New arable field plots

Acknowledgments

We acknowledge the friendly permission to install these plots granted by the responsible land owners, land users, and authorities, and the excellent work of all Local Management Teams in selecting and establishing plots in arable fields.

Rationale

The major aims of this activity are:

1. Extension of the land-use intensity gradient beyond forests and grassland to cropland, with significantly higher inputs of energy, to allow comparisons.

2. Covering a major land-use type to enhance analysis at landscape scale and to account for landscape effects.

Important note

Research on arable plots in 2026-2029 must always complement research conducted in grasslands and forests. Projects with a pure focus on arable land are not encouraged.

Design

In 2024, 10 plots were established on arable fields in each of the three Exploratories to test the feasibility of working in such plots. Four more plots on arable land per region will be installed for every exploratory in 2025, resulting in a total of **42 plots across all three Exploratories, 14 per Exploratory.**

Overall, the 42 arable plots cover intermediate soil conditions typical for the Exploratories, major crops (winter and summer cereals, oil seed rape, alfalfa fodder grass mixtures) and crop rotations as well as a representative proportion of conventional and biological agriculture.

The plots measure 30 x 30 m and are located in the center of the fields. Within these marked 30 x 30 m plots, subplots for specific research questions will be established and attributed to the different projects.

In 2024 a basic recording of data on accompanying vegetation, soil seed banks, arthropods, soil microbial communities, as well as major physical and chemical soil properties was performed by several core projects (plants, arthropods, soils, microbes) and one contributing project (RecovFun) on the 30 plots established so far.

Information on management such as tillage operations, sowing date, crop type, fertilization and pesticide application will be collected from the land users by the local management teams on a yearly basis.

Below, first results are presented from the field work in arable plots in 2024, in comparison with grasslands and forests.

Results from 2024

Plants

Plant diversity per plot was lower than in forests and much lower than in grasslands. Among arable fields, plant diversity was 2 and 3 times higher in the Alb and Schorfheide, respectively, than in the Hainich. A similar pattern could be found for the soil seed bank. These results mainly reflect the high proportion of organic agriculture in the Schorfheide and the particularly high management intensity in the Hainich.

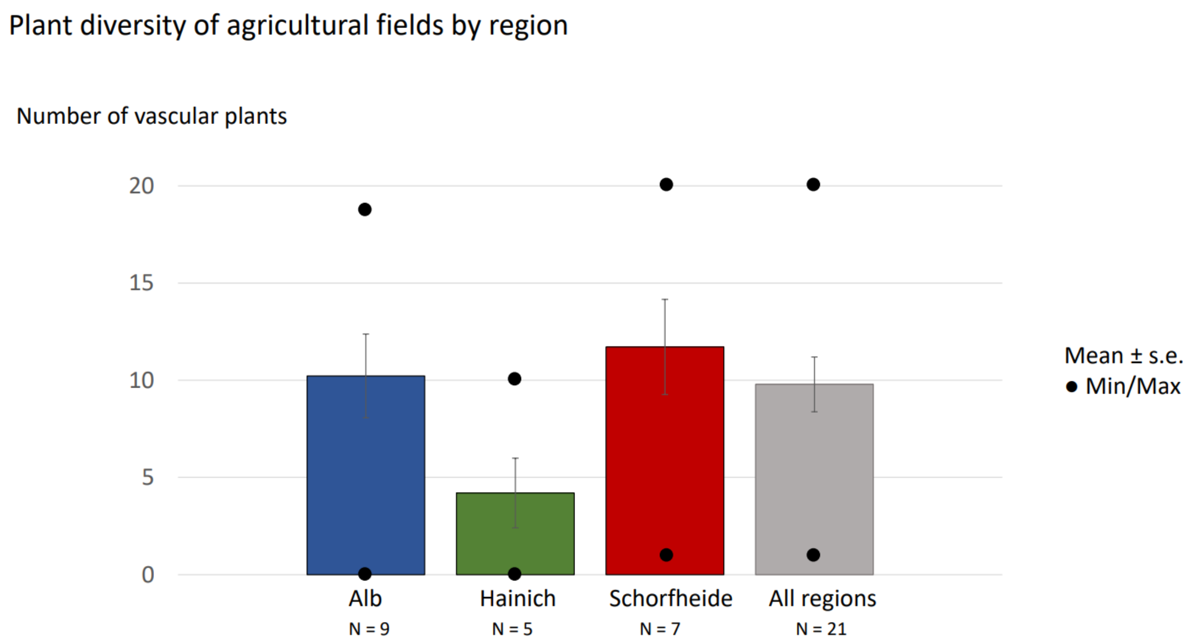

Fig. 1: Mean number of vascular plant species in arable field plots across the Exploratories.

