

Management impacts on soil structure – Evidence from twelve European long-term experiments

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Soil structure is affected by soil management

Soil management changes soil hydraulic and mechanical properties, which in turn affect water availability and accessibility by roots. Management impacts soil structure directly by loosening, compaction, or indirectly, for example by changes in soil organic carbon (SOC) content and changes in earthworm activity or root growth (Figure 1). Ultimately, the changes in hydraulic properties and mechanical resistance to root penetration affect plant water uptake and agricultural production.

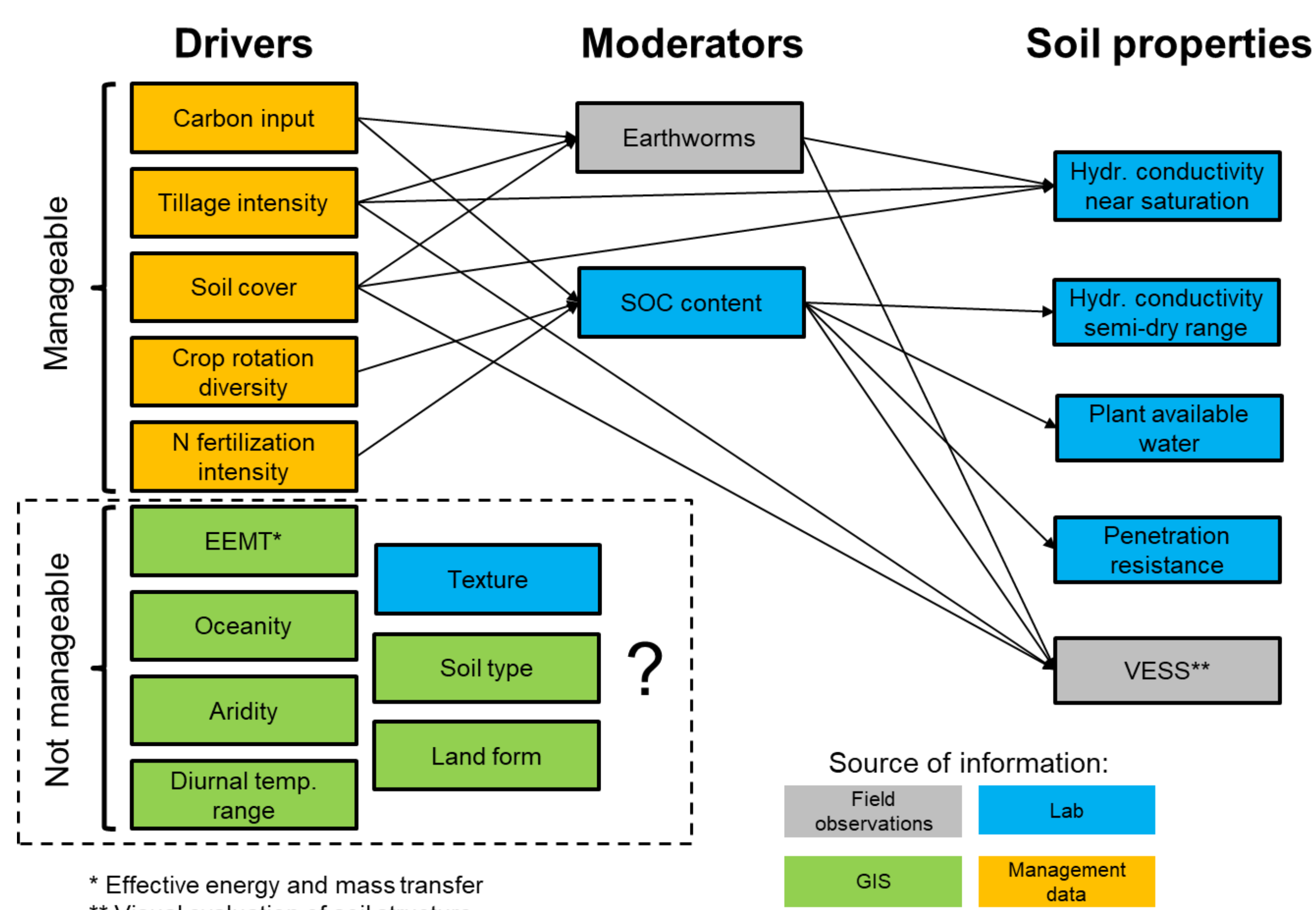


Figure 1: Drivers of soil structure dynamics and investigated soil properties

SoilX Project

In the SoilX Project, which is part of EJP SOIL, we assess the impact of soil management on soil hydraulic and mechanical properties. We have contrasting soil management treatments in 12 long-term agricultural field experiments (LTE) across Europe (Figure 2). The treatments include differences in organic amendments, residue management, tillage and cover cropping.

