

DESERT KNOWLEDGE CRC

Outback Institutions:
An application of the
Institutional Analysis and
Development (IAD) framework
to four case studies
in Australia's outback

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List of shortened forms

ABS	Australian Bureau of Statistics
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DKCRC	Desert Knowledge Cooperative Research Centre
DNRM&W	Department of Natural Resources, Mines and Water
GDCC	Georgina and Diamantina Catchment Committee
GDROP	Georgina and Diamantina Draft Resource Operations Plan
IAD	Institutional Analysis and Development
LGA	Local Government Area
ML	mega litre
NRM	Natural Resources Management
SIA	Strategic Impact Assessment
WRGDP	Water Resource (Georgina and Diamantina) Plan 2004

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Executive summary

Compiled by Anne Leitch

The Australian outback is a unique ecological and social landscape. The people who live here cope with harsh and variable environmental conditions, particularly in terms of rainfall and the availability of surface water. The human population density is very low – less than 0.001 people per km² – which is considerably less than the national average of 2.6 people per km². This population is widely dispersed around small urban centres that are remote from major Australian cities. The dominant land use is grazing, while other land uses include agriculture, mining, tourism, defence and nature conservation. There is a growing interest in a broader diversity of economic activities, particularly ecotourism, to supplement grazing activities.

Environmental drivers are dominated by the availability of water, with ‘droughts and flooding rains’ likely to remain a central feature of life in outback regions of Australia. Water supply for human or ecosystem use across this region is determined by the highly variable rainfall and very high evaporation rates relative to rainfall. Water issues are very different between coastal and interior outback regions, including in the regions in this study. Along the coastal and semi-arid region surface water flows are more reliable; in the interior they are highly episodic and hence unreliable. In the interior, water bores are vitally important sources of reliable water necessary to support human populations and their production systems.

These harsh environmental factors frame all human activities in these regions, and, in turn, some human activities lead to adverse environmental impacts such as erosion. Consequently, public interests and stewardship roles of various tiers of governance impose institutional constraints, such as rules, that seek to align individual activities and decision making with the interests of the wider community.

Water supplies, and the institutions that surround water supplies, have come into the spotlight in recent times. The institutional history of water in Australia is closely linked to the colonisation and settlement policy of the country, and in the main has been left within the jurisdiction of the states. Each state considers its water resources and its own approach to water management, allocation and use in isolation from the other states. Growth in water demand has been met over time by increased capture and storage of surface water and the development of ground water resources. The resource has appeared endless, but recent prolonged drought has challenged this thinking and the institutions surrounding water supplies.

In this context, the research project ‘Outback Institutions’ aimed to assess the rules and institutional arrangements across four case studies in outback regions of Queensland and the Northern Territory. The specific research goal was to test how well the Institutional Analysis and Development (IAD) framework (Ostrom 2005) applied to the circumstances of Australia’s outback regions. This framework has been applied to understanding institutions for managing common pool resources in more than twenty countries around the world but has not previously been applied systematically in Australia.

The case studies were chosen in close consultation with key stakeholders to provide a ‘two-by-two’ comparison. Two case study regions were chosen in Queensland (Etheridge Shire, Diamantina Shire) and two in the Northern Territory (Daly River region, Alice Springs). These also represent desert regions (Alice Springs, Diamantina Shire) and savanna regions (Daly River region, Etheridge Shire). Another important criterion for selection was the willingness of the local community to be involved in the research process.

Jurisdiction	Environmental conditions	
	<i>savanna regions</i>	<i>desert regions</i>
	<i>Queensland</i>	<i>Diamantina Shire</i>
	Etheridge Shire	
	Daly River region	Alice Springs

Etheridge Shire

The first case study presented in this report was used as a pilot study. It was based in the Etheridge Shire (population 1012, area 39 000 km²) which is located within the tropical savanna of the Northern Gulf region and has an economy predominantly based on pastoralism. Detailed attention in this case study was given to land-use decisions and engagement in community development activities because they are activities for which policies can be devised to improve economic and sustainable development outcomes. Changing the formal and informal rules that guide and govern these two different kinds of decisions that people can make in the Etheridge Shire – the decision to improve one's own situation and the decision to improve the situation for others in the community – may expand the available options for people in the Shire to achieve their goals and aspirations.

One of the defining characteristics of the Etheridge Shire region is the relatively low levels of interaction, not only among residents, but between the Shire's inhabitants and other stakeholders. Significant changes and the introduction of new government policies and regulations within the last decade represented a significant change for the region and added to a sense of frustration and uncertainty which, in turn, has had a considerable impact on land-use decisions. Key challenges facing the region include the community's limited ability to adapt to social, political and legislative changes affecting pastoralism; community attributes which reduce the amount of active community engagement; and lack of access to service industries, particularly banks, professionals and labour.

Methodologies used in this case study included an agent-based model, which analysed the potential impacts of the adoption of a new social norm.

The Etheridge Shire case study was implemented before the others and experienced a number of significant challenges, particularly the loss of key research staff. This resulted in a lack of consistent engagement with the region's study participants and complicated the application of the IAD framework. However, lessons learned through the case study informed and improved the application of the IAD framework in the other three case studies.

Diamantina Shire

The second case study focused on the development of the Water Resource (Georgina and Diamantina) Plan, which was prepared as a statutory requirement under the *Water Act 2000* of the Queensland Government and came into force on 6 August 2004.

The Diamantina Shire covers an area of 94 832 km² (5.5% of the Queensland land area) and is fully contained within the Georgina and Diamantina catchment. The estimated resident population of the Shire was 306 people in 2004. The regional economy of the Plan area is based on agriculture, mining, tourism and public sector employment. The Georgina and Diamantina catchment is unique, as it is a major tributary of the Lake Eyre Basin, the world's largest internally draining system, which covers an area of 1.2 million km², or about 18% of the land area of Australia. A feature of these types of arid and semi-arid environments is variable drought and flood cycles, which are important to the viability of the lower Diamantina and Georgina region.

The development of the *Water Resource (Georgina and Diamantina) Plan 2004* planning process involved a consultation phase, which was the key formal mode of interaction between the participants in the action arena. Two key areas of concern arose through this consultation process: enhanced protection of in-stream habitats and waterholes and connectivity between these; and the need for further and more explicit recognition of interstate interests and for integrated monitoring programs across the Lake Eyre Basin. Issues that emerged during the consultation phase were in the area of economic benefits, environment, equity issues and monitoring. Procedural and capacity issues emerged, with residents feeling that the process was not designed and executed with consideration of their needs; some key stakeholder groups, such as Aboriginal people, were under-represented in the process.

A key conclusion of the study was that the application of the IAD framework was a useful way to understand and evaluate the 'rules in use' in this region. Ostrom's design criteria that appear particularly relevant to this region are clearly defined boundaries, proportional equivalence between benefits and costs, collective-choice arrangements, monitoring, graduated sanctions and conflict resolution mechanisms, minimal recognition of rights to organise, and nested enterprises.

Daly Shire

The third case study, in the Daly River region, focused on the testing of a new institutional arrangement for the allocation of water in a tropical savanna setting for the Katherine-Daly River system in the Northern Territory under the broader policy context of the National Water Initiative, a national program of water reform.

The Daly River, with an average annual outflow of 6730 gigalitres, has the fourth largest discharge of any tropical river between Cairns and Broome. Its vast underground aquifers ensure relatively reliable flows of good quality water during the dry season which, combined with its high-potential soils, are leading to the consideration of further agricultural development in the region. This hydrological regime also contributes to the unique ecological nature of the Daly River system, its cultural significance for both Aboriginal people and non-Aboriginal people living in the region, and to the existence of habitats that support significant biodiversity and conservation values.

The core agricultural enterprises undertaken in the region are cattle production, hay and seed production, agroforestry and horticulture (including mangoes, melons, vegetables and citrus). All forms of agricultural production are considered likely to increase significantly.

In this project, the Northern Territory Government's Department of Natural Resources, Environment, the Arts and Sport (NRETAS, then NRETA) and Department of Primary Industry, Fisheries and Mines (DPIFM – now part of Department of Regional Development, Primary Industry, Fisheries and Resources), the NT Horticultural Association and the NT Agricultural Association formed a collaborative relationship to explore – by analysing a set of different institutional policy scenarios – the potential of a new water trading institutional arrangement.

This study was concerned specifically with how irrigating growers in the region might respond at the operational level, firstly to a market where there previously was none, and secondly to different market scenarios.

The IAD framework was found to be useful to gain a better understanding of how the interactions between formal rules (the National Water Initiative), human behaviours (growers' bidding strategies) and the economic, social and ecological context jointly structure the outcomes associated with the introduction of this new institutional arrangement. In particular, the use of the IAD framework provides important insights into the collective-choice and operational levels of decision making and how these different levels interact. In broad terms, the dynamics at the operational level may be understood as a response to the structure and dynamics of collective-choice level, and those at the collective-choice level may be understood as a response to those at the constitutional-choice level.

Alice Springs

The fourth case study is an institutional analysis of a recent draft strategy developed for the management of water resources in Alice Springs.

Alice Springs is the largest inland population centre in the Northern Territory, with a population of 28 000 (with a 5% annual turnover in population) and 300 000 visitors each year. Due to variable rainfall (median rainfall is 286 mm/year, but the range is highly variable at 60–903 mm/year) and high evaporation rates (3000 mm/year), there are no permanent surface waters but one intermittent river, one creek, and several waterholes.

In desert towns such as Alice Springs, water is one of the critical resources that determine sustainability. The primary sources of water for Alice Springs are the surrounding deep and shallow aquifers. Recharge of these aquifers is limited and the water is currently used mainly for town domestic water supply, business, stock and horticulture. The uncertainty of water supplies requires a re-evaluation of the water strategy every five years and an overhaul every ten years.

The action arena has two components: the action situation and the participants. For this study, the action arena of interest is the actors and interactions that contributed to drafting the *Alice Springs Water Resource Strategy* (ASWRS). The focal action situation is the Steering Committee, through which representative agencies bargain over the allocation of water and develop a draft ASWRS to include a range of perspectives. The draft ASWRS would be submitted to NRETAS for final editing, and then to the Controller of Water, the Minister and, upon the Minister's discretion, the Cabinet. The final ASWRS is then implemented with the advice of a separately constituted local review panel, the Alice Springs Water Advisory Committee.

The Steering Committee, as in other common-pool resource situations, is experiencing the tension between collective long-term outcomes and short-term organisational (individual) interests. As a result, both NRETAS staff and members of the committee continually reflect on the importance of rules to address this conflict, and subsequently the IAD design principles emerged as important. These principles were expressed in the Steering Committee interactions about: 1) their right to organise to develop 2) clear rules for resource use; 3) proportionally valuing the benefits of each use; 4) establishing local-level rules 5) nested in other layers; 6) a Water Advisory Committee to monitor and establish realistic sanctions for local water use; and 7) low-cost conflict resolution processes.

Evaluation of the community involvement processes and IAD analysis of the Steering Committee process support our finding that Alice Springs has the capacity for local governance of its water resource as a node in a polycentric system.

Cross-study synthesis

In all four case studies it was noted that decision-making power was centralised and was located outside of the local community. The colonial past has contributed to a top-down approach; in addition, low population densities (in three out of four case studies) contribute to evolving governance structures to centralise and externalise decision making.

The second finding common to three of the four case studies shows that the consideration of local knowledge and end-user perspectives in decision-making processes is considered in process-related rules. Such an involvement of the local community is often not mandatory and so defines a significant degree of uncertainty regarding potential involvement in processes on the collective choice and operational level for local communities.

The third finding in all case studies shows that the high demand for information by external (usually government) agencies is perceived as a significant burden for the community.

The fourth shared finding in all cases is that local communities note a lack of transparency in decision-making processes. While local knowledge is demanded, the information flow is perceived as one-way, and reasons for decisions are not clearly communicated. Stakeholders across case studies stated that it was unclear both how information provided by the local community was used and what criteria would be, or had been, used by decision makers.

These shared circumstances were associated with high levels of frustration in the local communities in all four case studies. The centralised and externalised nature of decision making means that local communities are responsible for contributing significant amounts of local understanding but must rely on the goodwill of higher tiers of governance to be able to genuinely participate in decision-making processes. Three of Ostrom's design principles seem highly relevant for Australia's outback: collective-choice arrangements, minimal recognition of rights to organise, and nested enterprises.

Institutional Analysis and Development (IAD) framework – utility in outback case studies

The four case studies applied the conceptual model of the IAD framework based on the definitions of institutions and typology of rules. In the Etheridge Shire case study, the IAD framework was applied to the operational level with strong links to the collective-choice level. In the Diamantina Shire and the Alice Springs case studies the framework was applied to the collective-choice level and framed the analysis in the relevant constitutional context. In the Daly River case study the IAD framework was applied to the collective-choice level and the operational level, with some focus on the link between these two levels.

The IAD framework very effectively allowed a systematic analysis of institutional arrangements across state and territory borders. The study found that in testing the IAD framework in the context of the Australian outback, the four research teams were very positive about the clarity and the suitability of the framework. They also found that the terminology used by the framework facilitated communication of research goals and plans across the case studies. They also found that the discipline of the framework increased the validity of the research by forcing them to work through all steps, which meant they captured the bigger picture rather than jumped to an earlier, and perhaps misguided, conclusion.

However, the application of the IAD framework is not necessarily straightforward as the different case study teams interpreted various elements of the framework quite differently, particularly with respect to the conceptual building blocks, which limited the ability for cross-study comparisons beyond the identification of some important but quite general common challenges and experiences. It was also found that the static comparative properties of the IAD framework limited its effectiveness in a dynamic research context, although there is some potential usefulness in linking the structuring value of the framework to an animating method.

Major challenges that arose while testing the utility of the IAD framework in the Australian outback included:

1. The research teams were not extensively prepared for how to apply the IAD framework.
2. All four teams applied the IAD framework for the first time and did not bring previous experience with the framework into the case study, which led in some cases to a 'retrofitting' approach.
3. The cross-comparative intention shows how an institutional and a biophysical gradient form the informational basis of the case study selection process. However, some outcomes could be explained by biophysical variables framing the action arena or by institutional attributes.
4. During various phases of field work, stakeholders influenced the action arena and power relationships of different stakeholders; the resulting dynamics reduced the ability to apply the IAD framework appropriately.

Implications and recommendations

The implications of these research findings and the application of these three principles for policy makers, natural resource managers and researchers are discussed in order to improve the outcomes of institutional arrangements in outback communities.

The recommendations centred on eight key areas:

1. Institutional change to devolve centralised power
2. Improve local capacity to participate
3. Improve transparency of the decision-making process
4. Improve fairness of the process
5. Ensure processes can accommodate a variety of inputs and manage conflict
6. Improve accessibility of information
7. Recognise the local context
8. Establish effective monitoring.

For policy makers, suggestions are to:

Devolve power

- Consider a suite of constitutional and institutional changes to decentralise power. This requires long-term collaboration of all groups within a region
- Assess political feasibility in developing transferable, enforceable and tradeable private property rights, and in minimising government intervention
- Ensure clearly defined resource boundaries based on credible and reliable science to establish a threshold level to signal what the environmental targets are for all resource users
- Clarify roles and ensure transparency of operations of controlling bodies
- Develop policies that legitimise the role of the community and that appreciate values of all stakeholders, especially local stakeholders.

Build capacity

- Develop and facilitate capacity-building programs (for the individual, groups and institutions) within the community that build community leadership, capacity, skills and inclination to stay and contribute to the community
- Base capacity-building programs on a ‘soft systems’ approach that recognises the roles of a wide range of players and different types of knowledge and expertise, not only scientific or technical knowledge
- Develop and implement (fund) capacity-building activities that recognise, value, and accommodate people’s differences, including different values and aspirations, e.g. strategies to build the capacity of key individuals (i.e. leadership) as well as key stakeholder groups.

Ensure transparency and fairness

- Be aware of potential ways in which outback regions may function differently from more ‘settled’ regions where most policy is made and tested
- Develop community engagement processes tailored for conditions of the Australian outback (see design process above); most regions have large travel distances and low population density

- Make policy documents available in plain language: terms used should be simple and clear and, where necessary, the relationship between terms explained
- Provide feedback about how the information provided by the local community was used as well as what criteria would be, or had been, used by decision makers
- Set up networks and processes for transparency and responsiveness on the part of government to create trust and long-term relationships that would benefit individuals, communities and institutions with an interest in the region.

Manage conflict

- Ensure provision for structuring negotiation over resource allocation problems, as this can help incorporate a range of aspirations and viewpoints and reduce conflict.

Recognise local knowledge

- Link policy making with local knowledge and science which would support development of more acceptable policy options as well as robust monitoring programs
- Develop an information ‘hub’ to support implementation of legislative and institutional responsibilities.

Effectively monitor

- Ensure early development of a comprehensive and negotiated monitoring system to enhance trust and improve perceptions about agencies’ ability to equitably and efficiently manage the resource
- Ensure regulatory agencies have jurisdiction to monitor and audit compliance and enforce individual breaches.

For managers, suggestions are to:

Devolve power

- Support development of a functional regional institution to coordinate negotiated solutions to regional problems.

Build capacity

- Support communities to be able to handle increased decision making through supporting, monitoring and providing feedback on capacity-building initiatives
- Support resource users to come to a wide agreement about the nature and extent of the resource and about the environmental target
- Build networks among resource users to increase trust and facilitate information sharing around data, processes and best practices
- Support all sectors within regions to develop their own planning and management capacity
- Support all sectors to develop their own capacity-building strategies and identify their own skill and training needs
- Provide a range of facilitation skills, techniques and processes to support negotiation and capacity building
- Improve local opportunities for vocational training, schooling and employment
- Support programs that facilitate provision/access to broadband internet by the community.

Ensure transparency and fairness

- Provide clear and timely information to all residents of the Shire about relevant institutional arrangements and the impacts of and opportunities arising from changes in legislation
- Support networks and processes for transparency and responsiveness on the ground in the region to create trust and long-term relationships that will benefit individuals, communities and institutions with an interest in the region
- Ensure communication is formalised to generate adequate and accessible information as well as trust in the process. Work with local community to determine appropriate and acceptable level of exchange of information and communication, and ensure that information provided is in an accessible format and language with minimal jargon
- Ensure a reporting system that establishes a clear link between land management actions and resulting environmental outcomes
- Use a range of communication processes to ensure that those not directly involved in the process are kept informed of progress and have the opportunity to become involved
- Make hidden costs subsidies more transparent to the public/local stakeholders. Develop processes that will accommodate diverse viewpoints
- Build networks among resource users to increase trust and facilitate information sharing of data, processes and best practices
- Minimise transaction costs of monitoring, gathering and exchanging information and enforcement when compared with the potential benefits gained.

Recognise local knowledge

- Improve the on-ground practices of state agencies in providing information and services
- Work with local community to determine appropriate and acceptable exchange of information/communication
- Develop information bases that are bottom up and recognise community knowledge
- Provide resources to participants to engage in the process (e.g. reimbursement for travel, time to participate and also to conduct representative activities)
- Apply the precautionary principle and greater integration of local knowledge.

Effectively monitor

- Set up monitoring schemes that are effective, transparent, consistent and credible to all participants and can be implemented
- Ensure a reporting system that establishes a clear link between land management actions and environmental outcomes
- Ensure there are effective incentives that support local participation in monitoring schemes. Ensure these incentives are well communicated and transparent.

For researchers, suggestions are to:

Decision making

- Conduct research into the influence of the role played by individuals and that their use of personal mental models plays in institutional change
- Undertake participative research to determine how communities can move from a piecemeal institutional system to one that is holistic and strategic

- Provide information and trial new ideas for institutions and processes that support remote and sparsely populated communities to effectively manage their resources
- Develop understanding of how instruments such as market-based instruments could influence pastoralists' abilities to manage their land for production and conservation outcomes
- Coordinate and engage with the community to generate research findings that meet their needs yet do not cause 'burn out' in the local community
- Develop methods for accurate pricing of water
- Better understand changing attitudes, including increasing demands for higher financial returns from water use as well as increasing demands for higher social, ecological and cultural benefits from water. Further investigation is needed about how these goals can be achieved in parallel, as well as about the individual and societal costs and benefits (and distribution of these) associated with these goals.

