

# Roles of Diverse Stakeholders in Natural Resources Management and Their Relationships with Regional Bodies in New South Wales, Australia

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## 1. Introduction

Governments invest in natural resource management (NRM) because of a lack or failure of markets for ecosystem services and to encourage the adoption of NRM practices that reduce the externalities of resource use (Cary et al., 2002; Beare & Newby, 2005; Stanley et al., 2005). Major global trends in NRM include a greater emphasis on community participation, decentralised activity to the regional scale, a shift from government to governance and a narrowing of the framing of environment policy to a largely utilitarian concept of NRM (Lane et al., 2009). Successive state and national governments in Australia, in actively seeking to improve the condition of Australia's natural resources, established a series of funding arrangements for their protection and enhancement (reviewed by Hajkowicz, 2009; Lockwood et al., 2009). In concert with this funding has been a greater emphasis on accountability for expenditure on public environmental programs because delivery of tangible impacts through recently established regional arrangements has proved difficult to quantify (eg. Australian National Audit Office, 2008).

Cooper et al. (2010) estimated that only 8% of the total land area of the Australian state of NSW is protected in public national parks and reserves. Consequently, the great majority of the NSW land mass and the ecosystem services it provides are subject to impacts from human activity, such as farming, mining, forestry and human settlement, and the capacity of the managers of natural resources to adapt to changed community expectations of sustainability by adopting improved resource management practices.

The work described in this chapter builds on the process described by Brown et al. (2010) to assess natural resource manager capacity, and a series of participatory assessments using that process conducted with agricultural land managers, which is currently being published (Leith et al., in press and Brown et al., in press). We concentrate here on four types of land manager, being: land developers, local government environment officers, coal mine environment officers, and private agricultural land managers. These types represent a range

of land managers likely to be found within many catchments in NSW, in other parts of Australia and globally. For the non-agricultural NR managers, focus was drawn on the institutional and organisational values/assets that these types of managers use to influence the condition of natural resources. This was important because, unlike traditional farm businesses, NRM takes place outside of the context of a rural household. The aim of this work was to describe the influence each type of manager has on NRM and their capacity to influence and opportunities to improve NRM. Key results from that work will be used to compare industry and stakeholder perspectives of NRM. This will be followed by a brief discussion of contemporary developments in NRM policy and planning by regional NRM bodies and government that attempt to incorporate the diverse roles NR managers in planning and to circumvent some sources of conflict over resource use.

## **2. NRM capacity in the context of monitoring, evaluation and reporting**

In Australia, activities to monitor and evaluate adaptive capacity for NRM are occurring at national, state, regional and industry scales. The Australian Government's National Land and Water Resources Audit (2002-2008) developed a National NRM Monitoring and Evaluation (M&E) Framework under which a number of projects to develop socioeconomic indicators for natural resource management were conducted. One of those projects focused on adaptive capacity of Australian agricultural land managers.

Nelson et al. (2005) used Australian Bureau of Agricultural and Resource Economics (ABARE) farm survey data to apply the Rural Livelihoods Analysis Framework (Ellis, 2000) to map the adaptive capacity of Australian broad-acre farmers. This enabled a nationally consistent comparison of regions in terms of adaptive capacity, and a preliminary discussion of the primary causes of vulnerability of natural resource managers in the agriculture sector. This analysis was subsequently updated and enhanced by Nelson et al. (2010) to employ a nested approach to weighting of indicators that enabled the ability to 'drill down' through the variables to explore which components of adaptive capacity have the greatest influence in a particular region and which indicators are most prominent.

Adaptive capacity is considered a useful concept because it includes the preconditions necessary to enable adaptation, including social and physical elements, and the ability to mobilise these elements through individual and collective action. Capacity partly depends on the diversity of assets and activities and the flexibility to substitute between them in response to external pressures. This includes the continual process of inventing, adapting and adopting more sustainable farming practices to anticipate and respond to change. Capacity can transcend changes in farm management to include broader livelihood strategies that farm families pursue, for example, through off-farm and non-farm employment.

For NRM purposes, Australia is formally divided into 56 NRM regions each with a community-based board of management with responsibilities for integrated management of the region's natural resources supported by a regional NRM body (Robins & Dovers, 2007). The Australian state of New South Wales (NSW) is divided into 13 NRM regions. The NSW Government implemented a series of 13 state-wide targets to enhance the natural resource condition (biodiversity, land and water resources), and the capacity of regional communities to manage these resources. Regional NRM bodies (called Catchment Management Authorities (CMAs) in NSW) are working with regional natural resource managers to

achieve these targets through NRM planning instruments called Catchment Action Plans (CAPs).

Of the State-wide NRM targets, Target 13 deals with the ways in which people influence natural resource (NR) outcomes through their management of natural resources (Figure 1). A joint team from the NSW Office of Environment and Heritage and CSIRO worked with CMAs in NSW to develop ways of identifying, building and reporting the adaptive capacity of NR managers. This team worked with NR interest groups, often established by the CMAs, to enable resource managers to self-assess and communicate their adaptive capacity across each of the catchment areas.

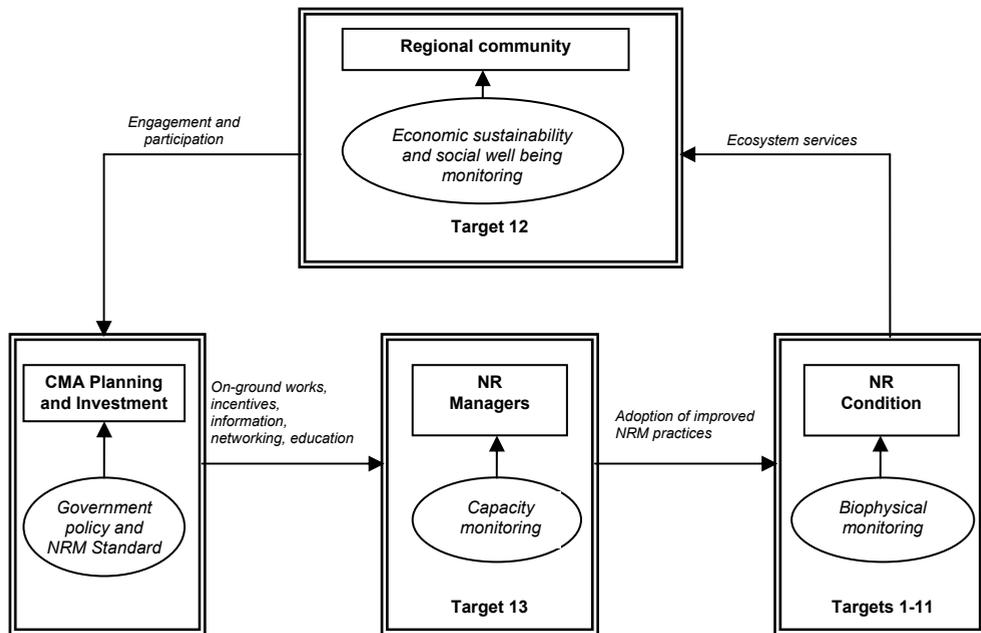


Fig. 1. Conceptual model of the relationship between regional communities, CMAs, natural resource managers and natural resource condition (After Jacobs et al., 2011). Improvements in NRM detected through traditional monitoring of the biophysical aspects of NRM is heavily dependant on improved understanding of the roles of a range of natural resource managers and of monitoring evaluation and reporting of socio-economic indicators of natural resource dependent communities.

Within any single catchment, the practices adopted by managers of land for agriculture often have an overriding impact on the provision of ecosystem services. However, at a local scale other types of NR managers (Figure 2) may have a significant impact on the ability of a CMA to achieve local and regional NRM outcomes associated with Catchment Action Plans. Therefore, the scope of any assessment of capacity needs to be broadened to include non-agricultural NR managers, such as peri-urban landholders and the mining sector, to ensure that regional NRM planning, monitoring and reporting reflects their importance.

