**The aim of this project is to verify if mowing, as a conservation tool for rich fen peatlands affected by tree- and shrub- encroachment, has an impact also on belowground communities of saprotrophic and mycorrhizal fungi.**

In this project we will investigate 24 rich fen peatlands throughout North-Western and North-Eastern Poland. Since "ideal" fens, where natural, tree- and shrub- invaded, and regularly mown patches co-occur, do not exist in nature, we will designate 12 fens with pairs of natural and invaded plots, and 12 fens with pairs of invaded and mown plots. We will characterize groundwater level dynamics, vegetation structure, basic physicochemical parameters of peat, and root density in each plot. Subsequently, we will characterize fungal community taxonomic structure using Next Generation Sequencing molecular methods, and fungal and microbial biomass using specific chemical biomarkers, and mycorrhizal mycelium density (microscopic analyses of mycelium from sand-filled ingrowth bags) in mixed peat samples from each plot. Additionally we will also characterize fungal community taxonomic structure in mixed tree- and shrub root samples from each plot, using the same molecular techniques. Sampling of macrofungal fruitbodies and their molecular identification will be included to supplement obtained database. Using specific bioinformatic tools and extensive literature search, we will also assign each identified fungal taxa to ecological function (e.g. saprotrophs, mycorrhizas, wood-decay fungi, etc.).

Peatlands, i.e. wetlands accumulating deposits of partially decomposed organic matter (peat), store approximately 1/3 of organic carbon on Earth, despite covering only a small fraction of total land area. **Groundwater-fed peatlands called rich fens are still largely neglected in general research, despite being major peatland type in temperate Europe, including Poland.** These ecosystems were and still are subjected to detrimental anthropogenic disturbance, most important being draining for agriculture, peat extraction, and abandonment of traditional management (mowing for hay). When groundwater-level is lowered, anoxic conditions responsible for peat accumulation are disturbed, which affects native, highly adapted organisms. This in turn enables e.g. invasion of trees, shrubs, and non-native vegetation. Tree and shrub invasions have significant negative impact on rich fens, decreasing diversity of native flora (rare moss, sedges, orchid species) and fauna (e.g. extremely rare and endangered bird, aquatic warbler), and changing biogeochemical cycles within the peatland, which usually leads to increased mineralization of peat, and, as a consequence, loss of sequestered carbon. To fight tree-encroachment, regular mowing and tree- and shrub removal is applied, and it is the most widespread conservation method of affected rich fens, maintaining open vegetation favorable for native species.

Among microorganisms responsible for decomposition, saprotrophic fungi are regarded as key players in organic matter-rich ecosystems, thanks to their enzymatic capabilities and specific, usually hyphal mode of growth. On the other hand, plant root-associated mycorrhizal fungi, which e.g. provide plants with soil nutrients in exchange for photosynthates, have profound influence on the structure of vegetation, driving competitive interactions between plant species. Therefore any changes to the proportions of mycorrhizal and saprotrophic fungi as a result of tree encroachment may potentially facilitate tree establishment and further fuel the invasion, and additionally accelerate decomposition of peat. **However, it is unknown what impact does the tree encroachment have on belowground microbial communities in rich fens, and to what extent regular mowing of rich fens may restore complicated structure of fungal communities.**

By comparing the degree of dissimilarities of fungal communities between investigated treatments (are differences between "mown" and "invaded" as distinct as between "invaded" and "natural"?), **we will answer the question if regular mowing of rich fens really does restore also "original" taxonomic or functional composition of belowground microbial communities, or the effects are visible mostly on the surface (as "fen-ish" vegetation).** Using abundant environmental data we will also point to possible factors responsible for differences in the structure and function of fungal communities. Finally, we will describe in detail taxonomical and functional changes in peat and root-associated fungal communities following shrub- and tree- invasion, and regular mowing as a conservation management. Results of this study may help in further decision-making regarding active conservation management of degraded peatlands, providing potential monitoring guidelines for belowground ecosystem health.