Public and private benefits of land use change in New South Wales and the policy implications for salinity management

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Introduction

Changing land use to achieve improved natural resource outcomes (including salinity) for catchments in NSW potentially involves benefits and costs of a public and private nature. How large are these benefits and costs, and how do they affect salinity policy development? A substantial amount of bio-economic analysis has been conducted by the NSW Department of Primary Industries (and other bodies) to answer these questions and here we summarise and interpret the results of these analyses in the context of the institutional policy framework for NSW.

Institutional settings

At the Australian Government level the priority and funding vehicles for natural resource management have been the National Heritage Trust (NHT) (see http://www.nht.gov.au/about-nht.html) and the National Action Plan for Salinity and Water Quality (NAP) (see http://www.napswq.gov.au/). At the NSW Government level the Natural Resources Commission (NRC) (see http://www.nrc.nsw.gov.au/) has developed a set of standards and targets for natural resource management within the State. Operationally, the CMAs have been set up to invest funds from the NAP, NHT and other sources into activities aimed at achieving catchment-wide natural resource and environmental improvements. The current phase of this activity is one of cooperation between government agencies and landholders with a directed focus on the investment of public funds as an incentive for change by landholders, based on appropriate public policy. Most of the land area in NSW is managed by private landholders.

Policy questions

Dryland salinity results from a set of processes initiated by human-induced change in vegetation management, leading to changed water flows in the landscape and salt mobilisation in soils and streams. This causes damage to agricultural activities, towns and other infrastructure. Dryland salinity has spatial and temporal dimensions, it varies with climatic patterns, it interacts with other natural resource issues (eg biodiversity, riverine systems), and it has implications for complex farming systems.

In policy terms dryland salinity impacts commercial (agricultural industries) and public infrastructure assets (roads, buildings) and has substantial externality dimensions. The salinity issue is beset by information uncertainties, including the nature of bio-physical processes, farm and agricultural industry impacts, and catchment (natural resource) outcomes. Given that governments are acting to address salinity by encouraging changes in management of private land, and that budgets are limited to achieve natural resource improvements, the major policy questions concern the public and private benefits and costs of land use change and what instruments should be used to address the problems of salinity (and other natural resource issues). How do governments and funding agencies obtain the most social welfare benefit from expenditure of public funds to achieve environmental and natural resource improvements in catchments and across landscapes?

A policy framework

A general classification for natural resource management decisions is presented in Figure 1. It consists of higher- and lower (or operational)-level questions and decisions as follows. First, the "higher-level" questions that need to be answered include:

1. What are the main priorities for natural resource management – how do we set priorities to achieve the greatest impact for the use of public funds? and

2. What is the best approach for natural resource management activities which potentially have both public and private benefits?

In each case these questions rely on being able to predict and quantify the likely improvements from alternative natural resource management activities and to assess how much such improvements add to the wellbeing of Australian society including individual landholders.

The answers to these higher-level questions provide direction to "lower-level" questions, such as the most appropriate instruments to use to achieve the objectives previously decided at the high level (eg the use of Market-Based Instruments (MBIs)). If there are difficulties that become apparent at this lower level then a feedback process can lead to a reassessment of priorities.

There are a number of mechanisms available to achieve natural resource improvement and an important policy decision is which to use in particular circumstances. Ridley and Pannell (2006) proposed an investment framework for dryland salinity in Australia, which guides the choice between policy mechanisms based on levels of private and public net benefits that are likely to result from the land-use change.

Pannell (2006) argues that the choice among these tools depends on the levels of private net benefits (benefits minus costs accruing to the private land manager as a result of the proposed changes in land management) and public net benefits (benefits minus costs accruing to everyone other than the private land manager). The selection of policy mechanisms can then be identified on a simple set of rules, and is represented in Figure 2.

The framework in Figures 1 and 2 identifies the importance of generating changed land management through private actions. If this is possible then public funds can be saved for cases where private incentives are insufficient. A substantial amount of research and development has been conducted to investigate management changes for private and associated public benefit. What can we learn from this work?

Some conclusions from analyses conducted

1. Land-use change within catchments to achieve downstream water and salt targets is likely to be costly to landholders, and this cost can be substantial.

This follows from work of Nordblom *et al*. (2006, 2007a, b) who used an optimizing framework at the farm and catchment level to show that setting end-of-valley targets for salt loads without knowledge of the impacts on water yields, economic efficiency or the distribution of costs and benefits to stakeholders can be problematic.

