Universitat Autònoma de Barcelona

2023/2024

Statistics and Environmental Modelling

Code: 42923
ECTS Credits: 12

Degree	Type	Year	Semester
4313774 Terrestrial Ecology and Biodiversity Management	OB	0	A

Contact

Name: Miquel Riba Rovira

Email: miquel.riba@uab.cat

Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Teachers

Josep Piñol Pascual

Javier Retana Alumbreros

Miquel Riba Rovira

Prerequisites

None

Objectives and Contextualisation

The main objective is to provide methodological advanced skills to perform quantitative analyses that can be applied in studies associated with the areas of ecology, biodiversity and environmental management.An important part of the module is focused on the development of advanced numerical and computer programming skills that are nowadays essential and very useful in ecology as well as many other technical and professional jobs.

The structure of the module is therefore is made of two complementary parts, the first dealing with advanced statistical methods and the second one with producing numerical models that can be applied n ecology and environmental management.

Competences

- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Use advanced modelling and statistical tools in the field of terrestrial ecology and conservation of biodiversity.

Learning Outcomes

1. Design a quantitative model and apply it to solve a particular problem in environmental biology.
2. Design a statistical sampling plan.
3. Interpret and integrate statistical evidence in the evaluation of environmental problems.
4. Know and correctly apply the main statistical techniques used in environmental biology.
5. Know the fundamentals of programming and its potential for solving problems in the field of environmental biology, both basic and applied.
6. Present and defend the results of an original study before an expert audience.

Content

Statistical methods. The most important estatistical methods used in environmental biology are introduced and discussed, from basic statistics to more elaborate experimental and mutivariate approaches. The mein objective is to provide students with a general understanding and a wide view of complementary tools that allow them to understand their own problems and databases using statistical analyses. Among others, the statistical methods covered are:

1. Experimental design

2. Basic statistics (Student's t test, ANOVA, simple regression, Chi-aquared test)

3. Log-linear models

4. Multiple regression analyses

5. Path analysis and SEM

6. General and generalized linear models

7. Ordination methods (multivariate analysis)

8. Classification methods (multivariate analysis)

Modelling *. This part introduces students into the basic conceptual modelling approaches in general, but with strong emphasis in the area of environmental biology. The aim is to provide students with the basic methods to develop independent and autonomous skills towards problem solving. In-class lectures will provide examples of the most common modelling methods. Later on, through personal tutorized work, students are asked to apply one of these methods to a particular situation or problem of their own choice. The contents include:

1. Introduction to modelling in ecology and environmental sciences.

2. Introduction to programming in R language. Variables. Conditional statements. Loops. Functions.

3. Models based on differential equations. Population exponential and logistic growth. Competition and predation models.Modelos de competencia y de depredación. Flow and compartment models.

4. Matrix models. Structured matrix population models. Community succession models.

5. Cellular automata models. The game of life. Epidemiological models: SI and SIR.

6. Calibration and validation of quatitative models. Model efficiency. Methods.

Methodology

Lectures, seminars, computer lab, deeolpment of a simulation model, personal study and assignments.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
In-Class Theoretical Lectures	20	0.8	4, 2, 3
Seminars	48	1.92	6, 1
Type: Autonomous			
Deelopment of a simulation model	80	3.2	5, 1
Study and assignments	143	5.72	4, 5, 6, 1, 2, 3

Assessment

- The final mark of the module (F) will be the weighted average of the four evaluation activities according to the weights given in the previous table.

- To pass the module will require both F being iqual or greater than 5 and the mark on the two parts of the module (Statistics and Modelling) greater than 4.

- Only A3 and A4 evaluation activities can be reassessed at the end of the module.

- The schedule of the evaluation tasks and the reassessment exams will be given in the programming schedule provided by the coordination of the Master or otherwise established by the teacher in charge.

- Students will be graded as "Not Assessable" when the number of evaluation activities fulfilled is less than 50% of all the total programmed activities.

- Students also have the possibility to be graded with a single assessment.

- Students taking the single assessment option must notify the subject coordinator before taking the first continuous assessment test. Students taking any of the continuous assessment tests will be excluded from the right to a single assessment.

- The single assessment option will include all the types of individual assessment activities performed for in the continuous assessment.

- The single assessment tests will take place on the same day as the last continuous assessment test of the subject.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
A1. Exam on computer programming	17%	1	0.04	5
A2. Personal work and public defense of a simulation model.	25%	4	0.16	5, 6, 1
A3. Exam on multiariate statistics	29%	2	0.08	4, 6, 2, 3
A4. Exam on linear models and experimental design.	29%	2	0.08	4, 6, 2, 3

Bibliography

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Harte J. (1985.) *Consider a spherical cow. A course in environmental problem solving.* William Kaufmann, Los Altos, CA (USA).

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Piñol J & Martínez-Vilalta J (2006) *Ecología con números. Problemas y ejercicios de simulación*. Lynx, Bellaterra (Barcelona).

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Software

The R Project for Statistical Computing / RStudio