ES7028 Experimental Design & Analysis for Ecology (4AUs)

This course introduces you to the basic principles of experimental design and analysis of ecological experiments. It introduces you to methods and key concepts for designing and implementing experiments in both the field and laboratory. You will learn how to plan and execute an experiment, key concepts in designing experiments, and how to analyse and present your results. This course builds on the statistical and R skills you should have learned in in your undergraduate/masters courses, and you will learn how to apply these statistical methods to real-life ecological field and lab experiments. This course uses R and assumes some introductory knowledge of statistics and the R language.

Students from other schools are required to provide a transcript for the course instructor to review. This is to ensure the student has sufficient background to take the course.

1. Questions, hypotheses & predictions
   Understand how to formulate a question, hypotheses, and predictions. Understand the difference between observational and experimental studies and why they might differ in the way they are analysed.

2. Variation, randomisation, replication and sampling
   Understand the importance of spatial, temporal, and with-in subject variation, and how to design replicated experiments, and select appropriate sampling designs.

3. Blocking/Grouping variables, co-variates, and random effects
   Understand the concept of blocking/grouping variables, and the advantages and disadvantages. Understand interactions between covariates and factors. Understand random vs fixed effects and how specify these.

4. Selecting the correct design and statistical test
   Apply different experimental designs (single, factorial, split-plot). Understand how to account for interactions. Apply the correct statistical tests for count, proportional, and continuous data.

5. Model Selection
   Recognize the difference between observational and experimentally-designed studies and when to use the information theoretic approach and AICs versus the likelihood approach and P values

6. Multivariate analyses
   Understand how to analyse community datasets, and account for environmental covariates.

7. Effect sizes
   Understand the difference between inaccuracy vs imprecision. Explain the difference between statistical vs biological significance, and how to use and report P-values. Recognise the difference intervals that can be fitted and when to use them.

8. Presenting your results and evaluating published papers
   Understand how to graph data, interpret results, and write and present results. Critically evaluate published work. Identify questionable research practices and explain the importance of open science.