UNIVERSITY OF SYDNEY

SCHOOL OF MATHEMATICS AND STATISTICS

Statistics Seminar

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# How can we perform experiments in real landscapes?

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**Abstract**

Environmental variability is a major problem for the design and the analysis of experiments performed in the field. In agronomic experiments, where design-based statistics are used, the traditional approach is to use blocking and randomization. Part of the variation due to the environment is attributed to variation between blocks, which reduces the residual variance and improves the sensitivity with which we can detect treatment contrasts. A major assumption of this approach is that block effect, treatment effect and residual variation are all additive effects. In other words the treatment effect is uniform across the study area. In a heterogeneous landscape this is less plausible. In the past agronomic experiments have been performed in carefully chosen fields where the environmental, i.e. soil variation, is relatively homogenous.

Increasingly, as agronomy moves beyond fertilizer trials, we are interested in other types of experiments which must be located in heterogeneous landscapes if they are to address real problems, e.g. the effect of different land uses on carbon sequestration rates, possibly across multiple fields or catchments. As we increase our spatial extent it is likely that more heterogeneity will be encountered, and the assumption of additivity will be less plausible. In addition, traditional approaches only inform us whether a particular contrast is significant on average over the experimental area. Increasingly we would like to manage at fine spatial resolutions, responding to environmental variability, rather than based on averages across areas. An example of this is the increasing interest in site-specific crop management. Clearly there is a need for new approaches for the design and analysis of experiments.

In this talk I will present a geostatistical approach for analysing experiments which enables the prediction of treatment responses or contrasts at points or regular blocks across an experiment, or averages over the whole experiment. The methodology will be illustrated by 2 case studies.

Enquiries about the Statistics Seminar should be directed to
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