Data

- Provide reliable, accurate and accessible information on resource boundaries and limits
- Provide baseline data through long-term commitment and investment by researchers and their funders
- Collect essential baseline data on which to base monitoring plans.

Monitoring and reporting

- Support development of new conceptual models for incorporating social and economic information which can be used to measure capacity for change in communities. These can inform regional negotiation processes as well as assess the impact of policy change.
- Investigate impact of information flows on:
 - levels of participation of community members
 - sustainable outcomes
 - management practice.
- Design and test monitoring schemes that are effective, affordable, transparent, consistent, credible and can be implemented.

Research methodology

- Important focus for future research is moving from analysis of components of the institutional systems to the analysis of the links, dynamics and drivers between the components
- Develop process technologies and decision-support tools that can be used to structure negotiation and are applicable to a wide range of natural resource conflicts.

For some regions several operational level questions still need to be investigated for effective implementation of the Water Resources Plan, such as 'How will compliance be achieved?' and 'Will the applications of sanctions be effective?'

1. Institutional analysis in outback Australia

Alex Smajgl and Anne Leitch

Australia's outback regions are defined by their remoteness from urban centres along the coast and their low population density. In the Australian outback, harsh environmental factors constrain human activities, and, in turn, some human activities challenge the given constraints and lead to adverse environmental impacts. Irrigation activities, for instance, aim to transform landscapes for productive agriculture, mostly through accessing groundwater aquifers. Depending on usage levels, such activity can lead to negative externalities for other community members and to social consequences such as conflicts between community groups. Similarly, grazing is the dominant land use in the outback and is linked to high levels of erosion by many scientists. While environmental consequences range from freshwater ecology downstream to impacts on estuary and the lagoons with their reefs, economic consequences are often defined in the long-term usability of land due to loss of top-soil.

Consequently, public interests and stewardship roles of various tiers of governance impose institutional constraints, such as rules, in order to regulate individual decision making. In this context, the research project 'Outback Institutions' aimed to assess rules, later defined as institutional arrangements, in four case studies in outback regions of Queensland and the Northern Territory.

Methodologically, the project aimed to test how applicable the Institutional Analysis and Development (IAD) framework would be in Australia's outback regions. This framework was developed by Elinor Ostrom and her colleagues at the Center for the Study of Institutions, Population and Environmental Change (CIPEC) at the Indiana University (Ostrom 2005). The IAD framework conceptualises a situation according to initial conditions, the definition of the action arena, patterns of interaction with their outcomes and existing evaluation criteria. Therefore, the IAD framework shows promise for providing a structured approach to generically identifying rules and action situations.

The case studies were chosen in a stakeholder-driven process. For analytical purposes, two case studies were selected in Queensland and two in the Northern Territory, which would allow for comparing rules and their outcomes across state boundaries. Additionally, it was decided to choose for each state one case study in the desert region and one case study in the savanna region to allow analysis of the impact of environmental conditions on existing rule sets. Consequently, four areas were chosen as case studies in consultations with various stakeholders: Etheridge Shire, Diamantina Shire, the Daly River region and Alice Springs.

This report is divided into nine chapters. First, the IAD framework is explained, and other methods this study used are summarised. In Chapter 3 the outback is described according to its biophysical aspects, community aspects and rules. This description focuses on aspects that are relevant across all four case studies. Chapters 4–7 are dedicated to applying the IAD framework to the four case studies and summarising case-study-specific findings. Chapter 8 synthesises lessons learnt across the four case studies and discusses the utility of the IAD framework in the outback regions. Implications for policy, management and research are summarised in Chapter 9 and recommendations are given for enhancing institutional arrangements and processes for achieving more sustainable outcomes for outback Australia.

2. Framework and methods for analysing institutional arrangements in Outback Australia

Alex Smajgl, Anna Straton, and John Ward

2.1 Methodological context

This study aims to test the usefulness of the IAD framework (Ostrom 2005) in the context of the Australian outback. The research goal requires an identification of rules that govern resource use in outback regions. Methodology has to be chosen that enables three steps:

- the elicitation of information about rules that are in use and their outcomes within selected case studies
- a framework for structuring and analysing effectiveness and efficiency of rules in a given context
- an approach that allows the analysis of institutional dynamics for a given context and assumed changes.

Table 1 lists the methods on which this study is based and describes the purpose of these methods. Table 2 shows how these methods are used across the four case studies.

Table 1: Research methods

Method	Purpose
IAD framework	Structured identification and classification of rules and of action arenas
Interviews, semi-structured	Identification of individually perceived behavioural rules
Desktop literature review	Background information and data
Agent-based modelling	Dynamic what-if simulation of institutional changes and their ripple effects
Field experiments	Calibration of behavioural responses and validation of interview-based typology

The application of the IAD framework requires rich information on physical conditions of the region, existing rules and other attributes of the communities. Additional information on stakeholders and current outcomes also needs to be collated through desktop analysis and interviews.

The goal of this study also includes analysing the potential impacts from changes in rules or environmental conditions. The application of the IAD framework does not seek to answer what-if questions as discussed in section 2.2. Therefore, the simulation capacity, agent-based modelling and field experiments were implemented.

Table 2: Methods used in relevant case studies

	IAD populating methods		IAD animating methods	
	Desktop analysis	Interviews	Field experiment	Agent-based modelling
Etheridge	used	27	—	applied
Daly River	used	14	applied	applied
Diamantina	used	23	—	—
Alice Springs	used	9	—	—

In order to provide the methodological background, the IAD framework and the methods listed in Table 2 are described in the following chapters.

2.2 IAD Framework

The IAD framework has been developed to enable the analysis of ‘institutional settings’ – any situations that involve people interacting together in a certain context and following certain rules. The sets of rules relevant to any institutional setting are the institutional arrangements of that setting:

... an institution is simply the set of rules actually used (the working rules or rules-in-use) by a set of individuals to organise repetitive activities that produce outcomes affecting those individuals and potentially affecting others. (Ostrom 1992, p.19)

Institutions thus define and limit the set of choices individuals have; they are the framework within which human interactions take place (North 1990). Bromley (2006) points out that while institutions may constrain some individuals, they may also enable other individuals. For instance, constraining water use by a group of irrigators might protect biodiversity values, which provides benefits for those (current and future) individuals who enjoy water-linked ecosystem services.

The IAD framework is based on work by Elinor Ostrom and her colleagues at the Workshop in Political Theory and Policy Analysis at the University of Indiana (Dietz et al 2003; Kiser & Ostrom 2000; Ostrom 1992, 2005; Ostrom et al. 1994). This framework has been trialled and applied in a range of situations to systematically analyse the structure of situations faced by individuals and to determine how rules, the nature of events and the attributes of the surrounding environment and local community affect these situations over time.

Theories explaining individual behaviour in an institutional setting have concentrated on five main components:

1. the decision maker
2. the community affected by decision making
3. events or goods and services that interacting individuals seek to produce or consume
4. institutional arrangements guiding individual decisions
5. the decision situation in which individuals make choices.

(Kiser & Ostrom 1982).

The IAD framework has since evolved from this (Figure 1), although these key components remain in slightly modified forms.

Each application of the framework focuses on a specific activity (the *action situation*), the people who take part in this activity (the *participants*) and the *patterns of interactions* between them. The combination of activity and participants is called the *action arena*.

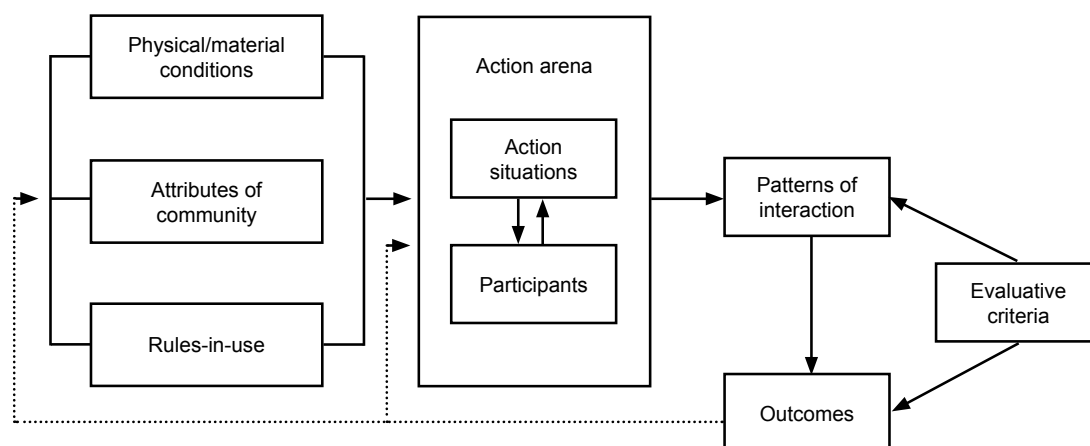


Figure 1: The Institutional Analysis and Development framework

Source: Ostrom 2005

Every action arena is influenced by a number of exogenous variables, broadly categorised to be *physical/material conditions*, *attributes of the community* and *rules*. The patterns of interaction between participants in an action arena result in *outcomes* that may feed back into the original exogenous variables and action arena and thereby restructure the situation. Both the outcomes and patterns of interaction are evaluated. It is most likely that different stakeholder groups will use different *evaluative criteria*. The following section explains these components in more detail.

2.2.1 Components of the IAD framework

2.2.1.1 The action situation and participants

The first critical choice to be made in applying the IAD framework is about the action situation for which the institutional arrangements need to be mapped and their impacts analysed: what is the particular action/activity that is to be understood? Ideally, the action situation is one for which the institutional arrangements can be modified to bring about more desirable outcomes.

An action arena involves *participants* in *positions* (playing specific roles) who must decide among diverse *actions* in light of the *information* they possess about *how actions are linked to potential outcomes*, the *control* they have over this linkage, and the *costs and benefits* assigned to actions and outcomes (Ostrom et al. 1994; Figure 2). These are the components that define the ‘internal structure’ of every action arena. An individual participant’s strategy in an institutional setting will be affected by this internal structure and also by whether they will face a situation once, or a specific number of times, or indefinitely (Ostrom 2005).

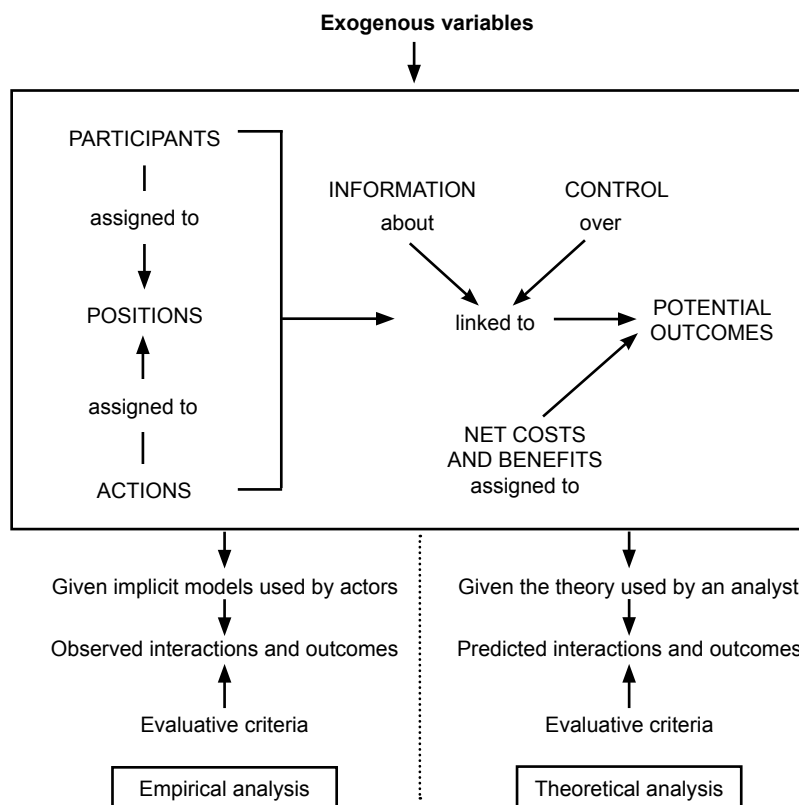


Figure 2: The internal structure of an action situation

Source: Ostrom 2005

The *participants* in an action situation are the decision-making entities who play a certain role and who are capable of selecting actions from a set of alternatives available in a decision process (Ostrom 2005). Several attributes of participants are relevant when representing and analysing specific situations. These

include the number of participants; their status as individuals representing their personal interests or as a team or ‘composite actor’ such as a household, company or organisation; and various individual attributes, such as age, education, gender and experience.

Positions are the connecting link between participants and actions, and they are seen as ‘slots’ into which participants move. For example, positions include: voters, judges, buyers, legislators, Councillors, etc. In most ‘organised’ situations, the specific position is assigned authorisation to take specific actions. The nature of a position assigned to participants in an action situation therefore defines the ‘standing’ or role of the individual in that situation.

Participants assigned to a position in an action situation must choose from a set of authorised *actions* at any particular stage in a decision process. An action can be an overt act as well as the choice not to act in some situations. For example, both voting for a candidate and abstaining from voting would be considered an action.

Outcomes are a combination of a physical outcome and the external and participants’ own intrinsic valuations of that outcome. The intrinsic valuation attached to an external reward or sanction is the internal value that individuals associate with the components of the rewards or sanctions (Frey 1997, Ostrom 2005). While this bundle of outcomes is often measured in terms of utility, assuming that this is the way that participants always evaluate outcomes is not necessarily the best practice (Ostrom 2005). When the analyst has a long-term interest in understanding how rules (or attributes of the biophysical world or the community) influence an action situation, greater precision is obtained by initially focusing on the physical outcomes of a situation rather than on utility of outcomes.

Concentrating on physical outcomes allows the analyst to understand how rules affect incentives, leading to the assignment of specific benefits and costs to that outcome. Furthermore, individuals may assign a positive or negative intrinsic value to actions or outcomes. If the person evaluates an action as being improper, they may assign a negative intrinsic value. If the person is proud of an action, they may assign it a positive intrinsic value.

Action–outcome linkages are the ways in which actions play out and result in outcomes and can be investigated through examining the relationships between ‘control’ and ‘state’ variables. People’s actions are the control variables that are considered to be linked to outcomes – state variables – if they cause an outcome to ‘come into being’, disappear or change in degree (Ostrom 2005).

The *extent of control* that a participant has over the linkage between an action and an outcome varies from absolute to almost none. Partial control can vary from an extremely small chance of affecting an outcome to a high probability of affecting an outcome (Coleman 1973, Ostrom 2005).

Access to information is another important working part of the action situation. Participants in an action situation may have access to complete or incomplete information. Almost all theoretical and formal representations of action situations assume that participants have access to complete information. It is assumed that each participant knows the number of other participants, the positions, the outcomes, the actions available, how actions are linked to outcomes (and thus the certainty, risk or uncertainty of the linkage), the information available to other players and the payoffs of the same (Ostrom 2005). In other words, complete information is an assumption that each participant knows the full structure of an action situation as described here. However, when information is less than complete, which is typically the case in practice, the question of who knows what at what juncture becomes very important. With incomplete information, how much any one individual contributes to a joint undertaking is often difficult for others to judge. When joint outcomes depend on multiple actors contributing inputs that are costly and difficult to measure, incentives exist for individuals to behave opportunistically (Ostrom 2005, Williamson 1975). *Benefits and costs* are cumulative external rewards (financial returns) or sanctions (fines) assigned to actions taken along a path to an outcome. For simplicity, the analysis

frequently assumes that acts are costly and outcomes are beneficial. Participants are then viewed as weighing the costs of an action against the benefits of an outcome. Actions may, however, have associated benefits and outcomes may be ‘bads’ instead of ‘goods’ (Ostrom 2005).

These components combine to define an action arena that can be analysed either empirically or theoretically (Figure 1). Empirical analysis involves observing actual interactions between participants and the outcomes that result from these interactions given the models used by participants to guide their behaviour. Theoretical analysis involves predicting the interactions between participants and the resulting outcomes given a certain theory chosen by the analyst. The analysis of patterns of interaction and outcomes will be discussed in further detail shortly.

2.2.1.2 Exogenous variables

After the action situation has been specified, the exogenous variables that may affect the structure of the action situation are described and their impacts on the action situation evaluated (left-hand section of Figure 1). These variables are grouped in the IAD framework into physical/material conditions (attributes of the physical world), attributes of community and rules (rules-in-use).

Physical/material conditions (attributes of the physical world): The biophysical world to which the action is related – for example, a fishery or a forest – is one of the critical variables that affects the structure of the action situation, as does the specific nature of the resource. For example, the material basis of a groundwater aquifer and the relationships with surface water in a river system will influence the decisions that participants can make about extraction from that resource, especially when these biophysical conditions underpin the designation of specific rules about extraction. This will be clear in the case study of the Katherine-Daly River system. Recent writings by Ostrom (2005) also include material conditions as influencing attributes, such as the funding available for a public consultation process or to support the infrastructure behind a water trading system.

Attributes of the community: The community broadly involved in the situation is another important variable. Several attributes of the community may influence the outcomes of an action situation. These include demographic attributes, such as education levels, size of the community and employment levels. These also include social attributes, such as the heterogeneity of aspirations or norms within the community.

The rules (rules-in-use): Each action situation is influenced also by sets of rules-in-use. These are the rules actually used by people to guide and govern their behaviour in repetitive activities, also known as ‘working rules’ (Ostrom 1992:19). Working rules are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what procedures must be followed, what information must or must not be provided, and what costs and payoffs will be assigned to individuals as a result of their actions (Ostrom 1986). Changing the working rules of an activity could result in changes to the outcome of that activity.

Working rules have been classified into seven types, each of which relates to the components of the internal structure of an action situation described above (Crawford & Ostrom 2005). The classes of rules are boundary, position, choice, payoff, information, scope and aggregation. The following summary is based on Crawford and Ostrom (2005).

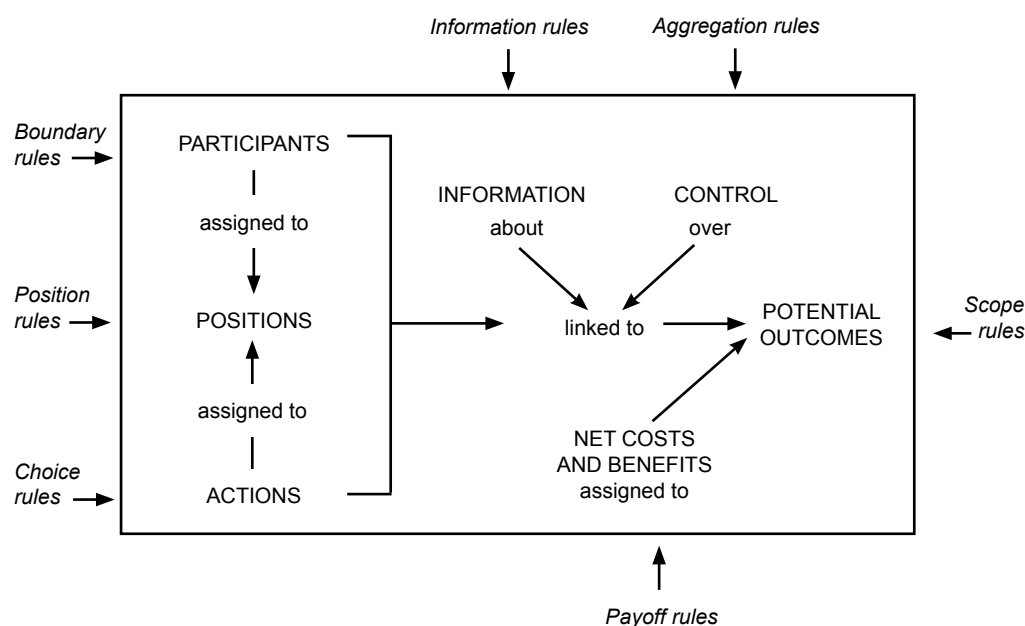


Figure 3: Rules as exogenous variables affecting the elements of an action situation

Source: Ostrom 2005

Boundary rules specify who is eligible to play a role, how the decision of who is eligible is made and how an individual can leave a role. As such, they define the attributes and conditions required to enter or gain a position in an action situation. Boundary rules that are used in the field can be broadly grouped into three general classes. The first type of boundary rules focuses on the generally acquired attributes of an individual such as citizenship, residency, or membership of a particular organisation. A second broad group of boundary rules relates to individual-ascribed or -acquired personal attributes. User groups may require that appropriation depends on age, ethnicity, clan or caste. A third group of boundary rules is based on the rights to appropriate a resource held by an individual and the relations of an appropriator to the resource itself or to other resources (for example, land holding has been a typical prerequisite for the right to hold an entitlement to water for irrigation). Boundary rules affect the types of participants with whom other participants will be interacting in relation to a particular resource. In applied terms this means that boundary rules define who has a right to enter and use a resource; that is, who has a right to a position in the resource use or management system.

