Sampling the environment: design and analysis for efficient and robust collection of data.


Registration

NERC funding covers travel, accommodation and subsistence costs for approved attendees. UK-based PhD students in environmental science and early-career researchers are eligible to attend.

Enquiries to mlark@bgs.ac.uk  To register contact Theresa Mankelow tkbl@bgs.ac.uk

Please bear in mind that there is considerable demand for places on this course. If you are offered a place you are expected to attend and NERC requires information on attendance. Please indicate in your email your status (PhD student or early-career researcher), and please CC your supervisor or line-manager. Please also tell us who funds your PhD/research project and the institution in which you work. Please write two or three sentences to indicate the sampling questions that emerge in your area of work.

Background

The purpose of this course is to train emerging environmental scientists in the principles and practice of environmental sampling design so that they know how to plan efficient and robust sampling, and know how to avoid poor sampling practices which may be wasteful of resources or produce unreliable information. Through collaboration with the Environment Agency (EA) we shall ensure that the course addresses real-world problems and that participants emerge with an understanding of the regulator's and policy maker's perspective on the collection and analysis of environmental information.

Course description

The course will build on the introductory statistical content of most BSc and MSc courses in environmental science, recognizing that this knowledge may be rusty. It will start with so-called design-based statistical methods (based on some sort of independently randomized sampling scheme), explaining their principles and showing how sound design can be made statistically efficient and logistically feasible. The concept of model-based statistical methods will then be introduced, in which independence is not assumed but statistical dependence (spatial and/or temporal) is described by an appropriate model. Model based analysis will be explained and exemplified, and the optimization of model-based sampling designs will be demonstrated. The particular problems of sampling processes in time and space will then be addressed. Throughout the course "lecture" style content is combined with practical exercises with real data on the computer and focussed questions for group discussion. The principles learned in the course will be
reinforced by a final set of exercises in which participants, in small groups, will design sampling schemes to address a number of contrasting problems using exploratory data sets and mock specifications (of varying quality) as produced by BGS in collaboration with the Environment Agency.

Course structure

Day 1 Introduction to the scope of sampling, how to use the R platform, revision of statistical concepts, basic ideas of design-based sampling.

Day 2. Design-based sampling: stratification, use of covariates and expert knowledge, spatially balanced sampling, multistage and nested sampling, sample size and optimization.


Day 4 Sampling in time and space by model and design-based methods for monitoring problems

Day 5 Exercises in sample planning based on EA problems. Presentations from Stuart Homan, EA.

Training outcomes

The participant will understand the principles of statistical sampling design, the questions that should be addressed when planning sample collection from scratch, the sampling methods that exist to address a variety of questions and the methods of data analysis that are appropriate. They will also be aware of the issues that may be presented by legacy data sets, collected in different ways, and be aware of methods which can be used for their analysis where the assumptions of standard methods are not supported. The trained environmental scientist does not become a statistician but (i) will know how to analyse data sets from simple design and model-based samples in the widely-used R platform and (ii) will have an informed understanding of the key issues, and so will be better-able to collaborate effectively with statistical colleagues and consultants.

Course leader

Dr Murray Lark is environmental statistician at BGS. He has made original contributions in relevant areas including the optimization of spatial sampling designs, model-based analysis of complex spatial data and methods for robust inference from messy data sets. He has undertaken research on sampling procedures for BBSRC, NERC, Defra, the Environment Agency and the Home-Grown Cereals Authority. He was joint-author of a recent textbook on environmental sampling (Webster and Lark, 2013) which covers much of the scope of the proposed course.

Webster, R. Lark, R.M. 2013. Field Sampling for Environmental Science and Management. Routledge