

# BEAT:

# BIODIVERSITY & ECOSYSTEM SERVICES IN AGROFORESTRY

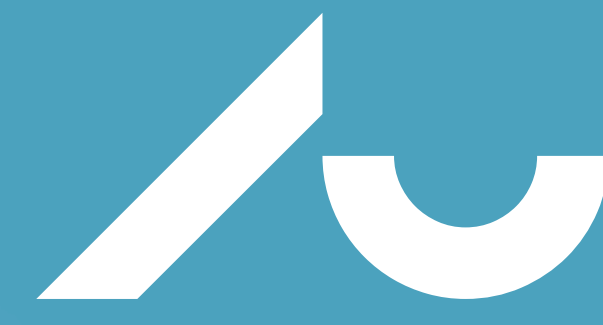
– preliminary results from a Danish study



Corn bunting, a bird species associated with hedgerow trees. Photo: Rasmus Due Nielsen.



Common skylark, a bird that only thrives in open fields. Photo: Rasmus Due Nielsen.



AARHUS UNIVERSITY



Innovation Centre for Organic Farming



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## Study set-up

- 8 hedgerows and adjacent fields with identical crop rotation (clover-grass, potatoes, spring cereal)
- 3 study years, 2024-26
- Plant diversity and measurement of carbon sequestration (tree stem diameters) in hedgerows
- 5 transects perpendicular to the hedgerow for low-mobile species, with c. 50 m between transects (Fig. 1)
- Walks near the hedgerow and mid-field for mobile species, i.e. birds and pollinating insects (2024)
- Pantraps for catching pollinators at 2 and 40 m distance to hedgerow (2025 and 2026).
- Phytometer plants to measure potential for crop pollination at 2 and 40 m from the hedgerows.
- Training courses for agricultural advisors as well as direct advisory services to farmers interested in implementing agroforestry systems, integrating scientific results from the project.
- Dissemination of results as well as practical aspects of agroforestry at agricultural conferences and public meetings

