

The project aims to evaluate effects of post-arable areas afforestation with silver birch (*Betula pendula* Roth) on soil properties, selected links of biogeochemical cycling of elements, assemblages of key indicative organisms and ability to provide various ecosystem services. The studies will cover selected physical properties of the soils, indices of ecochemical state, contents and temporal dynamics of organic carbon and major macro- and micronutrients, organic matter quantity and quality and enzymatic activity. Moreover, litterfall production and decomposition, assemblages of earthworms (*Lumbricidae*) and springtails (*Collembola*), as key indicative organisms of soil ecological condition and quality will be studied. The results of the mentioned above studies will be used then as proxies to evaluate potential of birch afforestation to sequester carbon and to provide various ecosystem services.

The studies will be conducted at 10 stands in central Poland. Soil reference group, stand age and land use history will be differentiating factors. Five stands will be located in complexes of Brunic Arenosols, representing light-textured, poor in nutrients soils and five in Cambisols, as medium-textured, more abundant in nutrients soils. Within each soil reference group stands at various ages (10-20, 25-35, 40-50 and 55-65 years) will be investigated. Moreover the studies will cover 55-65-year old stand at forest habitat. Each stand will cover two plots located in the same soil complex. One plot will be located in afforestation/forest and the second one in arable field in the vicinity of the forest. Every studies will be conducted within these plots.

The studies will cover various aspects of tree-soil feedbacks and some more utilitarian issues related to global biogeochemical cycling of elements and sustainable management of natural resources. Specific objectives of the project will cover:

- Evaluation of birch effect on soil physical properties.
- Evaluation of birch effect on soil organic matter quantity and quality.
- Evaluation of birch effect on soil ecochemical state, including pH, sorptive properties and buffer properties.
- Evaluation of birch effect on abundance and temporal dynamics of N, P, K, Ca, Mg, Fe, Mn, Cu and Zn in the soils.
- Assessment of litterfall production and its selected properties, including content of lignin and major elements – C, N, P, K, Ca, Mg, Fe, Mn, Cu and Zn.
- Assessment of birch leaf litter decomposition intensity and dynamics of C, N, P, K, Ca, Mg, Fe, Mn, Cu and Zn release.
- Evaluation of birch effect on soil dehydrogenase and acid phosphatase activity.
- Evaluation of birch effect on earthworms assemblages.
- Evaluation of birch effect on springtails assemblages.
- Evaluation of the potential of birch afforestation to sequester carbon.
- Evaluation of ecosystem services provided by the soils afforested with birch as compared to arable.

The proposed project is justified by increasing interest in afforestation of marginal arable soils over the last decades, that is reported by many authors as one of key challenges of the modern forestry. It is inscribed also into forest policy of Poland and many European countries. The results of many studies showed that afforestation can be an effective tool to improve soil quality, that allows to combine economic and ecological benefits. However, long-term experiments showed also that forest vegetation can strongly modify soil quality, therefore the choice of tree species is crucial. The used species should guarantee a certain balance between economic benefits and environmental effects. Post-arable soils have been mostly afforested with pine, however this tree presents many breeding problems. Therefore an increasing interest to use birch for afforestation can be observed over the last years. It is tolerant to wide spectrum of ecological conditions tree, resistant to “post-arable features” of the soils that does not show health problems. Although feedbacks between birch and soil, as a key component of forest habitats, have been a subject of many studies, there are many gaps in the knowledge that should be verified before introducing birch on a wider scale. These gaps concern in particular birch effects on soil ecochemical state, abundance and turnover of nutrients, soil organic matter quantity and quality, enzymatic activity and assemblages of living organisms. We propose interdisciplinary project focused on the mentioned-above issues, as well as more utilitarian issues, like carbon sequestration and ecosystem services provided by afforested soils. Realization of the project will provide new valuable information in the field of soil science, landscape biogeochemistry, forest ecology and landscape ecology, that can be highly useful in sustainable management of the soils, as sensitive to environmental changes and hardly renewable natural resources.