Modern challenges for biodiversity, connected with climate change, habitat transformations, and introductions of non-native species, have led to the significant alteration of species functioning. High-quality predictions of changes occurring at all levels of life organization are crucial for the development of proper management and conservation strategies. Advanced ecological models also expand our understanding of the threats to particular species, or alteration of ecosystem services under changing climate. Yet, such predictions rely on a high amounts of precise data. Although ecological databases are constantly being developed, the coverage of species with data is still insufficient. Broadening the range of assessed species will improve the accuracy of models regarding e.g. the pace and magnitude of changes in different elements of the environment.

One of the most promising tools for predicting future ecosystem changes are plant functional traits: morphological, physiological, and phenological traits that affect the growth, reproduction, and survival of individuals and populations. Previously, most studies of functional traits focused mainly on interspecific variability of traits as the one providing the best possibilities of quantitative comparison of the strategies of different species. In modern ecological studies, more and more attention has been paid to intraspecific trait variability (hereafter ITV), as it determines e.g. the adaptability of given populations and communities to different environmental conditions. In this proposal we aim to fulfil two parallel scientific needs: (A) provide the missing data about functional traits, and (B) to study the less addressed ITV as an important source of the total variability of plants functional diversity. We decided to focus on forest herbaceous species, one of the least studied groups of plant species, and six crucial functional traits, identified as the most relevant descriptors of the plant economics spectrum: height, leaf area, leaf nitrogen content, seed mass, specific leaf area (leaf area to mass ratio), and stem-specific density (stem volume to mass ratio). Thus, we believe that providing reliable measurements for this particular group of plants will strongly contribute to a more even coverage of the European flora.

We hypothesized that (I) the size of ITV is proportionally dependent on the spatial scale studied; (II) Climate-related factors and competition-driven factors affect ITV at a similar level; (III) ITV of evolutionarily younger species is higher than in the case of the older ones, which shows that phylogenetics determines the ITV of the species studied; (IV) ITV of the species studied affects their functioning (germination, decomposition, and net production), simultaneously influencing ecosystem functioning; (V) increasing sample size due to ITV assessment will broaden the known range of trait values and will lead to showing higher variability of the species traits and to the shift of currently used mean trait values; (VI) Different traits will vary to a different extent.

To realize the aims of the projects we will organize our research into two main groups of tasks: ITV sources and ITV consequences. Each one of them will consist of minor studies (nine and three, respectively). As part of study on the ITV sources we planned to check how the ITV is affected by the season, aspect, elevation, light availability, phylogenetics, climate continentality, within-habitat and among-habitats interactions, and intraspecific competition. As a consequence of ITV, we plan to study decomposition, biomass production, and seed germination. Each of the minor studies represents one aspect of the complex problem we want to address, and therefore we decided to plan their conduction separately and in an independent way. All those studies complement each other and allow for a holistic approach to study such a complex issue as ITV, which is different at different ecological scales. To wrap up the project, we will summarise the impacts of all ITV sources in collective analyses, to maximize the conclusiveness of our analyses.

Providing data on herbaceous forest plants ITV collected in Poland can make a significant contribution to the development of functional ecology at the European level. Until now, data on herbaceous species occurring in Poland were collected mainly in Western Europe. Using data collected in other regions, although beneficial for many studies, is somewhat biased due to the environmental variability. Accounting for the large scope of ITV, a large-scale data collection effort could constitute the next step to understanding the functional diversity of vegetation at the global level.

The outcome of our project will contribute to the further development of knowledge about the ITV in herbaceous species of forest ecosystems. Particularly, we will provide an in-depth analysis and comparison of the sources and consequences of ITV. A significant product of our project will be a robust trait-base of a particularly important, but still understudied group of plant species, as we plan to include over 100 forest herbaceous species. Data collected during the project will supply global trait databases, thus our project will contribute to the improvement of globally prepared models regarding ecosystem functioning and environmental changes. Such data will also support more specific subfields of ecology, e.g. studies on invasive species or nature conservation.