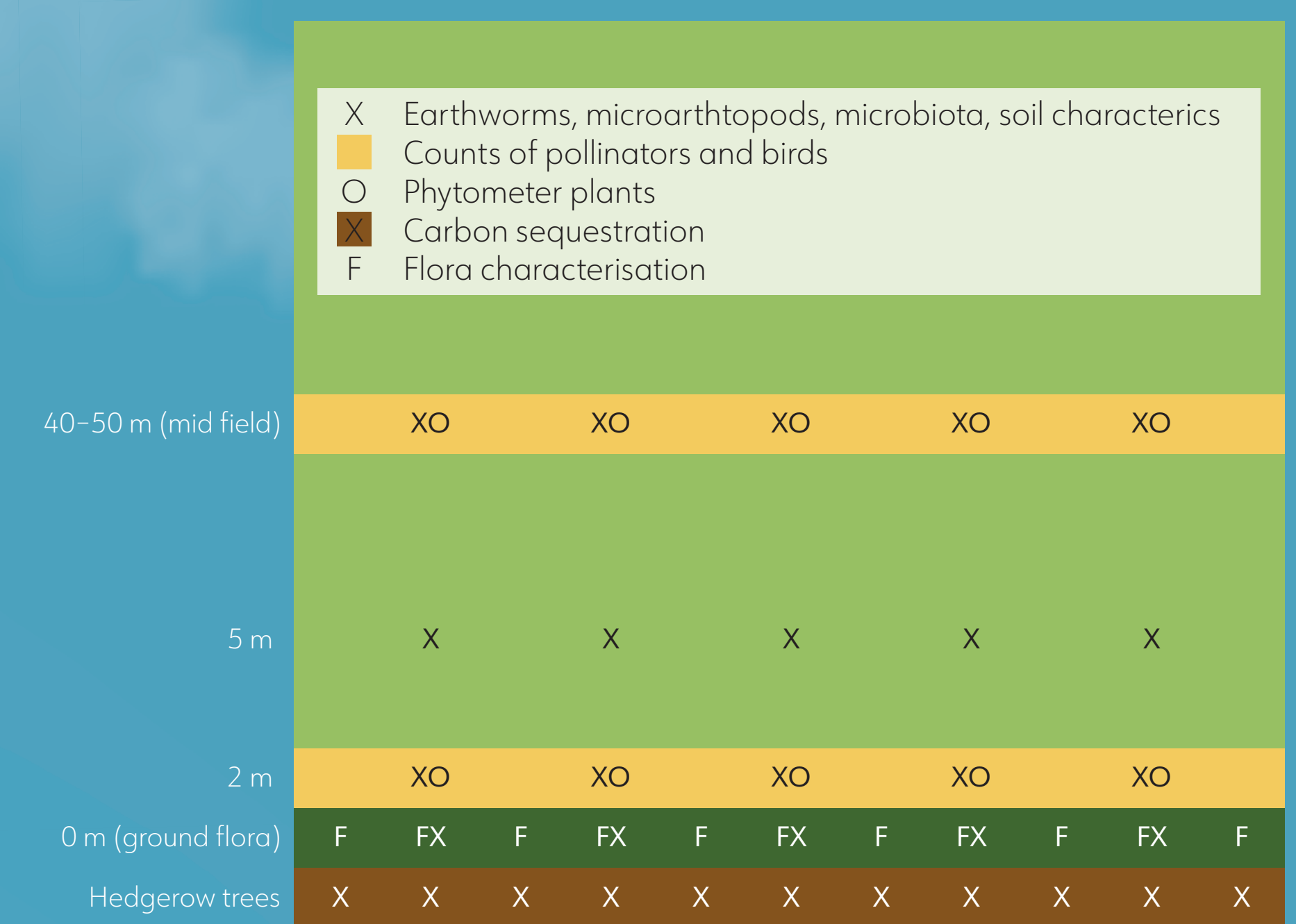


Figure 1. Outline of sampling strategy in a single field and adjacent hedgerow. Eight fields with identical crop rotation are sampled. All hedgerows run south-north, and sampling is done on the western side of the hedgerows.

## Approach

- Alley cropping under Danish conditions
- Existing hedgerows as proxy
- Biodiversity effects on plants, birds, pollinators, soil fauna and microorganisms
- Hedgerow impact on carbon storage, crop pollination, soil functionality and soil health
- Business potential of training advisers and advising farmers

## Results so far

- The study-hedgerows vary with respect to both abundance and diversity of woody species and herbs and thereby in the way they support ecosystem services (Fig. 2).
- Bird species composition is highly affected by the presence of hedgerows (Fig. 3).
- Pollinator abundance was studied in half of the study hedgerows. The abundance near hedgerows was up to 40% higher compared to mid-field (Fig. 4). Hedgerows may support pollinators that result in spill-over to the neighbouring fields. However, in the intensively grassed clover-grass fields, where crops had no resources for pollinators, no spill-over to the fields was observed.
- Earthworm abundance and biomass were higher in the open fields than in the hedgerows the first study year, when the crop was a third-year grass-clover ley, but higher in the hedgerow than in the field the second sampling year, where the crop was potatoes (Fig. 5). This indicates the importance of not only the presence of woody components, but also the choice of crop rotation in alley cropping.
- Similarly, the presence of the soil health indicator organisms, arbuscular mycorrhizal fungi (AMF), increased with the distance from the hedge when perennial grass-clover was grown in the field, whereas it was opposite when potatoes were grown in the field, i.e. the occurrence of AMF was highest close to the hedge (Fig. 5).
- In contrast to this, microarthropod abundance was higher in the hedgerows than in the fields with clover-grass (Fig. 6), and species composition differed between hedgerows and fields (Fig. 7). Data for potato fields are not ready yet.
- The distances between hedgerows often found in alley cropping are easily bridged by most/all pollinating insects. That is probably the reason why we did not observe any positive effects of hedgerow vicinity on pollination of phytometer plants.