Natural Resource Manager Types			
<b>Manager type:</b>	<b>Public NR managers responsible to community.</b>	<b>Public company NR managers responsible to shareholders.</b>	<b>Private NR managers where business unit is a farm or farm analogue.</b>
<b>Management of:</b>	<ul style="list-style-type: none"> <li>• National parks</li> <li>• State forests</li> <li>• Crown reserves</li> <li>• Waters and catchments</li> <li>• Local government parks and reserves</li> </ul>	<ul style="list-style-type: none"> <li>• Mining</li> <li>• Power generation</li> <li>• Plantation forests</li> <li>• Developers</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture</li> <li>• Aquaculture</li> <li>• Private Native Forests</li> <li>• Boat-based commercial fishing</li> </ul>
<b>Assessment frameworks:</b>	<b>Statutory Reporting Frameworks</b> Results and Services Plan State of Environment State of Parks	<b>Global Reporting Initiative</b> Corporate Social Responsibility Triple Bottom Line	<b>Rural Livelihoods Analysis</b> National vulnerability assessment Participatory appraisal techniques
<b>Focus of management:</b>	NR management is primary activity	NR management required as consequence of production	NR management supports production

Fig. 2. A broad spectrum of NR managers may be represented within NSW regions. The most significant regional NR managers should be included in a comprehensive capacity assessment. Examples of reporting frameworks that could be used to inform capacity assessment are shown.

### 3. Use of participatory monitoring for capacity assessment

We used the rural livelihoods analysis to enable natural resource managers across NSW to assess their adaptive capacity for improved NRM outcomes. The rural livelihoods framework developed by Ellis (2000) views livelihood strategies as comprised of assets or capitals (Box 1) that are continuously invented, accessed and substituted between in the process of generating livelihoods. In the short to medium term, NR managers with a greater diversity of capitals and livelihood options and the ability to switch between them are more likely to be resilient in times of stress. An important strategy for generating sustainable livelihoods in the longer term is the transformation of one form of capital into another. Natural capital, for example, can be transformed into physical and financial capital via economic activity, while financial, social and physical capital can be transformed into human capital by increasing access to education.

Rural livelihoods analysis also recognises that the transformation of capital into livelihoods is mediated by multiple interacting social, institutional and organisational processes. The institutional arrangements that influence the ability of NR managers to substitute between or transform capitals include legislation and regulation, as well as industry and informal community codes of behaviour. These institutional arrangements can affect multiple dimensions of NRM including access rights to resources such as land, water, forests and fisheries. Other institutional arrangements such as vegetation clearing and biodiversity conservation regulations can also affect management and access to markets.

**Box 1.** The five capitals associated with adaptive capacity

- **Human capital** – the skills, health and education that contribute to the capacity to manage natural resources.
- **Social capital** – the family and community support available, and the networks through which ideas and opportunities are accessed.
- **Natural capital** – the productivity of land, water and biological resources from which rural livelihoods are derived.
- **Physical capital** – the infrastructure, equipment and breeding improvements to crops and livestock that contribute to rural livelihoods.
- **Financial capital** – the level and variability of the different sources of income, savings and credit available to support rural livelihoods.

Non-farm NR managers that contributed significantly to NRM in a region were identified with the assistance of two CMAs that participated in the assessment process (Table 1 provides a rationale for their inclusion). The links between non-farm NR managers (land developers, local government, coal miners) and the regional, agricultural and conservation activities that form the focus of CMA intervention through investment programs remain relatively unexplored.

The aims of the workshop process used to assess capacity were to:

1. define the direct and indirect ways in which farm and non-farm NR managers influence NRM;
2. explore the enabling and constraining factors affecting the capacity of farm and non-farm NR managers to influence improved NRM;
3. identify priorities for collective action among farm and non-farm NR managers, CMAs, government agencies and other stakeholders to improve NRM; and,
4. develop an information base to assist in the *ex ante* evaluation of policy initiatives that alter landholder access to natural resources.

The general approach was to hold workshops of about 3 hours' duration separately with representatives of each of the non-farm NR managers of interest. Participants at each workshop numbered between 6-15 people and were conducted during May 2008. Each workshop involved a general introduction to the MER program and NRM capacity by project staff followed by a facilitated discussion which sought to answer three questions:

1. How do non-farm NR managers influence NRM?
2. What is the capacity of non-farm NR managers to influence improved NRM?
3. What opportunities exist to improve the capacity for NRM of these non-farm NR managers?

The assessment process for private agricultural land managers was to use the workshop format described by Brown et al. (2010). Twelve workshops were conducted between June and December 2008 across NSW in eight catchments with representatives of a range of farmer types (e.g. grazing, cropping, mixed farming). The data from these were reported in Leith et al. (in press) and Brown et al. (in press). In summary, the workshops were designed to allow NR managers to self-assess their capacity for NRM. They identified sets of regionally relevant, contextual indicators of capacity that constrained or enabled practice change and rated the indicators according to the 0-5 scale ("0" effectively constraining NRM, high priority for action; to "5" effectively supporting NRM, low priority for action).

Furthermore, they provided a narrative about the regional importance of these indicators and identified actions that collectively with CMAs and state and federal governments could build aspects of capacity for NRM. For each indicator, they were asked to suggest collective actions that might remove the constraint (or enhance enablement). The aim was to use this list of actions to assist in directing investment of limited funding for NRM into areas where it should be of greatest benefit to NRM outcomes and enable MER on change in regional landholder capacity that results from action to build capacity.

Activity	Importance and scope of operations
Land development <sup>1 2</sup> Essential to cope with demographic change.	<ul style="list-style-type: none"> <li>• NSW had an average annual population growth rate of 1.5% (2006-09) or 318,300 people.</li> <li>• Pressure for land development for housing highest in peri-urban areas that form belts of non-urban land fringing metropolitan centres.</li> <li>• Peri-urban areas, neither fully urban nor rural, form a mosaic of often incompatible and unplanned uses. They usually contain important natural resources, remnant biodiversity and significant landscapes, often remain important for agriculture and recreation, and attract diverse populations of people.</li> </ul>
Coal mining <sup>3 4</sup> Coal is the major mineral resource mined in NSW.	<ul style="list-style-type: none"> <li>• Coal resources located in the 500 km long, 150 km wide Sydney-Gunnedah Basin from the city of Wollongong north to Newcastle and north-westerly through regional NSW into Queensland.</li> <li>• 63 operational coal mines and 30 coal mine development projects (2009-10).</li> <li>• The Port of Hunter is the world's largest exporter of coal and the Hunter region is Australia's largest producer of coal-fired electricity.</li> <li>• 40 open cut mines in the Hunter Valley, covering more than 520 km<sup>2</sup> or approximately 20% of the Valley floor.</li> </ul>
Local government <sup>5 6</sup> Democratically elected, third tier of government.	<ul style="list-style-type: none"> <li>• 152 local councils in NSW.</li> <li>• Range in size, population, structure and in provision of services across urban and rural areas.</li> <li>• Can be made up of a group of urban suburbs, a town or rural areas of up to 10,000 km<sup>2</sup>.</li> </ul>
Agriculture <sup>2</sup> Provides food, fibre and export income	<ul style="list-style-type: none"> <li>• Farming businesses in NSW number over 38,000.</li> <li>• Farmers manage over 15 million ha of land or about 81% of the NSW land mass.</li> </ul>

Source:

<sup>1</sup> <http://www.periurban.org.au/references/monograph4.pdf>

<sup>2</sup> <http://www.abs.gov.au/AUSSTATS>

<sup>3</sup> <http://www.dpi.nsw.gov.au/minerals/resources/coal/coalfields>

<sup>4</sup> <http://www.australiancoalalliance.com/Information/CoalCommunities.pdf>

<sup>5</sup> <http://www.lgsa.org.au/>

<sup>6</sup> <http://www.coonambleshire.nsw.gov.au/>

Table 1. Significance for NSW of the land manager types that participated in capacity assessment.

The results of the workshops are presented below and reflect the views and opinions of workshop participants at the time of data collection.

## **4. Workshop results**

### **4.1 Land developers**

#### **4.1.1 Influence of land developers on NRM**

Urban developers transform land and other natural resource from relatively undeveloped states to more developed states that support human habitation and add to economic development and social wellbeing. This is analogous to transforming relatively undeveloped forms of natural capital into managed forms of natural, physical and financial capitals. This process can have either positive or negative implications for NRM, depending on the pre-existing condition of natural resources and the immediate and ongoing impacts of development.