Arthropods

Arthropod numbers were significantly lower in arable fields than in grasslands across all Exploratories. At the same time, arable fields differed significantly from grasslands in their species composition and added new species to landscape scale diversity.

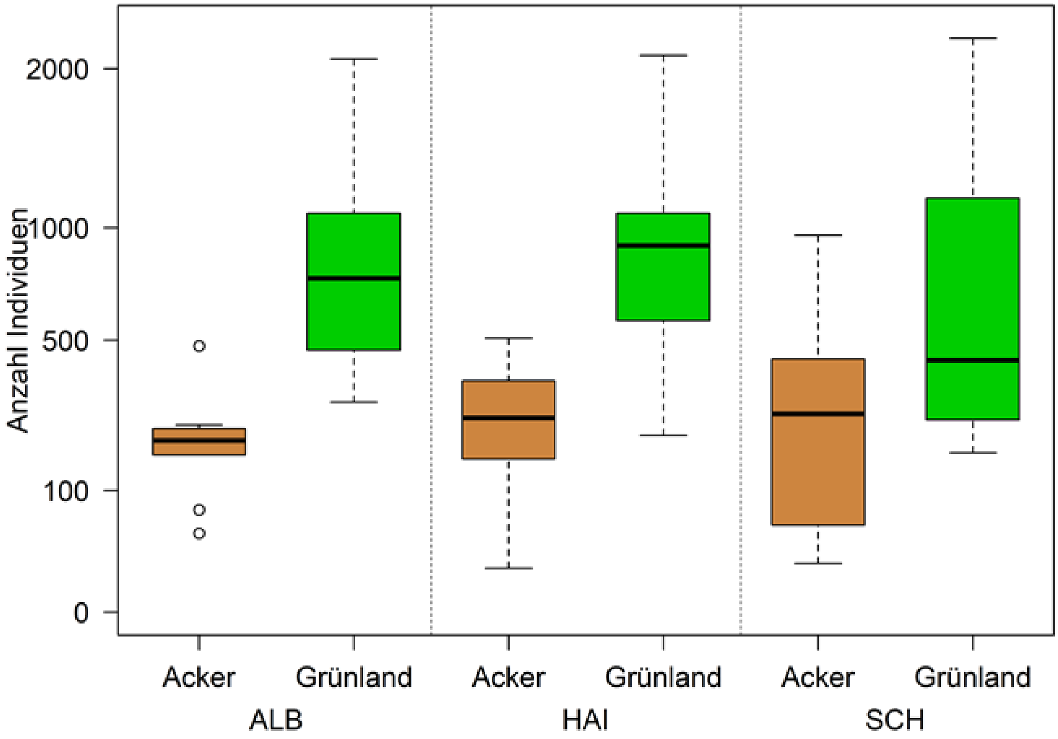

Fig. 2: Mean number of arthropod individuals in arable field plots and in comparison to grasslands across the exploratories.