Position rules are ‘placeholders’ to be filled by participants. In some action situations, there is only one position held by many participants (for example, the position of ‘resource user’). In other action situations, sets of rules assign different kinds of authority to different positions. For example, a resource user, government agency and community-based organisation are likely to have different types of authorities over natural resource management-based action situations and thus to have different actions available to them, creating the different positions (roles) to be filled (played).

Choice rules specify what a participant in a particular position must, must not or may do at a particular point in a decision process in light of conditions that may or may not have been met. For example, a choice rule might specify how many resource units appropriators may obtain from the resource, given that the appropriator has satisfied certain conditions. Choice rules may be devised to allow harvesting during a particular season only or to specify how resource appropriation must take place. Many forest resources, for example, are closed to all forms of harvesting during one portion of the year and open for extraction by all who meet the boundary rules during an open season. Most choice rules have two

components: rules about how resource units may be harvested and rules about how resources will be mobilised. These types of choice rules specify *duties* as contrasted to *rights*. Robust common-property regimes tend to rely on a close match between the *duties* and the *rights* of the users.

Payoff rules assign external rewards or sanctions to particular actions that have been taken, or to when outcome variables reach a particular level. This type of rule is often used in common-pool resource management as a way of introducing penalties for actions that are prohibited. Many user groups also adopt norms that socially ostracise or shun the rule breakers, and individual appropriators tend to monitor each other's behaviour rather intensely. Three broad types of payoff rules are used extensively: (1) the imposition of a fine, (2) the loss of appropriation rights, and (3) incarceration. Often sanctions are graduated to match the severity of the incursion.

Information rules specify what information participants in particular roles must, must not or may communicate to other participants in particular roles at particular points in the decision process, and the language and form in which this communication is to take place. These rules vary based on the size of the resource pool. Many smaller and informal systems rely entirely on a voluntary exchange of information and on mutual monitoring. Where resource units are very valuable, and the size of the group is larger, there are more and more requirements for the information that must be kept by appropriators or their officials.

Scope rules define the set of outcome variables that must, must not or may be affected as a result of actions taken within the action situation. These also define the range of outcomes for each variable that informs whether it has or has not been affected. Scope rules are generally created in order to limit harvesting activities in certain locations. Not allowing any appropriation from these locations can enhance the regenerative capacity of a system.

Aggregation rules specify who has responsibility for an action at each particular point in a decision process. For example, an aggregation rule will specify whether a decision is required by a single participant or by multiple participants, how much weight each participant will have relative to others, and how each person's contribution will accumulate to produce a final decision. Aggregation rules can be of two types: aggregation required to ensure actions are monitored and aggregation in the decision-making process. One aggregation rule found in diverse systems at the operational level is the requirement that harvesting activities be done in teams. This requirement increases the opportunity for mutual monitoring and reduces the need for the development of formal monitoring and enforcement mechanisms. At a different level of management, aggregation rules also determine who has the right to decide.

Adding together all of these types of rules for any one action arena makes it clear that the number of rules guiding and governing an institutional setting can be large. The interactions between all of these types of rules as they guide the actions of participants often result in a complex system of institutional arrangements. The ability of an analyst to conceptualise these multiple rules and multiple interactions is limited to the insight and tools we have available. In providing this common set of concepts and language, the IAD framework makes a significant contribution. One interesting finding from the literature (Ostrom 2005) is that no particular rule has a statistically positive relationship to performance across resource types, ecological zones and communities. On the other hand, the absence of any boundary or choice rule was found to be consistently associated with poor performance. Relying on only a single type of rule for an entire set of common-pool resources in a large region was also found to be negatively related to resource performance.

2.2.1.3 Patterns of interaction, outcomes and evaluative criteria

Three sets of attributes – physical/material conditions, community attributes and rules-in-use – combine to create the incentives and constraints for participants in an action situation. Participants behave according to these incentives and constraints, which also structure the situations they face. Participants'

behaviours combine into the *patterns of interaction* that determine the dynamics of an institutional setting. This box of Figure 1 is often animated for analysis using game theory (Ostrom et al. 1994) and/or agent-based modelling (Smajgl et al. 2007).

The strategic interactions among participants in different action situations produce different *outcomes* (Tang 1992). As stated above, analysis of the action-outcome linkages and the influence of exogenous variables can be either empirical (based on observations of actual behaviour) or theoretical (based on behaviour predicted by existing theory).

The patterns of interaction and their outcomes are evaluated based on certain *evaluation criteria*. These criteria may differ between stakeholder groups and it is important to be clear about which groups will evaluate the outcomes from which perspective. The same physical outcome may be evaluated positively by one group and negatively by another. Depending on the particular action situation chosen and the nature of the impacts and how they are evaluated, the analysis may then lead to insights about how current institutional arrangements restrict or enable desirable outcomes and to recommendations about a set of institutional arrangements that may be able to bring about more desirable outcomes.

2.2.2 Levels of analysis

The IAD framework can be used to analyse sets of rules existing at different ‘levels’. Rules are often nested within, or form the greater context for, sets of rules at a different level of operation. Three vertical levels of rules analysis, proposed by Ostrom et al. (1994) and Kiser and Ostrom (1982, 2000), are seen as cumulatively affecting the actions taken and outcomes obtained in any setting (Figure 4):

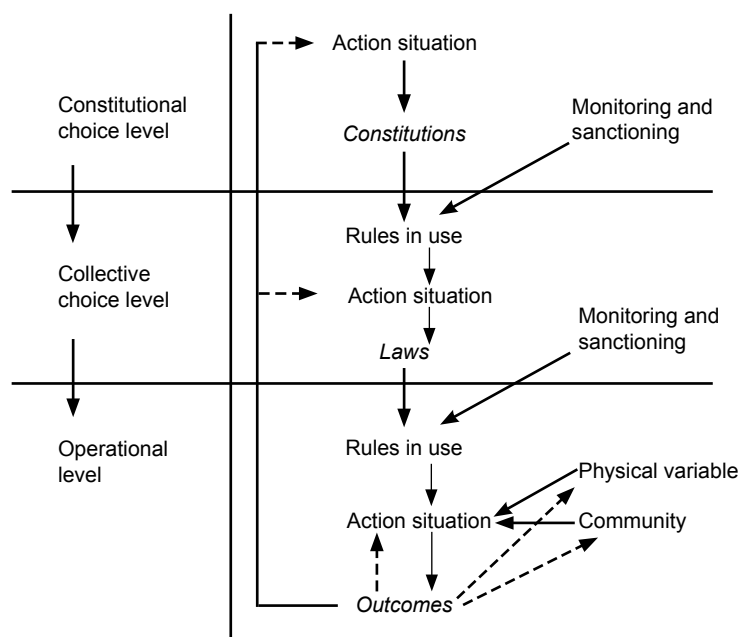


Figure 4: Levels of rules and the linkages between them

Source: adapted from Ostrom et al. 1994:47

1. *Operational rules.* This is the set of rules that affects day-to-day decisions in action settings. Actions are taken or decisions about future actions are made by individuals operating at this level and are based on the set of institutional arrangements within which they operate.
2. *Collective-choice rules.* The next tier of rules typically determines what the basic operational rules are and in particular sets the rules about who is eligible to participate at the operational level. Collective-choice level decisions are made by officials in order to determine, enforce, continue or alter actions authorised within institutional arrangements. This level of rules is typically reviewed or recreated in a 5–10 year time frame.

3. *Constitutional-choice rules.* This is the top tier, determining frameworks for lower-level rule creation. At this level, rules are set to guide future collective-level decisions that will authorise future operational-level actions. Therefore, constitutional choices are decisions about decision rules.

Constitutional-level decisions and rules have a very long, and often undetermined period of existence. Constitutional decisions establish institutional arrangements and their enforcement for collective choices; in other words, they create constitutions. Collective-choice level decisions, in turn, establish institutional arrangements and their enforcement for individual actions (Kiser & Ostrom 2000); they create laws. Operational-level decisions determine, through the actual on-ground behaviour of participants, the outcomes in any institutional setting. Each level has its own action situation characterised by the internal structure described above.

Figure 4 presents linkages between the three levels of rule creation. The constitution resulting from the constitutional-choice action situation creates the rules-in-use governing the collective-choice action situation. The outcome of the collective-choice level action situation is the resultant laws that then become the rules-in-use governing the operational-level action situation. The constitutional-choice level monitors and sanctions the use of rules at the collective-choice level, and the collective-choice level monitors and sanctions the use of rules at the operational level. This is the influence of higher levels on lower levels. Outcomes at the operational level may also feed back to influence changes in collective-choice level rules, and changes in collective-choice level rules may feed back to influence constitutional-choice level rules. Thus the influence flows both downward and upward, although less so in the upward direction.

2.2.3 Application of the IAD framework in the Outback Institutions project case studies

The IAD framework has been applied in the current case studies in a number of different ways.

The Etheridge Shire case study involves a theoretical and empirical analysis of an operational-level institutional setting where residents of the Shire are making decisions about land uses in which to become involved. This case study also includes a theoretical and empirical analysis of a collective-choice level institutional setting involving residents of the Shire making decisions about whether to engage in community development activity. These two levels of analysis are not directly linked.

The Katherine-Daly case study involves a theoretical analysis of the institutional setting within which collective-choice level decisions are made about water allocation and management. These rules are impacted upon at the constitutional-choice level by a national process of water reform known as the National Water Initiative, and they play out at an operational level by impacting on the day-to-day water use decisions of growers through the implementation of a new set of rules about water allocation, being a water trading system. This case study is mainly an empirical analysis of the behaviours of growers in responding to this new set of rules and the use of this to simulate a number of policy options.

The Diamantina Shire case study applies the IAD framework to theoretically and empirically analyse the water planning process in the Georgina-Diamantina catchment at the collective-choice level.

The Alice Springs case study involves an institutional analysis of a recent draft strategy developed for the management of water resources in the region. Water is one of the critical resources that determines the sustainability of the desert town of Alice Springs and is supplied primarily by the surrounding deep and shallow aquifers.

Two key features of the IAD framework are, first, that it presents a set of concepts and a common language for individual analysts which enables meta-learning about institutional settings and arrangements. The second feature is that it does not limit the use of any particular theory in applying the framework, which means that researchers, while they apply a common framework, are not constrained

in the methods they use. Thus, the application of the IAD framework to these four case studies has enabled a picture to be sketched of some of the institutional settings faced in outback regions of Australia. It also aids understanding of how these institutions may help or hinder people in these regions to achieve their aspirations, and of the way in which these institutions affect sustainability.

2.3 IAD contextualising methodologies

To gather the information needed to apply the IAD framework to the four case studies, two more methodologies were applied.

2.3.1 Desktop study

The various elements of the IAD framework require rich information in order to describe the context adequately. As a first step, the context of each case study was scoped out by a desktop study. The term ‘desktop study’ (or ‘desktop analysis’) describes in general the analysis of published material (Wheeler & Peszynska 2002) and excludes generation of primary data via field work.

In this study the application of the IAD framework was prepared by reviewing literature on the case study regions and data sets that quantify indicators such as population and land use. Crucial for all case studies was the study of documents that describe planning processes relevant to each action arena.

2.3.2 Interviews

Across all studies 79 open-ended interviews (Marshall & Rossman 1999) were conducted to gain insights into formal and informal rules perceived by individuals. As rules are not determined by individuals, the existence of rules has to be confirmed by several individuals.

2.4 IAD animating methodologies

2.4.1 Agent-based modelling

Agent-based models (ABM) are often used in a land-use context and allow the simulation of interactions between heterogeneous actors and landscape dynamics (Brown & Slee 2004, Parker et al. 2002). More generally, they allow analysis of ‘evolving systems of autonomous interacting agents’ (Tsfatsion 2003). As Deadman (1999) points out, ABM is a bottom-up approach, and instead of defining the overall behaviour ‘this overall behaviour emerges as a result of the actions and interactions of the individual agents’. The modeller defines the initial conditions of the game, which includes, for instance, how many actors exist in the first period, and how much of a natural resource is available. Critical for the specification is the definition of strategies for each of the agents as well as the ‘if ... then’ conditions. ‘The result is a complicated dynamic system of recurrent causal chains connecting agents’ behaviours, interaction networks, and social welfare outcomes’ (Tsfatsion 2002). In-depth descriptions of agent-based modelling can be found in, for instance, Holland and Miller (1991) and Holland (1992).

Trials in two of the case studies (Etheridge Shire and Daly River) implement the IAD framework results in an agent-based model. These models broaden the IAD capacity by allowing the analysis of institutional dynamics in what-if scenarios. The underlying assumption is that rules have the ability to respond to institutional changes (or other changes in the context). As a collective outcome, rules adapt according to how group members can fulfil their goals under given changes (Bromley 2006, Smajgl & Larson 2007).

The calibration of both models is based on information from desktop studies, interviews, and the application of the IAD framework. Additionally, field experiments were conducted in the Daly River case study in order to test model assumptions. While the Daly River case study (Chapter 6) describes the contextual use of agent-based modelling and experiments, the following section explains experimental methods across the case studies in detail.

2.4.2 Field experiment

Experimental economics provides a formalised, replicable approach to rapidly assessing alternate policy directives prior to their implementation region-wide (Dinar et al. 1998). The methodology provides a relatively inexpensive means of institutional analysis and substantially reduces the time it takes to gather sufficient data. Well designed experiments can be used to evaluate the stability of diverse institutional structures across an array of conditions, to test the efficacy of policy directives and to highlight potential detrimental outcomes. Applying experimental results can provide authorities and decision makers with sufficiently robust information to circumvent or mitigate the consequences of inappropriate policy commitments, minimising the time for trial and error and associated social expense (Murphy et al. 2000).

Plott and Porter (1996) highlight an additional advantage of evaluating and developing economic policies using experimental methods. They argue that designing such an experiment requires specifying the details of a policy as well as the economic environment for which the policy is designed. Accordingly, this process raises questions that might never be asked until the policy is actually implemented.

Economic experimental settings generally include abstract experimental settings, free of connotation or context. The experimental control of context is achieved through unambiguous, parsimonious instruction sets, sufficient to enable task completion by participants while avoiding leading examples. These instruction sets carefully articulate the rules of exchange in anonymous settings with autonomous agents, specific participant endowments, transparent payments and credible threats. The main aim is to express behaviour in monetary terms. Participants are required to follow the instructions and experimental scripts carefully and rigorously. As Shogren (2006) noted, '*context* can be desirable if the goal is to avoid creating an environment that is too sterile and too abstract from reality'.

In contrast to supporting evidence from laboratory experiments (Smith 2002), policy makers question the validity of interpreting abstract experimental results into an operational setting implemented in a complex real-world situation comprising diverse participants. While Friedman and Sunder (1994) and Harrison and List (2004) support policy-relevant context, a countervailing view highlights the need for field experiments to address the potential disregard of experimental instructions by subject pools selected to represent target populations or specific behavioural characteristics. Such subject pools bring to the experimental decision environment their range of experience and vision, their professional bias and confounding norms and conventions, despite the experimental rules articulated in the instruction sets. Considerations of policy relevance contribute to a methodological trend combining lab and field experiments to investigate economic behaviour, permitting sharper and more convincing inference (Harrison & List 2004).

The Daly River case study (Chapter 6) described below included field experiments in order to calibrate individual behaviour for an agent-based model. The context is a trading scheme for water access rights, which has not yet been implemented. Therefore, behavioural data cannot be observed and interviews would be based on speculation. Such a new and unexperienced institutional setting can be tested in an experimental situation. As the goal included capturing as much context as possible, the experiments were conducted with real irrigators from the case study region. The following chapter describes the case studies and their results.

3. The biophysical, social and institutional context for the case studies

Tim Lynam, Alexander Herr and Alex Smajgl

The biophysical, social, economic, political and institutional attributes of the world frame the stage in which institutional analyses are conducted. This chapter highlights the defining characteristics of the world or context in which the institutional analysis took place. It includes descriptions of the biophysical attributes of Queensland and the Northern Territory and their major social and economic attributes. It also outlines the key policy, legislative and regulatory processes that define the institutional context for the discussion of specific case studies. Where individual case studies reflect different attributes, these are identified.

3.1 Attributes of the biophysical world

The biophysical context for the analyses carried out as part of this project was the physical space of the Northern Territory and Queensland (Figure 5). The water available for human or ecosystem use across this region is determined by the rainfall, which is highly variable both in space and through time, and by the very high evaporation rates relative to rainfall (Figure 6). Runoff is redistributed across the landscapes of the study region through the river systems that drain to the north, east and south into the Lake Eyre Basin (Figure 7). In general, runoff rates are low. For the 25 monitored catchments in the study region for which Peel et al. (2000) provide data, the mean annual runoff was 24% of mean annual rainfall. Although infrequent, floods in the rivers draining south into the LEB are an important source of water for these outback landscapes. An additional hydrological feature of the region is the Great Artesian Basin (Figure 8).

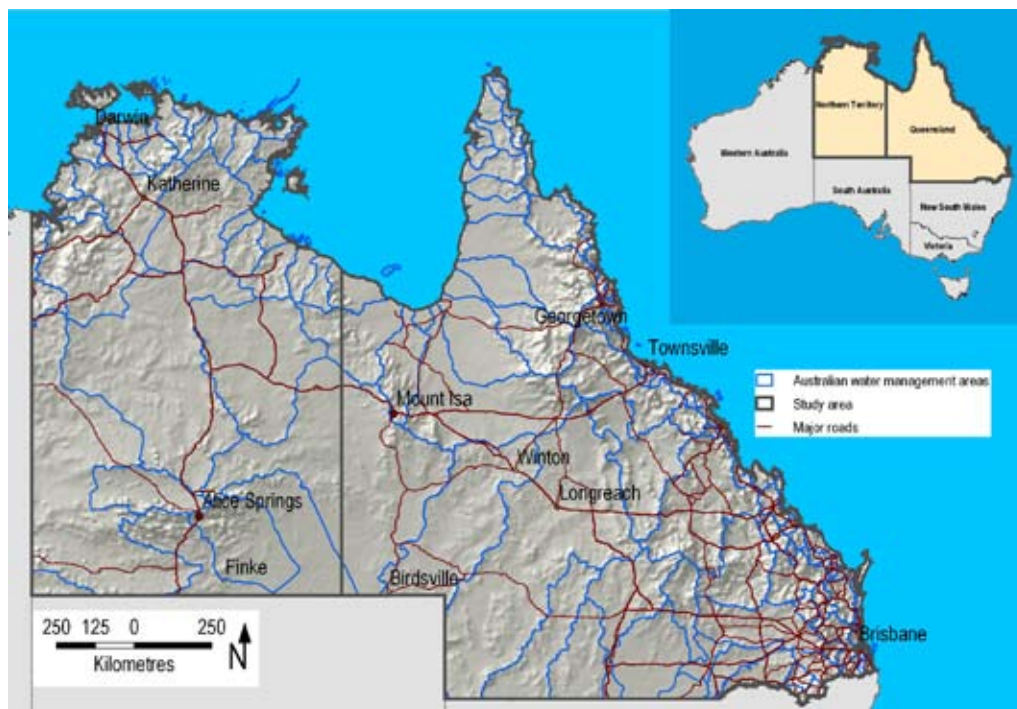


Figure 5: Study region showing major topographical features, water management areas, major settlements and major roads

Rainfall in the arid interior of Australia is highly variable in timing, duration and intensity, even when compared with other arid regions of the world (Stafford Smith & Morton 1990). Consequently, Australian rivers have greater variation in flow and flooding patterns than elsewhere on the globe (Puckridge et al 2000, Williams 1981). Evaporation is up to 18 times greater than rainfall in the interior of the region, but the ratio of evaporation to rainfall declines to less than one along the coast (Figure 6).