Developers have important direct and indirect impacts on NRM. Firstly and perhaps most obviously, developers influence NRM directly by driving development processes that transform relatively undeveloped or natural landscapes into more urban landscapes. Urban land development includes decisions on where to locate development across the landscape, and on the nature and intensity of development at specific sites.

Secondly and perhaps less obviously, developers influence the balance of development and conservation across broader regional landscapes. Through land use planning processes they contribute to decisions over which areas are managed for NR outcomes and which areas are conserved or protected. Developers have a strong and increasing awareness of the ecological footprint of development, and their business success is increasingly influenced by their ability to minimise these impacts. Although, not yet operationalised at the time of the workshops, there is growing interest in development offset schemes (such as the NSW Biobanking scheme for biodiversity offsets) with potential to balance development and conservation across the broader landscape. More efficient and intensive development in areas of low natural resource value can create reduced demand to develop areas of high natural value.

#### **4.1.2 Capacity of developers to influence improved NRM**

The capacity of developers to influence improved NRM is itself influenced by the policy environment in which land use planning decisions are made. In turn, developers contribute to the creation of institutional arrangements that affect the future management of NR by others.

Developers are influenced by a multitude of legislation and regulations affecting the management of native vegetation, protection of buffer zones along water courses, and the management of vegetation to reduce bushfire hazard among others. The process of development approval currently involves a linear, consecutive resolution of individual issues with separate agencies. No single agency has responsibility for achieving an integrated overall balance of development and NRM outcomes, undermining the perceived credibility of approval processes. The result can be a prescriptive implementation of fragmented regulation which leads to both sub-optimal development and NRM outcomes.

For example, restrictions on development in areas with low conservation value can exacerbate demand for development in areas of higher conservation value.

The institutional context in which developers currently operate does not promote the basic principles of adaptive management and governance. Urban development frequently results in natural areas managed under community title. Developers have a significant influence on establishing the conditions under which these areas are managed into the future. Once established, it is often impractical to seek agreement to adapt management to changing environmental, social or economic conditions across the many joint holders of a community title. The result can be less than ideal NRM outcomes in the longer term.

### **4.1.3 Opportunities to improve the NRM capacity of developers**

Workshop participants identified several opportunities for developers, CMAs, government agencies and other stakeholders to work collectively to improve NRM outcomes:

1. Establish informal deliberative, participatory and adaptive facilitation processes that enable the multiple stakeholders with an interest in urban development to come together to holistically design optimal development and NRM outcomes;
2. Emphasise a whole-of-landscape perspective in planning processes to enable development trade-offs to be made across regional landscapes rather than on a site-by-site basis.
3. Develop holistic land development approval processes that systemically integrate and trade-off the multiple development and NRM outcomes across regional landscapes by:
  - investing in the development of science-based methods and metrics that can inform development/conservation trade off decisions at regional scales; and
  - embed the use of these metrics in deliberative, participatory and adaptive resource governance mechanisms that facilitate the resolution of competing interests between multiple stakeholders to achieve holistically optimal development and natural resource management outcomes

Participants recognised that while CMAs could potentially make an important contribution to improving the capacity of developers to enhance NRM outcomes, urban development is not a CMA's primary role. CMAs can contribute to the informal facilitation of deliberative, participatory and adaptive processes for resolving competing interests in NRM.

## **4.2 Local government environment officers**

### **4.2.1 The influence of local government on NRM**

In the past, NRM was largely considered to be the responsibility of State governments and was not seen as a core activity of local government. Despite the significant work done by local government on NRM, its role was often not explicitly recognised. The issue of direct and explicit responsibility for NRM is therefore new to many local councils, and as such, it has to compete with other council priorities (e.g. road maintenance, collection of rates and domestic waste disposal). The interests and priorities of elected councillors and their constituents play a significant role in how NRM is prioritised among these competing priorities.

Local councils are, however, involved in a range of activities that affect NRM outcomes:

- Councils endeavour to manage NR appropriately through the management of roadside verges, urban areas, and bushfire related hazards. They face a diverse range of water management issues including: ground water management, water quality, treatment plant upgrades, storm water harvesting, rainwater tanks in urban areas, water sensitive urban design, sediment management, management of septic tanks and issues relating to runoff and pollution, grey-water use and effects on groundwater of, for example, agricultural activities. Councils also manage creeks and riparian zones, including adding habitat complexity to water bodies to allow slow percolation.
- Councils are required to evaluate and approve buildings and construction, and control the use of land through Local Environment Plans (LEP). Local governments influence construction and building in urban areas and focus on the sustainable use of resources (energy consumption, heating, lighting, water etc) through statutory building codes. Furthermore, applications for development require local council approval and there can be reviews of the LEP.
- Local councils have a role to play in NRM related education, and often through an environmental officer who can facilitate on ground NRM activities. These include management of remnant vegetation, weed control, enhancement of biodiversity, minimisation of human impact and riparian vegetation management; and management of pests and weeds (in particular enforcement of control of weeds declared noxious). In addition, councils have some responsibility for management of pest birds in urban areas, and larger vertebrate pests in reserves; a role in community education to raise awareness of salinity problems to minimise its effects in urban areas; and community tree planting (arbour) days.

#### **4.2.2 Capacity of local government to influence improved NRM**

The capacity of local governments to improve or influence NRM was considered reasonably high in most local government areas. There were, however, some general and NRM-specific constraints on the ability of local councils to manage natural resources:

- Funding ultimately constrains all local government activities, although there are some issues specific to NRM. For example, the role of local councils in managing NR is not yet recognised fully in the funding allocation formulae used by State governments. Furthermore, there is contention surrounding the idea of raising rates to pay for NRM, and the potential acceptance of this approach by communities varies widely.
- The level of interest and priority given to NRM by communities and within local governments is important for generating activity and achieving outcomes:
  - Councils face a range of competing pressures, and NRM can not be a high priority for all councils at all times. On occasions, community perceptions can unhelpfully transfer most or all of the responsibility to councils rather than accept some level of civic responsibility for NRM.
  - NRM can be in tension with economic development. For example, the scaling back of resource-based industries such as sawmills through the conversion of regional forests to conservation areas and the impacts this may have on local communities can create negative reactions to environmental issues.

- Some communities show strong interest in NRM, and people often want to contribute. For example, in many regional towns strong community-based environment groups have evolved that are leading NRM activities. A recreational fishing club that removed willows and re-stocked a river with fish by community fund raising and CMA support was proffered as an example of grass-roots support for NRM albeit motivated by largely private-benefit.
- The interest of local communities and governments need to be aligned to achieve optimal natural resource outcomes. Governments can encourage or discourage local action, and not only through funding but also by assisting in monitoring the NRM outcomes of community activities.
- Issues internal to local government also influence NRM. These issues include the capacity of councils to manage NR, which depends critically on the awareness, knowledge and skills of elected councillors. This in turn influences the priority given to NRM within local government. The difficulty in attracting and retaining qualified staff to small towns and remote rural areas, often for short term contracts, limits the NRM skills-base of local government. Additionally, the success of NRM can depend on alignment between local and state government priorities.

#### **4.2.3 Opportunities to improve the NRM capacity of local government**

Participants suggested a range of ways that capacity of local government for NRM could be enhanced. For example, NRM facilitators and community champions have been particularly effective in catalysing community action. They provide a focus for activities, awareness raising and education on how to address NRM challenges, in particular through activities in local schools. They also provide direct support to small communities, coordinate activities, and build the capacity of local communities to manage NR. However, further improvements in capacity are likely to accrue from:

- Appropriate recognition and prioritisation of NRM in council budgets, and in the funding formulae used by State governments to allocate resources to local government.
- Development of a team approach with CMAs and councils in neighbouring local government areas to provide NRM services across a region. This was suggested as a way of sharing resources and coping with skills shortages in NRM.
- Greater co-operation among councils and collaboration with CMAs could assist in funding of NRM facilitators, community champions and environmental officers in line with Council and State government priorities.
- Raising the awareness and knowledge of elected councillors through formal briefings on NRM issues and opportunities to address them could aid their recognition and prioritisation.