2. It is essential to target investment to avoid adverse outcomes (otherwise proportionally more water can be removed compared to salt, so that salinity will increase). A corollary of this is that spreading the money thinly will be ineffective. Resources for salinity are not large compared to the size of the problem. We need to focus on high value assets under threat.

Based on analyses conducted by Bathgate *et al.* (2004), who used damage functions for river salinity impacting urban, industrial and irrigation water users and a specification of landscape characteristics, the net external benefits of salinity management in the Boorowa River catchment of NSW were negative except where management was targeted to areas with the highest groundwater salinity. The main reason for this result was the cost due to reduced stream flow.

3. The net benefits of salinity control depend critically on the marginal value of water (lost water could cost more than the reduced cost of salinity).

From the work of Bathgate *et al.* (2004) and Nordblom *et al.* (2006) the downstream costs of reducing stream yield will be significant as excess water is reduced on a broad scale in a non-targeted way. This is likely to occur in the absence of sound scientific data to characterise catchments. Downstream benefits of salinity management will be positive only where management is targeted in watersheds that have high groundwater salinity and on soils with a

relatively high recharge fraction.

4. Optimal intervention for salinity abatement depends on the impact of land use change on a range of catchment characteristics which have been largely ignored in salinity policy up to now, eg the need to assess the biodiversity impact of salinity policy and vice versa.

At the catchment or sub-catchment scale the implications for farm profit, area of salinity-affected land, stream flow, and aggregate levels of carbon and biodiversity are not clear. Bathgate *et al.* (2008) conducted bio-economic analyses to show that trade-offs do occur.

5. River salinity is fairly unresponsive to land use change and therefore to incentives provided for land use change. Stated another way, this means that we still don't have an adequate range of productive options for salinity abatement.

Pannell (2001) has argued that a major focus of salinity policy should be research and development, particularly to make improvements in the range and scope of profitable perennials. Bathgate *et al*. (2004) showed that economic welfare in the Boorowa catchment would be increased by the identification or development of new perennial species that improve farm profitability by more than $3.50/ha. The downstream benefits of establishing species that reduce excess water will be greatest where they are most suited to lighter soils that have a high recharge fraction.

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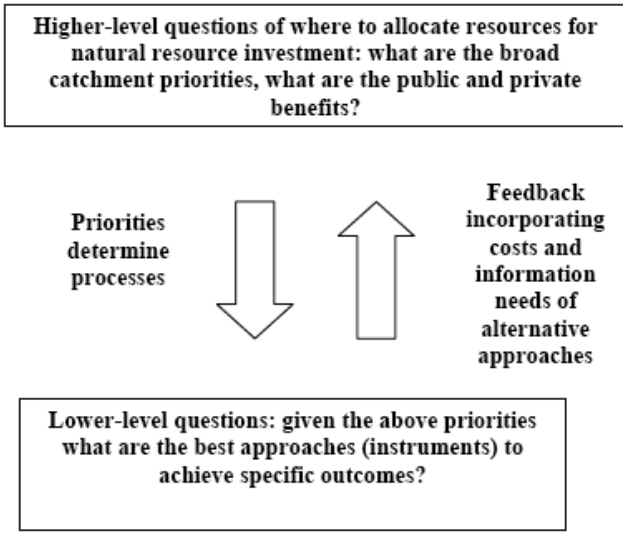

Figure 1. A general classification of decision making needs for natural resource management

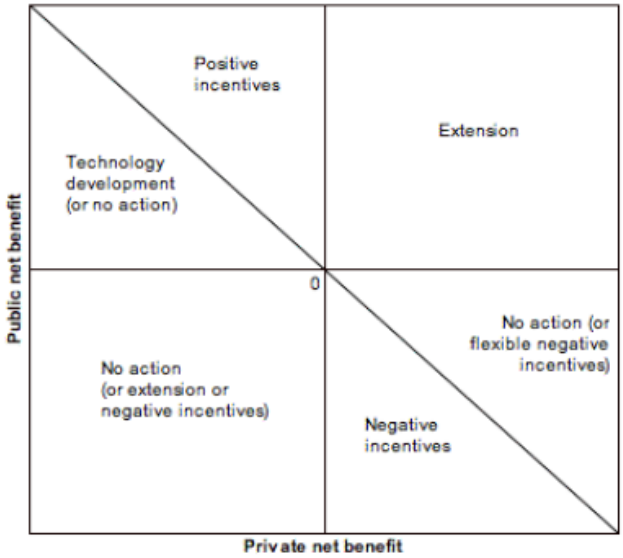

Figure 2. Recommended efficient policy mechanisms based on a simple set of rules Source: Pannell (2006)