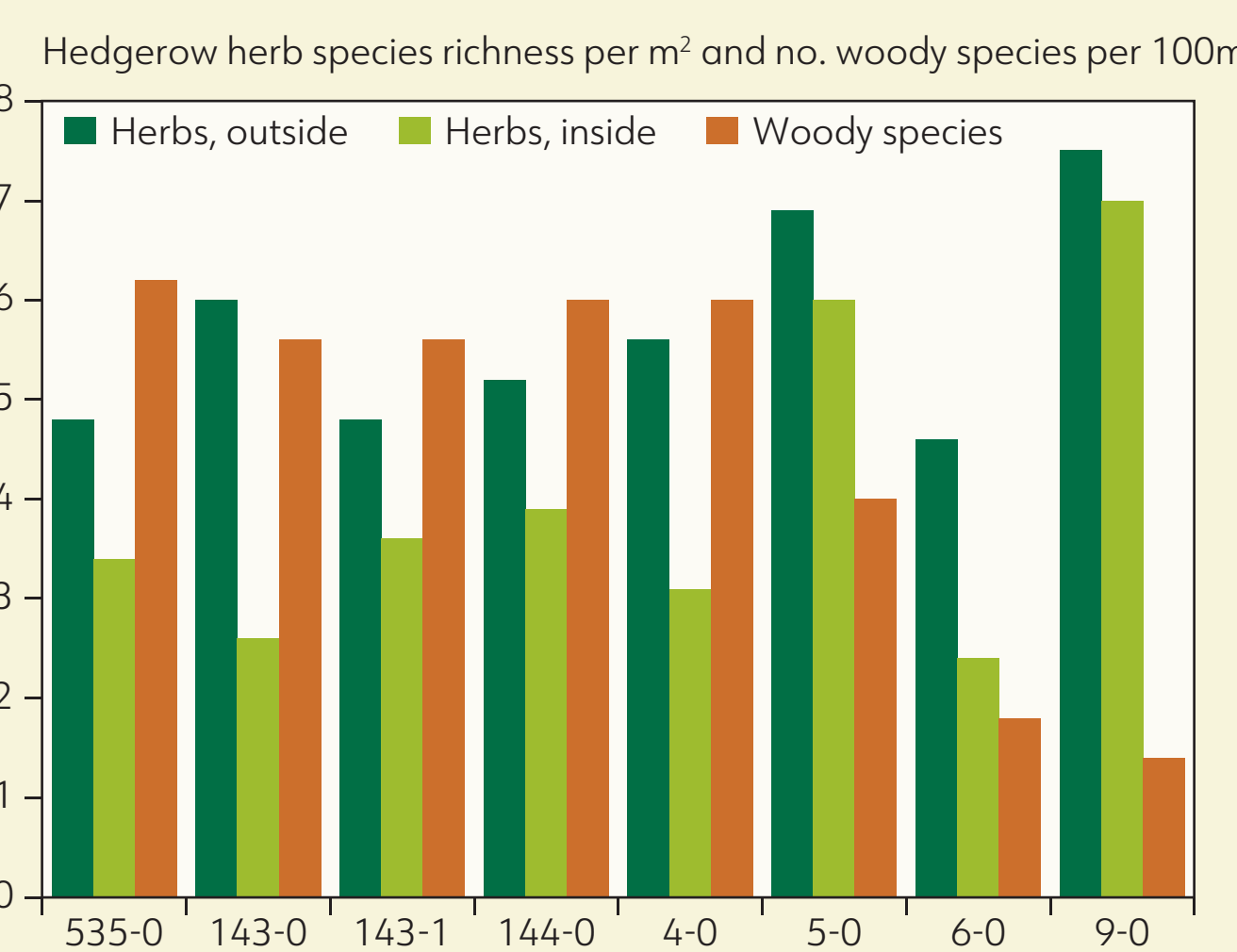


Figure 2. The eight study hedgerows vary with respect to both abundance and diversity of woody species and herbs and thereby in the way they support ecosystems services.