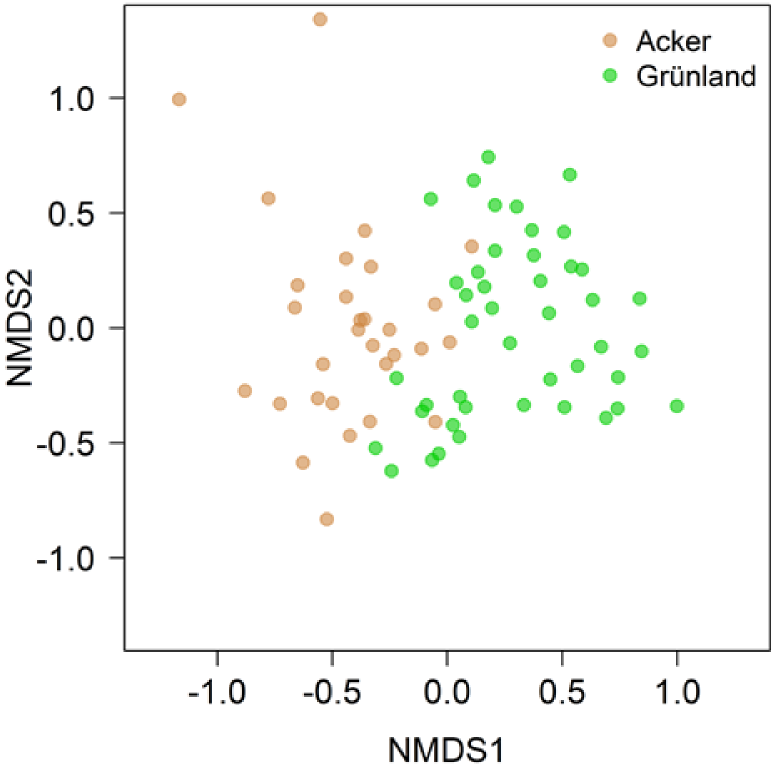

Fig. 3: Species composition of arthropods in arable field plots in comparison with grasslands across the exploratories.

Soil parameters

Across all exploratories, arable fields had significantly lower **soil organic carbon** stocks in the mineral topsoil compared with grasslands and forests, while topsoil **pH-values** were very similar to those of grasslands.

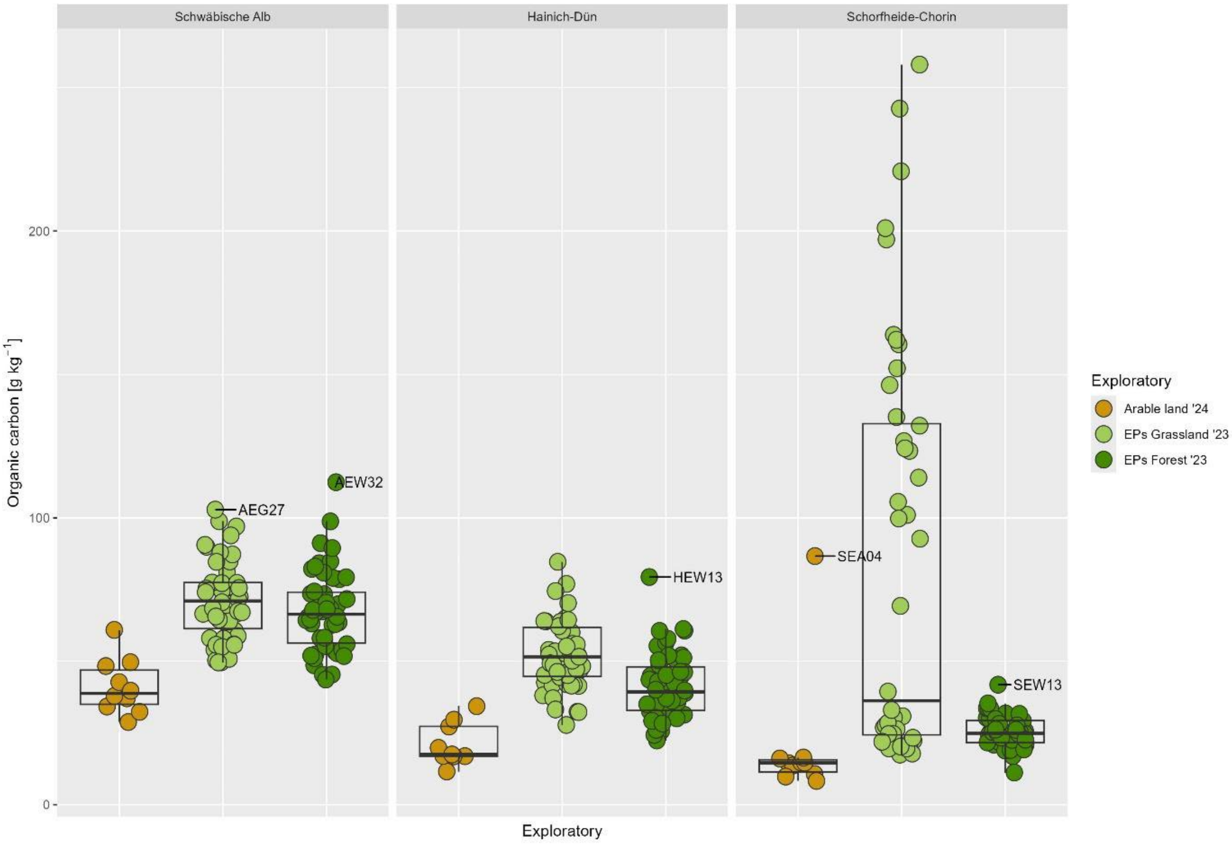

Fig. 4: Soil organic carbon (SOC) concentrations in arable field plots and in comparison with grasslands and forests across the exploratories.