### **4.3 Coal mine environment managers**

#### **4.3.1 The influence of mining industry on NRM**

The ways that land is used for coal mining, both open cut and underground forms, varies from extraction of resources at one end of the scale to protection and enhancement of NR at the other extreme. There are a range of positive and negative effects on NRM from the process of mining, depending on the potential extent of mineral resources that are

targeted for extraction, the extent of buffer areas and the success of regeneration and rehabilitation activities after mining operations are concluded. In general, participants indicated that the aim of the mining industry is to provide mutual positive impacts for NRM at various scales and to involve the local communities where possible in NRM management.

Land is managed by coal mines for three purposes:

1. *Areas of land that are currently subject to mining.* The impacts are both direct on natural resources and indirect on neighbouring landholders from mining activities. To minimise these impacts mining companies generally seek to own the land where these effects occur. In the case of open-cut mining, impacts on neighbouring landholders include air pollution, dust, noise and loss of visual amenity. Where these impacts are significant, neighbouring owners are given an option to sell their land to the mining company. Actions such as the establishment of plans of management with neighbouring landholders are carried out on a site-by-site basis. For underground mining, issues of subsidence are often significant. Companies conduct extensive monitoring to assess the extent of subsidence, and where it occurs, undertake on-ground work towards repairing dams and fences, and installing additional contour banks for erosion control. The mining industry works collaboratively with landholders directly affected by mining to ensure that their current use of land and livelihoods continue. Significant social impacts may also occur as a result of mining operations. For example, land deemed suitable for mining may have been owned by successive generations of farming families and they may have developed strong emotional and cultural ties to the land. In some cases, landholders who sell their properties to mining companies may be offered an option to lease the land back to continue in agriculture after mining operations are completed. After mining has ceased in an area, the industry conducts activities to reclaim and rehabilitate the land. In this case tensions may exist between proponents of biodiversity and the re-establishment of agricultural production on these sites. The industry attempts to manage these tensions through consultation with the community about final landforms and land-uses. This incorporation of community consultation to gauge local values is aspirational rather than regulatory, and the mining industry is not bound by community recommendations on mine site rehabilitation.
2. *Areas earmarked as having potential for mining in the future.* Mining companies may own areas of land containing significant mineral resources that they expect to exploit in the future. This land often remains in use for agriculture either by pastoral companies owned by mining companies or leased to private agricultural operators while awaiting development. For lease-holders of this land, licences are generally for periods of 2 years, but can be for up to 5 years. Such short-term leases often result in limited incentive for good NRM outcomes. While companies do not seek to prescribe management practices, lease-hold agreements often include descriptions of appropriate NRM practices that should be adopted. Examples of management guidelines might include limitations on grazing of river banks and construction of major earth works (dams) without the consent of the mining company and requirements to undertake routine pest and weed control.

3. *Mining area buffer zones.* These are areas on the periphery of mines without potential for mineral extraction but which act as buffer zones for mining activities. In buffer areas, the mining industry encourages the continuation of agricultural production to maintain links to the land, but there is an opportunity to integrate benefits to biodiversity through the use of offsets. This comes from the use of vegetation to screen and reduce the aesthetic impact of mining in adjacent areas of land. In addition to improvements to visual amenity, vegetation plantings may provide some ecosystem services such as cleaner air through dust capture and biodiversity connectivity in the landscape. The mining industry is keen to ensure this land is managed appropriately, with a good balance between production and conservation. Direct partnerships between CMAs and mining companies on buffer zones are common and have resulted in projects that achieve significant NRM outcomes on agricultural land. Such collaborative projects include working with volunteer environmental groups on weed control, tree planting and erosion control, and with neighbouring landholders to revegetate shared riparian areas.

Important outcomes for regional NRM include protection and enhancement of native vegetation, amelioration of soil salinity, contributions to regional biodiversity strategies and NRM monitoring and research activities.

#### **4.3.2 Capacity of mining industry to influence improved NRM**

While mining activity is sometimes limited on ecological grounds because of potential impacts on threatened ecosystems, often it presents an opportunity to take marginal pasture land out of production and convert it into conservation land following a period of coal extraction.

Biodiversity offsets schemes, under development at the time of the workshop, afford a methodological approach to reconcile mining with conservation and to help target specific areas with the aim of having a net positive impact on biodiversity outcomes. The mining industry manages offset areas on a case-by-case basis and environmental research on such areas is encouraged. Participants envisioned market-based instruments for carbon sequestration as becoming a feature of offset areas in the future.

In general, participants indicated that mining companies are well aware of NRM issues and their aspirations for raising the profile and importance of NRM in their regions coincides with the activities of CMAs. Although involvement of CMAs in NRM activities on mining land is not mandated formal interaction in the shape of a CMA staff member identified as a designated contact for the industry occurs particularly in catchments where the industry is a significant landholder. The CMA also assists the industry by providing guidance on where in the catchment investment on NRM should occur. This guidance is coupled with appropriate technical experience and often provides financial assistance in the form of incentive payments for landholders. The CMA's Catchment Action Plan is used as a basis for planning and development within the CMA, to align consistency of action, and provides a background for policy statements.

There is now considerable overlap of interest between the mining industry and CMAs, for example in areas affected by salinity and for the management of riparian vegetation. The CMA also has established links to local communities and the mining industry has a strong interest in working with these communities with cooperation from the CMA to form partnerships and set up formal NRM agreements.

### 4.3.3 Opportunities to improve the NRM capacity of mining industry

The opportunities to improve NRM capacity of the mining industry include:

1. Rationalisation of the number of government agencies with responsibility for aspects of mining operations. There was a perception that there were too many government agencies and for each different management issue there was a range of departments that required liaison.
2. Provision of advice and assistance to the mining industry by CMAs. While CMAs have no role in the regulation of mining activities they can provide a link between regulators and the mining companies. CMAs comment on mining plans, and ensure they are consistent with regional NRM plans to maintain environmental outcomes. The main focus of these activities is in off-mine and buffer areas.
3. Ensure a role for CMAs in the implementation of regional NRM outcomes through involvement in long-term planning for the industry conducted by government mineral resources agencies. This action would facilitate the development of landscape plans across mine sites, improve connections between discrete landholdings, assist in the establishment of biodiversity corridors through offset schemes and raise awareness of the big picture on regional NRM, which often tends to get lost when regulators closely examine single resource management issues.
4. Increase the NRM profile of the industry through improved communication, research and awards for industry environmental excellence.
5. Maintenance of communication and links with local and Indigenous communities. The coal industry, for example, actively gives Indigenous owners a voice in the salvage and management of archaeological sites and influences the management of mining areas to maintain natural and cultural values. The industry needs to maintain good links with Indigenous and non-Indigenous local cultural heritage groups. The industry should ensure companies comply with legislation on preservation of cultural heritage.

## 4.4 Agricultural land managers

### 4.4.1 The influence of agricultural land managers on NRM

Private agricultural land managers control most of the landmass of Australia and their practices influence the ecosystem services this land provides. Any improvement in the condition of the natural resource base in Australia is heavily dependent on the adoption of more sustainable agricultural practices on private land. While the total number of farms is in decline, the majority are operated by individual families, which support and are supported by the farm business. Therefore, the goals and aspirations of farm families are inextricably linked to agricultural livelihoods. Where improvements to agricultural productivity, farming systems and NR sustainability coincide, the adoption of improved NRM practices is often rapid. For example, adoption of minimum tillage cropping systems, which deliver soil conservation outcomes, is as high as 86% in some parts of Australia (D'Emden & Llewellyn, 2004). It is estimated that Australian farmers spent \$3 billion on NRM over 2006-07, managing or preventing weed, pest, land and soil, native vegetation or water-related issues on their properties (Australian Bureau of Statistics, 2008).

Recent shifts in emphasis of government NRM investment away from improvements in agricultural productivity to practices seeking to deliver conservation outcomes may not be

compatible with a landholder's goals. The evidence is compelling that up to 75% of farms in some parts of Australia fall below a farm financial benchmark that would provide an acceptable standard of living for a farm family and allow for investment to mitigate income fluctuation and investment for future productivity increases (Barr, 2011). The lack of adoption of conservation practices is often interpreted by government agencies and NRM bodies as a lack of motivation on behalf of landholders for improved NRM. However, such landholders may be unable rather than unwilling to make an in-kind investment in adoption of conservation practices even though they deliver broad public benefits.

