Two-day statistics intensive course III for soil scientists
from March 11th until March 12th 2026 (in English)

III. Analyses of variance and mixed-effects modelling using R for soil scientists

Almost all scientific studies rely to some extent on correct statistical analyses. While statistical software packages for scientists offer great opportunities and provide many powerful tools (e.g., in data mining and exploratory statistics), there are many pitfalls, which may result in wrong or nonreproducible manuscripts. This problem has been known for a long time and has been addressed explicitly in some research fields other than the geosciences. This short course aims to address potential problems in geoscientific studies and to reduce the number of non-reproducible studies.

Examples of such problems could be (I) a lack of understanding of important special topics such as Box-Cox transformations and logistic regressions; (II) a lack of knowledge of the great importance of statistical independence of data as condition for the analyses of variance (dealing with spatially and/or temporally dependent data); (III) a lack of understanding of residual inspections and how to deal with missing normality or with variance heterogeneity; (IV) research without hypotheses with a focus on mechanically carried out post-hoc tests; (V) a lack of knowledge how to handle unbalanced designs; (VI) a lack of understanding how to handle more complicated designs (split plot, multi-stratum designs); and (VII) inaccuracies in factor formulations.

The intensive course III aims to improve soil scientists' statistical knowledge. A main objective is to reduce the occurrence of the above-mentioned problems in soil science research and publications.

Date: Intensive course III: March, 11th 2026 9:30 a.m. until March 12th 5:00 p.m.

Location: The intensive course will be held as Zoom session.

Costs: The costs for the intensive course III are 100.00€. The price stated here is a final price and must be transferred before the start of the course.

Materials: Lecture notes, exercises and model solutions will be provided.

Recommended literature:

- Dormann (2020). Environmental Data Analysis. Springer.
- Jones et al. (2022). The R Book. 3rd Ed., Wiley.
- Welham et al. (2024). Statistical Methods in Biology. Design and Analysis of Experiments and Regression, Taylor & Francis Ltd.

- Ludwig, B., Song, X., Gunina, A., Greenberg, I., Dippold, M.A., Piepho, H.P. 2021. Importance of sources of variability, scales and experimental design: A case study about the effects of biochar and slurry application on soil properties in agricultural silty loam soils. Eur. J. Soil Sci. 72, 1954-1968. DOI: 10.1111/ejss.13120

Lecturer: Prof. Dr. Bernard Ludwig

Schedule of the intensive course:
Wednesday, 11.03.2026

Time	Contents
09:30 - 11:00	Welcome, one-way anovas (analyses of variance), structure of anova tables and residual inspections; post-hoc tests
11:00 - 11:15	Break
11:15 - 12:45	Multi-way anovas (blocking, interactions), model simplification, multiple mean comparisons and contrasts
12:45 - 13:45	Lunch break
13:45 - 15:15	Formulating factors and unbalanced model, exercises on one-way and multi-way anovas using R
15:15 - 15:30	Break
15:30 - 17:00	Combined ANOVA and regression analysis, split plot designs

Thursday, 12.03.2026

Time	Contents
09:30 - 11:00	Types of sums of squares, experimental designs (CRD, RCBD, Latin square design, balanced incomplete block design, multi-stratum designs) and associated analyses
11:00 - 11:15	Break
11:15 - 12:45	Data analysis for a CRD - case studies and exercises using R
12:45 - 13:45	Lunch break
13:45 - 15:15	Introduction to mixed effects models for different designs I, REML and ML estimation procedures, adjustment of the denominator degrees of freedom, and pseudo R^2 values
15:15 - 15:30	Break
15:30 - 17:00	Mixed effects models for different designs II

Registration is open until February 01st 2026. Registration and general queries: Prof. Bernard Ludwig, Kassel University, bludwig@uni-kassel.de

Please note that the intensive courses may be cancelled if not enough registrations have been received. In this case or in the event of cancellation due to illness of the lecturer or any other events beyond the control of the lecturer, there will be no claims possible, except for the reimbursement of participation costs.

Additional information on statistical training courses: see

https://www.uni-kassel.de/fb11agrar/en/sections-facilities/environmental-chemistry/statistics-courses