

Life Sciences Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form is intended for publication with all accepted life science papers and provides structure for consistency and transparency in reporting. Every life science submission will use this form; some list items might not apply to an individual manuscript, but all fields must be completed for clarity.

For further information on the points included in this form, see [Reporting Life Sciences Research](#). For further information on Nature Research policies, including our [data availability policy](#), see [Authors & Referees](#) and the [Editorial Policy Checklist](#).

► Experimental design

1. Sample size

Describe how sample size was determined.

All individual ecosystem variables measured in the Jena Experiment between 2002 and 2007 were used in this analysis. This selection resulted in 82 ecosystem variables which have been measured on 81 plots in the Main Experiment resulting in 6642 individual data points in the main analysis.

2. Data exclusions

Describe any data exclusions.

A single plot – the monoculture of *Bellis perennis* – showed very low establishment of the target species and therefore was removed from this analysis. For this reason, there are 81 rather than the originally sown 82 plots.

3. Replication

Describe whether the experimental findings were reliably reproduced.

Many of the relationships between individual ecosystem variables and plant species richness have been documented repeatedly over multiple years in the Jena Experiment and have been published in various peer-reviewed journals. Positive effects of plant species richness on ecosystem functions have been documented in a wide range of biodiversity experiments.

4. Randomization

Describe how samples/organisms/participants were allocated into experimental groups.

Plant communities and diversity levels were allocated randomly to plots in the Jena Experiment in a blocked design.

5. Blinding

Describe whether the investigators were blinded to group allocation during data collection and/or analysis.

Researchers collecting data in the field were not blinded to sown diversity level on the plot but were unaware of the results for most other ecosystem variables.

Note: all studies involving animals and/or human research participants must disclose whether blinding and randomization were used.

6. Statistical parameters

For all figures and tables that use statistical methods, confirm that the following items are present in relevant figure legends (or in the Methods section if additional space is needed).

n/a Confirmed

- ☐ ☒ The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement (animals, litters, cultures, etc.)
- ☐ ☒ A description of how samples were collected, noting whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
- ☒ ☐ A statement indicating how many times each experiment was replicated
- ☐ ☒ The statistical test(s) used and whether they are one- or two-sided (note: only common tests should be described solely by name; more complex techniques should be described in the Methods section)
- ☐ ☒ A description of any assumptions or corrections, such as an adjustment for multiple comparisons
- ☐ ☒ The test results (e.g. *P* values) given as exact values whenever possible and with confidence intervals noted
- ☐ ☒ A clear description of statistics including central tendency (e.g. median, mean) and variation (e.g. standard deviation, interquartile range)
- ☐ ☒ Clearly defined error bars

See the web collection on [statistics for biologists](#) for further resources and guidance.

► Software

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

7. Software

Describe the software used to analyze the data in this study.

All statistics were calculated in R with the functions and packages as indicated in the methods section. R-code to calculate the multivariate approach to multifunctionality is provided in the supporting materials as is R code to update the turnover approach to multifunctionality to included more stringent criteria for considering an effect of an individual species informative.

For manuscripts utilizing custom algorithms or software that are central to the paper but not yet described in the published literature, software must be made available to editors and reviewers upon request. We strongly encourage code deposition in a community repository (e.g. GitHub). *Nature Methods* [guidance for providing algorithms and software for publication](#) provides further information on this topic.

► Materials and reagents

Policy information about [availability of materials](#)

8. Materials availability

Indicate whether there are restrictions on availability of unique materials or if these materials are only available for distribution by a for-profit company.

No restrictions.

9. Antibodies

Describe the antibodies used and how they were validated for use in the system under study (i.e. assay and species).

Not applicable

10. Eukaryotic cell lines

a. State the source of each eukaryotic cell line used.

Not applicable

b. Describe the method of cell line authentication used.

Not applicable

c. Report whether the cell lines were tested for mycoplasma contamination.

Not applicable

d. If any of the cell lines used are listed in the database of commonly misidentified cell lines maintained by [ICLAC](#), provide a scientific rationale for their use.

Not applicable

► **Animals and human research participants**

Policy information about [studies involving animals](#); when reporting animal research, follow the [ARRIVE guidelines](#)

11. Description of research animals

Provide details on animals and/or animal-derived materials used in the study.

Not applicable

Policy information about [studies involving human research participants](#)

12. Description of human research participants

Describe the covariate-relevant population characteristics of the human research participants.

Not applicable