#### **4.4.2 Capacity of agricultural land managers to influence improved NRM**

Capacity to sustain and improve natural resources at the farm scale depends on a variety of drivers of behaviour, ranging from human characteristics, such as motivation, education, and attitude, to social, cultural, financial and physical considerations which affect people's ability to develop and implement management strategies and actions.

Despite the diverse range of locations, farming systems, demographics and socio-economic contexts of the workshop participants (12 workshops involving approximately 90 landholders throughout NSW), indicators of effective NRM consistently emerged that suggest widespread impediments and drivers of NRM on private land in NSW. In particular, participants emphasised the need for consistent NRM policy at local, state and national scales, inclusive cross-scale institutions, and continued support for successful programs and organisations. Constraints to effective NRM were frequently related to agricultural commodity markets and cultural changes to local communities resulting from underlying national demographic trends.

Leith et al. (in press) showed that the balance between enabling and constraining factors to NRM and their strength (occurrence and importance) varied with the type of livelihood capital. In general, constraints tended to be broad-scale, multi-dimensional issues, such as the trend towards an ageing of the farm population (human capital) and declining farm profitability (financial capital), which are largely beyond the control of individual land managers and do not lend themselves to simple solutions. These complex constraints were often partially offset at a local scale by weaker, frequently ephemeral, enablers of NRM, such as the development of local networks (social capital) and nurseries providing local tree species for revegetation activities (physical capital).

Livelihood assets (capitals) are linked and convertible in various ways. For example, the erosion of financial capital in much of rural Australia because of declining terms of trade has led to falls in employment on farms and out-migration from rural areas. This has left an ageing farm population and a diminished agricultural labour force. The ability to operate a farm with less labour is enabled by increasing physical capital in the form of technologies and large-scale farm machinery. Nevertheless, depleted human capital makes land managers more time-constrained. Participants commonly said that, as they have become busier doing more work with less human and financial resources, they have given a lower priority to social activities, such as attending and organising sporting and social events. Rural towns without such social events, in turn, become less attractive places to live. Not all interaction of the capitals leads to spiralling rural decline. Some workshop groups described how a few well-connected champions had built substantial morale or generated enthusiasm within their community.

Through this generation of human capital, social capital can be enhanced, making communities more attractive. Vibrant communities may be more capable of generating financial and physical resources. Enhancements to natural capital, perhaps through a series of good seasonal conditions, can similarly transform the resources available within a community. Drought, an intrinsic part of the operating environment for landholders in much of Australia, progressively depletes financial, human, social and physical capitals over its duration.

#### **4.4.3 Opportunities to improve the NRM capacity of agricultural land managers**

Agricultural land managers view NRM as primarily of secondary importance to commercial farming activities although they recognise that natural resources underpin farm productivity. Actions identified by landholders to address constraints to NRM capacity are best considered in terms of their impact on agricultural livelihoods (Brown et al., in press). Traditionally, direct interaction between government interventions in NRM and agricultural livelihoods occurs through the regulation of landholders' access to natural capital, which changes the way in which landholders combine and transform assets to support agricultural production. Not surprisingly then, of the issues for action identified by landholders to address capacity constraints to effective NRM, many related to changes to transforming structures and processes, such as NRM legislation and policy, price regulation, planning processes and tax incentives. However, equally important were actions that would address the context of rural isolation that contributes to landholders' vulnerability such as social networking, local NRM champions, community input to policy, provision of regional health and counselling services and general community development. Actions that might result in expansion of landholders' portfolio of livelihood assets (capitals) included improvements to the capability and health of soils and to the management of grazing, water and groundcover that contribute to natural capital; skills, knowledge and training that contribute to human capital; and, fencing to enhance land management that contributes to physical capital. NRM action that would expand livelihood strategies focused on diversification of regional employment to provide off-farm income and opportunities for youth; the profitability of agricultural production such as business efficiency and forward contracting; and, the financial contribution of NRM to the farm's ability to support a livelihood, such as through stewardship payments. NRM actions contributing to livelihood outcomes were confined to the commercial and social value of agriculture and the value of agricultural land, one of the constraints to achieving viable farm size.

## **5. Discussion**

The opportunities to enhance the capacity of each of the farm and non-farm NR managers to influence improved NRM outcomes identified during the workshops also suggest obvious opportunities to monitor changes in this capacity over time (Table 2).

A key question in relation to longer term monitoring of capacity is the extent to which the non-farm NR managers consider themselves to be direct managers of natural resources, or as part of the institutional environment influencing the management of natural resources by others. To the extent that non-farm NR managers directly manage natural resources, a conceptual framework analogous to the five capitals on which rural livelihoods analysis is based could provide an appropriate set of indicators for assessing their capacity.

NRM group	Monitoring and evaluation opportunities
Land developers	<ul style="list-style-type: none"> <li>• Implementation of informal deliberative, participatory and adaptive facilitation processes that enable engagement with multiple stakeholders to holistically design optimal development and NRM outcomes.</li> <li>• Evolution and effectiveness of whole-of-landscape planning processes over time in lieu of existing linear and fragmented approaches.</li> <li>• Development of science-based methods and metrics capable of informing development/conservation trade off decisions across regional landscapes.</li> </ul>
Local Government	<ul style="list-style-type: none"> <li>• Recognition of NRM issues in funding allocation, priority and planning mechanisms of local governments.</li> <li>• Exploitation of opportunities for investment into better NRM outcomes from local government activities and through joint funding applications with other councils and through support of NRM facilitators.</li> <li>• Sharing of resources and expertise of NRM staff across councils and with CMAs.</li> <li>• Raise awareness of the role that local government plays in delivering and supporting natural resource outcomes.</li> </ul>
Coal miners	<ul style="list-style-type: none"> <li>• Improved coordination across government agencies on mining regulation.</li> <li>• Establishment of links with CMAs, regulators and mining companies regarding mining plans, CAPs and native vegetation plans.</li> <li>• Communication with local communities and Indigenous communities to improve awareness of the industry's role in NRM.</li> </ul>
Agricultural land managers	<ul style="list-style-type: none"> <li>• Indicators of resource condition related to broad-scale drivers of agricultural productivity and structural adjustment such as labour force changes, farm profitability, landholders' terms of trade, return on capital, and socio-demographic and cultural changes in the Australian population.</li> <li>• Indicators of the effectiveness of government investment in NRM including the strength of local social networks, locally relevant NRM information, land manager skills, regional research and development capability and engagement of NR managers in planning and decision making.</li> </ul>

Table 2. Recommendations for monitoring and evaluation identified for each of the NRM groups.

Each of the non-farm NR managers examined here directly manages NR to some extent as part of their normal operations. However, if the transformation of forms of capital to support diverse livelihood strategies is taken an essential concept underpinning the livelihoods approach, then the distinction between managers of agricultural land and non-farm NR managers becomes clearer. For local government the transformation of capital

plays little or no role in its activities and the livelihoods framework would not be a suitable assessment process for monitoring its capacity. The purpose of the mining industry is principally to convert natural capital (minerals) into wealth (financial capital), these activities are conducted by large corporate entities rather than households, and the intervention of mine environment managers in NRM is largely mandated by government. These issues complicate the use of the livelihoods framework for capacity monitoring. Rural livelihoods analysis, however, could be used legitimately to monitor the capacity for NRM of the lease-holders and pastoral companies that manage buffer areas and future sites of mines. The actions of coal mines as effective regulators of NRM on these areas of land could then be viewed through the prism of the rural livelihoods of these managers of agricultural land. While conversion of capital is the central activity of land developers, the institutional framework in which they are embedded and on which they exert significant influence, the relatively short term nature of their involvement in NRM and the lack of dependence of their activities on sustainable NR use (except where mandated by government) again makes the use of a livelihoods approach in capacity monitoring problematical.

Where the influence of non-farm NR managers is largely indirect and mediated through institutional arrangements, such as planning and land use decisions, an alternative framework for monitoring this influence should be used.