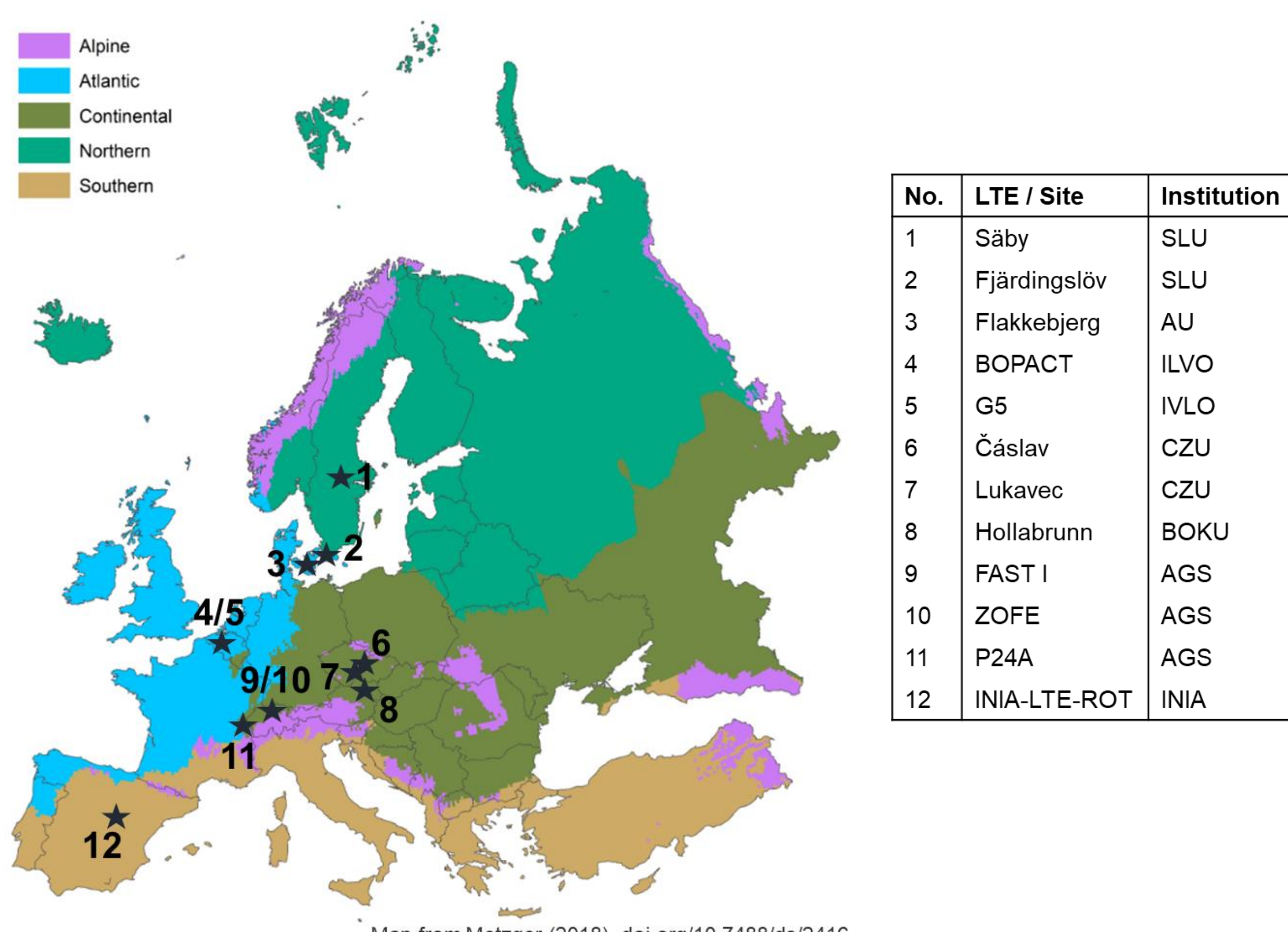


Figure 2: Long-term field experiments (LTE) that are assessed in SoilX

And here are first results from Switzerland

Field observations on earthworm biomass and soil structural quality (based on visual evaluation of soil structure, VESS) are available for the Swiss LTEs (Figures 3 and 4). Earthworm biomass was higher in treatments without inversion tillage. Organic amendments (compost, slurry or manure) had minor effects on earthworm biomass. Furthermore, our results suggest a correlation between earthworm biomass and VESS.

