CONSIDERATIONS FOR DESIGN AND STATISTICAL INTERPRETATION OF ECOTOXICOLOGICAL COMMUNITY STUDIES

ALAN LAWRENCE[1], KEVIN BROWN[2], GEOFF FRAMPTON[3], PAUL VAN DEN BRINK[4]

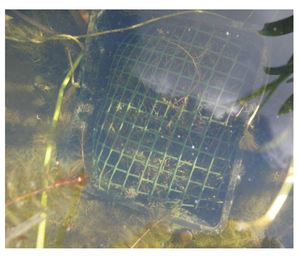
[1]CAMBRIDGE ENVIRONMENTAL ASSESSMENTS, UK alan.lawrence@cea-res.co.uk; [2]INDEPENDENT CONSULTANT, UK; [3]UNIVERSITY OF SOUTHAMPTON, UK; [4]ALTERRA & WAGENINGEN UNIVERSITY, NL

Abstract

Regulatory ecotoxicological community effect studies may be conducted as part of a programme of tiered testing. Studies may be conducted in discrete experimental units (e.g. outdoor aquatic microcosms) or in more open test systems (e.g. terrestrial field plots). The experimental design, in terms of blocking, randomisation, replication and connectivity can have important implications for study outcome. The data generated may be complex and represent a large number of taxa with varying abundance and responses. During interpretation, considerations such as relevance of the taxa present to the test system, relative abundance and responses should be considered. Univariate and multivariate methods are available for statistical analysis, but these should be applied carefully. This project aims to summarise existing information and provide guidance on the design and statistical interpretation of regulatory ecotoxicology community effect studies. This ongoing work is kindly funded by the UK Chemicals Regulation Directorate (CRD) project PS2363.

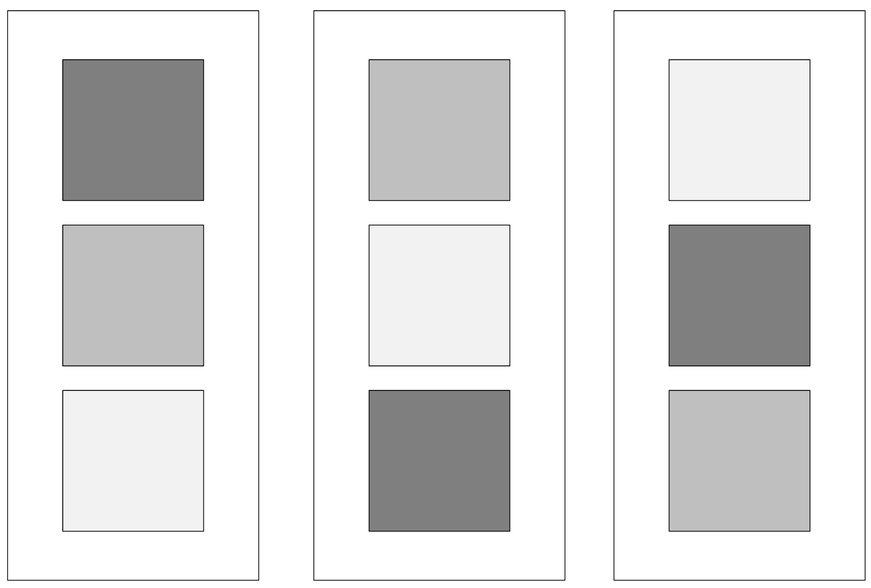
Scope

The project aims to assimilate existing information and provide guidance on the design and statistical interpretation of regulatory ecotoxicology community effect studies, including aquatic mesocosm/microcosm designs, terrestrial non-target arthropod studies and soil mesofauna studies.



Experimental design

While laboratory test methods are largely standardised (e.g. OECD guidance), the experimental layout of field community studies may vary between test facility (e.g. aquatic mesocosms) or due to availability of appropriate test sites (e.g. terrestrial studies). Field studies must be designed to avoid bias.



Randomised complete blocks controls for environmental heterogeneity.
Plots are randomised within blocks

Environmental gradients (other than treatment regimes) may be present in a test system, and controlled by appropriate blocking.

Approaches include randomised complete plots or split plot designs. Latin squares may be used, esp. in terrestrial systems.

Gradients may be caused by proximity to sources of recolonisation, for example, or abiotic factors such as soil moisture.