### **5.1 Conflict among stakeholders**

While the stakeholders participating in this study expressed similar aspirations toward being more effective managers of natural resources, the nature of their roles (Figure 2) inevitably leads to tension. Close examination of the issues underlying NR conflict is beyond the scope of this chapter. It is nevertheless instructive to recognise the existence of conflict among stakeholders because it leads into a discussion of some contemporary developments in NR policy being trialled in NSW in an attempt to ensure a more holistic approach to the management of land, water and biodiversity by, and for the benefit of, regional communities.

The major sources of conflict in NRM in Australia are well documented and include:

- Demographic change particularly immigration to rural areas close to large population centres (Luck et al., 2011). Conflict arises between NRM stakeholders as a result of changes in land use from predominantly agricultural to multi-functional landscapes and the struggle to maintain ecosystem function and services implied by such changes. Conflict often centres on land use planning to accommodate housing and other developments, escalation of land prices and the divergent social and economic values of new residents from largely urban backgrounds.
- Mineral extraction. Expansion of demand for minerals coupled with the juxtaposition of mining activity and agriculture in areas with high environmental and NR values continues to be a source of conflict in many regions. In particular, externalities from mining activity (NSW Minerals Council, 2011), local social and labour force change (Luck et al., 2011), impacts on agricultural production (Brereton et al., 2008), biodiversity loss (Commonwealth of Australia, 2007) and potential damage to surface and groundwater aquifers (Smith, 2009) are issues of concern to NRM stakeholders. However, the importance of the mining industry as a driver of regional wealth and

provider of services to remote communities (Smith, 2009) ensures that views on mining are not held uniformly by stakeholders or their representatives.

- Sustainable natural resource use. Government attempts to protect broader public benefits often conflict with local exploitation of and dependency on natural resources. In Australia, much of this conflict is centred around water where contemporary 'supply-side' policies have favoured technological and engineering solutions rather than institutional, organisational and community practices for managing water (Godden & Ison, 2010).

These three issues are complex, multi-faceted, contextual in nature and resistant to traditional forms of problem solving making them classic wicked problems (Australian Public Service Commission, 2007).

## 5.2 A systemic approach to NRM planning

Ison (2010) identified the institutionalization of systems thinking to drive new forms of horizontal governance as required to improve the sustainable use of natural resources. Among the systems approaches to the management of NR, application of the concept of resilience may be a way to resolve the 'wickedness' of NRM problems through improvements to both NR governance and management capacity (Lebel et al., 2006). Resilience is a measure of the amount of change a system can undergo and still retain the same controls on structure and function or remain in the same domain of attraction (Walker & Salt, 2006).

Resilience thinking in the planning of NRM should provide recognition of the systemic interconnection of humans to their environment (Ison & Wallace, 2011). Devolution of NR governance to regional institutions, such as CMAs, is viewed as enhancing the ability to manage catchments as coupled social-ecological systems. In NSW, resilience thinking is being promoted to CMAs as 'a new frame for helping communities understand how their catchments work and where and how they can best intervene to keep landscape systems operating effectively' (Natural Resources Commission [NRC], 2011). CMAs are being encouraged to adopt a resilience approach in upgrading their Catchment Action Plans (CAPs) because it 'influences the types of NRM targets CAPs might contain, the partners that might be involved for the best results, and the type of knowledge that CMAs should draw on to analyse, understand and communicate how the landscape functions' (NRC, 2011).

Many of the issues confounding adoption of a resilience framework for the management of social-ecological systems have been detailed in the literature and include governance (Lebel et al., 2006), surprise (Carpenter et al., 2009), multidisciplinary (Longstaff, 2009), regional scale (Maru, 2010), community participation and collaboration (Walker et al., 2002, Nkhata et al., 2008), adaptive co-management (Olsson et al., 2004; Rammel et al., 2007), and political and institutional changes not supportive of the resilience paradigm (Leach, 2008). These issues are assumed to be more manageable at regional than at state and national scales because the complexity of the factors affecting ecosystems and the behaviour of actors with influence on the environment is reduced (Lebel et al., 2006).

Olsson et al. (2004) developed a conceptual model for the transformation of a social-ecological system from an undesired trajectory of resource management to a new context for ecosystem management that could help to inform actions at regional scale (Figure 5). This

model suggests that to effect a change of trajectory involves building a NRM knowledge base; developing a comprehensive planning and monitoring framework for NR; sustaining inclusive social networks to involve NRM stakeholders and regional communities; and, taking advantage of windows of opportunity for effecting NRM policy changes.

While it is still too early to assess the outcomes of adopting resilience thinking for regional NRM in NSW many of the components of the model are in place. Evidence from the current round of catchment planning being undertaken by CMAs suggests that a formal knowledge base is under construction and CMAs appear to be making good progress towards building capacity to detect and plan to manage thresholds through state-and-transition modelling of regional social-ecological systems (Central West Catchment Management Authority, 2011).

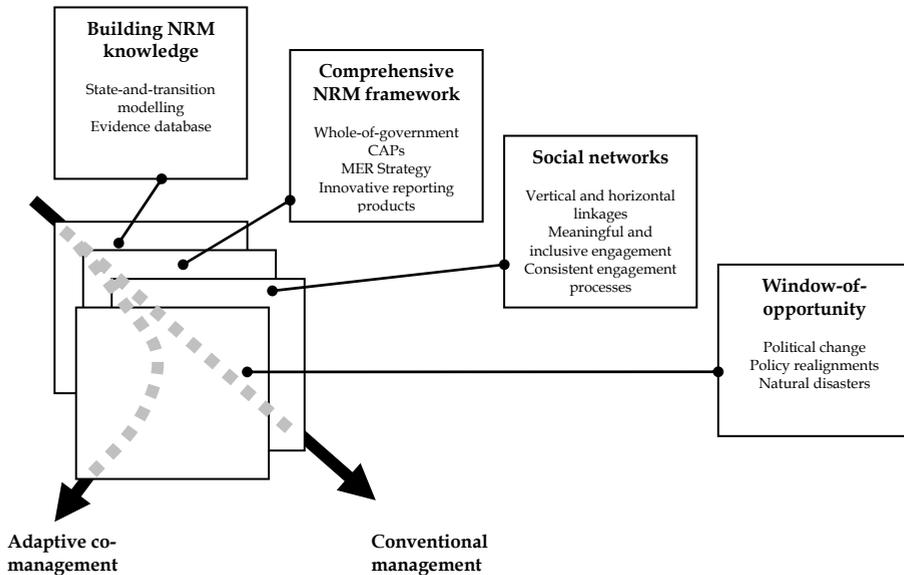


Fig. 5. Conceptual model for the transformation of a social-ecological system from an undesired trajectory of resource management to a new context for ecosystem management (Adapted from Olsson et al., 2004).

A comprehensive framework for defining regional visions and goals for NRM is being established through a whole-of-government approach to catchment planning that includes community engagement processes (NRC, 2011). In addition, a statewide monitoring, evaluation and reporting strategy is in place which seeks to support continuous improvement of NRM and investment decisions (Department of Environment, Climate Change and Water, 2010) through MER of the condition of natural resource assets in the longer term, and of the performance of NRM investment programs in the short and medium term.

Perhaps the component of the model where progress appears most difficult to achieve is in the establishment and maintenance of social networks. At regional scale our work with

diverse NRM stakeholders supports that of Olsson et al. (2004) indicating that the capacity to address the range of issues involved with ecosystem management is dispersed over a range of actors at different levels in society from individual landholders through to national policy makers. In particular, CMAs tasked with coordinating regional NRM differ widely in their organizational capacity to meet planning and management responsibilities (Robins & Dovers, 2007). Effective social networks contribute to capacity by providing access to resources embedded in the network and the importance of relationships and partnerships in collaborative community-based projects is well recognised (Lauber et al., 2008).