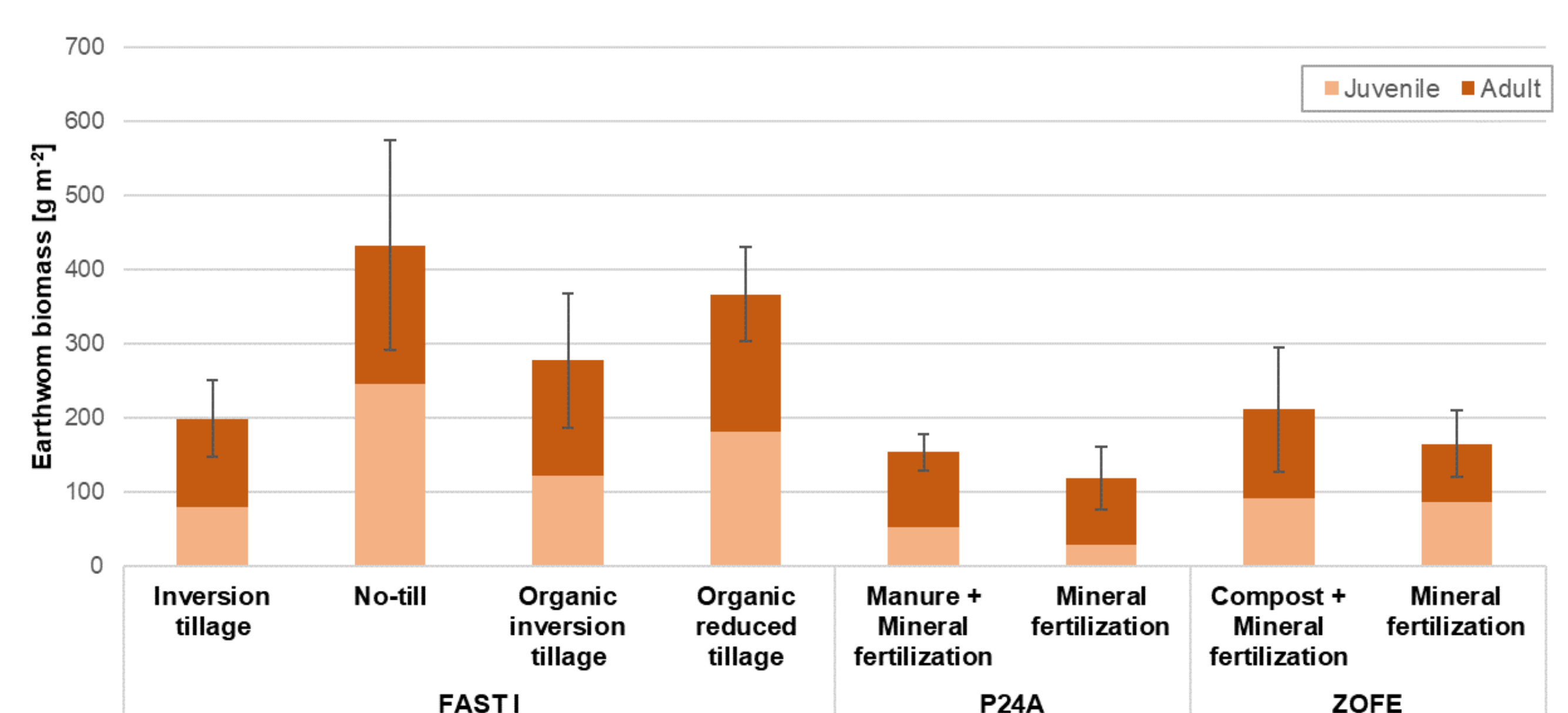


Figure 3: Earthworm biomass in Swiss LTEs. N = 4 plots per treatment, 3 pseudo-replicates were averaged within each plot, error bars indicate SD of the total biomass

