



Sveriges lantbruksuniversitet  
Swedish University of Agricultural Sciences

# SLUkurs

## Syllabus

**PFS0104 Spatial statistics for Ecologists, 7.5 credits**

## Syllabus approved

2013-09-18

## Subjects

Biology/Mathematic Statistics

## Education cycle

Third cycle

## Grading scale

Pass / Failed

The requirements for attaining different grades are described in the course assessment criteria which are contained in a supplement to the course syllabus. Current information on assessment criteria shall be made available at the start of the course.

## Language

English

## Prior knowledge

The equivalent of: 7 Swedish Higher Education Credits (HEC) of basic courses in Mathematical Statistics and 7.5 HEC of basic courses in Regression Analysis.

## Objective, including learning outcomes

This course will introduce the methods of spatial statistics so that the students can apply it to test ecological questions on spatial data. The course is divided in

two parts of 4.5 and 3 credits each. On completion of the course the students shall be able to:

Part 1 (4.5 credits)

- discuss different types of spatial data including point patterns, geostatistical data, areal data, and spatial interaction data,
- recognize some common methods to visualize, explore and model spatial data,
- select model and method, and to carry out and interpret analyses by means of computer software.
- Take spatial dimensions into consideration during sampling and design of experiments

Part 2 (3 credits):

- select, apply and interpret appropriate spatial methods to test ecological hypotheses from their own research project.

## Content

The course is divided in two parts:

### Part 1

The first part consists of a combination of lectures and computer lab sessions. The lectures introduce the students to concepts and methods of spatial data analysis, and contain several worked examples to illustrate the concepts and methods. Lectures will cover descriptive spatial statistics, geostatistics including the spatial interpolation methods kriging and inverse distance weighted method, spatial sampling and design of experiments, methods to analyse point patterns, discrete and hierarchical models including spatial regression, areal data, estimation and validation of models. Computer lab sessions are held during which students work on specified assignments with the lecturer(s) and other staff on hand to help. This provides each student with one-to-one help when needed. The assignments aim to reinforce the lecture material, in addition to giving students practice of spatial data analysis. Written reports of the assignments provide the basis for examination of the first part of the course. The statistical software package R will be used in computer labs and exercises.

### Part 2

In the second part of the course the students apply the knowledge gained during the course for analyzing a specific spatial data set of their own. The students should then continue working individually from home with the project during two weeks. Some supervision via e-mail is possible. In the end of the course the students will

present and discuss their project. A written report as well as an oral presentation provide the basis for the examination of the second part of the course.

### **Requirements for examination**

Written assignment reports (part 1) and written project report and oral presentation (part 2).

### **Additional information**

The course is given in two parts of 4.5hp and 3hp each. It is possible to take only part 1.

Part 1 (4.5hp) consists of three weeks work. In the first and third weeks there are four days with lectures and computer labs, respectively. Between the two sets of lectures the students work from home. Every student should, before the course starts, have chosen a spatial data set of their own that they would like to analyse. At the end of part 1 each student will give a presentation discussing how and with which spatial methods their spatial data set is to be analysed. It is preferred that students use their own data set but for students without own spatial data there will be example data available, or they may work in pairs with data from one student. In Part 2 (3hp) students work on their own data, analysing them using spatial statistical methods. Students can, if they want, work in pairs on the same data set. Five hours of supervision per student is available by the teachers of the course. The students prepare a written report on their analyses including discussion and conclusions. The students also prepare and give an oral presentation of their data and their analyses. One day is scheduled for the students to present their own work and listen to the others work as well. Approximately 30-45 min is scheduled for each presentation including discussion. People not living in Umeå can participate and have supervision via Skype/Video connection.

### **Responsible department**

Department of Forest Ecology and Management