However, for resilience to become the driver of a transformational shift in the management of social-ecological systems, rather than simply the latest in a string of catchment planning fads, existing institutional frameworks will need to change to accommodate new ways of learning, new ways of sharing information, and new ways of incorporating learning into planning (Allan & Curtis, 2005). Meaningful and inclusive engagement processes that value the context-specific tacit knowledge of NRM stakeholders about the social-ecological system in which they are embedded (Busch, 2004; Smith & Bosch, 2004) are fundamental to this transformation. The knowledge generated through such processes must also be used actively in decision making because policy makers' information about actual institutional performance is very limited, rarely field based, and drawn mainly from interested parties (Fox, 2001). Marshall (2011) suggests that strong incentives need to be created for NRM decision makers to embrace investment decision-making frameworks that are more rigorous and comprehensive than those they currently use. Leith et al. (in press) and Brown et al. (in press) demonstrated that participatory monitoring and evaluation of landholder capacity can provide an appropriate information base for policy-makers on the constraints to changes in the management of NR on private land and may assist in the design of novel strategies to effect change. They argued that the inclusion of an aspirational target for NR manager capacity in a state wide MER strategy, as in the Australian state of New South Wales, was a positive development because it recognised that people are an integral part of the cultivated landscape and that NR managers are key local stakeholders in the delivery of landscape-scale change through their active use and management of NR in maintaining livelihoods (Bohnet, 2009).

In addition, regional NRM bodies and NRM stakeholders need to be prepared to exploit windows of opportunity to promote change in the management of NR that occur through broader political processes or through shocks to national and regional economies, such as those following natural disasters (Bruckner & Ciccone, 2009; Burke & Leigh, 2010). There is evidence in Australia that the opening of such policy windows has recently occurred. At the national scale, and following a severe drought that affected most of Australia, a large-scale planning process is underway to improve the environmental management of the Murray-Darling Basin catchment, the major water catchment of the eastern part of the continent (Connell & Quentin Grafton, 2011). In NSW, a recent change of government has led to increased emphasis in land use planning on food security and local agricultural livelihoods, and a re-evaluation of the impacts of mining, in particular for coal seam gas, on natural resources (NSW Liberals and Nationals, 2011). The extent to which the resolution of these policy processes might involve evolution of governance regimes that assist the transition to a new context for the management of regional ecosystems is at present unclear.

## 6. Conclusion

Effective NRM requires concerted action on the part of a broad range of actors that influence the management of regional ecosystem services and that extends beyond agricultural landholders. Participatory monitoring of NRM capacity indicates that NRM actors are genuinely interested in contributing to regional NRM planning. However, NRM stakeholders such as the mining industry, land developers and local government need to be engaged by regional NRM bodies and their actions better coordinated with those of agricultural land managers.

The approach described in this chapter is an effective way to define the roles of diverse stakeholders in NRM, to improve their relationships with regional NRM bodies and ensure their perspectives are included in regional NRM plans. Adoption of resilience thinking as a paradigm for systemic NRM planning processes as in the Australian state of NSW, offers hope of transformational change in the management of social-ecological systems.

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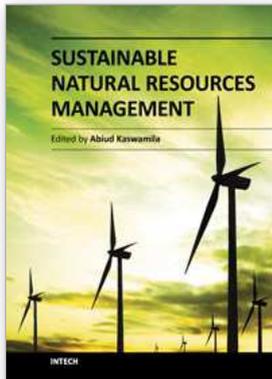
## 8. References

- ABS (2008) *Natural Resource Management on Australian Farms 2006-07*, Australian Bureau of Statistics, Canberra. Retrieved from:  
<[http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/4B8FE17686FA051BCA2574720011AEE7/\\$File/46200\\_2006-07.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/4B8FE17686FA051BCA2574720011AEE7/$File/46200_2006-07.pdf)>
- Australian Public Service Commission (2007) *Tackling wicked problems: A policy perspective*, Australian Government, Canberra. Retrieved from:  
<<http://www.apsc.gov.au/publications07/wickedproblems.pdf>>
- Allan, C., and Curtis, A. (2005) Nipped in the bud: why regional scale adaptive management is not blooming. *Environmental Management* Vol. 36, 3, pp 414–425.
- ANOVA (2008) *Regional Delivery Model for the National Heritage Trust and National Plan for Salinity and Water Quality. Audit Report No. 21*, Australian National Audit Office: Canberra.
- Barr, N. (2011) I hope you are feeling uncomfortable now: role of conflict and the natural resource extension officer, In: *Changing Land Management: adoption of new practices by rural landholders*, Pannell D. and Vanclay F., pp 129-139, CSIRO Collingwood, Australia.
- Beare, S., and Newby, J. (2005) Incomplete markets, excluded goods and natural resource management, *Proceedings of the Australian Agricultural and Resource Economics Society Conference*, Coffs Harbour, 9-11 February 2005, ABARE, Canberra. Retrieved from:  
<[http://www.abareconomics.com/publications\\_html/conference/conference\\_05/CP05\\_5.pdf](http://www.abareconomics.com/publications_html/conference/conference_05/CP05_5.pdf)>.
- Bohnet, I. (2009) Assessing retrospective and prospective landscape change through the development of social profiles of landholders: a tool for improving land use planning and policy formulation. *Landscape and Urban Planning*, Vol. 88, pp 1-11.

- Brereton, D., Moran, C., McIlwain, G., McIntosh, J. and Parkinson K. (2008) *Assessing The Cumulative Impacts Of Mining On Regional Communities: An Exploratory Study Of Coal Mining In The Muswellbrook Area Of NSW*. ACARP Project C14047. Centre for Social Responsibility in Mining, Centre for Water in the Minerals Industry and University of Queensland.
- Brown, P.R., Jacobs, B., and Leith, P. (in press) Participatory monitoring and evaluation to aid investment in natural resource manager capacity at a range of scales. *Environmental Monitoring and Assessment*
- Brown, P.R., Nelson, R., Jacobs, B., Kokic, P., Tracey, J., Ahmed, M., and DeVoi, P. (2010). Enabling natural resource managers to self-assess their adaptive capacity. *Agricultural Systems* Vol. 103, pp 562-568.
- Brückner, M., and Ciccone, A. (2008) *Rain and the Democratic Window of Opportunity*, CEPR Discussion Paper No. 6691, Centre for Economic Policy Research, London.
- Burke, P., and Leigh, A. (2010) *Do output contractions trigger democratic change?* IZA Discussion Paper No. 4808 pp83. Institute for the Study of Labour, Bonn. Retrieved from: <<http://people.anu.edu.au/andrew.leigh/pdf/Autocrats.pdf>>
- Busch P (2004) Knowledge management implications of articulable tacit knowledge: case studies on its diffusion. PhD Thesis Macquarie University.
- Carpenter, S., Folke, C., Scheffer, M., and Westley, F. (2009) Resilience: accounting for the noncomputable. *Ecology and Society*, Vol. 14, 1: 13. [online] URL: <http://www.ecologyandsociety.org/vol14/iss1/art13/>
- Cary, J. W., Webb, T. J., and Barr, N. F. (Eds.). (2002). *Understanding landholders' capacity to change to sustainable practices. Insights about practice adoption and social capacity for change*. Bureau of Rural Sciences, Canberra.
- Commonwealth of Australia (2007) *Leading Practice Sustainable Development Program for the Mining Industry: Biodiversity Management*, Department of Industry, Tourism and Resources, Australian Government, Canberra. Retrieved from: <<http://www.ret.gov.au/resources/Documents/LPSDP/LPSDP-BiodiversityHandbook.pdf>>
- Connell, D., and Quentin Grafton, R. (Eds.) (2011) *Basin Futures: Water Reform in the Murray-Darling Basin*. ANU E Press, Canberra.
- Cooper, N., Webber, L., and Nicolson, K. (2010) Conservation Partners for the National Reserve System Program: a Western NSW focus. In: *Proceedings of the 16th Biennial Conference of the Australian Rangeland Society*, Bourke, Eldridge, D.J. and Waters, C., Australian Rangeland Society, Perth.
- Central West Catchment Management Authority (2011) *The Catchment Community. Central West Catchment Action Plan 2011-2021 – Consultation Draft. A shared vision for the management, preservation and improvement of the Central West Catchment's natural resources*, 14 June 2011, Available from: <<http://cw.cma.nsw.gov.au/AboutUs/2011capconsultation.html>>
- Department of Environment, Climate Change and Water (2010) *NSW Natural Resources Monitoring Evaluation and Reporting Strategy 2010-2015*. 14 June 2011 Available from: <<http://www.environment.nsw.gov.au/soc/NaturalresourcesMER.htm>>
- D'Emden, F., and Llewelyn, R. (2004) No-till adoption and cropping issues for Australian grain grower, *New directions for a diverse planet: Proceedings of the 4th International Crop Science Congress*, Brisbane, Australia, 26 Sep - 1 Oct 2004.