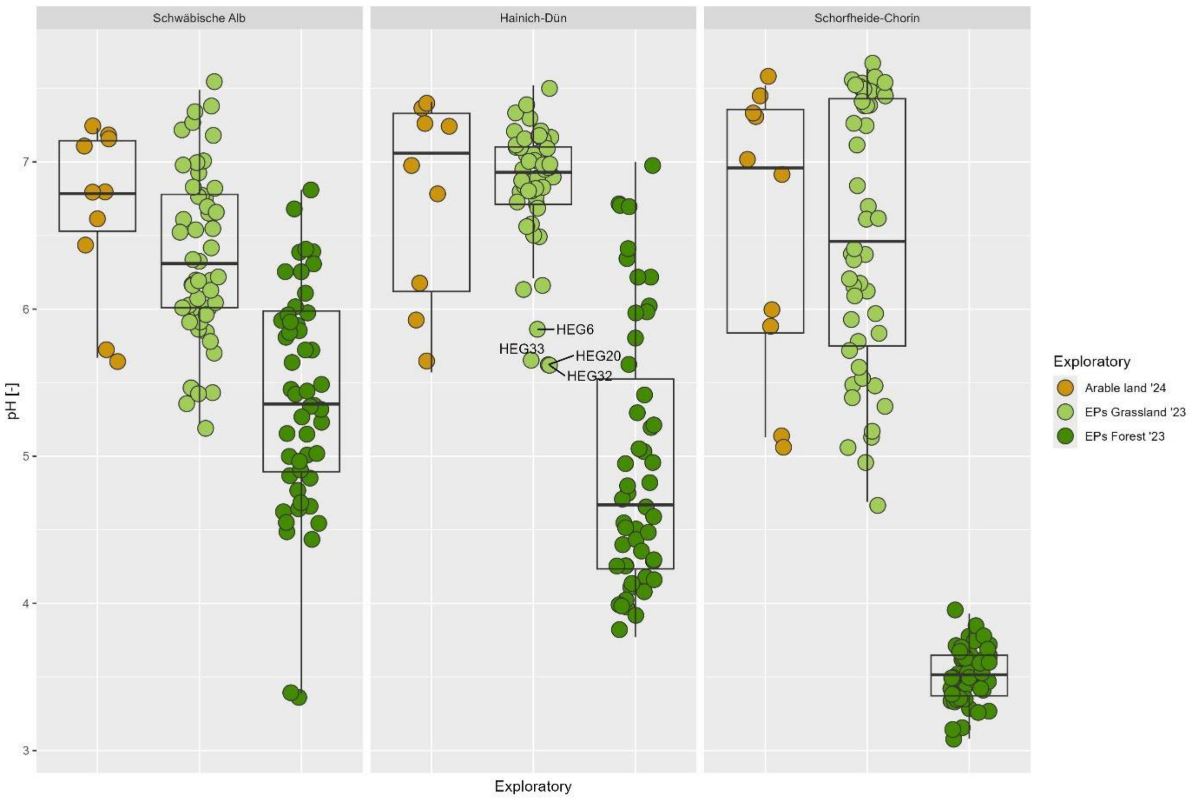

Fig. 5: Soil organic carbon (SOC) concentrations in arable field plots and in comparison with grasslands and forests across the exploratories.

CN ratios are rather similar in arable fields to those of grasslands, although they are on average slightly narrower. In contrast, **Olsen P** shows considerable differences between regions and land-use types, most likely due to variations in local and regional land-use history and differences in bedrock composition.