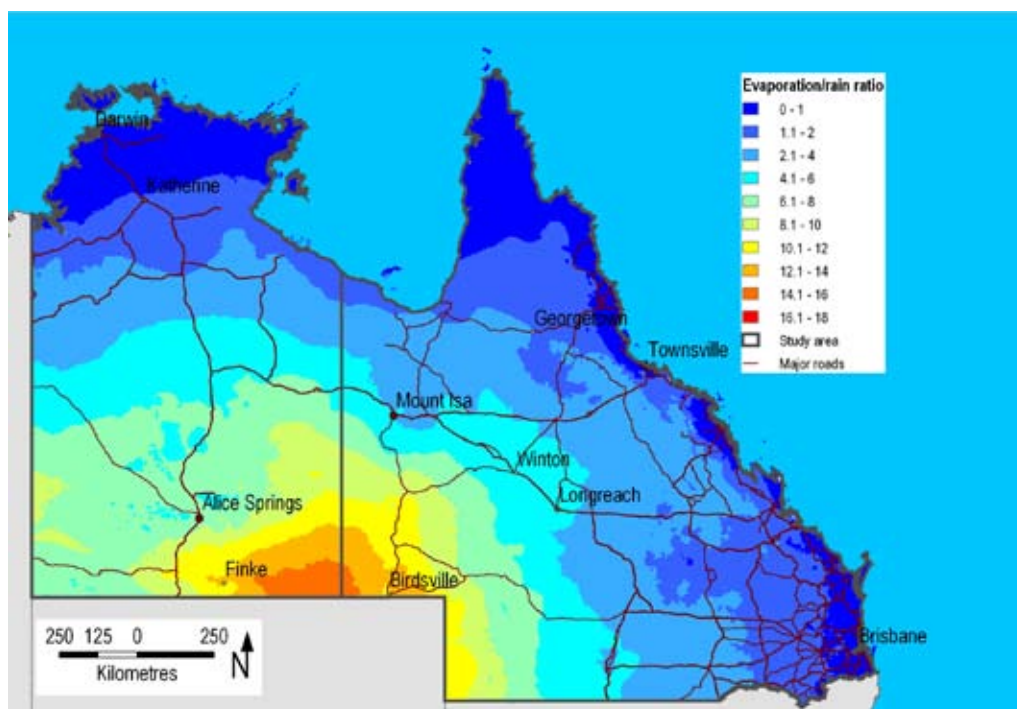


Figure 6: Ratio of mean annual evaporation (mm) to rainfall (mm) for the study region

Note: Blue areas indicate rainfall is about the same as evaporation. Red areas are those where evaporation greatly exceeds (by up to 18 times) the rainfall

The combination of higher rainfall, lower evaporation and lower rainfall variability in the coastal region (compared with the interior, outback region) means that water supply issues are notably different in the two regions: along the coastal and semi-arid region surface water flows are more reliable; in the interior they are highly episodic and hence unreliable. Mean annual values are less useful indicators of water availability in the interior, because ecosystems, as well as human production systems, have to be adapted to the high variability. Bores become vitally important sources of reliable water in the interior to maintain people and their production systems (Figure 8). At least in the short term, the availability of water from bores is not contingent on use or management practices upstream.



Figure 7: Study region with overlays of the major river systems and the internally draining Lake Eyre Basin

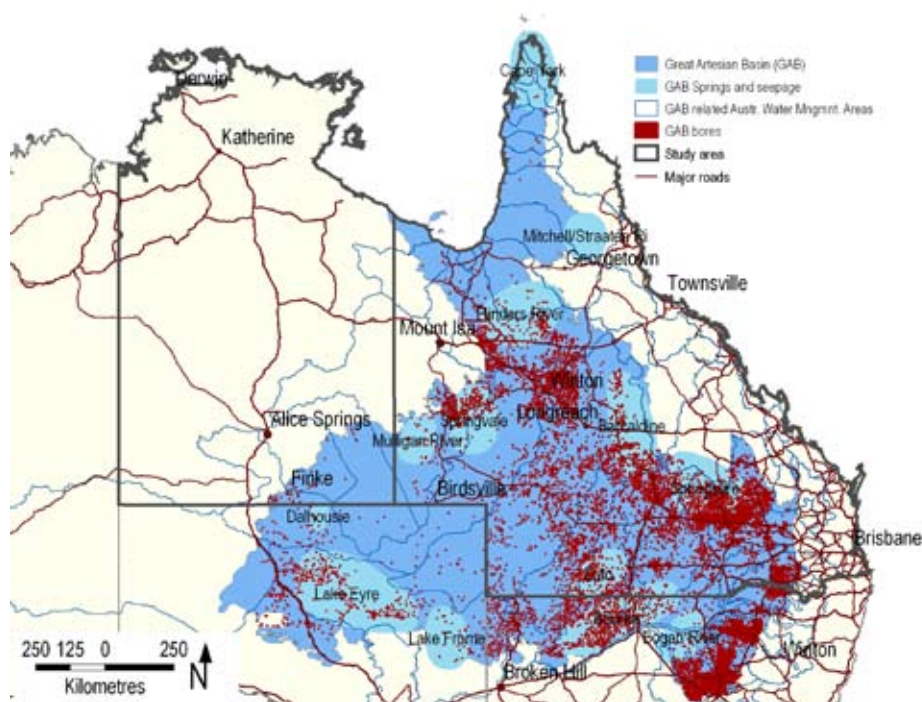


Figure 8: Study region with the Great Artesian Basin (GAB) and major spring and seepage areas of the Basin, as well as known boreholes in the GAB region

In the 2001 assessment of Australian Rivers condition (Norris et al. 2001) few rivers in the outback areas of this project were assessed (Figure 9). In the NT, only 10% of the assessed rivers were deemed to be ‘significantly impaired’, with 66% of assessed rivers considered largely unmodified and 34% considered ‘moderately modified’ (Figure 10). The assessment for Queensland rivers found more rivers

that were ‘moderately modified’ (71%) and ‘substantially modified’ (16%) than in the sample from the Northern Territory (Norris et al. 2001). However, most of the assessed rivers were outside of, or on the periphery of, the Outback Institutions project study area (Figure 9).

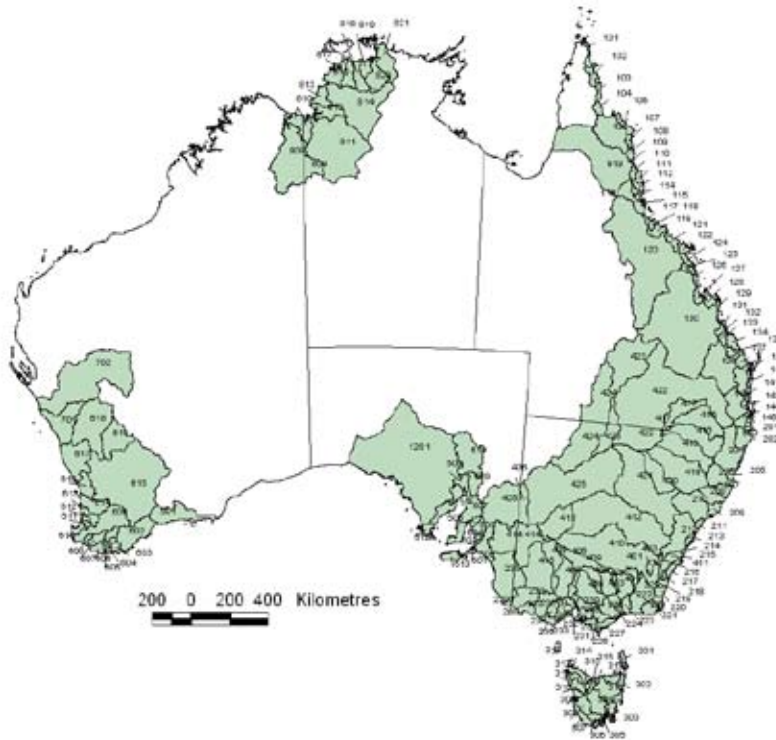


Figure 9: Catchments and rivers assessed as part of the 2001 Australian Rivers Condition (ARC) assessment
Source: Norris et al. 2001

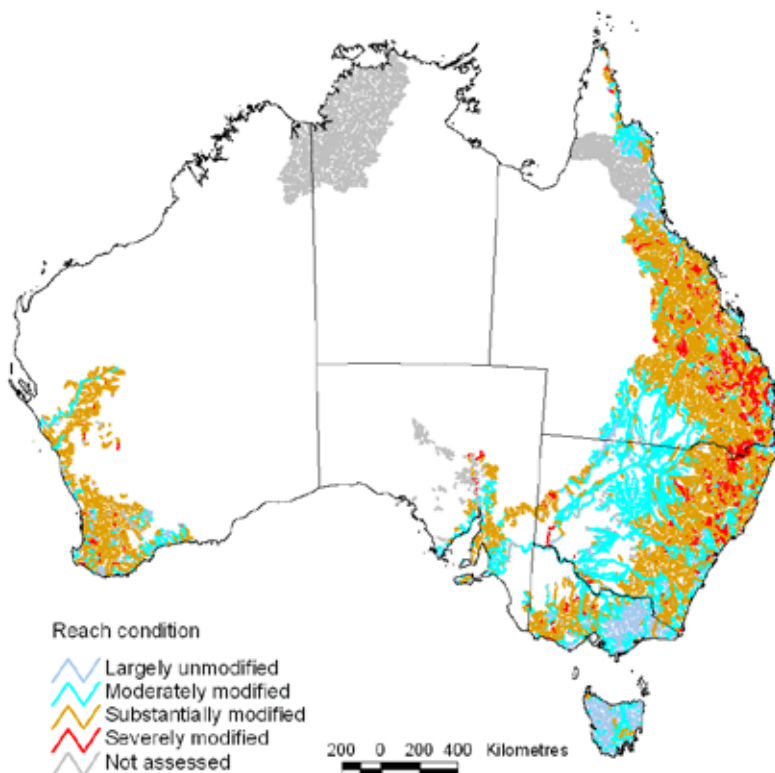


Figure 10: Nutrient and suspended sediment load condition of the rivers of Australia assessed in 2001
Source: Norris et al. 2001

While water has been a direct, primary determinant of human activity, it has also been an important determinant of biodiversity, and through this has further influenced human activities such as ecotourism. The springs and seepages of the GAB (Figure 8) are important for the development and maintenance of a number of ecosystems and hence play an important role in maintaining the biodiversity of the region as well as thereby supporting tourism and other economic activities. Einasleigh and the desert uplands of northern Queensland have been identified as one of Australia's 15 biodiversity hotspots (Sattler & Creighton 2002). Although much of the study area appears to be the focus of some conservation effort, some areas still require further attention at a very large scale (Figure 11).

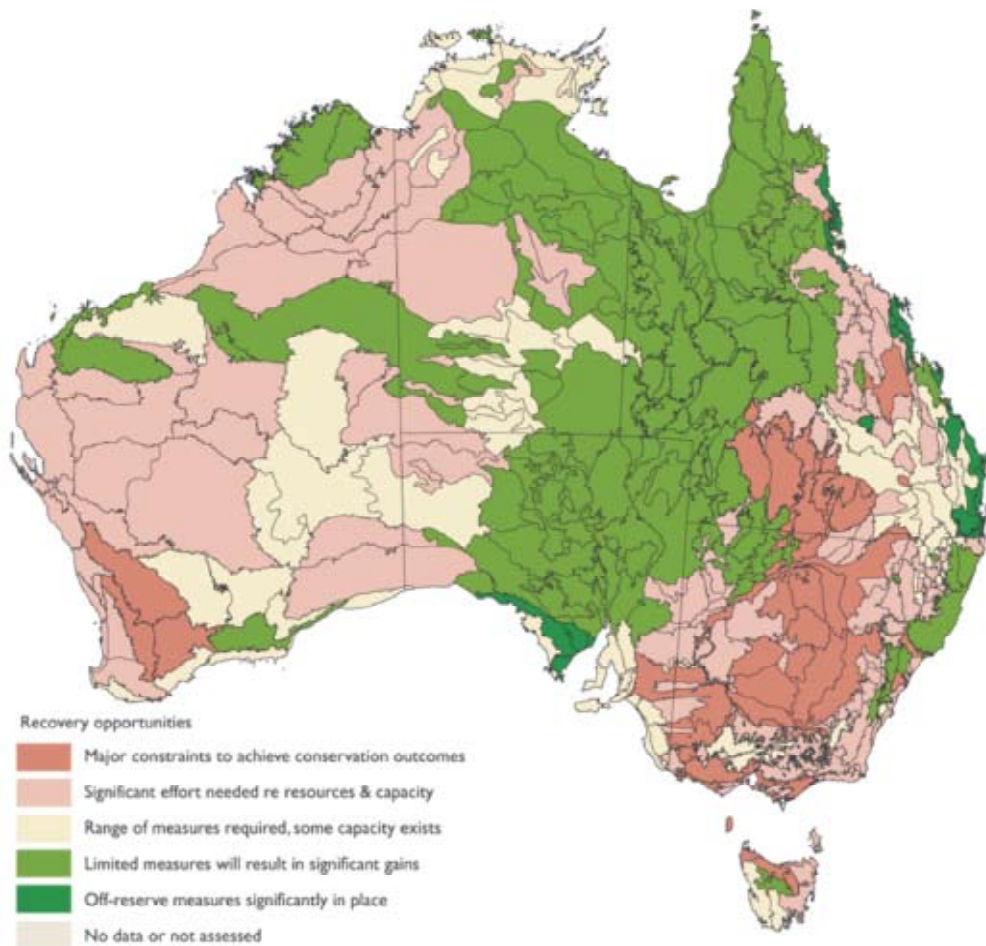


Figure 11: Effort required to achieve conservation goals in different regions of Australia

Source: Sattler & Creighton 2002

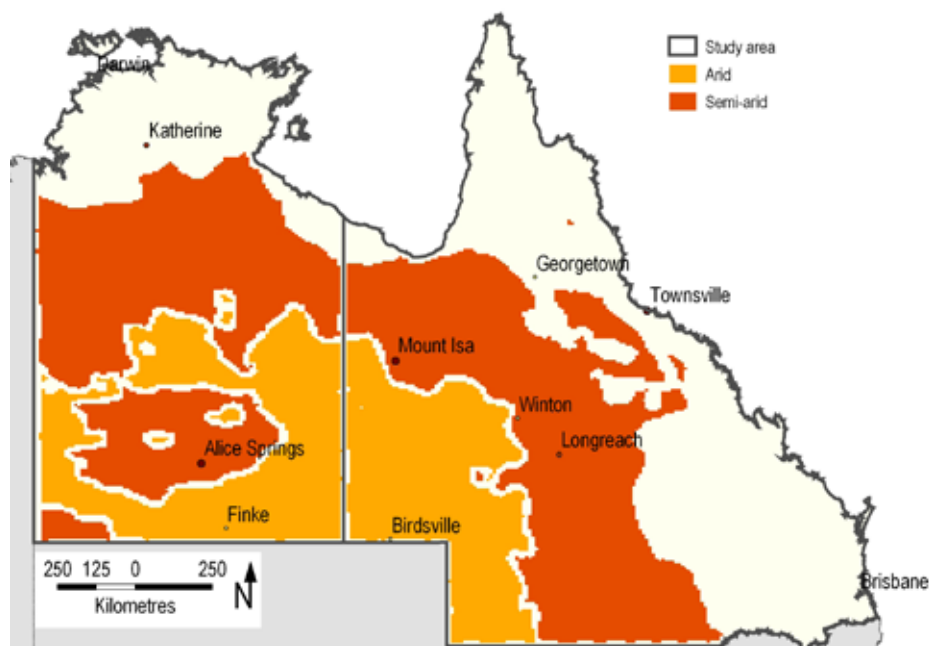


Figure 12: Classification of study region by aridity zone

Source: (ABS 2006a)

Drought has been, and is likely to remain, a frequent feature of outback regions of Australia. Major droughts affecting the outback regions of Queensland and the Northern Territory occurred in 1864–66, 1880–86 (and 1888), 1895–1903, 1911–16, 1918–20, 1939–45, 1958–68, 1982–83 and 1991–95 (BoM 1988). Summarising the effects of the 1895–1903 drought, which affected much of Australia, BoM noted the following:

This was probably Australia's worst drought to date in terms of severity and area. Sheep numbers, which had reached more than 100 million, were reduced by approximately half and cattle numbers by more than 40%. Average wheat yields exceeded 8 bushels per acre in only one year of the nine, and dropped to 2.4 bushels per acre in 1902.

BoM 1988

Droughts of lesser severity or smaller extent occurred in 1922–23 and 1926–29, 1933–38, 1946–49, 1951–52, 1970–73 and 1976 (BoM 1988). Two of the more notable droughts occurred in the periods of 1982–83 and 1991–95. These were exceptionally devastating events with widespread effects and significant agricultural impacts. Droughts occur often and have significant impacts on the ecological productivity, and therefore the economic productivity, of the region. The ecological, social and economic impacts of these major droughts were extensive. Total economic losses from the 1982–1983 drought were estimated to be three billion dollars.

In summary, the study region is characterised by very high evaporative water demand and hence water stress. Major water sources such as groundwater (accessed through bores) and surface water flowing as rivers or emerging as seeps or springs are therefore exceptionally important determinants of ecosystem productivity and thus human economic and cultural activity. The institutional controls that govern these water resources are the subject of this study.

3.2 Attributes of the community

A major constraint to adequately characterising the study region from social and economic perspectives is the high uncertainty in the data available for use at this scale. The Australian Bureau of Statistics (ABS) is almost the sole source of this data. However, the very low populations in many regions of the outback mean that for the 2001 census the non-resident population was very high, often greater than 50%. This means that the characteristics of the enumerated population may be very different from the characteristics of the resident population. We have tried to provide indications of where this is a particular problem in the descriptions that follow, but many of the descriptions based on ABS census data need to be treated with caution, as they are based on this rather difficult data set.

For most of the study area the human population density is exceedingly low, less than 0.001 people per square kilometre (Figure 13), which is considerably less than the national average of 2.6. A few regions of higher population density and urban centres are scattered through the study region. In the 2001 census, in the Northern Territory 56% of the population was considered to be remote and 44% remote (ABS 2006b). For Queensland, the population was very much more urban and regionally based (ABS 2006b).