- Ellis, F. (2000). *Rural Livelihoods and Diversity in Developing Countries*, Oxford University Press, Oxford, UK.
- Fox, J. (2001) Vertically integrated policy monitoring: A tool for civil society policy advocacy. *Nonprofit and Voluntary Sector Quarterly*, Vol. 30, 3, pp 616-627.
- Godden, L., and Ison, R. (2010) From Water Supply to Water Governance, In: *More Than Luck*, Davis M. and Lyons M., pp. 177-184, Centre for Policy Development, Sydney Australia.
- Ison, R. L. (2010) Governance that works. Why public service reform needs systems thinking, In: *More Than Luck*, Davis M. and Lyons M., pp.215-228, Centre for Policy Development, Sydney Australia.
- Ison, R. and Wallace, P. (2011) Planning as Performance: The Murray-Darling Basin Plan, In: *Basin futures: water reform in the Murray-Darling basin*, Connell, D. and Quentin, Grafton R., p399-412, ANU E Press Canberra.
- Jacobs, B., Brown, P. R., Nelson, R., Leith, P., Tracey, J., McNamara, L., Ahmed, M. and Mitchell, S. (2011). *Monitoring, Evaluation and Reporting Natural Resource Manager Capacity for NSW Catchments*. Final Technical Report to NSW Department of Environment, Climate Change and Water. NSW Government, Sydney, Australia.
- Lane, M., Taylor, B., and Robinson, C. (2009). Introduction: contested country - regional natural resource management in Australia, In: *Contested Country: Local and Regional Natural Resources Management in Australia*, Lane, M., Robertson C., and Taylor, B., pp91-107, CSIRO, Collingwood, Australia.
- Lauber, T. B., Decker, D. J., and Knuth, B. A. (2008) Social networks and community-based natural resource management. *Environmental Management* Vol. 42, pp 677-687.
- Leach, M. (Ed.) (2008) *Re-framing Resilience: a Symposium Report*, STEPS Working Paper 13, STEPS Centre, Brighton, UK.
- Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes T. P., and Wilson J. (2006) Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, Vol. 11, 1, 19. [online] URL: <http://www.ecologyandsociety.org/vol11/iss1/art19/>
- Leith, P., Jacobs, B., Brown, P.R., and Nelson, R. (in press). A participatory assessment of NRM capacity to inform policy and practice. Cross-scale evaluation of enabling and constraining factors. *Society and Natural Resources*.
- Lloyd, M., Barnett, G., Doherty, M., Jeffree, R., John, J., Majer, J., Osborne, J., and Nichols, O. (2002) *Managing the Impacts of the Australian Minerals Industry on Biodiversity*. Australian Centre for Mining Environmental Research , 7 September 2011, Available from: <<http://pubs.iied.org/pdfs/G00569.pdf>>
- Longstaff, P. H. (2009) Managing surprises in complex systems: multidisciplinary perspectives on resilience. *Ecology and Society* Vol. 14 1, 49. [online] URL: <http://www.ecologyandsociety.org/vol14/iss1/art49/>
- Luck, G., Race, D., and Black, R. (Eds.) (2011) *Demographic Change in Australia's Rural Landscapes: Implications for Society and the Environment*. CSIRO Publishing, Collingwood, Australia.
- Marshall (2011) *Improving Economic Accountability when using Decentralised, Collaborative Approaches to Environmental Decisions*. Institute for Rural Futures, University of New England, Armidale, Australia

- Maru Y. (2010) *Resilient regions: Clarity of concepts and challenges to systemic measurement*. Socio-Economics and the Environment in Discussion. CSIRO Working Paper Series, CSIRO, Canberra.
- Nelson, R., Kokic, P., Crimp, S., Martin, P., Meinke, H., Howden, M., Devoil, P., and Nidumolu, U. (2010). The vulnerability of Australian rural communities to climate variability and change: Part II - Integrating impacts with adaptive capacity. *Environmental Science and Policy*, Vol. 13, pp 8-27.
- Nelson, R., Kokic, P., Elliston, L., and King, J.-A. (2005). Structural adjustment: a vulnerability index for Australian broadacre agriculture. *Australian Commodities* Vol. 12, pp. 171-179.
- Nkhata, A., Breen, C., and Freimund, W. (2008) Resilient social relationships and collaboration in the management of social-ecological systems. *Ecology and Society* Vol. 13, 1, 2. [online] URL: <http://www.ecologyandsociety.org/vol13/iss1/art2/>
- Natural Resources Commission (2011) *Framework for assessing and recommending upgraded catchment action plans*. Document No: D11/0769, 21 June 2011, Available from: <<http://www.nrc.nsw.gov.au/content/documents/Framework%20for%20CAPs.pdf>>
- NSW Liberals and Nationals (2011) *Strategic regional landuse: triple bottom line assessment to protect our regions*, 5 September 2011 Available from: <<http://grip.org.au/documents/doc-47-strategic-regional-land-use-policy---document.pdf>>
- NSW Minerals Council (2011) *NSW Coal and Gas Strategy - April 2011*. 5 September 2011, Available from: <<http://www.nswmin.com.au/default.aspx?FolderID=36>>
- Olsson, P., Folke, C., and Hahn, T. (2004) Social-ecological transformation for ecosystem management: the development of adaptive co-management of a wetland landscape in southern Sweden. *Ecology and Society* Vol. 9, 4, 2. [online] URL: <http://www.ecologyandsociety.org/vol9/iss4/art2>
- Rammel ,C., Stagl, S., and Wilfing H. (2007) Managing complex adaptive systems - A co-evolutionary perspective on natural resource manngement. *Ecological Economics* Vol. 63, pp. 9-21.
- Robbins, L., and Dovers, S. (2007) NRM regions in Australia: the 'haves' and 'have nots'. *Geographical Research*, Vol. 45, 3, pp. 273-90.
- Smith, C., and Bosch, O. (2004) Integrating Disparate Knowledge to Improve Natural Resource Management, *Proceedings of the 13th International Soil Conservation Organisation Conference*, Brisbane, July 2004.
- Smith (2009) Mining and the Environment. Briefing Paper No 6/09, NSW Parliamentary Library Research Service, Sydney.
- Stanley, J., Clouston, B., and Binney, J. (2005). *Understanding social and economic influences on natural resource management decisions*. Department of Natural Resources, Mines and Water, Queensland State Government, Brisbane, Australia.
- Walker, B., Carpenter, S., Anderies, J., Abel, N., Cumming, G., Janssen, M., Lebel, L., Norberg, J., Peterson, G., and Pritchard, R. (2002) Resilience management in social-ecological systems: a working hypothesis for a participatory approach. *Conservation Ecology* Vol. 6, 1, 14. [online] URL: <http://www.consecol.org/vol6/iss1/art14/>.
- Walker, B., and Salt, D. (2006) *Resilience thinking: sustaining ecosystems and people in a changing world*, Island Press, Washington.



## **Sustainable Natural Resources Management**

Edited by Dr. Abiud Kaswamila

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Natural resources conservation is one of the dilemmas currently facing mankind in both developed and the developing world. The topic is of particular importance for the latter, where the majority depend on terrestrial ecosystems for livelihood; more than one billion people live in abject poverty earning less than a dollar per day; more than 3.7 billion suffer from micronutrient deficiency and more than 800 million suffer from chronic hunger. Population increase, resource use conflicts, technological advancements, climate change, political doldrums, and unsustainable use and harvesting of resources have all put more pressure on natural resources leading to land degradation and poverty. To achieve a win-win situation, we need to change our mindset by thinking outside the box through advocating integrated and holistic approaches in managing our natural resources. This book presents a variety of sustainable strategies and/or approaches including use of GIS and Remote Sensing technologies, decision support system models, involvement of stakeholders in major decisions regarding use of natural resources, community level initiatives, and use of surveillance and monitoring mechanisms.

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