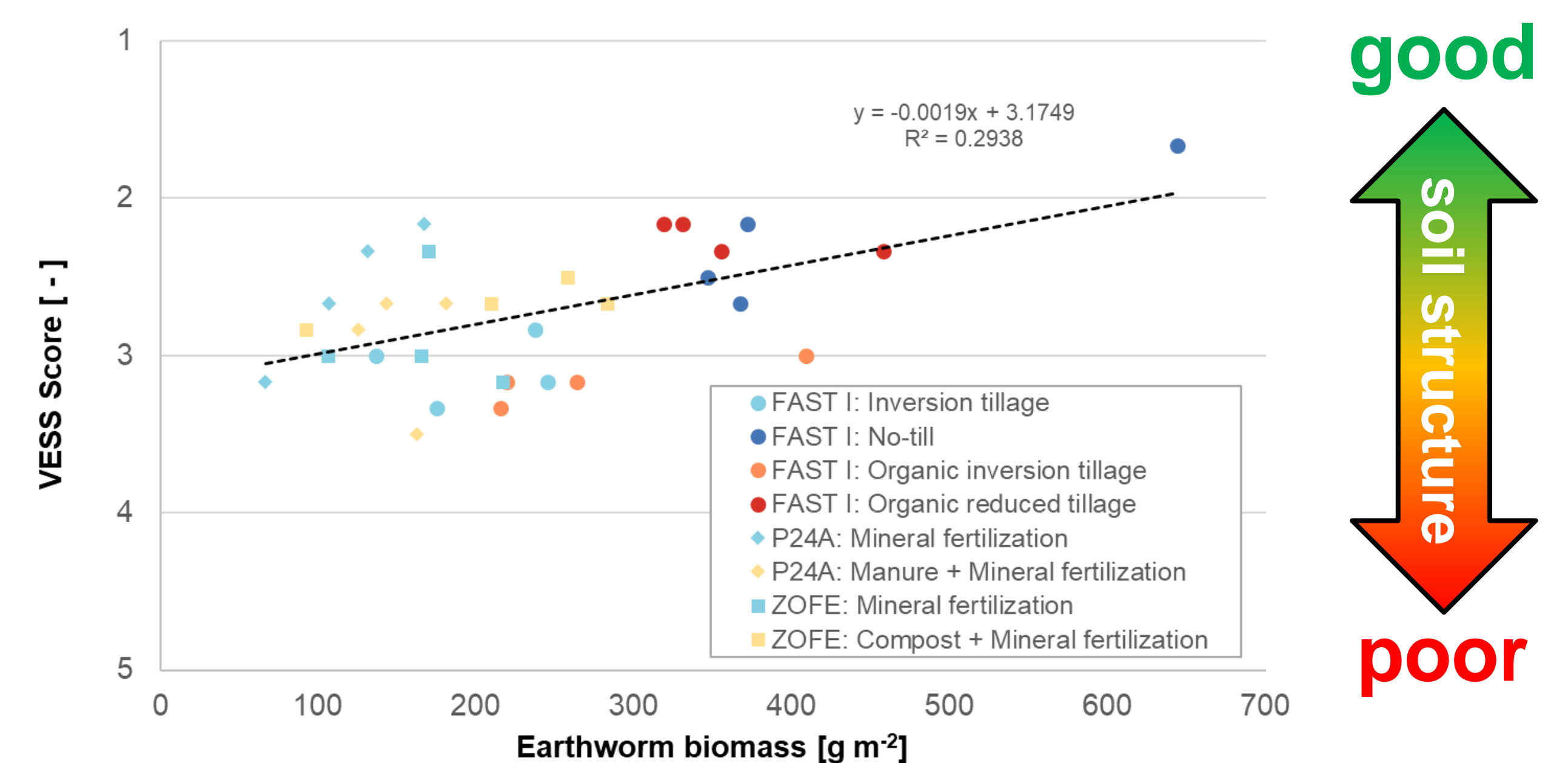


Figure 4: VESS Scores and earthworm biomass in Swiss LTEs. One data point is the average of 3 pseudo-replicates within one plot

Outlook

- All LTEs will be sampled in spring 2023
- The soil properties depicted in Figure 1 are investigated in top soils and sub soils
- Management indices allow the comparison of the agricultural soil management

Summary

Soil structure and their drivers are assessed in 12 long-term field experiments across Europe. The observed properties will be linked to soil management by management indices.

Field observations from Switzerland indicate that soil management impacts earthworm abundance and soil structure, and that earthworm biomass and soil structural quality are positively correlated.