Table 3: Per cent of Queensland population enumerated in 2001 that lived in each remoteness category

Remoteness class	Percentage of 2001 population resident in class
Major cities	52.3
Inner regional	25.8
Outer regional	17.7
Remote	2.6
Very remote	1.5

Source: Source 2006b

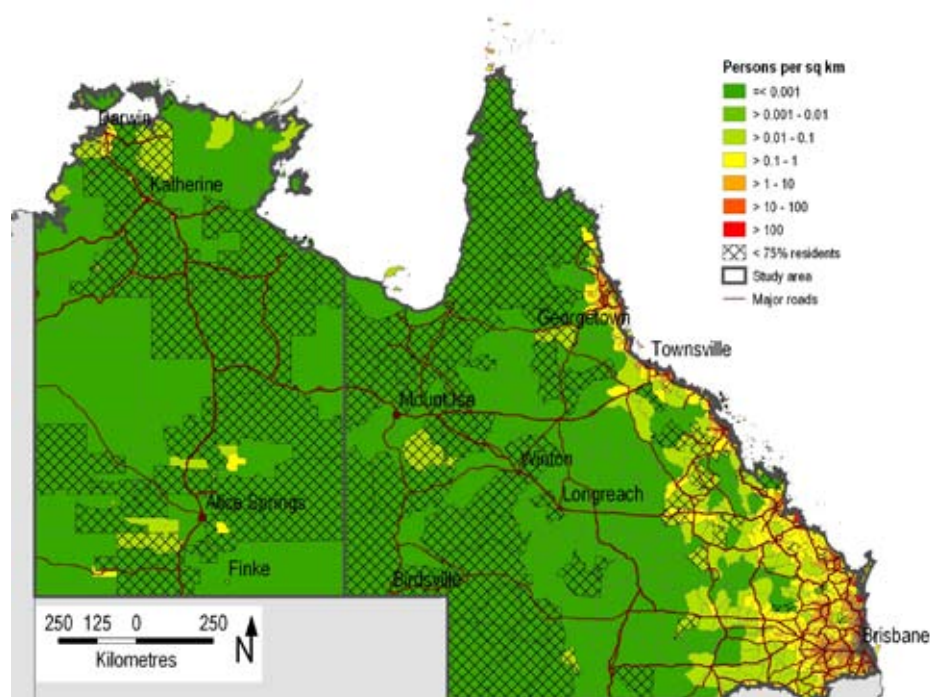


Figure 13: Population density (people per square kilometre) for the study region in 2001

Note: For much of the study area the data are unreliable because of the dominance of non-residents at the time of the 2001 census.

The demographic trends of Queensland and the NT are for relatively rapid growth in the cities, and therefore inner regional Queensland's population increased in 2004/05 by 75 900 people, the largest increase of any Australian state. The source of this growth was from net interstate migration (31 500 people or 42%, the largest of any state or territory), net overseas migration (17 100 people or 23%), and the natural increase of 27 300 people or 36% (ABS 2006b). Queensland's annual growth rate of 2.0% was the fastest of any state or territory. Queensland's average annual population growth rate over the five years to June 2005 was also the highest in Australia, at 2.2%. Most (70%) of this growth occurred, however, in the urban areas of south-east Queensland, and particularly in Brisbane.

The Northern Territory's population experienced similarly high growth rates (albeit from a much smaller base) with a 1.5% increase (3000 people) in 2004/05, giving it the third fastest growth of all the states and territories. For the first time in a decade, net interstate migration was positive, although it added few people to NT's population. The natural increase of 2600 people remained the main component of growth, while overseas migration added 390 people.

The pastoral belt of Queensland was the only remoteness area to decline in population over the four years to June 2005, with an average annual rate of 0.1% (ABS 2006b).

Holmes et al. (2005) classified Queensland into six zones for population change analyses (Figure 14). These are useful as they provide practically oriented regions to describe population trends across the state (Table 4). The analysis of Holmes et al. (2005) indicated a great deal of population growth in south-east Queensland, along the coastal strip of Queensland and in the remote northern areas. The agricultural zone of Queensland has shown more moderate growth, while the pastoral and remote interior regions exhibit declining populations (Table 4). Similar analyses were not available for the Northern Territory; however, the analysis by Taylor et al. (2006) indicates a decline of 0.6% in the population of non-Aboriginal people in the NT and an increase of 3.8% in the population of Aboriginal people in the NT between 1996 and 2001.



Figure 14: Population analysis areas of Queensland, 1961–2001

Source: Holmes et al. 2005

Table 4: Percentage population change by settlement zone, 1971–2001

	1971	2001	Total	% Change	% of Queensland's population	
					1971	2001
South-east Queensland	1 040 423	2 372 104	1 331 681	128.00%	57.10%	64.90%
Coastal Queensland	438 354	839 139	400 785	91.40%	24.10%	23.00%
Agricultural Queensland	255 419	349 894	94 475	37.00%	14.00%	9.60%
Pastoral Queensland	43 683	38 327	-5 356	-12.30%	2.40%	1.00%
Remote interior	30 056	25 862	-4 194	-14.00%	1.70%	0.70%
Remote northern	13 071	28 359	15 288	117.00%	0.70%	0.80%
Queensland	1 821 006	3 653 685	1 832 679	100.60%	100.00%	100.00%

Source: Holmes et al. 2005 after ABS, unpublished data.

At the time of the 2001 census, Aboriginal and Torres Strait Islander people comprised 3.5% of the enumerated population of Queensland in 2001 and 28.8% of the population of the Northern Territory, both larger than the national figure of 2.4% (ABS 2006b).

In 2004, the unemployment rate for Queensland was 6.0% and for the Northern Territory it was 5.7% (ABS 2006b). While the broad patterns of employment are similar in both regions, there remain some notable differences (Table 5): the manufacturing sector is a relatively larger employer in Queensland than in the Northern Territory; and the government, administration and defence sectors are very large in the Northern Territory compared with Queensland (Table 5). Although a dominant land use, the agricultural sector is a relatively small employer. Much of the employment in the region is within the service and government sectors rather than in agricultural production.

Table 5: Employment by sector (in thousands and percentage of total) for the Northern Territory and Queensland, 2001

Employment sector	Northern Territory		Queensland	
	Total	Percentage	Total	Percentage
Agriculture, Forestry and Fishing	2.8	3.08%	97	5.80%
Mining	2.2	2.45%	17.7	1.06%
Manufacturing	4.1	4.49%	178.9	10.69%
Electricity, Gas and Water Supply	7.8	0.86%	10.2	0.61%
Construction	5.6	6.19%	135.3	8.09%
Wholesale Trade	3.3	3.62%	83.9	5.01%
Retail Trade	10.7	11.86%	264.1	15.78%
Accommodation, Cafes and Restaurants	5.4	6.02%	98.1	5.86%
Transport and Storage	4.8	5.27%	81.3	4.86%
Communication Services	1.0	1.13%	25.6	1.53%
Finance and Insurance	1.5	1.70%	43.3	2.59%
Property and Business Services	7.7	8.48%	182.7	10.92%
Government Administration and Defence	16.0	17.65%	62.3	3.72%
Education	7.2	7.94%	119.8	7.16%
Health and Community Services	8.0	8.82%	165	9.86%
Cultural and Recreational Services	2.7	2.94%	40.5	2.42%
Personal and Other Services	4.3	4.76%	67.6	4.04%
Non-classifiable economic units	0.9	0.96%	nd	nd
Not stated	1.6	1.79%	nd	nd
Total	90.4	100%	1,673.3	100%

Source: ABS 2006b

The majority of the land area of Queensland and the Northern Territory is used for grazing, with managed resource protection areas (e.g. nature conservation) being a second important, but lesser land use (Figure 15). Although there are a number of other land uses carried out in the region they do not occur over large, contiguous land areas.

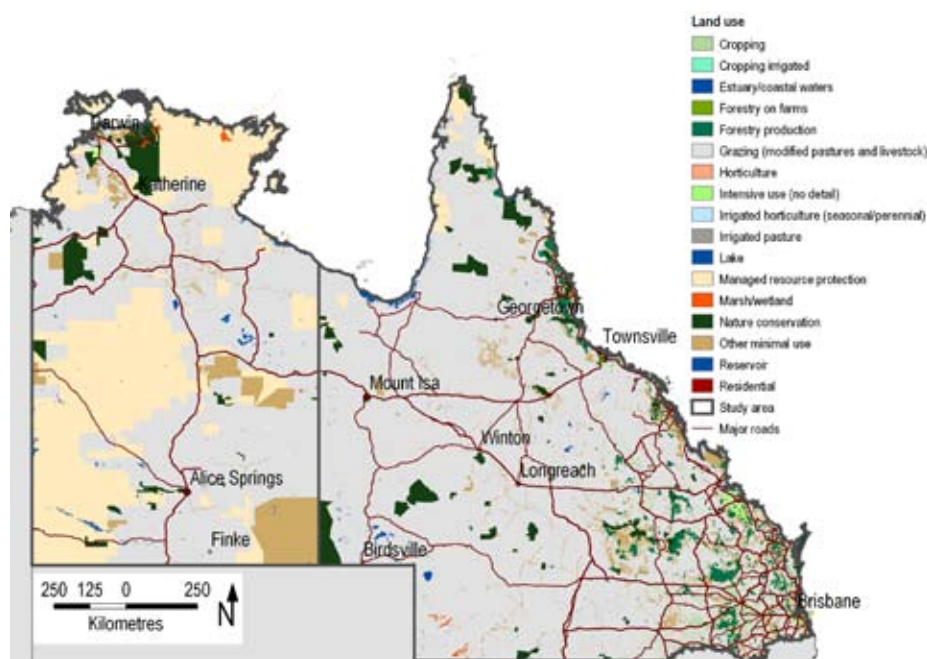


Figure 15: Land use in the study region from 1 April 1996 to 31 March 1997 with major settlements and roads
Source: Stewart et al. 2001

Although mining uses a relatively small area of the land of either the Northern Territory or Queensland, it is an important employer and economic contributor in both areas (Table 5). The number of mines in Queensland is greater than in the Northern Territory (Figure 16). They run in an arc from north-west to south-east across the state and cover the remote interior and pastoral areas under the classification developed by Holmes et al. (2005).

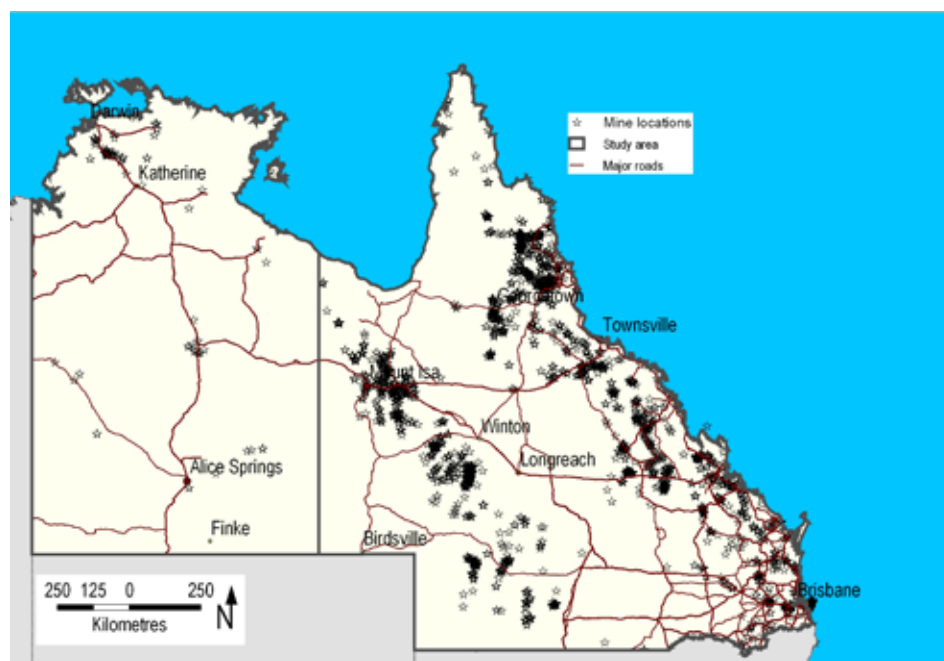


Figure 16: Mines and mining leases in the study area, 2000

Source: Ewers et al. 2002

In summary, the landscape that is the subject of this study is characterised by very low populations of people that are, for the most part, sparsely distributed over the region. In many areas the population is actually in decline. The landscape is mostly used for grazing, so we would expect the rules governing water use will critically affect, and be affected by, this sector. Although very localised in their physical occupancy, mines and the mining sector exert a tremendous influence on the economies of the region and therefore on the institutions controlling use of water. Although numerically relatively small, the Aboriginal and Torres Strait Islander populations of both the Northern Territory (where they make up a much larger proportion of the total population) and Queensland are culturally important and so add an important dimension to the analysis of institutions governing water in these regions.

3.3 Rules in use

The constitutional level of rules-in-use is defined by the Commonwealth and State governments. This chapter gives a brief overview on constitutional arrangements regarding land use and water use relevant to case studies in Northern Territory and Queensland.

3.3.1 Land related regulation

Land ownership in Australia is mainly divided into freehold title and Crown land. The *Land Title Act 1994* defines freehold title for Queensland, while the *Law of Property Act 2002* defines freehold for the Northern Territory. Freehold title entails the greatest bundle of land-related rights. The most significant forms of Crown land holdings are different types of leases, defined for Queensland under the *Land Act 1994* and for the Northern Territories in the *Pastoral Land Act 1998* and the *Crown Lands Act 1999*.

In Queensland the *Land Act 1994* confers land allocation powers and powers to determine the most appropriate tenure type. Figure 17 shows that in the rangelands of the Northern Territory and Queensland the most common tenure regime is pastoral leasehold property; in Queensland this is followed by freehold land, and in the Northern Territory it is followed by Aboriginal freehold under the *Aboriginal Land Rights Act 1976*, the *Land Acquisition Act 2004* and the *Native Title Act 2003*.

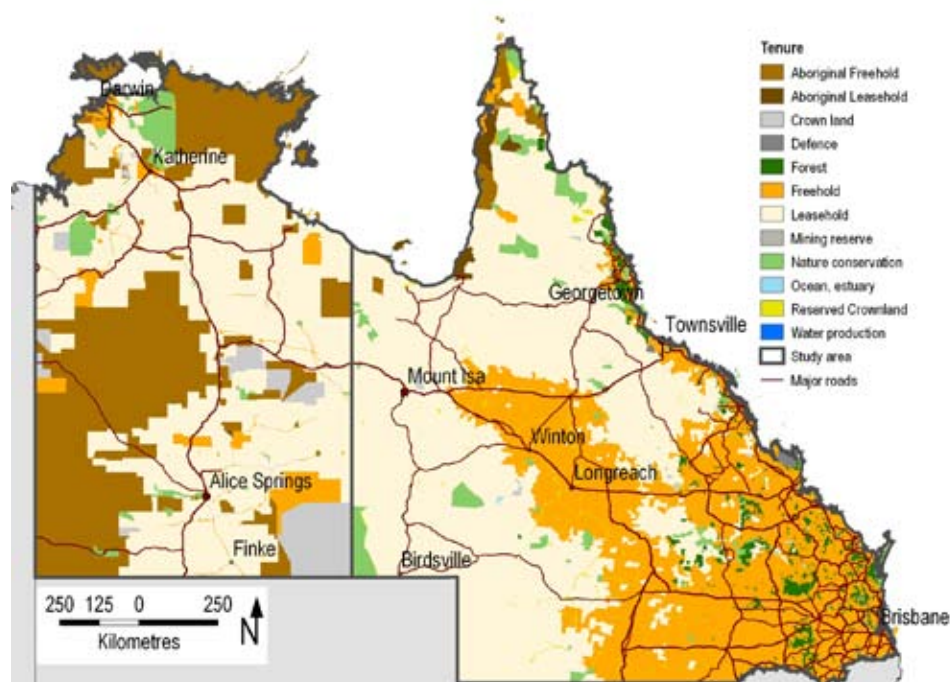


Figure 17: Land tenure for the study region

Source: Stewart et al. 2001

Land under a pastoral lease remains Crown land, that is, land owned collectively by the people of Australia. A pastoral lease gives the leaseholder the right to use the land for pastoral purposes, including raising livestock and developing the infrastructure necessary for pastoralism, such as fences, yards, bores and accommodation. Pastoral leases are governed by the relevant state government land acts. Lease terms and conditions vary greatly from one state to another. Specific conditions and prohibitions are also often spelt out in individual leases.

A pastoral lease is a limited form of property right; it does not give pastoralists full ownership rights. The pastoralist does not own the land, but pays rent to the Crown. At the expiry of the lease, the lease reverts to the Crown. Leasehold tenure also requires that the lease property must remain undivided, which means that members of the one family may divide the property for the purpose of their multiple businesses, but control over the whole resource (the whole property) must remain with one single entity. However, if there is a change in land use, this may afford the option to excise parts of the land into a different type of tenure, which requires extended negotiations with the state to gain approval. Diversification to allow properties to take advantage of alternative resources remains limited on leasehold lands. Leaseholders have the option to submit applications for special leases, such as low-impact tourism, but it is a lengthy process without guarantee of success. Leaseholders also have the possibility of changing their leases to a perpetual lease, which grants landholders rights closest to freehold on their property. However, applicants must meet a series of strict conditions/criteria, among them having to resolve native title issues. The regulations and mechanisms for doing so are set out in the *Native Title Act 1993*.

The *Native Title Act 1993* was introduced by the Commonwealth to provide recognition and protection of native title. It defines processes that must be followed for native title to be claimed, protected and recognised through the courts (see Table 7). Queensland enacted its own *Native Title (Queensland) Act (1993)*, which is consistent with Commonwealth Native Title. The Act gave legislative recognition of an existing common law of customary Aboriginal and Torres Strait Islander law, that of native title. This recognition was important because ‘it does not suggest the granting of a right by government but rather accepts that the right has existed and is now recognized’ (p&e Law: 27). Native title is not the same as land rights, and the concept of claiming land rights is independent of native title. Land rights are new legal rights that are created and granted under Australian law to Aboriginal and Torres Strait Islander Australians. In addition, native title can co-exist with non-Aboriginal and Torres Strait Islander proprietary rights, and in some cases different Aboriginal and Torres Strait Islander groups can exercise their native title over the same land. The Act provides for Indigenous Land Use Agreements (ILUAs). The definition of ILUAs includes area agreements and alternative procedure agreements, processes for defining and negotiating them, and impact on land use. The basis of an ILUA is the memorandum of understanding (MOU) which is an agreement between the Traditional Owner(s) and the leaseholder.

In the Northern Territory the federal native title Act did not change incentives for Aboriginal groups to claim land rights, as these rights already exist since the *Aboriginal Land Rights Act (Northern Territory) 1976*. Titles granted are equivalent to communally freehold land. However, urban areas had been excluded and the Commonwealth Act introduced potential claims within town boundaries. This led in 2004 to a successful claim by the Lhere Artepe Aboriginal Cooperation over 113 land parcels; Australia’s first native title in an urban area (Davies & Aboriginal Legal Right Movement Inc 2005).

A key piece of legislation guiding use and management of land is the *Vegetation Management Act 1999*. At the level of the state, the Queensland Government’s State Policy for Vegetation Management lays out the principles that underlie the policies, its desired outcomes, and how these will be achieved (NRW 2006). The Act allows for clearing fence lines (10 metres on either side) and development sites (e.g. 5 hectares for a dam site, 5 metres for a road) without a permit.

3.3.2 Water related regulation

The institutional history of water in Australia is closely linked to the colonisation and settlement policy of the country as well as Australia's economic needs. With the establishment of the Australian Constitution and the federal system of government in 1901, the constitutional division of power left water resources largely within the jurisdiction of the states. Each state began to develop its own approach to water management, allocation and use by considering its water resources in isolation from the other states (McKay 2005). This section summarises the situation in Queensland, based on Larson (2006), followed by a discussion on the Northern Territory, based on Straton et al. (2006).

McKay (2005) compares the underlying paradigm governing water resources development in Australia from the start of the colonisation period in the late eighteenth century to the 1990s with the story of 'the magic pudding', written by Norman Lindsay in 1918 (cited in McKay 2005:38) '... peculiar thing about the magic puddin' was that, though they had all had a great many slices off him, there was no sign of the place whence the slices had been cut off. The custodians of the puddin' ... were always on guard in case it should run away or be stolen by puddin' thieves'. In other words, growth in water demand was met over time by growth in water supply, through increased capture and development of water resources. The resource appeared endless.