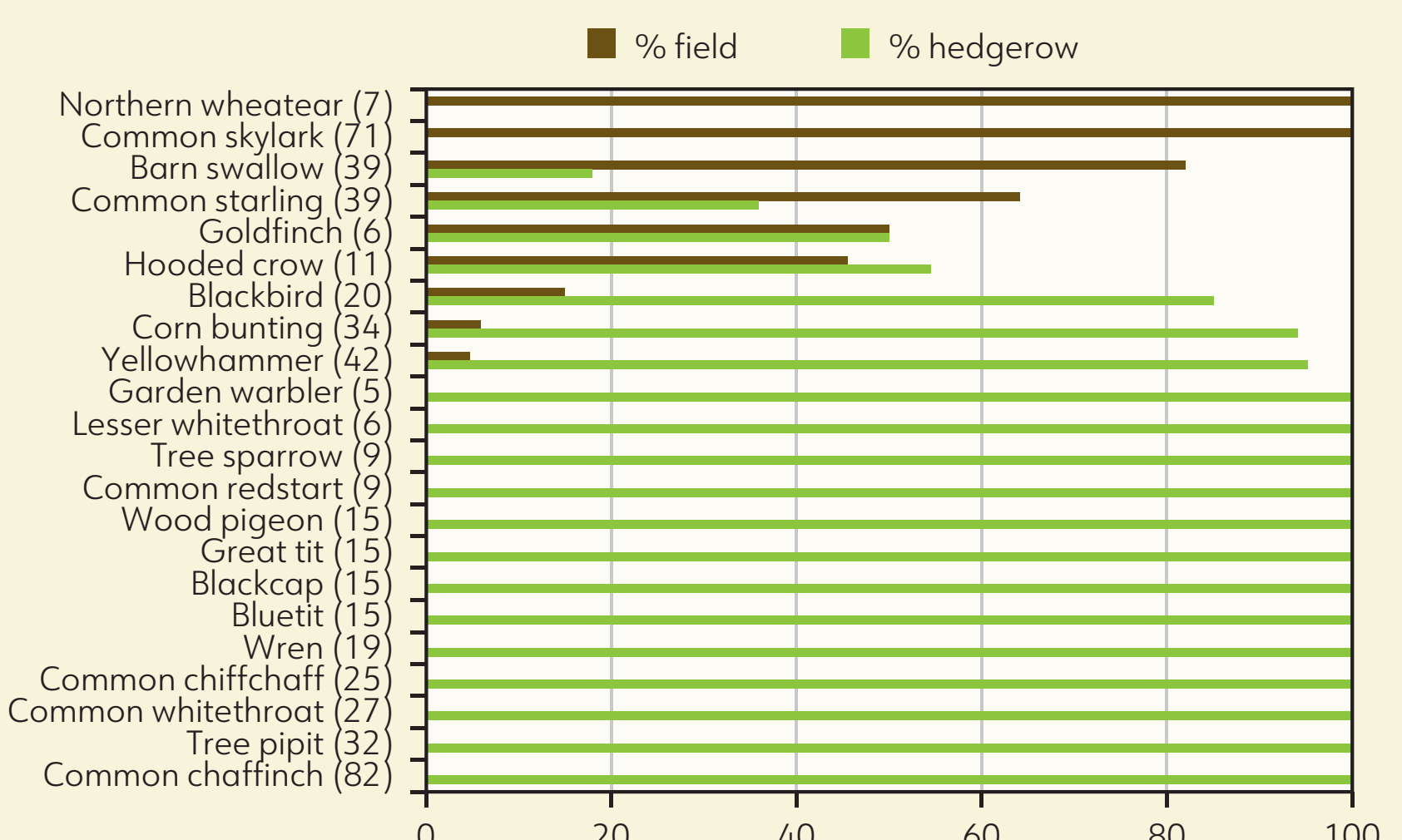


Figure 3. Bird species found in 2024 and 2025. Percentage found in open field and in hedgerow, respectively. Figures in brackets refer to the total number of observations. Only species with more than 5 observations are included.