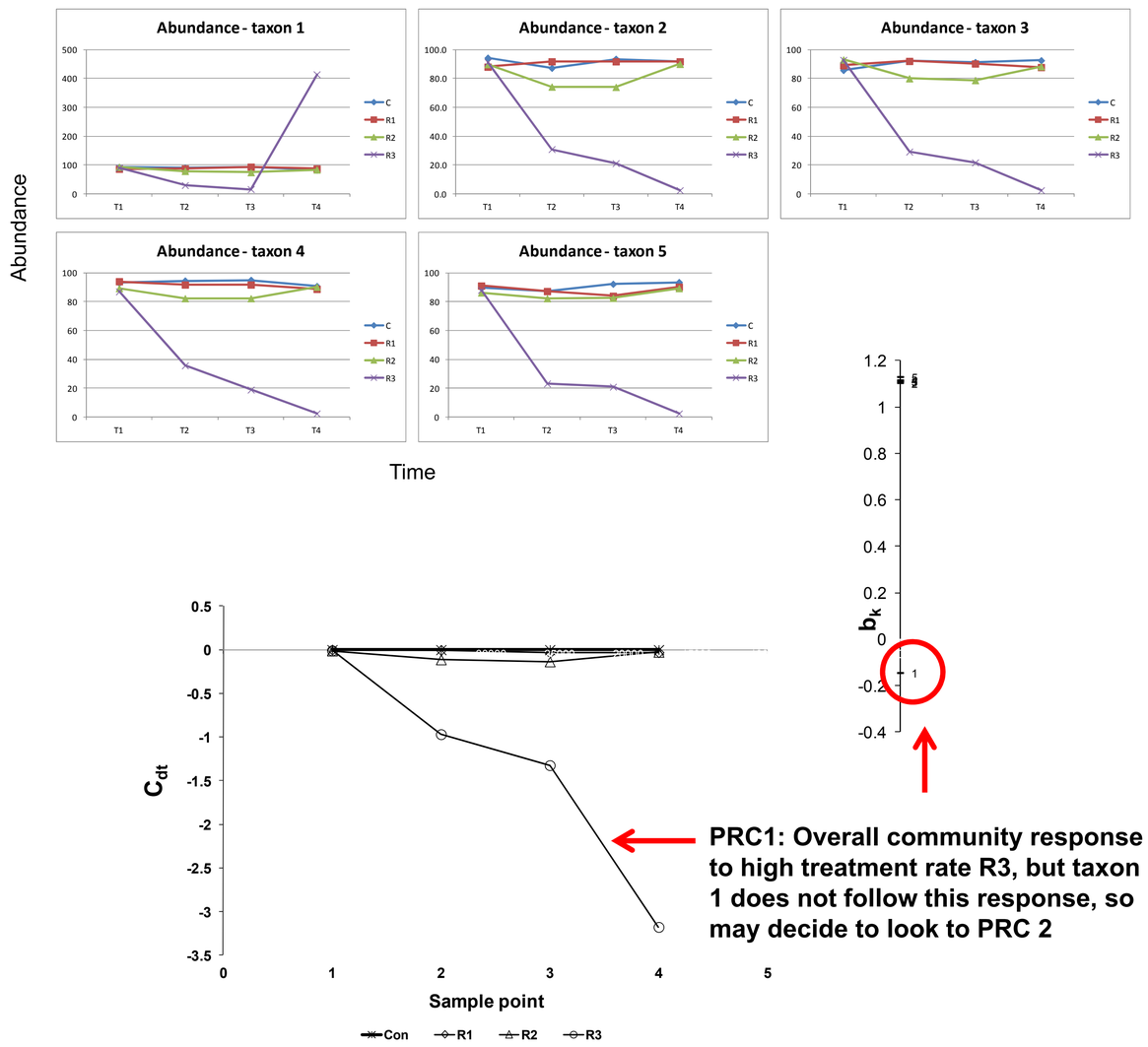
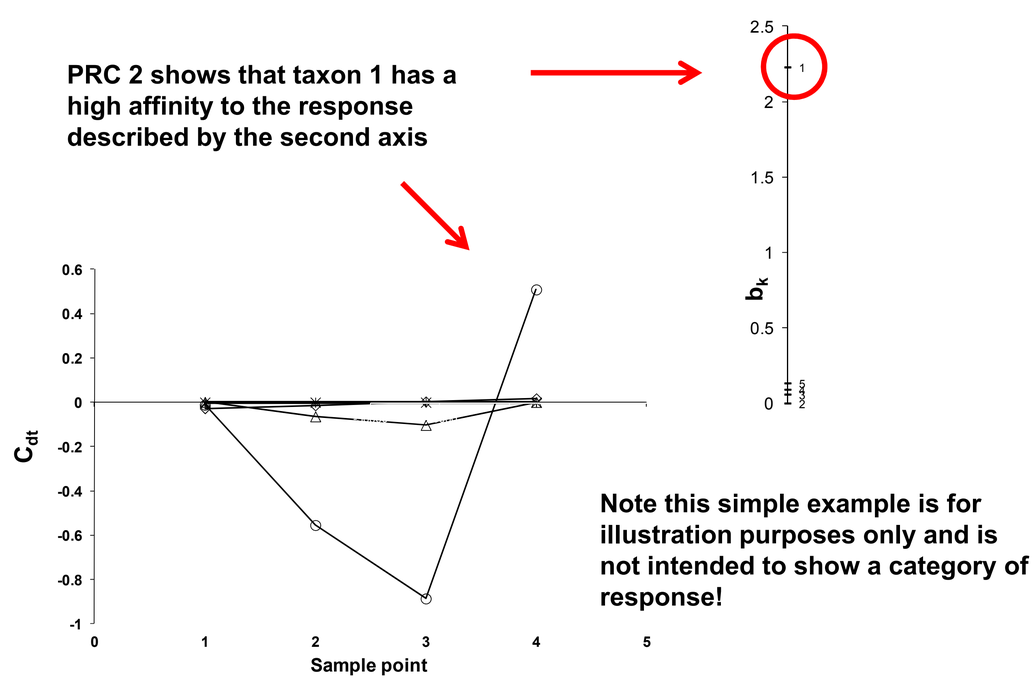
Summary

This project will assimilate existing information and provide guidance on the design and interpretation of complex ecotoxicological community effect studies

Community responses

Community responses are typically complex. The project will seek to provide guidance on the statistical interpretation of such data.

Univariate and multivariate methods may be used. It is recommended that both approaches are considered.

The project will refer to published examples of field studies and artificial examples for illustration purposes where necessary.

The example below shows artificial abundance data for 5 taxa, where one taxon responds differently to the others. Taxa 2-5 are affected by treatment rate 3 (R3) and do not recover; taxon 1 resurges late in the study. Principal Response Curves 1 and 2 are shown for this artificial data. Various other responses will be explored in the project.