

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a Confirmed

- | | | |
|-------------------------------------|-------------------------------------|--|
| ☐ | ☒ | The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| ☐ | ☒ | A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| ☐ | ☒ | The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| ☐ | ☒ | A description of all covariates tested |
| ☐ | ☒ | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| ☐ | ☒ | A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| ☐ | ☒ | For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| ☒ | ☐ | For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| ☒ | ☐ | For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| ☒ | ☐ | Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection All data were collected from soil animals using manual counting and identification. No software was used during the data collection.

Data analysis All data manipulations and statistical analyses were done in R version 4.2.2 (R Development Core Team, 2021) with RStudio interface v. 1.4.1106 (RStudio, PBC). The following packages were used: lme4 v1.1-33, tidyverse v2.0.0, plyr v1.8.8, reshape v0.8.9, reshape2 v1.4.4, fluxweb v0.2.0, readxl v1.4.2, ggrepel v0.9.3. Food-web reconstruction code is openly available from Figshare (<https://figshare.com/s/eeb55e0831f1c74e75e0>). Linear models are specified in the Supplementary Table 5 and Table 6.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Raw data used in the analysis are available from Figshare: <https://figshare.com/s/eeb55e0831f1c74e75e0>.

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender	N/A
Reporting on race, ethnicity, or other socially relevant groupings	N/A
Population characteristics	N/A
Recruitment	N/A
Ethics oversight	N/A

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☐ Behavioural & social sciences ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	The study combined the energy flux approach with compound-specific stable isotope analysis of amino acids (CSIA-AA) of carbon and nitrogen to reconstruct soil food webs in 24 paired AMF- and EMF-dominated deciduous forest sites.
Research sample	We quantified energy channelling from basal resources (plants, fungi and bacteria) to primary consumers and predators across a wide body-size spectrum: nematodes, microarthropods, macroarthropods and earthworms.
Sampling strategy	The sampling was done on paired arbuscular mycorrhizal fungi (AMF) and ectomycorrhizal fungi (EMF) dominated forests at 12 locations (n = 24 sites in total). No procedure was used to predetermine the sampling size.
Data collection	Authors of the paper applied a combination of collection methods to assess soil nematodes (modified Baermann funnels), soil microarthropods, macroarthropods and earthworms (heat extraction).
Timing and spatial scale	Soil samples for extracting microarthropods, macroarthropods and earthworms were collected by taking four soil cores (15 cm in diameter) per site (96 soil cores in total), including both litter and the top 10 cm of the underlying soil, in September and October 2023.
Data exclusions	No data were excluded from the analysis.
Reproducibility	Both the data and the programming code are available from Figshare: https://figshare.com/s/eeb55e0831f1c74e75e0 allowing for a full reproduction of the analyses.
Randomization	Sites, subplots within sites, and samples within subplots were randomly established taken.
Blinding	No formal blinding was applied. Blinding was not feasible during field sampling because AMF- and EMF-dominated sites were associated with visibly different dominant tree species and site information was required for the paired sampling design. Subsequent extraction, counting, identification and biomass estimation followed standardised protocols and predefined criteria, and analyses were conducted using the grouping information required to test the study hypotheses.

Did the study involve field work? ☒ Yes ☐ No

Field work, collection and transport

Field conditions	The study was carried out in deciduous temperate forests with domination of either EMF- or AMF-associated trees situated across Denmark and Germany (Supplementary Fig. 1). The study design included paired EMF and AMF sites at 12 locations (n = 24 sites in total). In AMF systems, the dominant tree species across sites were maple (<i>Acer</i> sp.) and/or ash (<i>Fraxinus excelsior</i>), while in EMF systems, the dominant tree species across sites were oak (<i>Quercus</i> sp.) and/or beech (<i>Fagus sylvatica</i>). Soils were silty loam with pH ranging between 4.3–7.1 (AMF) and 3.7–6.6 (EMF). Details on these sites are available in Supplementary Table 1.
Location	The study sites were distributed across Denmark and Germany, spanning approximately 48.70–55.98°N in latitude and 9.05–12.35°E

in longitude. This corresponds to a latitudinal range of about 7.28° and a longitudinal range of about 3.30°, covering a broad north-south gradient from southern Germany to Denmark.

Access & import/export

Access to the field sites and permission for soil sampling were arranged through local collaborators and/or site managers before sampling. Soil cores were collected for non-commercial scientific research using a standardised and minimally invasive sampling design, and sampling disturbance was kept to a minimum. Samples were transported to the laboratory within the European Union for further extraction and analysis. The study did not involve protected species, CITES-listed organisms, endangered species or commercial use of biological material. To our knowledge, no additional import/export permits were required; all sampling and sample transport complied with applicable local, national and European regulations.

Disturbance

Work on the study sites was implemented with care, to minimize disturbance. Whenever possible, manipulations with samples were done in a laboratory, outside the field sampling areas.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☐	☒ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals

Study did not involve laboratory animals.

Wild animals

Only invertebrate animals (nematodes, arthropods and earthworms) were collected and killed using ethanol during the study. This was necessary to assess biomass and community composition. We collected soil nematodes using modified Baermann funnels, soil arthropod using heat extraction.

Reporting on sex

Sex was not considered in the study.

Field-collected samples

Collected soil samples were transported in the lab within 2-3 days for heat or wet extraction. All invertebrates were stored in 70-80% ethanol solution. No field-collected environmental samples were used in this study.

Ethics oversight

No ethical approval was required. The study did not involve vertebrate animal capturing and killing.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Plants

Seed stocks

This study does not involve seed stocks.

Novel plant genotypes

This study does not involve novel plant genotypes.

Authentication

This study did not involve plant material, seed stocks, plant specimens or novel plant genotypes. The dominant tree species at each site were used only as site-level information to classify forests as AMF- or EMF-dominated, and no plant material was collected or analysed.