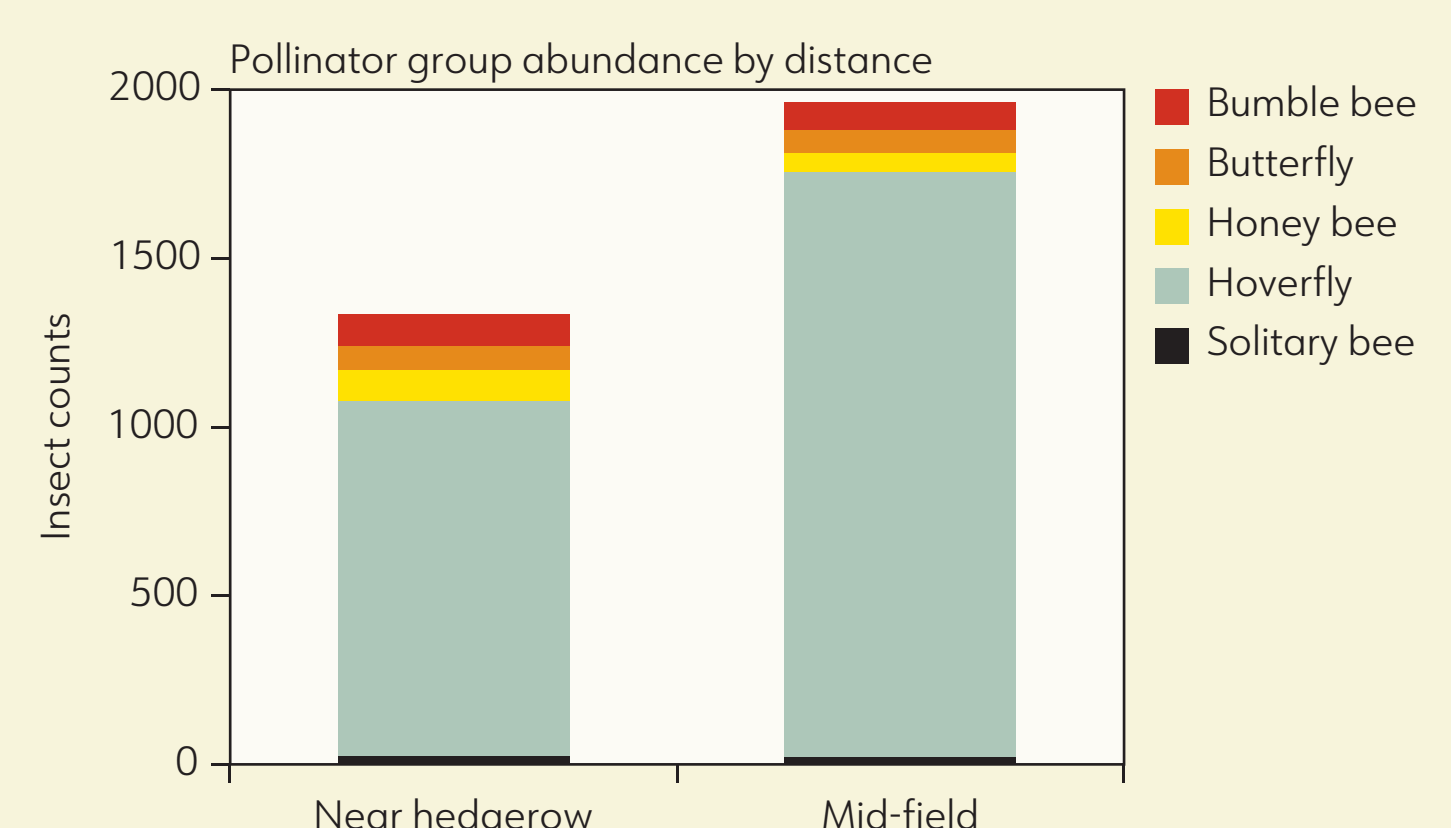


Figure 4. Pollinator groups by distance to hedgerow. Data from four of the eight study hedgerows. Figure by Lærke Bruun.