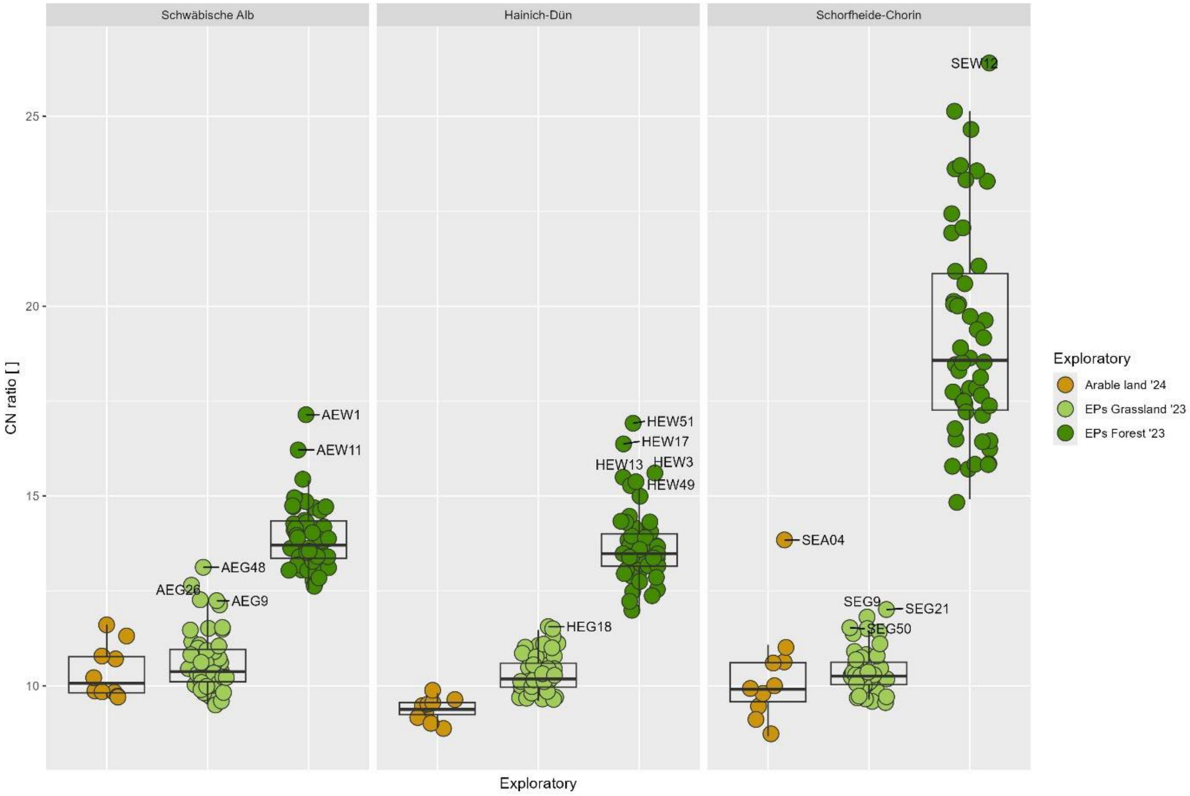

Fig. 6: Soil C/N-ratios in arable field plots and in comparison to grasslands and forests across the exploratories.

