Course Guide 2022

Ecological methods II
(a.ka. Experimental Design for Ecology)

REG 32306

Wildlife Ecology and Conservation Group

WAGENINGEN
UNIVERSITY & RESEARCH

Course details

Components:	Lectures Intensive practical training Extensive practical training Field work Self-study
Period:	Period 6-1
Coordinator:	dr Patrick A. Jansen (WEC) ede.wec@wur.nl
Teachers:	dr Patrick A. Jansen (WEC) dr Frank J. Sterck (FEM) dr Henjo de Knegt (WEC) dr Fons van der Plas (PEN)
Assistants:	Laurens Dijkhuis MSc (REG) Janneke Troost MSc (WEC) Yorick Liefting MSc (WEC) Francisca Araújo Virtuoso MSc (FEM)
Examiner:	prof dr Frank van Langevelde (WEC)
Language:	English
Assumed knowledge:	Ecological Methods I (REG-31806)

Course profile

Students learn how to design, plan, carry out, analyse and present ecological field and lab research projects. The emphasis is on the formulation of a challenging hypothesis and testable predictions, the design of an effective correlative test and manipulative test, and an appropriate choice and application of statistical techniques for the analysis of ecological data.

Students carry out their own field research project in two ways – through an experimental study and through a correlative study – based on a research proposal written beforehand. These hypothesis-driven research projects serve as a good preparation for the MSc thesis projects.

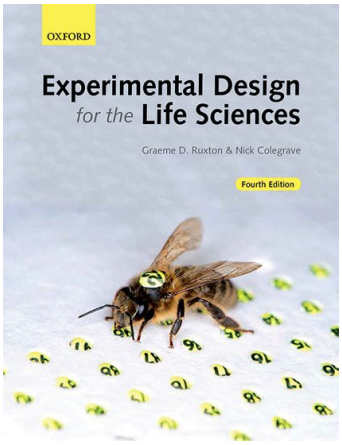
Participants are students from MFN (restricted optional) and various other programmes (e.g., MBI, MAS, MES, MIL).

Learning outcomes

After successful completion of this course, students should be able to:

- formulate ecological hypotheses.
- judge the variation, replication and sampling in experiments.
- design field and lab experiments for testing hypotheses.
- assess measurements required for testing hypotheses.
- create a research proposal.
- properly apply statistics to a given data set and hypothesis
- summarise the ecological consequences of experimental results

Learning materials and resources



- Ruxton & Colegrave (2016). Experimental Design for the Life Sciences. Oxford University Press (available for purchase at the WUR store)
- websites on power analysis.
- Recordings of lectures (Brightspace)
- Additional materials (Brightspace)

Educational activities

The course includes the following activities

- Self-study of the Ruxton & Colegrave (2016) book.
- Lectures introducing the design of ecological research.
- A digital test on experimental design for ecology.
- Writing of a research proposal by groups of ca. 5 students, in close consultation with the lecturers. The proposal includes a (1) clear problem definition and research question, (2) hypothesis and testable predictions, (3) justified methods and sampling techniques for both an experimental study and an observational study, (4) proposed statistical data analyses and visualizations, and (5) a time schedule. The supervisors will provide detailed feedback.
- Conducting the proposed research by the same groups, to gain experience with research methods, logistical organisation, solving problems in the field, and data collection. Supervisors will advise and monitor progress.
- Analysis and interpretation of the data, using appropriate statistical methods and software (SPSS, R, Canoco), by the same groups.
- Oral presentation of the findings by each group in a plenary session, with an emphasis on the choice and application of the experimental design, the field methods, and the statistical techniques for hypothesis testing.

Examination

Students will be evaluated in three ways:

- Knowledge of experimental design and methodological issues – acquired by studying the book and the lectures – will be tested in an individual digital exam with multiple choice questions. The test will be taken in ANS in the second week, before the start of the research project. The score is 25% of the final mark. Re-exams consist of open questions.
- The research proposal will be evaluated by the supervisors , who will rate the quality by the following aspects:
  - Scientific content
  - Justification and formulation hypothesis
  - Theoretical backup with existing literature
  - Overall clarity
  - Appropriateness of the methods, including choice of sample size
  - Choice of statistical analyses

  This score is 30% of the final mark.
- The research projects will be evaluated by at least two supervisors, who will rate the quality of the following aspects:
  - Fieldwork input
  - Scientific content
  - Justification and formulation of the hypothesis
  - Quality of the statistical analysis
  - Ecological interpretation
  - Quality of the presentation

  This score is 45% of the final mark.

The final marks for the research project may change via peer review, in which students assess the relative contribution of the participants in their group. This ensures that all group members participate in the group work.

Lecture themes

The following themes will be dealt with during the lectures, and serve as the backbone for the planning and execution of the fieldwork, and the data analysis:

- From observations to hypothesis and predictions.
  Causal relationships, correlation and reverse causation.
- Experimental design: advantages and disadvantages of correlative and manipulative studies, blocking, split-plot, and randomized block design, how to deal with covariates?
- Sampling: sample size, replicates, power analysis, controls, pseudoreplication and pooling, sampling schemes
- Noise and bias reduction: repeatability, confounding variables, random factors

Continuation courses

Courses that build on Ecological Methods II include:

- Animal Ecology (REG-30306)
- MSc thesis (FEM, PEN, REG/WEC)

Assessment strategy

Learning outcomes\where assessed	Exam (test)	Research proposal	Final presentation
	Anderson scores		
To formulate ecological hypotheses	3	6	6
To judge the variation, replication and sampling in experiments	3	6	6
To design field and lab experiments for testing hypotheses	3	6	6
To asses the measurements that best test the hypotheses	2	6	6
To create a research proposal		6	
To apply statistics properly for a given hypothesis and data set	1	3	5
To summarise the ecological consequences of experimental results	2	4	5
Contribution to final mark (%)	25	30	45
Type of questions/examination			
Multiple choice	x		
Other criteria (explained during lecture)		x	x
Assessed by:			
Patrick Jansen	x	x	x
Henjo de Knegt		x	x
Fons van der Plas		x	x
Frank Sterck		x	x
Time Schedule, week nr	2	3	5
A self-study test is available to test the knowledge that is required at the exam			
The marks of the individual parts will remain valid for 3 academic years			
Minimum mark of all components: ≥ 5.5			

Planning

The course takes 4 full weeks live in Wageningen.
A detailed course planning can be found on Brightspace

Legend
Theory
Study design
Research

Mon	Tue	Wed	Thu	Fri
9	10	11	12	13
Theory: Lectures				
Theory: Self study		Group work: proposal writing		Self study

Mon	Tue	Wed	Thu	Fri
16	17	18	19	20
Self study	Lecture	Group work: proposal writing + pilot	Group work: Research	
Exam				

Mon	Tue	Wed		Fri
23	24	25		27
Group work: Research				Research

Mon	Tue	Wed	Th	Fri
30	31	1	2	3
Group work: Analysis and synthesis				Presentations