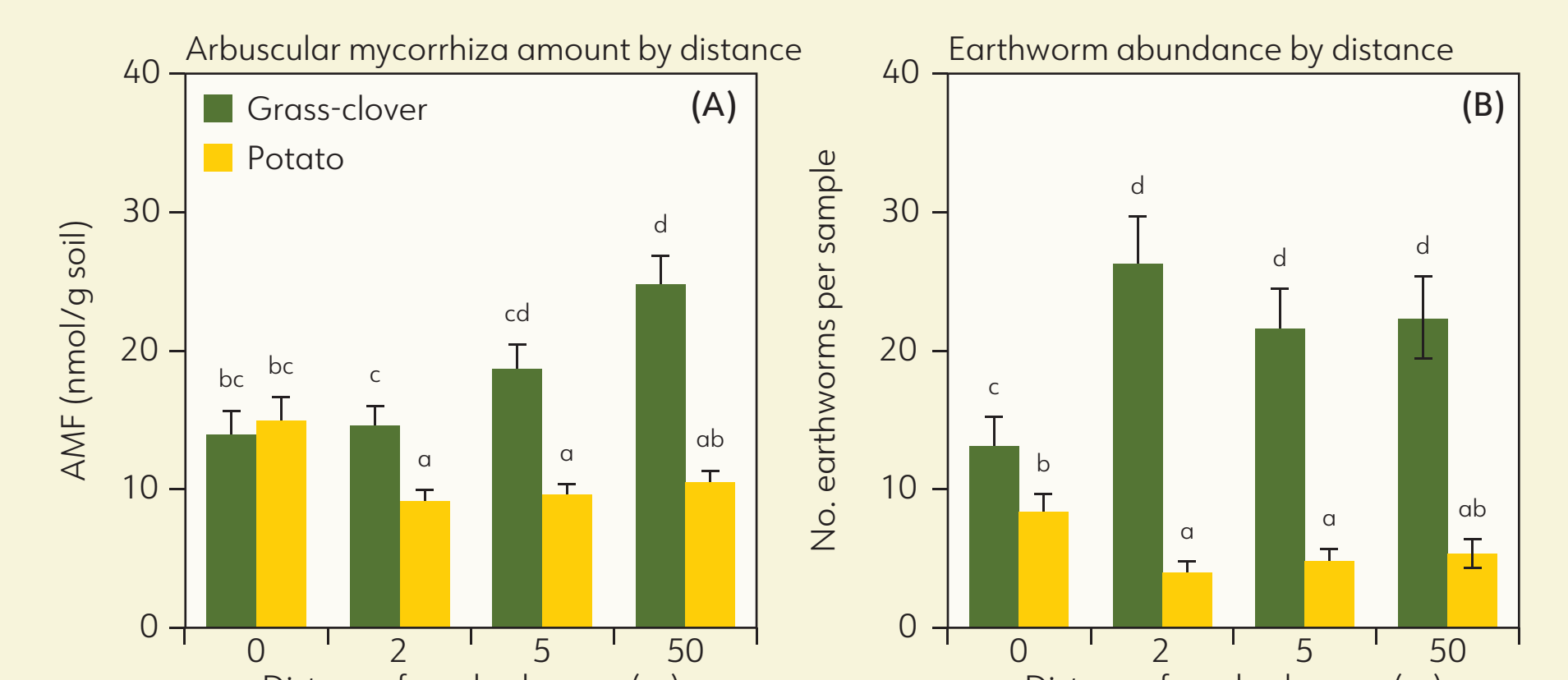


Figure 5. Amount of arbuscular mycorrhiza (AMF) (A) and number of earthworms (B) at increasing distance from hedgerow in 2024 (green bars, clover-grass) and 2025 (yellow bars, potato). Means and SEM. Different letters indicate significant difference at 5% significance level. Figure by Thea Asser Munk.



Soil samples for hand-sorting earthworms.



Pantraps used to catch pollinator insects. Photo: Lærke Bruun.