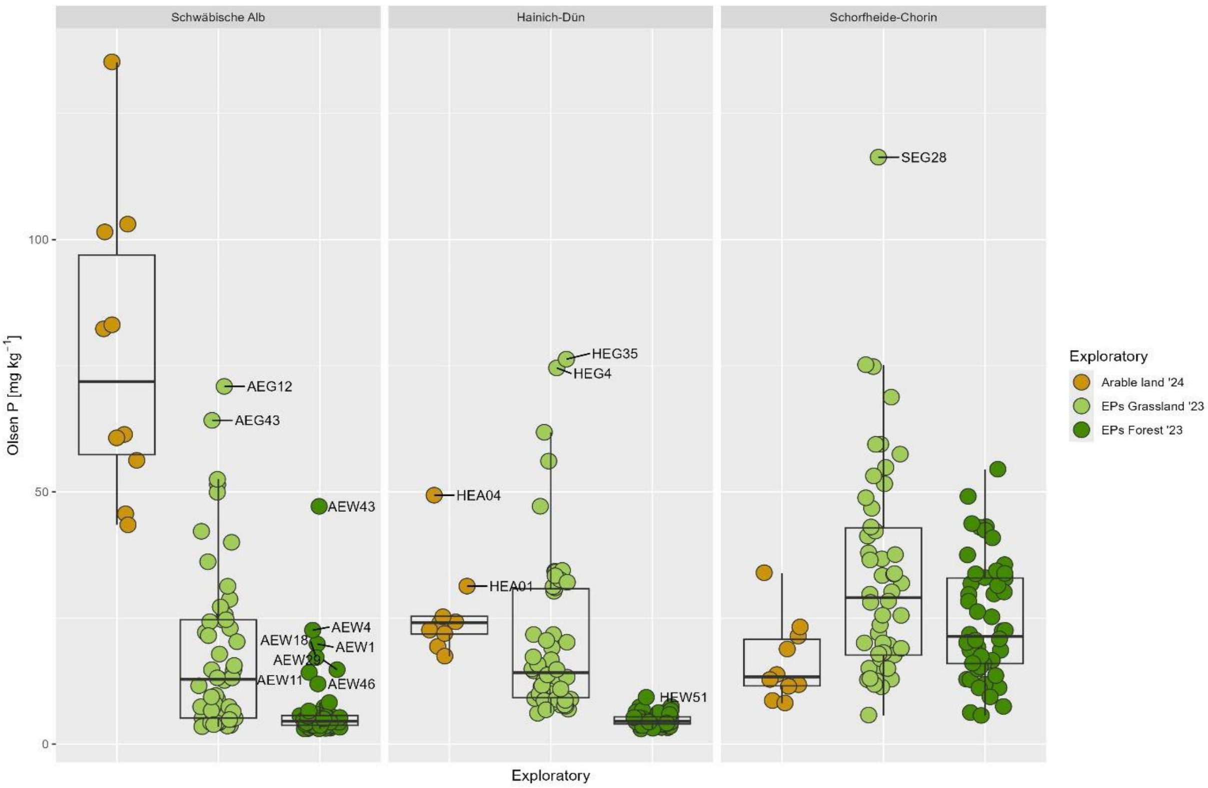

Fig.7: Soil Olson P concentrations in arable field plots and in comparison with grasslands and forests across the exploratories.

Microorganisms

Independent of Exploratory, agricultural sites appeared to be richer in soil bacteria and fungi than grassland or forest sites. There were less arbuscular mycorrhizal fungi (AMF) in agricultural sites than grassland sites, but more AMF than forest sites.

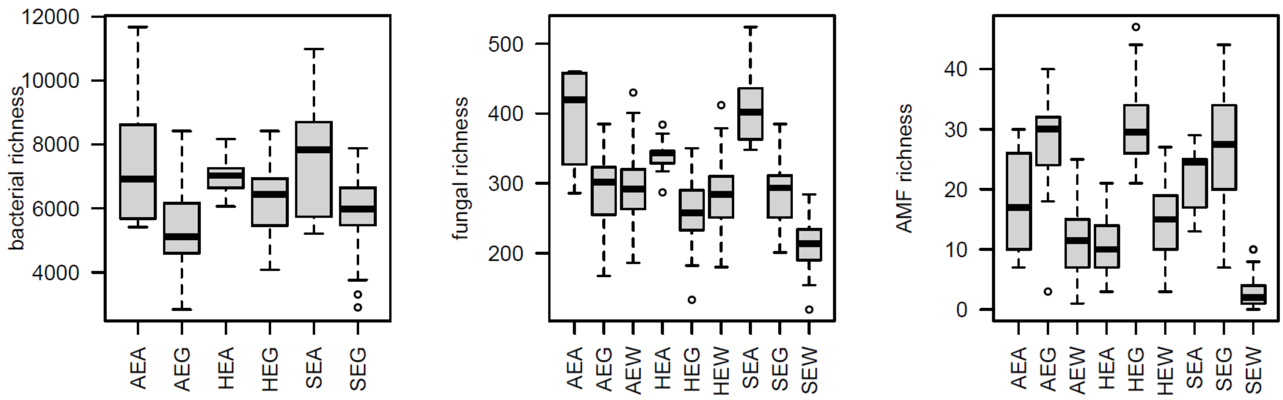

Fig. 8: Bacterial, fungi and AMF richness in arable field plots and in comparison with grasslands across the exploratories.