection of native forests.