FunDive: Monitoring and mapping fungal diversity for nature conservation

Fungi constitute one of the largest groups of organisms on Earth and play a crucial role in functioning of most ecosystems. Despite their obvious relevance, they have traditionally been neglected in monitoring and conservation studies, which left a wide knowledge gap. This project application has an overarching goal of closing this gap, by **bringing fungi firmly on the biodiversity map**.

Currently, most of the data on the distribution of fungi comes from inventory studies based on the limited occurrence of fruiting bodies. At the same time, molecular methods based on high-throughput DNA sequencing are being intensively developed. They enable the quick acquisition of sequences of all fungi present in a given sample, regardless of the sporocarp presence. However, a reliable reference database that would allow the unambiguous assignment of sequences to traditional species names, which allows proper identification is crucial for all methods based on environmental DNA (eDNA) analysis.

In cooperation of 26 partners from 16 European countries, we plan to develop such a database by obtaining reference DNA sequences for fungal species which are deposited in European herbaria and are not yet represented in gene databases. It is estimated that only in Poland ca. 500 herbarium-type specimens will be barcoded.

We also plan to sequence eDNA from environmental samples taken from selected forest areas, included in Annex 1 of the Habitats Directive. The material will be sampled in a standardized way throughout Europe (including Poland) and jointly sequenced. At the same time, citizen scientists will be engaged to study the fungal diversity of the same areas. We are planning two international field campaigns, consisting of a large-scale inventory of fruiting bodies. During these events, mobile molecular laboratories will also be launched, making it possible to obtain DNA sequences from collected specimens not only by scientists but also by citizen scientists.

During the project the standardized tools and applications will be developed, enabling easy integration of fungal data collected in all ongoing and future biodiversity monitoring projects. Joint analysis of data from different sources will allow the selection of the best approaches for fungal monitoring. By combining project data with previously published open data, it will be possible to better analyze fungal biodiversity patterns in time and space.

This project will provide much-needed insight into the conservation status of fungi in Europe. Moreover, given the critical roles fungi play in ecosystems, and their sensitivity to ecosystem change, improved insights into the fungal dimension of biodiversity that the project provides, will be of huge importance for understanding, more broadly, how global change affects ecosystems and associated ecosystem services mediated by fungi. Finally, we believe that the project will have an impact on conservation and monitoring in other organism groups, by showcasing how molecular and AI methods in combination with unambiguous communication on species can be combined to increase the credibility and impact of biodiversity data.