Numerous studies indicate progressing climate change, leading to increasingly often observed and prolonged no-rain periods causing drought. These changes affect the functioning of forest ecosystems; consequently, the ability to predict plant responses to climatic and environmental factors is of key importance for foresters when planning species composition of stands and ensuring forest sustainability. Interactions between the forest and water resources are very strong, for this reason broadening our knowledge on potential consequences of climate change on the forest-water relations may aid in the development of concepts for sustainable management of water and forest resources within feasible scenarios of future climate change. In order to gain insight into forest-water relations and mitigate adverse consequences of climate change in forest areas it is crucial to have knowledge on the effect of climate change on forests, as well as knowledge on the effect of forests on potential acceleration or mitigation of climate change and its effects. In this context it is essential to determine the effect of species composition of the stand on the water cycle in forest ecosystems, as well as the manner, in which this impact may be modulated by prolonged no-rain periods (drought). Tree species may influence soil properties through varying amounts and quality of organic matter supplied through litterfall (leaves, branches, seeds, cones) and decaying roots. The organic matter is accumulated mainly in the top layer of the soil profile (in the organic and humus horizons of forest soils) and it is characterized by different decomposition rates. Individual tree species exhibit a different effect on the amount and quality of soil organic matter, and thus the physical, chemical and biological properties of the organic and humus horizons of soils. The main aim of our project is to conduct comprehensive field studies and laboratory analyses on the effect of species composition of the stand on: 1) the amount and quality of soil organic matter as well as the physical and chemical properties of the organic and humus horizons of forest soils, 2) the amount of water reaching the soil surface in the form of throughfall and stemflow, and 3) dynamics of infiltration and water retention in the organic and humus horizons of forest soils.

Characteristics of aboveground tree parts (e.g. leaf shape, bark structure) may influence the amount of water, which reaches soil surface during rainfall. Organic and humus horizons are the first soil horizons, which intercept rainfall penetrating through the canopy (throughfall) or flowing down the tree stems, and the properties of these soil horizons frequently determine the amount of intercepted water which is evaporated to the atmosphere, retained in the soil (retention) or penetrates within the soil profile (infiltration). We expect that the retention and infiltration properties of the organic and humus horizons are strongly related with the species composition of the stand. The determination of the effect of tree species on retention and infiltration properties of the organic and humus horizons of soils in the first part of this study will facilitate the assessment of the effect of prolonged no-rain periods (drought) on these properties in the next stage of the study. It is also expected that during drought the organic and humus horizons become more or less hydrophobic depending on the species composition of the stand and the duration of the no-rain period. Hydrophobicity of these horizons may lead to a reduction in water retention and infiltration, and thus this may lead to increasingly adverse consequences of the drought in forest areas. Our investigations cover four coniferous species (Scots pine, silver fir, European larch and Douglas fir) and six deciduous species (English oak, red oak, European beech, Norway maple, sycamore and small-leaved lime).