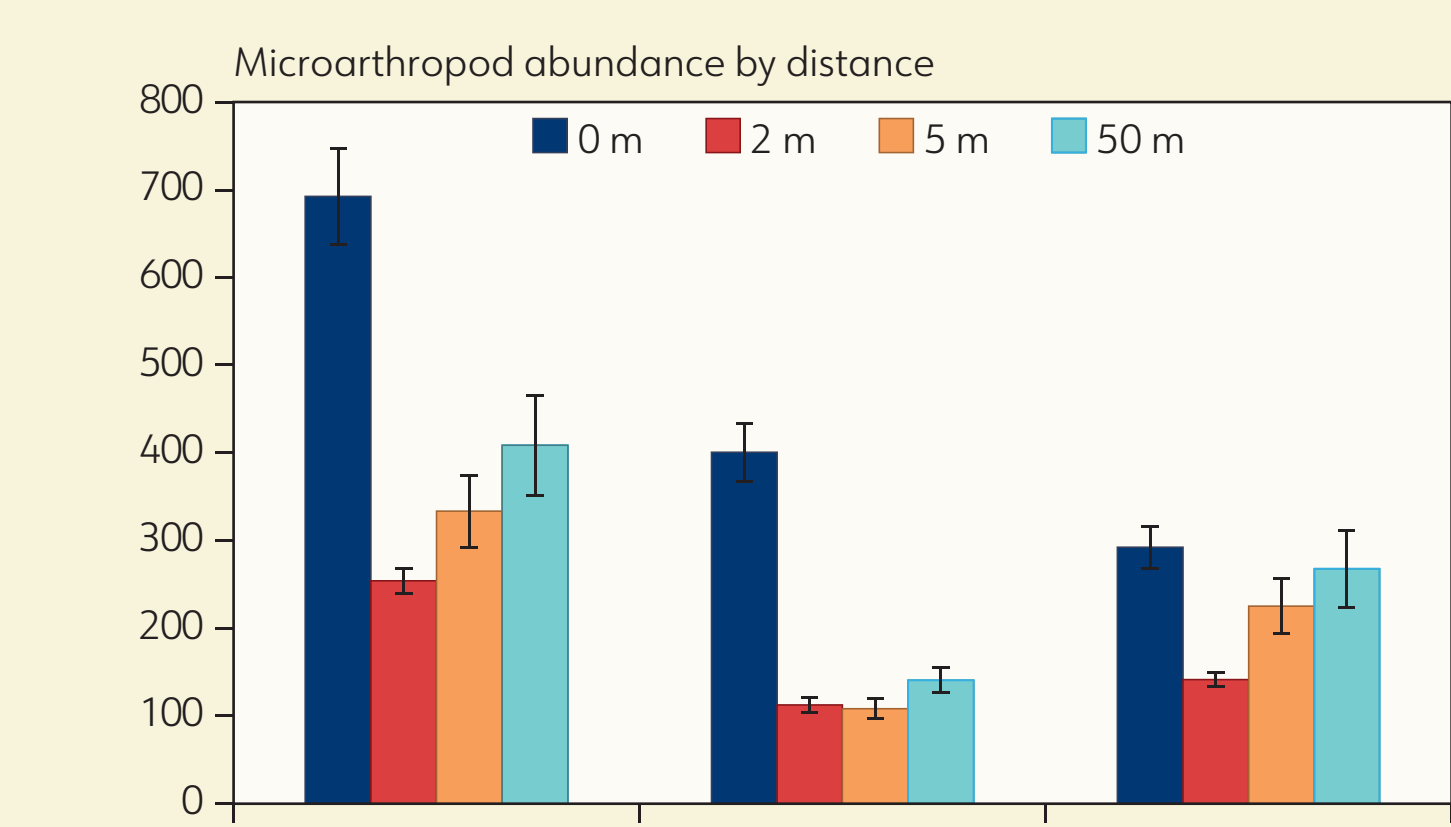


Figure 6. Microarthropod (total counts, mites, springtails) abundance in 2024 (clover-grass) at 0-5 cm soil depth. Bars indicate means and standard errors of the means at increasing distance from hedgerow.