However, by the mid-1970s, concerns were voiced about rising scientific and anecdotal evidence of deterioration in the qualities and quantities of waters in Australia. The concerns grew, and led to several key institutional developments in the early 1990s. The National Strategy for Ecologically Sustainable Development (1992) and the Council of Australian Governments Water Reform Framework (1994), among other institutional changes, have created a new era of water management. The new frameworks promote markets for water entitlements to improve efficiency but also promote allocation of water for environmental and social needs. Furthermore, since the Water Reform Agreement was signed in 1994, water institutions have evolved to include national and interstate concerns. The key initiatives of the agreement are improvement of the water quality, refinement of the water rights system and water allocation procedures, independent review of water prices and promotion of community participation (Department of Land and Water Conservation 1998).

In response to Commonwealth changes, Queensland enacted the *Water Act 2000* in order to 'advance sustainable management and efficient use of water and other resources by establishing a system for planning, allocation and use of water'. The Queensland *Water Act 2000* requires that all catchments in Queensland develop Water Resource Plans, the subordinate legislations of the Act. The Resource Operations Plans are then developed to implement Water Resource Plans. The Department of Natural Resources, Mines and Water (DNRM&W) is the responsible governmental body for water-related issues in Queensland.

Several other key pieces of legislation are relevant to water in the study area: the *Integrated Planning Act 1997*, the *Environmental Protection Act 1994*, the *Native Title Act 1993* and the *Mineral Resources Act 1989*.

The *Water Act 2000* is also linked to the *National Strategy for Ecologically Sustainable Development* (section 11(b)), *Environmental Protection Act 1994* and *Environmental Protection (Water) Policy 1997* (Part 7).

The Queensland Government also enacted new legislation, the *Wild Rivers Act 2005*. This Act does not automatically declare or list any river as 'wild'; rather, it outlines a process to declare a river 'wild' and outlines how activities and future developments will be managed and regulated to preserve the natural values of declared catchment areas. Under the Act, the Minister for Natural Resources, Mines and Water can propose a river for declaration. However, the Act does allow for an extensive consultation process

before a river is declared a ‘wild river’. No rivers, creeks nor waterholes in the two Queensland case studies – the Diamantina and Georgina catchments and the Etheridge Shire – have been nominated under this Act.

Similarly to Queensland, the Northern Territory defined the *Water Act 1999* with the then Department of Natural Resources, Environment and the Arts (now NRETAS) as the relevant governmental entity in the Northern Territory. The staff from the department are charged with implementing the Intergovernmental Agreement on a National Water Initiative, which contains the substance of a constitutional-level change in the rules governing water planning, allocation, use and management in Australia. These rules are based around the following principles:

- a commitment to identifying over-allocated water systems, and restoring those systems to sustainable levels
- the expansion of the trade in water resulting in more profitable use of water and more cost-effective and flexible recovery of water to achieve environmental outcomes
- more confidence for those investing in the water industry due to more secure water access entitlements, better registry arrangements, monitoring, reporting and accounting of water use, and improved public access to information
- more sophisticated, transparent and comprehensive water planning
- better and more efficient management of water in urban environments, for example through the increased use of recycled water and stormwater.

(National Water Commission 2005)

As a signatory to the Intergovernmental Agreement, the Northern Territory Government has agreed to establish water market and trading arrangements that will:

- facilitate the operation of efficient water markets and the opportunities for trading, within and between states and territories, where water systems are physically shared or hydrologic connections and water supply considerations will permit water trading
- minimise transaction costs on water trades, including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions
- enable the appropriate mix of water products to develop based on access entitlements that can be traded either in whole or in part, and either temporarily or permanently, or through lease arrangements or other trading options that may evolve over time
- recognise and protect the needs of the environment
- provide appropriate protection of third-party interests

(Council of Australian Governments 2004)

These Commonwealth and state-level regulations define the legislative framework for land use and water use in the four case study regions analysed in Chapters 1–7.

3.4 Case study selection process

This section summarises the process of case study site selection based on the institutional and ecological gradients outlined in the previous section. A scoping study defined the study area in the outback of Australia through two states and through arid to sub-tropical environments. Within this broad framework, the approach required the selection of sites for use as case study areas. Identification of potential study sites was based on rules that identified:

1. a location within 100 km of a town
2. mixed land use potential (e.g. tourism, grazing or cropping, conservation)
3. an Aboriginal or Torres Strait Islander population proportion equal or above 15% where possible.

This led to the identification of several potential study locations located in the savanna and the arid regions of outback Australia.

A list of these potential areas formed the basis for obtaining expert and local knowledge to identify the feasibility of conducting a study. Workshop discussions with experts helped focus and converge conditions for site selection. The importance of community willingness to participate in the research emerged as paramount in the site selection process.

Based on these conditions the study team undertook a pilot study in Etheridge Shire with its administrative centre of Georgetown. This pilot was to trial the methodology and process of engaging stakeholders. Upon completion, three further locations (the Daly River, Alice Springs and the Diamantina Shire) were selected and subjected to an institutional analysis of common pool resources. The study area locations (Figure 18) are aligned with the institutional and ecological gradients identified in the scoping report.

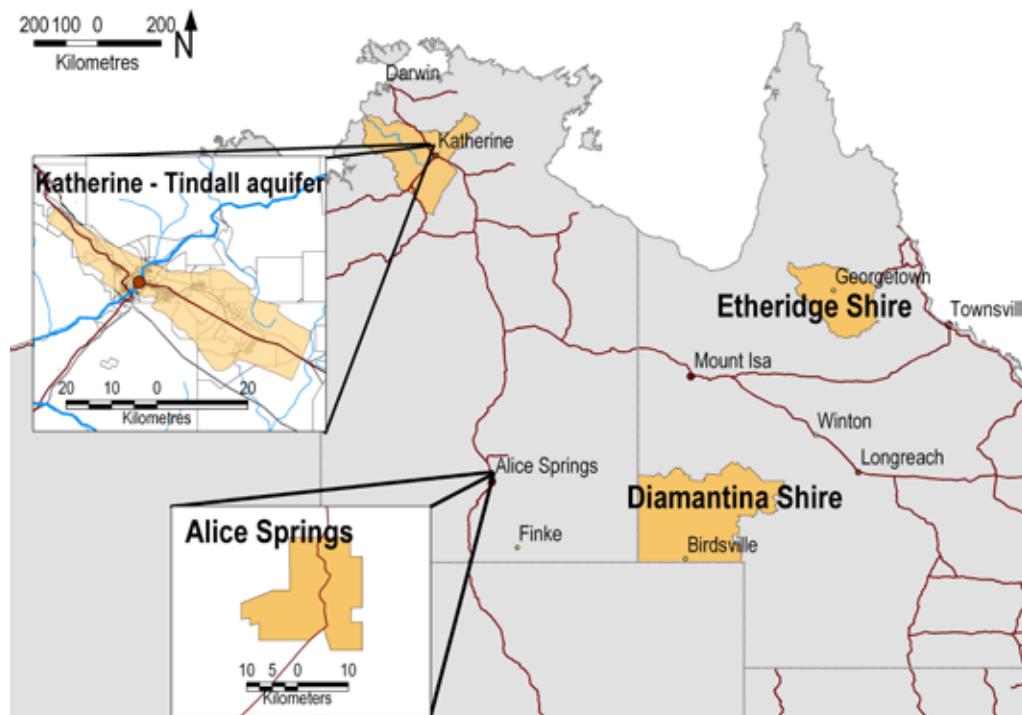


Figure 18: Pilot study site (Etheridge Shire) and the other study site locations: Katherine-Daly with the detail showing the Tindall aquifer, Alice Springs and the Diamantina shire

4. Incentives for community participation and land use decisions in Etheridge Shire, Queensland

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4.1 Action arena

Natural resource management planning in the Northern Gulf region of Queensland is concerned with ‘how [natural assets] and community aspirations can be protected and enhanced to provide the Northern Gulf community with the economic, social and environmental means to meet the continuing growth of the region in an ecological and economically sustainable way’ (McDonald & Dawson 2004). In the Etheridge Shire, located in the tropical savanna of the Northern Gulf region, two of the activities that influence the balance between economic growth and long-term sustainable development are:

1. the land-use decisions people in the Shire make with regards to their own enterprises
2. their decisions to engage in civically-minded activities aimed at improving conditions in the region.

Land-use decision and engagement in community development activities were chosen for detailed analysis because they are activities for which policies can be devised to improve economic and sustainable development outcomes. Changing the formal and informal rules that guide and govern these two different kinds of decisions that people can make in the Etheridge Shire – the decision to improve one’s own situation and the decision to improve the situation for others in the community – may expand the set of available options for people in the Shire to achieve their goals and aspirations. Identifying appropriate and effective changes in rules requires, first, an understanding of the ‘action arena’, in this case comprised of a diversity of ‘participants’ from both within and outside the Etheridge Shire, and secondly knowledge of ‘action situations’ (land-use decisions and engagement in community development activities) in which stakeholders are involved and/or have a stake. These discussions are presented in sections 4.1.1.1 and 4.1.1.2.

4.1.1 Participants: Key stakeholders

4.1.1.1 Key stakeholders in land-use decisions

At the time field interviews were conducted, from October to December 2004, key stakeholders involved in land-use decisions in the Etheridge Shire were residents of the Shire (freeholders, leaseholders, Traditional Owners and town residents), government entities, interface agencies¹, Aboriginal and Torres Strait Islander-focused organisations, industry, industry associations and environmental advocacy organisations (Figure 19). These stakeholders greatly varied in their capacity to influence, make and enforce decisions regarding different land-use options in the Shire.

¹ Agencies established by the national government to act as interfaces between local community interests and state or national government interests.

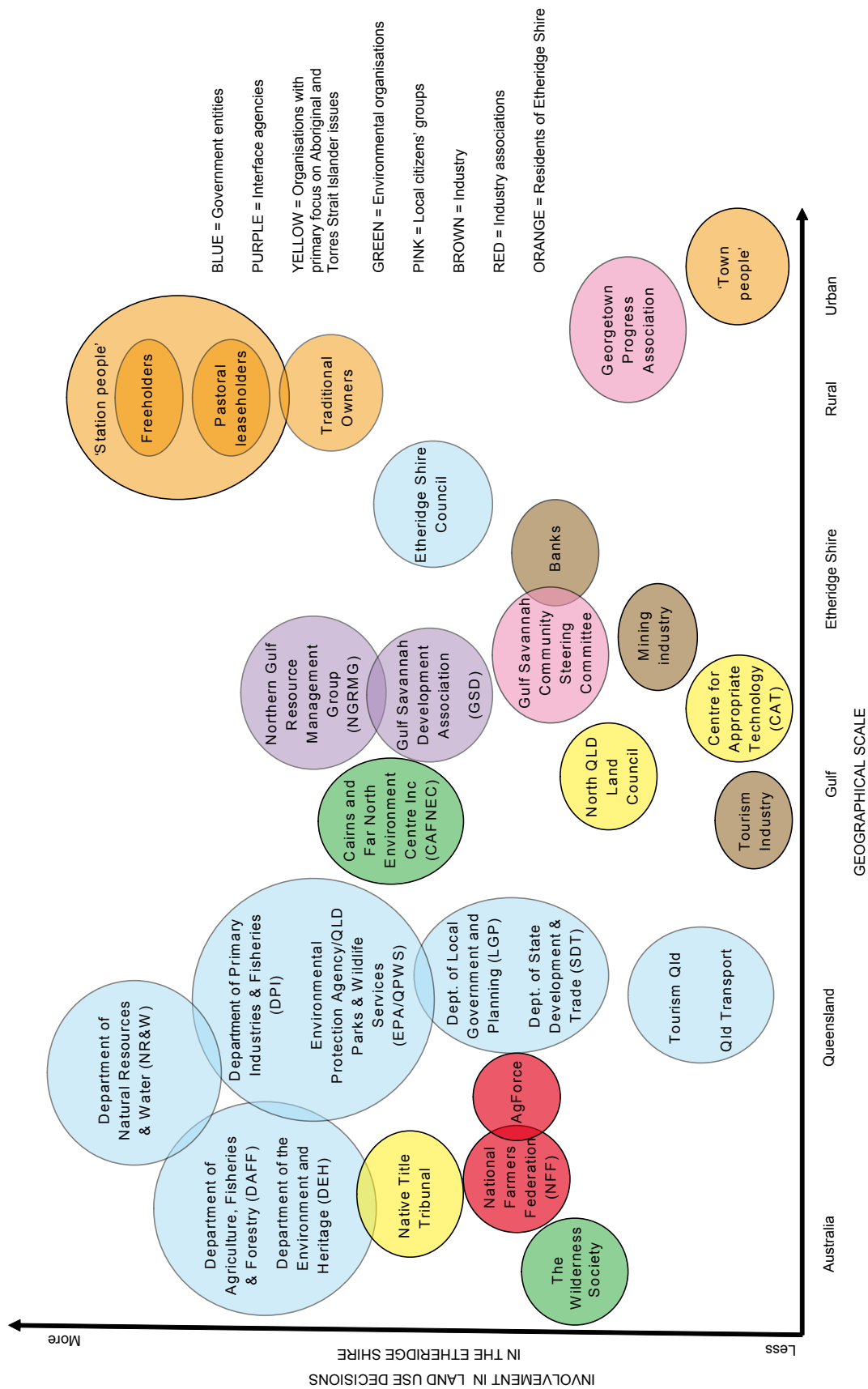


Figure 19: Key stakeholders involved in land-use decisions in the Etheridge Shire

Landholders of the Etheridge Shire, usually referred to by local residents as ‘station people’, are the most directly involved with land-use decisions in the Shire, as these occur daily. Station people include pastoral leaseholders who use and manage the majority (89%) of the Shire’s land. Only 1% of the shire’s land is freehold land (Queensland Government Planning 2004).² The Aboriginal Ewamian and Tagalaka people are also involved in land-use decisions through their access rights as Traditional Owners (*Native Title Act 1993*) to public lands, which include leasehold properties. By comparison, residents of the local townships, known locally as ‘town people’, have had a much smaller influence on how land is used and managed. For these people, some impact occurs through their business activities (in particular, tourism) and involvement in the Etheridge Shire Council.

Stakeholders located outside the Etheridge Shire have had a significant influence on the types of land-use activities and management practices implemented in the Shire. The Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) and the Department of the Environment and Heritage (DEH) (now Department of the Environment, Water, Heritage and the Arts – DEWHA) have indirect but important impacts (policy and program development) on land-use decisions in the Shire. DAFF is responsible for developing and implementing policies and programs to ‘ensure Australia’s agricultural, fisheries, food and forestry industries remain competitive, profitable and sustainable’ (DAFF 2006). DEWHA develops and implements national policy, programs and legislation ‘to protect and conserve Australia’s natural environment and cultural heritage’ (DEH 2006). DEWHA is also the primary source of funding for the regional NRM bodies, including the Northern Gulf Resource Management Group (NGRMG), which is involved in the Etheridge Shire. Within DEWHA, the (then) Natural Heritage Trust program funded several community-level projects in the Etheridge Shire, including an NGRMG administered project on Native Vegetation Management and Rehabilitation.

Government departments at the state (Queensland) level have played a more direct role in how land is used and managed in the Etheridge Shire. As the majority of the Shire is comprised of public lands, stewardship of the land and associated natural resources falls under the jurisdiction of the Queensland Department of Natural Resources and Water (NR&W). NR&W retains all decision-making powers regarding land leases and management of resources on the land and thus plays a critical role. The department manages and allocates the state’s (including the Etheridge Shire’s) land, water, mineral and petroleum resources, and manages native vegetation and the control of pest plants and animals. In addition to NR&W, several other state government departments and agencies are also involved in land use and natural resource management planning, notably the Department of Primary Industries and Fisheries (DPI) and the Environmental Protection Agency/Queensland Parks and Wildlife Service (EPA/QPWS). The Department of Local Government and Planning (LGP) and the Department of State Development and Trade (SDT) both affect land-use decisions through their policies aimed at promoting sustainable development. As the government department responsible for developing and managing the land, air and sea transport in Queensland, the Department of Queensland Transport (Qld Transport) also influences specific land-use activities in the Shire, notably tourism, through its provision and management of roads and rail transport. Tourism Queensland, a statutory agency of the Queensland Government, is responsible for enhancing the development and marketing of Queensland’s tourism destinations in partnership with industry, government and the community. However, its direct involvement in land-use decisions in the Etheridge Shire is minimal. The types of tourism services leaseholders and town tourist operators in the Shire can provide are also affected by the food processing regulations for food hygiene and safety of the EPA/QPWS.

² The remainder of land in the Etheridge Shire is parks (3%) and other types of tenure (7%) (Queensland Government Planning 2004).

The local government administrative body in the Shire is the Etheridge Shire Council. The Council is responsible for the provision of community facilities such as libraries and parks, maintenance of local roads, land use zoning and financial planning, and local services such as waste disposal. Compared with the Queensland State Government, it has limited powers and, as such, has a modest influence on land-use decisions in the Shire.

In addition to government entities, two interface agencies are involved in land-use decisions in the Etheridge Shire. The Northern Gulf Natural Resource Management Group (NGRMG), the natural resource management NRM body for the Northern Gulf, is a non-statutory organisation charged with community-based NRM planning. The role of the NGRMG is ‘brokering government, research and development and philanthropic investments towards achieving maximum benefit for community and environmental outcomes’ (NGRMG website, 2006). Local government, industry, Aboriginal and Torres Strait Islander, community and conservation representatives meet 4–6 times a year to discuss, plan and advise on issues and best practices for natural resource use in the Northern Gulf region. These feed into the development and revisions of the Northern Gulf Regional Natural Resource Management Plan (Northern Gulf NRM regional plan). The organisation also sets regional priorities and accesses funds for specified on-ground activities and outcomes. In the Etheridge Shire, NGRMG has taken on a strong role of improving land management for sustainability and profitability (NGRMG staff interview respondent). This has included ‘providing tools and incentives and assistance to land managers to look past the cattle and look at the health of the country’ (NGRMG staff interview respondent). An additional interface agency, the Gulf Local Authorities Development Association (GLADA), renamed Gulf Savannah Development (GSD), influences land use in the Etheridge Shire. The organisation is comprised of local government members and corporate and associate members. It liaises with local Aboriginal and Torres Strait Islander communities to coordinate lobbying activities aimed at improving the provision of services (primarily road infrastructure) to the Gulf Savannah region (GSD 2006). It is also involved in the formulation of the Gulf Regional Development Plan³, a joint initiative between state and local governments and communities to create a framework for planning and development in the Gulf region.

Organisations with a primary focus on Aboriginal and Torres Strait Islander issues have also been involved in land-use decisions in several ways. The National Native Title Tribunal of Australia is a Commonwealth Government agency that ‘works with people to develop an understanding of native title and reach enduring native title and related outcomes that recognise everyone’s rights and interests in land and waters’ (National Native Title Tribunal 2006). It is the administrative framework for the Native Title Act. Claims by Aboriginal and Torres Strait Islander peoples are brought to the Tribunal for investigation. In the Gulf region of Queensland, there are two additional Aboriginal and Torres Strait Islander organisations: the Centre for Appropriate Technology (CAT) and the North Queensland Land Council. CAT, which works to ‘increase the access of Indigenous people to a range of services that enable them to live safely and happily in communities’ (CAT 2006), has a limited influence in land-use activities and management in the Shire. In contrast, North Queensland Land Council has a more active role. As the Native Title Representative Body, it is recognised by the Commonwealth Minister for Aboriginal and Torres Strait Islander Affairs and is responsible for fulfilling functions under the *Native Title Act 1993* for the region of Cairns and surrounding areas. This includes assisting in the negotiation of Indigenous Land Use Agreements (ILUAs).

