NATIONAL PROGRAM FOR Sustainable Irrigation

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factsheet

IRRIGATION ECOLOGICAL RISK ASSESSMENT PROJECT

Investigations for Risk Assessments

BACKGROUND

The sustainability of Australia's irrigation industry is currently under serious challenge. Irrigation uses ca. 75% of the water extracted from Australia's rivers and groundwater systems, contributes to the pollution load in these rivers, and often leads to degradation of the irrigated land.

In response to these challenges, the National Program for Sustainable irrigation (NPSI) has established an *Ecological Risk Assessment Project*, the overall objective of which is to develop a generic framework for assessing the ecological risks associated with Australian irrigation systems. This new decision support tool should assist the Australian irrigation industry in quantifying and prioritising the ecological risks from their activities, and also to better focus research efforts and management actions to minimise these risks. Additionally, this information should also provide an opportunity for regulatory authorities (such as EPA's) to better determine what needs protection and to use this as the basis for licensing and monitoring requirements.

This tool will contribute to the Australian irrigation industry's thrust towards more knowledge-based management.

THE PROJECT

The Project has four components - a coordinating linkage project being run by the Water Studies Centre (WSC) and CRC for Freshwater Ecology at Monash University, and three case studies located in irrigation regions on the Goulburn-Broken, Ord and Fitzroy rivers. The central organisations involved in the case studies are:

- Goulburn-Broken – Monash University, CRC for Freshwater Ecology & Goulburn Murray Water,
- Ord – Edith Cowan University and Water & Rivers Commission (Department of the Environment),
- Fitzroy – Central Queensland University & Department of Natural Resources & Mines.

The Project is being undertaken in three phases. The first phase – problem formulation - was completed in mid 2001. The second phase, to undertake further detailed investigations designed to provide specific information on key issues identified in Phase 1 is currently underway. A brief progress report on these activities is given below. The final phase of developing the ERA protocol will be completed in 2004.

RISK INVESTIGATIONS

What we are doing

The Phase 1 studies identified a small number of priority ecological issues associated with irrigation in each of the three regions. In Phase 2, each of the Case Study Teams is undertaking a

detailed ecological risk assessment (including additional work where this is necessary) of the priority issues.

The *Goulburn Broken* team identified two ecological issues chosen for detailed risk assessment:

- the influence of irrigation on the abundance and diversity of native fish in the Goulburn and Broken catchments,
- the influence of irrigation on the occurrence of blue-green algal blooms in the Goulburn River.

The *Ord* team also identified two ecological issues for detailed risk assessment:

- influence of irrigation (and associated eutrophication) on biological diversity in the Ord river (to be determined by measuring changes in the macroinvertebrate populations),
- influence of irrigation on the occurrence of blue-green algal blooms in the lower Ord river and further downstream in the Ord estuary (this being undertaken in collaboration with CSIRO Land & Water).

The major ecological issue identified by the *Fitzroy* team for detailed risk assessment was the influence of irrigation runoff on biological diversity in the Dawson River. This is being determined by measuring changes in the macroinvertebrate populations.

A summary of what is being done in each of the projects is available from the WSC web site (www.wsc.monash.edu.au/sresearch.htm).

The issue

In developing the research programs to provide the additional information needed to complete the first detailed ecological risk assessment in the three Case Study catchments, it became clear that there are a number of important differences between 'normal' (null-hypothesis testing) scientific investigations and those required for risk assessments.

Risk investigations are focused on quantifying the relationships between cause and effect – or more often between indicators of cause and effect - so that predictive models of the system can be created. In contrast, null-hypothesis test-based investigations determine whether statistically significant effects have occurred due to the imposition of a stressor on the ecosystem.

Given the complexity and variability of most natural systems and the inherent considerable level of uncertainty, a statistically significant finding often requires that many samples are collected over a long period of time. This often results in prohibitively expensive investigations that are either done poorly or not at all. Studies based on hypothesis testing also rarely concentrate on quantifying a biologically meaningful effect size of a certain level of stressor. This information is a central part of models of cause-effect relationships

Possible solutions

For these reasons, Bayesian methods are gaining increased favour for risk investigations. Bayesian methods have a number of advantages, the most important being that probabilistic predictions can be obtained, and that existing information and knowledge (including expert opinion) can be used to supplement poor-quality data sets, and thereby generate more precise estimates than is possible using 'standard' statistical techniques. The majority of ecosystems that we are required to manage suffer from such a lack of information. A Bayesian Network is being developed as part of the Goulburn-Broken case study to assess the influence of irrigation on the abundance and diversity of native fish in the Goulburn and Broken catchments.