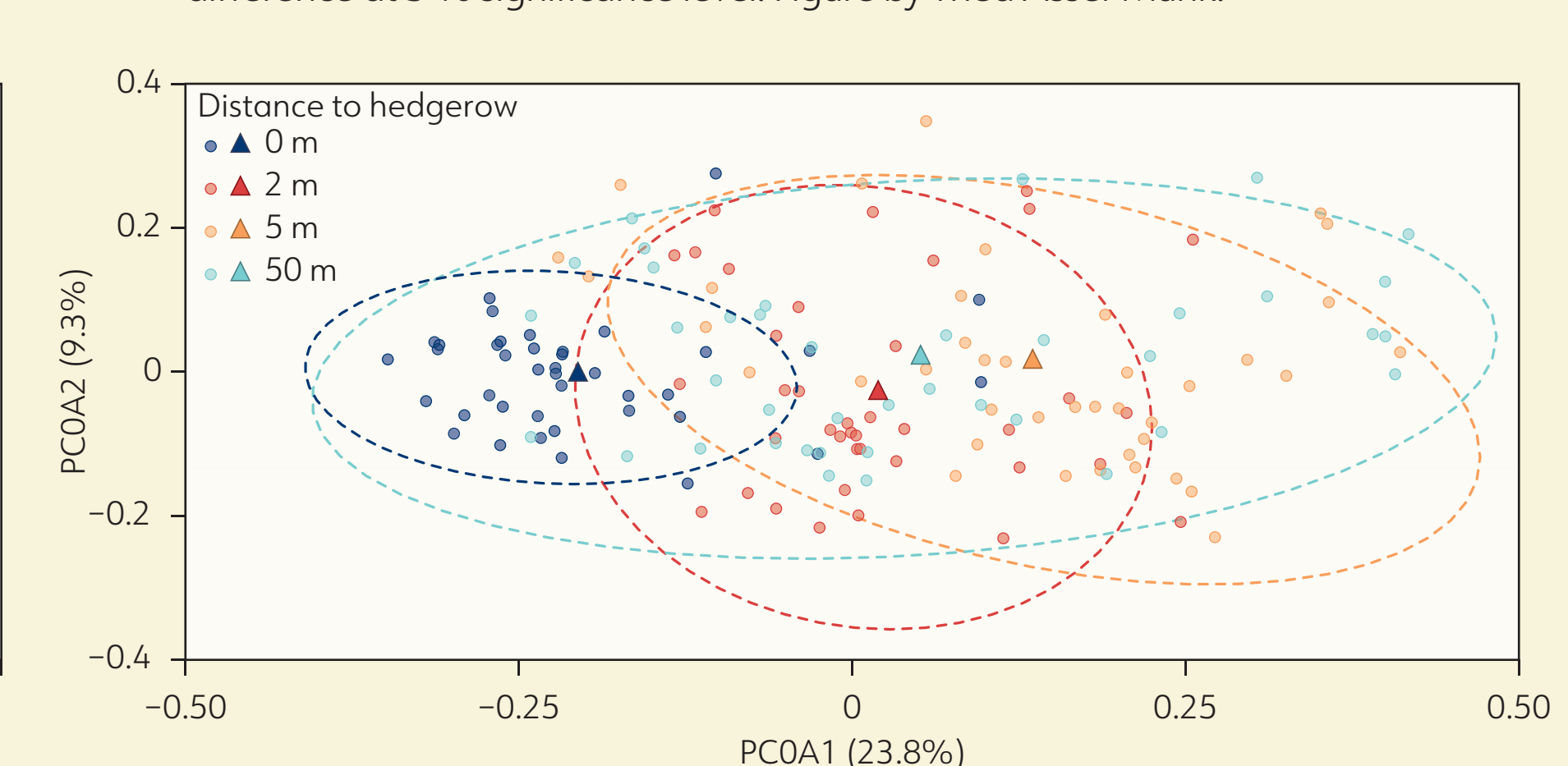


Figure 7. PCOA plot of microarthropod community composition. Each point represents a sample, and the colour indicates distance to the hedgerow. Triangles represent centroids for each distance group, and each ellipse contains 95% of the samples of its group. Figure by Laura Drilling.

## Acknowledgement

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Fonden for økologisk landbrug

