



knowledge for managing Australian landscapes

Spatio-temporal effectiveness of natural resource and rural adjustment policies

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Background

Regional or catchment scale management is important in addressing the multitude of natural resource problems within the Murray Darling Basin for several reasons:

- the range of single natural resource issues and farm policies needs to be coordinated to account for a potential interaction at the paddock, farm, subcatchment or regional level;
- several issues, such as biodiversity, river flows and water quality, require regional level management;
- a range of stakeholders from across a region need to be involved in identifying priority issues, areas and actions; and
- the employment, population, and economic impacts of agricultural trends and policies and natural resource policies can best be analysed and managed at a regional level.

To support catchment scale decision making we need to learn about individual issues and how the catchment behaves as a whole. This requires viewing the catchment as a system composed of environmental, economic and social issues, processes, and drivers, and examining how the links between these components affect the overall system behaviour.

Learning about these system-level effects requires methods that can take account of the large uncertainties in the system, the diverse priorities and viewpoints of stakeholders, and the wide-ranging informational demands of the policy process.



Objectives

The INSIGHT project aims to support a balanced approach to policy development by helping resource managers consider the full range of social, economic and environmental assets valued by the community, and learn how these might change over time in response to external pressures and different policy options.

The project trialed a systems approach involving the development of a simulation model of natural resource use in the Lachlan catchment in central New South Wales. The model provided a framework for systematically exploring what the important policy, behavioural and biophysical drivers of changes might be, and the key uncertainties in determining a particular outcome.

The model was designed to be embedded in a social process, firstly to determine the issues that should be modelled, and secondly to enhance peoples' understanding of it. A second objective of the project was to trial new ways for conducting the model end-user interface.

Approach to the Project

The model, as shown in Figure 1 on the following page, is developed to proof of concept stage. It links the social, economic and environmental aspects of the catchment for a limited number of issues and policy options. These issues include: native vegetation degradation, biodiversity decline, soil acidification, the water balance of the catchment, salinisation of the Lachlan River, farm profitability and rural population adjustment.

Each process, or issue, was built as a specific module. This allows issues to be added to, or removed from, the basic framework, so the model can be adapted to specific interests and locations.

The model is written in the Vensim simulation software package, (Ventana Systems Inc.; <<http://www.vensim.com>>), which provides a user-friendly interface for examining the model structure, assumptions, results and behaviour. Data is stored

in an Excel workbook for accessibility. Data includes land areas, soil properties, climate, farm numbers, farm characteristics, rural populations, and farm input and production statistics.

The model has been developed for the Lachlan catchment, an area of approximately 84,700 square km. The model is run for 100 land units that can be aggregated into the 14 Lachlan Local Government regions or 12 subcatchments that cover the catchment for reporting purposes. Model output is presented as a series of graphs reporting catchment-wide trends over 20 years in the key output variables. Several runs can be compared to explore the impact of different policies or parameter assumptions.

Central to the model is a decision module that explores how dryland farming decisions respond to price changes, new technologies, resource degradation and natural resource policies. The farm decision module describes allocation of investment funds and non-irrigated land among crop options, grazing options and native vegetation.

The farmer's response depends on farmer objectives and constraints. Farm constraints vary by farm type and include management ability, financing and on-farm-labour. Farmer objectives are defined as a weighted mixture of maximising the net present value of production, maintaining the productive capability of the natural resource base (sustainability) and biodiversity conservation. The various biophysical, social and economic modules calculate how the dryland farming options affect the rest of the system and how the different parameters of the system evolve over time.

The investigator ran an initial workshop to help define the model subject matter, encourage stakeholders to view the catchment as a system by diagramming the range of issues and the links among them, and start to develop a shared language and understanding among stakeholders and modellers. A final workshop was conducted to assess the usefulness of the model in addressing current natural resource policy proposals in the Lachlan.

Key Findings

The purpose of the modelling was not to provide predictions about the state of the system in the future, nor was it to provide accurate quantification of the impacts of different policy options. Rather, the aim is to provide a modelling tool that facilitates joint learning by policy makers, stakeholders and modellers about the system.

Three different policy areas have been explored with the model to illustrate this capability to examine system-wide impacts:

- the impact of incentive payments for native revegetation protection and rehabilitation;
- the impact of the development of new non-leaking cropping and grazing systems; and
- the potential for rural adjustment and rural adjustment schemes to influence natural resource policy outcomes.

In each instance the focus is not on analysis of the immediate and intended impacts, but on identifying the flow-on, long term and spatial implications.

Key model features include:

- the presentation of a balanced overview of the catchment by modelling potential trends in key variables over a 20+ year time frame in order to provide an overview of where the system is heading and why;
- the ability to place potential magnitude of policy impacts in the context of underlying trends and variability due to climatic shocks;
- modelling the chain of causation from policy lever to farm level behavioural response to farm level biophysical impact to aggregate regional level biophysical impact, and identify critical links and uncertainties in this chain;
- the ability to identify the factors that may determine the spatial impact of a policy; and
- the ability to calculate the approximate cost and benefit of policies to government and landholders.

The model is designed for facilitated interactive use, where a model developer runs scenarios specified by the policy makers and stakeholders and explores and explains the results of the scenario that are of interest.

Implications for policy makers, advisory & community groups

The INSIGHT model is designed to be portable to other issues and regions. However, use of the model should be seen as part of a group learning process. The process requires the scoping of issues, key indicators, system behaviour and options. The involvement of other groups will familiarise potential users with the modelling approach, help in the identification of new applications and speed up model development time.

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