In addition to CAT and North Queensland Land Council, there are two environmental organisations that have an indirect impact on land-use decisions in the area. The Cairns and Far North Environment Centre Inc. (CAFNEC) is a not-for-profit peak regional environment group for far north Queensland, based in Cairns since the 1980s. CAFNEC’s main activities include campaigning for environmental issues through grassroots activism and political lobbying at local, state and federal levels; representing environmental interests in the far north region to tourism, agricultural/industry and other sectors of

³ This is different from the Northern Gulf Regional Natural Resource Management Plan coordinated by NGRMG.

the community; providing communication services for the region's environmental movement; and sponsoring grants for projects and research (CAFNEC 2006). Their work with landholders in the Etheridge Shire has focused on 'community awareness of important environmental issues' (Interview respondent). In addition, CAFNEC has been involved with NGRMG and associated local participants in the development of the Northern Gulf NRM regional plan. The other environmental organisation active in the region is the Wilderness Society, 'a community-based environmental advocacy organisation whose mission is protecting, promoting and restoring wilderness and natural processes across Australia for the survival and ongoing evolution of life on Earth' (Wilderness Society 2006). The Wilderness Society's work in north Queensland has focused on the Wild Rivers campaign, a joint campaign between the Wilderness Society and the Queensland Conservation Council aimed at supporting and improving the Queensland State Government's Wild River Act. In 2006, the Wilderness Society was invited by the Etheridge Shire Council to participate in the planning of the Gilbert River Catchment Rehabilitation Plan Development Project. The project, which involved a team of landholders and government agency representatives, aimed to address the weed and degradation problems across the Gilbert River catchment within the Shire (Etheridge Shire Council 2006).

In addition to government and non-government organisations, the mining industry also has had an impact on land-use decisions in the Etheridge Shire. Originally a region rich in mining activities, particularly gold (see section 4.2.2), a small mining industry remains active in the area. This includes Teck Cominco Limited (Canadian company) and Kagara Zinc Limited. There are also mining operations testing prospects in the Croydon and Etheridge mineral fields (Gulf Savannah Development 2006). Despite the presence of these ventures, the impact of the mining industry on land-use decisions in the Shire is quite minimal. Some landholders have trialled fossicking with metal detectors, a popular activity around Forsayth and Georgetown (Gulf Savannah Development 2006), as a potential tourist service to complement other activities on their land.

The tourism industry in the Etheridge Shire is very small, although there are efforts to bolster it. The Georgetown Progress Association has been 'trying to develop the town tourism growth' (Interview respondent). In addition, the Gulf Savannah Development (GSD) has played a role in promoting tourism in the area as part of the Gulf Regional Development Plan. This has included organising awards, the Savannah Tourism Awards, to provide recognition for the gulf's tourist operators. These were last held in the Etheridge Shire.

Industry associations, notably the National Farmers Federation (NFF) and AgForce, have been engaged with local graziers in the Etheridge Shire. NFF is the peak farm lobby group and represents rural producers of all major commodities. It is a national umbrella organisation for state farm organisations, commodity councils, and a range of associate and affiliate members (NFF 2007). Its primary role is to lobby the federal political arena for rural producers' interests. Individual farmers are supported by NFF via membership in sub-national organisations under NFF, which include AgForce. Agforce is a state-level farm organisation and is the main group representing Queensland's rural producers. Its aim is to 'ensure the long-term growth, viability, competitiveness and profitability of broad acre industries of cattle, grain, sheep and wool in Queensland' (Agforce 2007).

There are no banks with branches in the Etheridge Shire. The lack of banks and access to financial services, notably business lending, has limited the local landholders' options for developing activities on their land. In response, the Gulf Savannah Community Steering Committee was formed in 2006. Comprised of representatives from the Etheridge and Croydon Shire Councils, regional graziers, and local business people, the committee aims to open at least one community bank branch in Georgetown, under the Bendigo Bank's Community Bank Franchise.

4.1.1.2 Key stakeholders in community development activities

There are only a few organisations and groups actively involved in fostering and promoting community development activities through either formal or planned group activities or events in the Etheridge Shire. The most active organisations have been the Northern Gulf Resource Management Group (NGRMG), the Gulf Savannah Community Steering Committee, the Etheridge Shire Council, the Hann Highway Action Group, and the Georgetown Progress Association. DEH, through its Natural Heritage Trust programme, has funded several community-level projects in the Etheridge Shire, including the Georgetown Community Partnership project coordinated by the Georgetown Progress Association (see below).

Local staff of the Northern Gulf Resource Management Group (NGRMG) (see section 4.1.1.1) have played an important role, not only as ‘brokers’ between Etheridge Shire landholders and government agencies but also in exchanging information and experiences among graziers. In addition to liaising with government representatives and working with individual graziers, NGRMG staff have coordinated and facilitated meetings (notably the meetings for the Northern Gulf NRM regional plan) which have brought graziers together to discuss land management issues.

The Gulf Savannah Community Steering Committee (see section 4.1.1.1), as part of their effort to open a Bendigo Community Bank Branch, launched a community awareness campaign. This included a series of ‘informative discussion evenings’ on community banking at local venues across towns in the Etheridge and Croydon Shires.

Another citizens’ action group in the Northern Gulf region involved in community development activities is the Hann Highway Action Group. Comprised of residents from Etheridge Shire and neighbouring shires crossed by the Hann Highway, the lobby group was formed in 2004 in response to an increase in accidents on the highway due to the hazardous conditions of the road. It has been involved primarily in lobbying the federal government for funding to seal the road and improve both the safety of the road and access for transporters and tourists.

Within the Shire, the Etheridge Shire Council’s (see section 4.1.1.1) primary role in community development activities is the provision of social services and infrastructure (such as child care, a library and swimming pool) which have provided opportunities for community members to interact. The Council also has given financial support to local community groups, such as the Georgetown Progress Association, and helped residents access funding to establish new community groups, such as a Local Arts Council. The Council also has helped fund and organise community events such as public holiday ceremonies.

The Georgetown Progress Association is another local citizens’ action group. It is comprised of Georgetown residents and has been primarily focused on ‘advancing’ the Georgetown community (Interview respondent). This has included coordinating the Georgetown Community Partnership and a Natural Heritage Trust-funded project to rehabilitate Georgetown’s degraded commons. This project brought together members of the Georgetown Progress Association, the Etheridge Shire Council and town residents to replace exotic woody weed species with native endemic tree species and to stabilise the banks of the rivers with grasses. Other community development activities sponsored by the Georgetown Progress Association include the Folk Art Project.

There are several other community groups that are established within the major townships (predominantly, Georgetown). These include the Bushman’s Ball Committee, the Etheridge Little Athletics, the Rural Fire Brigade and the Local Arts Council.

In addition to these formal organisations and groups, both ‘town people’ and ‘station people’ of the Etheridge Shire are involved in informal groups and social networks that provide opportunities to interact and participate in collective actions.

4.1.2 Action situations

Two action situations form the focus of the Etheridge Shire case study: (1) residents' decisions about land use, and (2) residents' engagement in community development activities (Figure 20). Each of these action situations, and their interconnections, are discussed in the sections that follow.

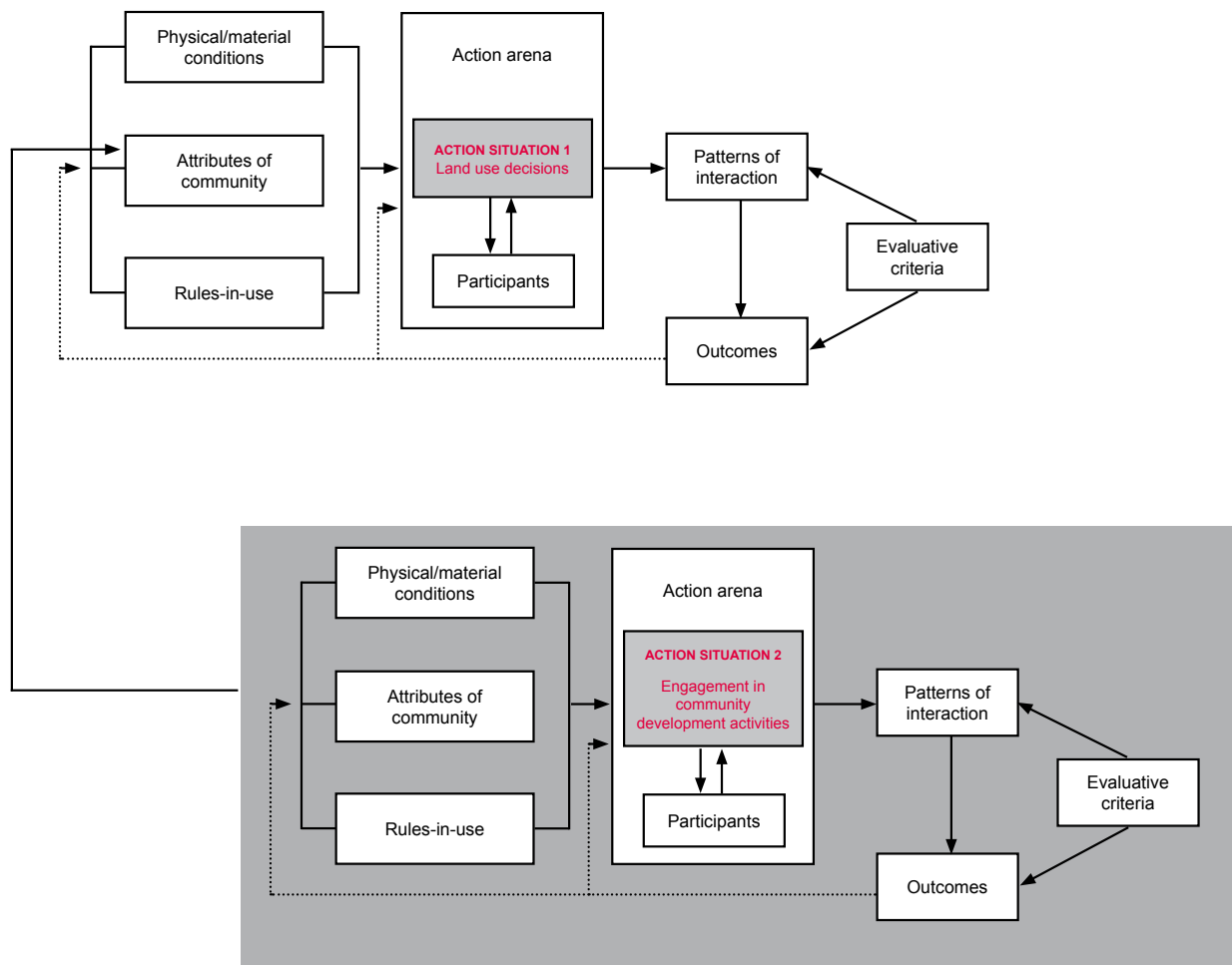


Figure 20: The two linked action arenas in the Etheridge Shire

4.1.2.1 Action situation 1: Land-use decisions

Over the past three decades, landholders in Queensland and the Etheridge Shire (89 % of which is under pastoral leasehold (see Figure 14) have experienced significant economic and environmental changes that have directly affected their decisions concerning their pastoral activities. Two major sources of economic change have been market fluctuations in cattle prices and the exodus of labour from pastoral enterprises, partially in response to the Fringe Benefit Tax and the mining industry boom (see section 4.2.2). Droughts, soil depletion, and the replacement of annual grass species by perennial tussock grasses, among other ecological factors, have contributed to deteriorating pastures and limited cover (see section 3.1). Combined, these social and ecological changes have placed significant pressure on cattle stations in the Etheridge Shire, making it difficult for graziers to maintain their pastoral enterprises and to support their families. In general, graziers' response to these changes has been to intensify production, or to increase cattle stocking rates, as a means to sustain farm profitability (Greiner et al. 2003). The decision to increase herd sizes on pastoral properties, many of which have decreased in size as a result of family subdivision of properties, has been a major pressure in the region (McDonald & Dawson 2004). In combination, these factors may undermine the economic and ecological

sustainability of cattle production in the Etheridge Shire. The ability to cope with this situation, through adaptation in land use activities and management practices, has become crucial for the Shire's landholders to secure their futures in the region.

In addition, graziers' relationships with the government and policy-making processes have changed in recent decades. As the economic importance of pastoralism has declined, so has graziers' political power and ability to influence policy (McAllister et al. 2006). Notably, there has been a shift away from pastoral activities as the dominant and historically privileged (in terms of policies) land use on rangelands to an inclusion of other values including protection of ecosystem services, biodiversity maintenance, and recognition of Aboriginal people's rights of access to land (McAllister et al. 2006). This has increased pressure on graziers to adjust their existing land use practices to meet these diverse and at times conflicting demands in the use and management of pastoral properties (McAllister et al. 2006).

At the same time, the number and complexity of Commonwealth and Queensland legislative and policy frameworks regarding land tenure and natural resource management (see section 3.3), as well as the repeated amendments to these, have made it difficult for landholders to adapt cattle production activities and/or take on alternative land-use activities. In addition, the inflexibility of the rules and limited opportunities and mechanism for local input into their construction have further limited graziers' choices regarding land use activities and management practices. Although government departments have initiated processes and set up institutional arrangements (such as interface agencies) to increase public consultation, natural resource planning and management remain largely in the hands of government staff. The limited interest and experience among the Shire's residents to organise collectively (see action situation 2) through local citizen action organisations or group membership in interface agencies and to engage government departments has also limited graziers' influence on land title and natural resource management rules and curtailed opportunities to expand land-use options available to them.

As a consequence of these changes in ecological and economic circumstances and institutional arrangements, residents in the Etheridge Shire who make their living from natural resource-based activities (primarily graziers) have a narrow range of land-use options available to them. In the midst of these changing circumstances (at the time of field research in October – December 2004) landholders were facing the need to make three broad land-use decisions:

1. to maintain the current dominant land use (cattle production) but diversify management practices (e.g. drought proofing through rotational grazing and supplementary feeding)
2. to discontinue the current land use and adopt a different activity (e.g. agriculture, tourism)
3. to diversify land-use activities and combine cattle production with agriculture and/or tourism.

Landholders interviewed in the Shire during field research in 2004 were engaged predominantly in pastoralism, with a small group involved in horticulture (primarily freeholders), and others complementing pastoralism with small-scale tourism and mining (Table 6). Among pastoralists, some were experimenting with additional management practices, including drought proofing, feedlots and share farming.⁴ While agriculture and horticulture were not major land uses in the region, opportunities were being considered for the development of these industries through irrigation sourced from the Gilbert River (Northern Gulf Resource Management Group 2001). Carbon sequestration was mentioned by a couple of landholders interviewed as a possible future land management option. Some farms were providing limited tourist facilities, including unserviced camping and farm stays. A small group of town residents were also engaging in small-scale tourism activities, mainly providing accommodation and auxiliary services such as catering, shops and tours.

⁴ Share farming is a system of farming in which sharefarmers make use of agricultural assets they do not own in return for some percentage of the profits.

Table 6: Current and potential land use activities and management practices in the Etheridge Shire

Land-use activities	Management practices		
	Most common current practices	Variations	Future options
Grazing	• Rangeland beef cattle production	• Rotational grazing • Agistment • Share farming • Feedlot-based fattening • Livestock export	• Carbon sequestration (maintenance of and/or planting of additional tree species)
Agriculture	• Horticultural (small-scale cropping) • Livestock feed production	• Intensive irrigated cropping of highvalue crops • Irrigated hay production	• Carbon sequestration
Tourism	• Small-scale enterprises • Fossicking • Camping • Hunting • Fishing • Heritage mine site visits	• Caravanning • Organised tours to cattle stations • 4WD tours • Farm stays • Hiking • Aboriginal tours	• Organised wildlife tours • Guided hunting tours

Source: Etheridge Shire interview respondents

Decisions about which land use or management practice to undertake are made by the members of family or business units. Their decisions, however, are influenced by the physical/material conditions and the attributes of the communities in the Etheridge Shire, as well as by the formal and informal rules that guide and govern property rights and land management. These are discussed in section 4.2.

4.1.2.2 Action situation 2: Engagement in community development activities

Only a small group of Etheridge Shire's residents are actively engaged in activities aimed explicitly at improving the community and its wellbeing. The majority of these residents are members of one or more of the regional and local citizens' action groups (e.g. the Gulf Savannah Community Steering Committee, the Hann Highway Action Committee, Georgetown Progress Association) or the Etheridge Shire Council.

This lack of active community engagement is partially tied to the historical division in the region between graziers and residents of townships (see section 4.2.2). 'Station people' and 'town people', as they are locally known, do not have much interaction. Graziers typically spend most of their time working on their property, with family members, hired labour, and other graziers. They visit towns when necessary, usually to purchase commodities and take care of paperwork. Similarly, town residents spend most of their time within the vicinity of where they live and work in the townships.

This division within the Shire's population has limited the nature and extent of landholders' involvement in community groups and activities. A few community events are coordinated and attended by graziers, notably the Bushman's Ball and rodeos. Among graziers, events such as birthday parties and playgroups offer additional opportunities for interaction. However, most of these activities involve only small groups of people, typically extended family members and social networks. Overall, the majority of residents in the Shire involved in formal organisations that promote and organise community development activities are town people.

These social norms, or collective-choice rules, are not the only factors that have impacted both station people's and town people's decision to engage in community development activities in the Shire. Their decisions are also impacted by physical/material conditions (such as the lack of water), community attributes (such as the tendency to base friendships within the family rather than within the community) and other rules (such as not engaging in such activity if it takes too much time). These are further described in section 4.2.

4.2 Conditions in the Etheridge Shire

4.2.1 Physical and material conditions

The Etheridge Shire is located within the tropical savanna region of Northern Australia at the base of the Cape York Peninsula. It covers an area of approximately 39 000 km², which extends across parts of the Einasleigh Uplands and Gulf Plains bioregions (Thackway & Cresswell 1995). The Shire boundaries are approximately equidistant from the east coast of Queensland and the Gulf of Carpentaria, where the shortest distance to the coast is 170 km. The top of the Great Dividing Range flanks the eastern boundary of the Shire and the Gregory range lines the south.

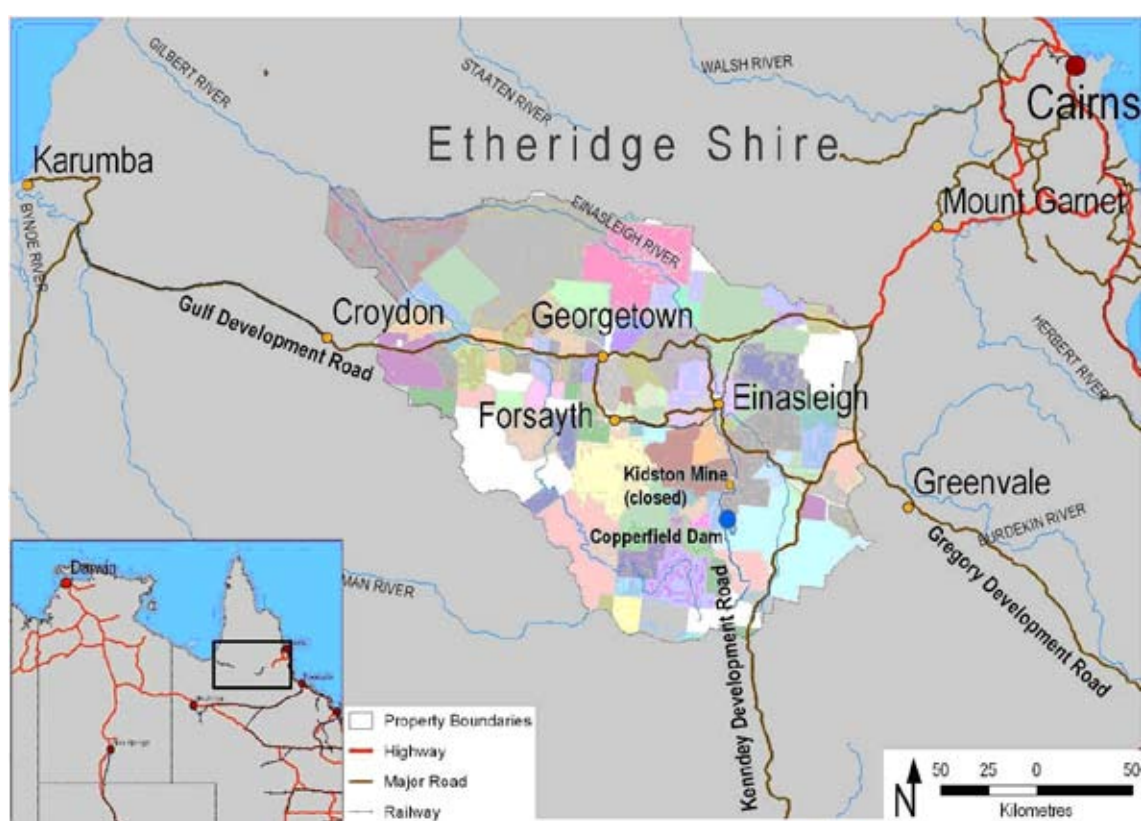


Figure 21: Location of and Grazing Properties in the Etheridge Shire in Northern Australia

Climatically, Etheridge Shire may be characterised as being warm to hot, and dry. Daily temperatures can range between 3°C and 37°C in July and 11°C to 44°C in December. The mean daily maximum temperature ranges from 30°C to 35°C throughout the year. Frosts can also occur between May and September, especially in eastern and southern parts of the Shire; however, the hot climate is more important in limiting primary production than are the occasional frosts (Gulf Regional Planning Advisory Committee 2000, McKeague 1977).

