The aim of the study is to assess the impacts of differences in morphological features (functional traits) of plants on decomposition and release rates of nutrients for the most common understory herb species. The most important research questions are:

- **How are decomposition rates of understory forest species related to their functional traits?**

It is known that traits connected with plant life strategy like plant morphology and chemistry (chemical composition) have important influences on decomposition rates. We will investigate how a specific group of plants – understory herb species (generally excluded from this kind of study) reflects global patterns. We will include a wider spectrum of species and functional traits than previous studies.

- **How are decomposition ratios of herb species connected the type of forest where they occur?**

Previous studies showed that in relatively "richer" habitats in terms of fertility, decomposition rates of the same substratum was higher in comparison with "poorer" sites. These studies were conducted mostly on tree leaves or grasslands plants. For this study we will choose herb species from forest types along a fertility gradient to check whether the thesis mentioned above is true.

- **Are the decomposition ratios of herb species different during particular stages of**

decomposition courses? Our previous study showed that differences between decomposition ratios of different species were largest after two months of exposition. At this time litter of species with the fastest decomposition rates was completely decomposed, whereas litter of other plants was only 20- 40% decomposed. Later, after six months of exposition, the differences observed during the first stage of decomposition were much less visible. We will check whether these patterns are general for herb species.

- **How big are differences in decomposition ratios among different parts of plants?**

Our previous studies including a singular species of herb indicated that shoots decomposed more slowly than leaves. We will check how big these differences are and how they are connected with plant traits.

- **Why is decomposition faster for spring-ephemeral species?**

Generally, higher temperature and precipitation stimulate mass loss during decomposition. Our previous study indicated that decomposition was fastest in the group of plants known as spring ephemerals, which grow, develop, senesce and decompose in spring and summer. We will check whether this phenomenon is connected with plant traits, or maybe more with microclimatic conditions occurring in the understory during decomposition.

We will conduct our studies in three different forest complexes in three different forest types along a wide gradient of soil hydrologic and light conditions. For our study we chose 11 vascular plant species of the forest understory with differences in their life-history traits. We will use the 'litter-bag' method in our study. We will harvest plants during one growing season (2020) at the time when most of the plants within each population begin senescing. The senescent plants (aboveground biomass) will be dried in the laboratory to constant weight. Dried litter will be weighed and placed into 'litter -bags'. In total, 6624 litter bags will be placed in the forest. We will collect litter bags monthly during the first year of the experiment and at three-month intervals after that. After drying, litter will be removed from bags, cleaned and weighed. Mass loss of the plant material will be determined systematically during the experiment. To ensure proper background for conclusions we will also provide detailed descriptions of sample plots and we will measure environmental conditions (light, temperature). To characterize herb plant species traits, 100 individuals of the chosen species will be collected from sample plots in the second year of the study. In total, we will analyze 18 different traits. Moreover, we will determine nutrient (Mg, Ca, N, C, P, K and Na) concentrations in living plants, initial litter and in litter collected at different stages of decomposition.

Results obtained in the proposed study will increase knowledge about the impacts of functional traits of plants on their decomposition rates and accompanying nutrient release. This is crucial in modeling of ecosystem processes. Such models, based on plant functional traits instead of species identity, would allow enhanced estimation of global biogeochemical cycles in forest ecosystems. This is especially important in the face of species range shifts in response to environmental changes. Moreover, results of the proposed study will improve carbon pool assessments in forests, which is currently one of the crucial tasks in forest ecology.