How will this project assist?

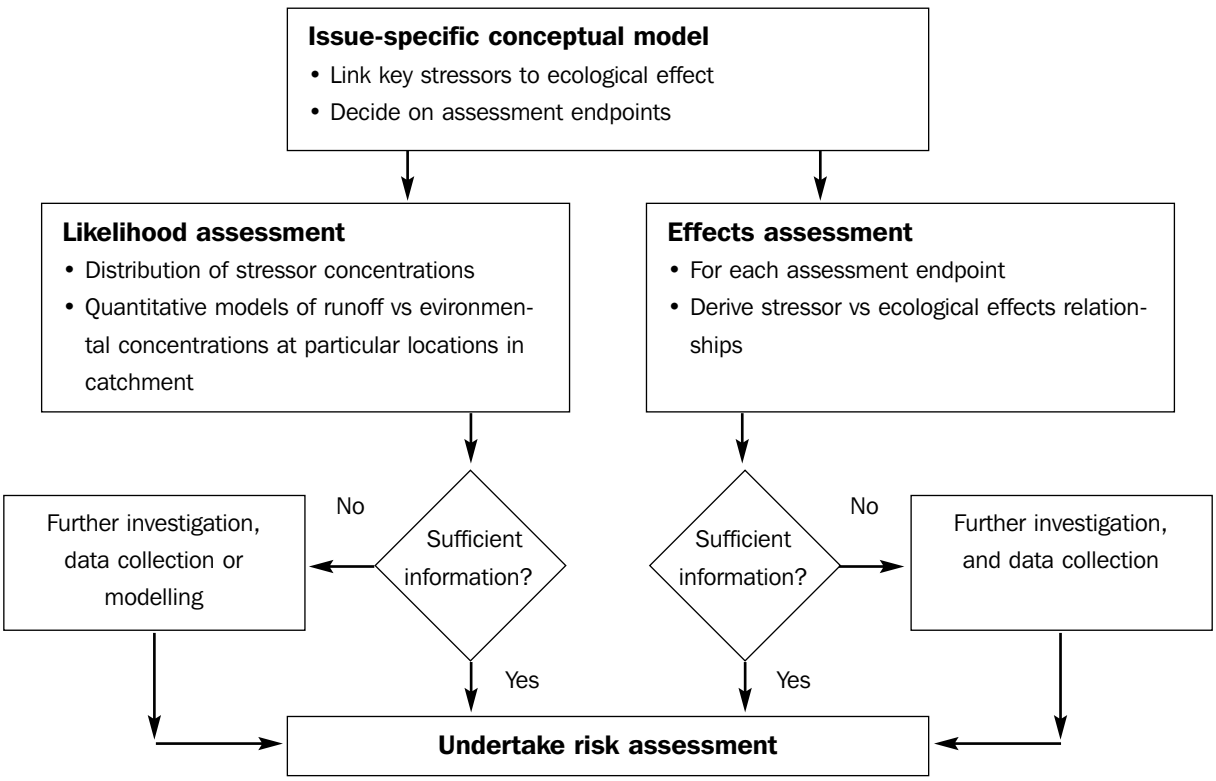
Recently, the project team reviewed the process we used in Phase 1 of this project to identify the important knowledge gaps and the further investigation(s) needed to address these gaps. We identified a number of important lessons, the most important being:

- It is desirable to separate the two processes of identifying the ecological issue and of identifying knowledge gaps (we will show in Fact Sheet No 3 how the development of conceptual models can be used to help identify knowledge gaps),
- The best outcomes will result if the technical/scientific team is multidisciplinary and able to adequately assess all aspects of the system under investigation (this minimises the potential for the scientific team to 'bias' the knowledge needs to their particular interests),
- The process needs to be transparent with all data and information relevant to each issue clearly identified, collated and analysed, and this information base documented.

It is desirable that the final conclusions on the main information needs be peer reviewed. In many cases, there is enough information already available to undertake a risk assessment, perhaps with some additional site-specific information.

The figure below shows the steps involved in deciding whether further investigations are needed.

Fig. 3: For each key issue



FURTHER DETAILS

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