The northern parts of the Shire experience higher rainfall. However, the eastern reaches are influenced by the easterly weather stream and thus experience higher rainfall in winter. Average annual rainfall ranges between 625–800 mm over the region. Etheridge Shire covers the upper part of the Gilbert River Basin and includes the Einasleigh and Etheridge Rivers, which are both fed by substantial creeks. The Shire, however, is not well supplied with water. No streams within the basin, including the Gilbert River, flow all year. There are permanent water holes and extensive sandbanks, and permanent water is obtained by tapping into these sandbanks, although the supply is not large. In some areas, such as the Einasleigh Tablelands, underground supplies of water have not been found at all. The only other major storages for water are farm dams, which are common and of variable size (McKeague 1977).

The Etheridge Shire is situated over a large formation of ancient Pre-Cambrian rock, which is rich in minerals and semi-precious stones (Gulf Savannah Development 2006). The region is predominantly characterised by igneous basaltic rock that is particularly mineral rich. The exception is the north-eastern corner of the Shire, which is comprised of red basaltic soils.

The soil types greatly affect the carrying capacity of grazing lands within the Shire. In sandy forest country only 1–2 head per km² can be sustained, whereas up to 16 head can be sustained on black basaltic soils on open flats and plains. Red basaltic soils can sustain around 8 head per km² (McKeague 1977). The soil type also determines whether cattle receive supplementary feeding. The annual productivity of the land varies between 400 to 1100 kg ha⁻¹, with 100 kg/ha on basalt country. Overall, however, stock numbers are limited more by the quality of pasture than by the quantity (McDonald & Dawson 2004).

The dominant vegetation type within the shire is ironbark woodland. These woodlands cover 60–70% of shire where rainfall exceeds 500 mm. The grass layers within the woodlands are dense and are composed of perennial drought-evading tussock grasses that are 1–2 m high such as kangaroo grass (*Themeda australis*), blue grass (*Bothriochloa ewartiana*) and black spear grass (*Heteropogon contortus*). Poisonous plants also exist, such as heartleaf (*Gastrolobium grandiflorum*) which causes death in cattle. Heartleaf is dangerous to travelling stock (McKeague 1977).

Native pastures in the Shire fluctuate in quality. Large areas are control burned annually to keep pasture grasses short and of higher quality. These native pastures provide the bulk pasture for grazing; however, after they reach their peak they do not ‘hay off’ but tend to deteriorate. Introduced grass Townsville stylo or Townsville lucerne (*Stylosanthes humilis*) is the only sown pasture and can greatly increase animal performance in terms of annual weight gain. Townsville stylo areas can sustain 25 head per km². This pasture improves what would otherwise be very second-rate grazing country. Although Townsville stylo once had spread widely throughout the Shire, graziers note that, ‘those days are gone ... Townsville Lucerne has not been responding as well as it could I would say for many years, probably for 20 years’.

Tree thickening is occurring in many places and woody weeds are a major problem. Riparian zones are especially vulnerable, since they experience intense grazing pressures during the dry periods and are commonly choked with weeds (Macleod 2002).

Wallabies, dingos and feral pigs are also major problems within the Shire, causing substantial damage to crops, calves and riparian zones respectively (Norris & Low 2005).

4.2.2 Attributes of the community

The population within the Etheridge Shire as at June 30, 2005 was 1 012 (421 females and 605 males). Natural increases in the year to June 2005 (births minus deaths) accounted for an increase of seven people, while net migration resulted in a loss of four people. Generally, the population is relatively stable; the percent change over the previous 10 years ranged between -2.2 % and 3.3 %. In 2001 there were 329 households and 242 families. One hundred couples had children under 15 and/or dependent students. The average household size was 2.3. Projections of the population size to 2011 and 2026 are

for between 980–1030 people in 2011 and between 910–1080 in 2026. The median age is predicted to increase by 17 years from 36 years old in 2001 to 53 years old in 2026 (Department of Local Government and Planning 2007).

Most recent ABS figures (2004) show that the Aboriginal population comprises less than ten people (1.7 % of the community) while people born overseas comprise 8.1 % of the total. Almost 30 % of the population have post-school qualifications and 53 % of employed people are in medium/high skill occupations (ABS 2006c). Forty-nine people received the aged pension in 2001. Thirty-seven people received a disability support pension, 73 received the job-seeking payment Newstart Allowance, and 35 people received single parent payments. The average individual taxable income in 2004 was \$32 824 (ABS 2004).

Georgetown is the administrative centre of the Etheridge Shire, with a population of 300 people. Cairns is located 412 km to the east of Georgetown along the Gulf Developmental Road and the Hann Highway (renamed the Kennedy Developmental Road) (see Figure 21). Normanton is 301 km to the west. Atherton, Townsville, Mareeba, Charters Towers and Richmond are other major regional centres servicing the Etheridge Shire.

There are three major highways passing through the Etheridge Shire. The Gregory Developmental Highway runs southward from outside Georgetown off the Gulf Developmental Road, via Lynd Junction and Charters Towers, to Rolleston. The Gulf Developmental Road road begins 7 km south of Normanton, and passes Mt Surprise, Georgetown and Croydon, before it joins the Hann Highway near Mt Surprise. The Hann Highway stretches from Hughenden to the Lynd junction, where it meets the highways that carry traffic from Townsville and Cairns through the Gulf peninsula to Karumba. It is an unsealed highway that is crucial for livestock and freight transporters as well as tourism.

Georgetown has a hospital, library, police station, courthouse, state primary school, two churches, a student hostel, rodeo grounds, a post office, a Shire Hall, Council Chambers, a cemetery and two hotels, in addition to local services such as supermarkets and service stations. The hospital operates in conjunction with the Royal Flying Doctor Service and other health care programs. There are no veterinarians within the Shire, which means that graziers must learn many of the skills themselves or access services from another major regional centre such as Cairns or Townsville. There are no secondary or vocational education facilities that operate in the Shire. This means that children of secondary schooling age must attend boarding schools outside of the district. Little support exists to allow children to receive secondary school while living at home, although distance education is available.

People living and working within the Shire are heavily dependent on fast-speed internet services. The internet provides access to goods and services and has changed the nature of the grazing industry within the Shire. As one grazier explained:

I don't know how we used to run our business without broadband Internet. We sell our cattle over it, we do our banking over it, we buy cattle, we buy parts, we sell tractors, real estate – we do everything on it now! It was [also] totally free. They came out and they put it all in and they gave us a computer package. We just had to have the right computer, and if you didn't have a computer they gave you one to pay off interest free. (Interview respondent)

The dominant land use within the Shire is cattle grazing. There are 95 grazing properties within the Etheridge Shire (see Figure 21). Property size is an important influence on management practices. The mean property area is 346 km² (sd=470) and the median property is 196 km². The largest property is 2 815 km² and the smallest is 0.03 km² [excluding town lots or properties that are less than 0.1 km² (=10ha)]. The size of herds ranges from 400 head to 20 000 head. Larger properties (>1 600km²) tend to be owned by companies whereas smaller properties tend to be run by families. Companies use a 'camp' system with strategically placed yards and employ mustering teams of 3–6 people to move

the cattle between them. Large properties also use helicopters for mustering and aircraft for cattle spotting, checking fences, checking watering points and transport around the property. The herd is often separated out into sale cattle, breeding cattle and 'weaners'. Smaller properties tend to work the herd as a single unit and employ more intensive husbandry practices. Generally, smaller properties concentrate on producing fat bullocks, while large properties concentrate on producing steers which are then fattened elsewhere such as on the Atherton tableland, the east coast or the Brigalow area. However, according to some graziers, 'this ... is just purely breeding for us now ... this is not good fattening country'.

A variety of beef cattle breeds exist within the Shire and include straight breeds (such as Hereford, Brahman, Droughtmaster, Santa Gerturdis and Shorthorn) as well as associated crossbreeds. The development of live export facilities and port infrastructure at Karumba in 1994 helped secure the viability of the cattle industry within the region. Cattle exports through Karumba vary considerably from year to year with almost 49 000 head exported in 2000 but less than 10 000 exported in 2004 (Drum & Gunning-Trant 2008). The majority of animals are produced to meet the American grinding beef market via live exports to the USA and to a lesser extent the Japanese, Korean, Indonesian and Philippine markets (Northern Gulf Resource Management Group 2001). Prior to the development of the live export facilities, cattle were transported to Darwin and the southern markets. From the 1870s, when the industry became established in the region, cattle were walked to Bourke, Muswellbrook and Melbourne to be sold. This was common practice until the 1950s when drought meant that droving became more difficult and there was a move to road transport.

While grazing in the Etheridge Shire dominates the area's economy, predictions for outback Queensland indicate that grazing is declining and its capacity to contribute to future economic and social welfare is limited (Fargher et al. 2003). Studies carried out in other regions of Australia also indicate that family-based grazing enterprises are facing considerable challenges in generating economic returns for long-term survival (Pitt & Wynne 1994, URS Australia 2007, Wilcox & Cunningham 1994). Difficulties with succession planning and long-term dependence on government support are some of the problems these types of pastoral communities are encountering that have constrained their ability to manage changes (Fargher et al 2003, URS Australia 2007).

The gross value of cropping within the Etheridge Shire is \$1.4 million per year (Office of Economic and Statistical Research 2002). This may increase in the future as a result of diversification into horticulture, which could take place principally along the Gilbert River. Access to water for irrigation development, however, is a limiting factor (McDonald & Dawson 2004). Dry land agriculture is estimated to require (with a probability of at least 80 %) at least 16 weeks per year of rain to constitute an adequate growing season (McKeague 1977). This requirement is met only on the extreme east of the Shire, in the Mt Surprise-Spring area, but this region is very rocky and difficult to cultivate.

Cotton is one of the newest crops being developed within the Shire. It is a potentially very valuable crop for the Shire, although environmental concerns relating to water consumption rates, pesticides and off-site impacts are beginning to emerge and graziers have expressed strong reservations about planting cotton. Some graziers grow peanuts because they provide good cash flow, although one grazier explained, 'they [peanuts] are high risk ... Cattle are a little less risk.' Only a few graziers are growing and selling hay. Hay is insurance against drought and those that sell the product say that they 'cannot keep up with the demand.' The conditions in the Etheridge Shire are ideal for growing and curing hay.

Copper, gold, lead, silver and tin were all discovered in the region in the late 1800s, which led to relatively rapid development. However, in 1900 after these discoveries were proclaimed as 'too small', development slowed or halted and much of the population left. Although there are 'thousands' of derelict mining shafts in the region, there are now only a few very small working operations mining for alluvial gold.

Reflecting the general trend in grazing areas across Australia (Fargher et al 2003), tourism in the Etheridge Shire has grown in importance as a generator of employment and economic wealth. The Etheridge Shire is promoted as a relatively new destination for the 'self-drive' market. Ninety-five % of tourists are currently domestic, locally known as 'grey nomads', represented mostly by over-55-year-olds towing caravans. However, the unsealed roads within the regions can be dangerous for those not familiar with unsealed roads or the etiquette of sharing the roads with cattle trains. Tourists can stay at local Bed and Breakfasts and pubs/hotels, or, with permission, they may camp on private lands. Tourism is limited to the dry season between April and October.

The major natural attractions in the region include Mt Surprise, the Undara Lava Tubes, Cobbold Gorge and Copperfield Gorge. There is also panning or fossicking for gold near Forsayth and Georgetown, agates at Agate Creek and gemstones at Mt Surprise and Tallaroo Hot Springs (Gulf Regional Planning Advisory Committee 2000). Cultural attractions include 'Terrestrial', the Mt Surprise Museum, the Savannahlander Train, the Gulflander train and the collection of agates and thunder eggs (a type of solid geode) at the Goldfields Hotel.

The three leading industries by employment for the Etheridge Shire's residents are:

1. agriculture, forestry and fishing (41.7 %)
2. mining (8.6 %)
3. accommodation/cafes and restaurants (8.6 %) (AdvanceCairns 2004). In 2004, the unemployment rate in the Shire was 4.6 % (31 people).

Employment within the Shire is in a conundrum. On the one hand, there is an increasing shortage of skilled labour within the region. On the other hand, there are insufficient opportunities to retain even family members within the region. As one grazier explained:

...as management [of the grazing lands] improves, the employment requirements get less and less. It means that for every family property there is probably a job for only one of the kids. Everyone else will have to leave to get a job. Currently, because we have no other industry in the Shire, it means they probably have to leave the district to get a job. (Interview respondent)

Instead of employing permanent staff, there is a rise to more widespread use of contract musters to assist with labour-intensive periods. Contract musters are required to pay their own workers' compensation, super, taxes, and are responsible for their own conduct.

Graziers are locally referred to as 'station people'. They strongly identify with their land. As described by one property-holder, graziers are 'people who have been on properties a long time, they have this connection with the country similar to what the indigenous people do ... just this love and feeling.' The former are known in the region for largely keeping to themselves [e.g. 'for me, working with a mob of cattle is easier than working with people' (Interview respondent)]. They also are involved in specific types of community activities, as explained by an interview respondent: 'the station people are more drivers of events like the Bushman's Ball and rodeos.' Other residents within the Etheridge Shire are the 'town people', a name given to those who identify mostly with their local township. There exist tensions between graziers and residents of the towns as expressed in the following quote:

The station people are just so damn busy out there on their properties, very few of them have time to commit and drive to anything in town ... [creating] a division ... between the towns' people and the station people. (Interview respondent)

People living on the land have varying levels of interactions with the broader community. For example, one lady remarked how, ‘like at one stage I couldn’t even sign my name, it had been so long: you just forget how to talk to people’. However, the isolation is part of the attraction for many land-holders. One grazier explained, ‘landholders came to this region to be on their own ... away from annoying neighbours, visitors, government people’ (Interview respondent).

Networks do exist among graziers for business purposes. For example, about 50 % of properties in a recent survey were run in conjunction with another nearby property. There was evidence of specialist roles for the additional properties (Bortolussi et al. 2005). However, one grazier explained that, ‘there are [only] a few odd occasions where you would work in conjunction with a neighbour’ (Interview respondent). Formal linkages between Aboriginal people, fishers and graziers are encouraged through the Southern or Northern Gulf NRM bodies.

4.2.3 Rules in use

4.2.3.1 Formal rules

Land-use choices in the Etheridge Shire are strongly influenced by government policies and related legislation regarding land tenure and natural resource management. These formal rules are complex and characterised by multiple planning and legislative arrangements. Most of these arrangements are not exclusive to the Etheridge Shire, but form part of the overall institutional framework guiding natural resource use for the entire Gulf Region.

Under the Australian federation, the states are responsible for land administration, natural resource management and statutory (‘town’) planning.⁵ Formal rules that guide and govern land use choices in the Shire derive generally from the State’s sovereign power (authority to legislate on behalf of its people) and proprietorial power (authority to allocate resources according to law to those who can use them) (Queensland Government 2002). A State’s land and natural resource laws and policies can be divided into two broad categories: (1) proprietorial, or tenure-related, mechanisms (e.g. leasehold, freehold, statutory covenants), and (2) regulatory mechanisms (planning schemes and by-laws) (Queensland Government 2002). These, combined, strongly affect land use choices and patterns.

The key arrangements that most influence land use and management in the Shire include the *Land Act 1994*, the *Native Title Act 1993* (Commonwealth and Queensland), the *Vegetation Management Act 1999*, the *Queensland Nature Conservation Act 1994*, the *Integrated Planning Act 1997*, and the *Water Act 2000*. These are summarised in Table 7.

Of these policy and legislative frameworks, three in particular were frequently cited by interview respondents in the Etheridge Shire as significantly impacting their land-use decisions: the *Land Act 1994*, the *Native Title Act 1993*, and the *Vegetation Management Act 1999*. These are discussed in more detail below.

⁵ The Commonwealth has jurisdiction in the territories and on issues such as world heritage sites, defined under the Constitution as part of external treaties. While responsibility for statutory planning largely lies with local governments, they remain ‘creatures’ of the States (Queensland Government 2002).

Table 7: Key legislative arrangements impacting land use choices

Title	Purpose	Specific regulations and processes that affect land use choices in the Etheridge Shire
<i>Land Act 1994</i>	To consolidate and amend the law relating to the administration and management of non-freehold land and deeds of grant in trust and the creation of freehold land.	• Confers land allocation powers and powers to determine most appropriate tenure type. • Specifies processes for allocating State land and procedures for determining who to allocate land to. • Specifies terms and conditions of leasehold tenure and sale. • Land administered under this Act must be consistent with the <i>Native Title Act 1993</i> (Commonwealth) and the <i>Native Title Act 1993</i> (Queensland). • Provides mechanisms for compensation and resumption of land, lease or easement.
<i>Native Title Act 1993</i> (Commonwealth)	To provide for the recognition and protection of Native Title and establish ways in which future dealings affecting Native Title may proceed and to set standards for those dealings. The Act also aims to establish a mechanism for determining claims to Native Title and to provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of Native Title.	• Definition/confirmation of processes/acts that have extinguished Native Title and circumstances where Native Title is not extinguished. • The impact of future acts on Native Title (extinguishment, non-extinguishment). • Definition of Indigenous Land Use Agreements (body corporate agreements), including area agreements and alternative procedure agreements, processes for defining and negotiating them and impact on land use. • Processes and procedures for the renewal, re-grant, re-making or extension of certain acts for primary production on non-exclusive agricultural and pastoral leases (including farm tourism). • Measures of compensation for loss of rights and definition of who pays. • Right to land use defined for Traditional Owners, landholders and third parties.
<i>Native Title Act 1993</i> (Queensland)	To implement Native Title legislation in Queensland in accordance with the Commonwealth Native Title Act. In particular the Act provides mechanisms to validate past acts, and intermediate period acts, invalidated because of the existence of Native Title and to confirm certain rights. It also seeks to ensure that Queensland law is consistent with standards set by the Commonwealth Native Title Act for future dealings affecting Native Title.	• Native Title claims in Shire. • Processes and capacity to negotiate Indigenous Land Use Agreements within Shire. • Mechanisms to purchase land. • Definition of different kinds of past acts and their impact on Native Title extinguishment (e.g., public works, granting interests in land and water). • Definition of different kinds of future acts in cases where ILUAs exist and there are potential compensation opportunities. • Confirmation of certain rights (e.g. ownership of natural resources confirmed to the state, public access to beaches and water ways, etc, confirmed) and that these rights do not extinguish Native Title rights and interests. • Confirmation of the total extinguishment of Native Title by previous exclusive possession (e.g. freehold estate, perpetual pastoral lease) and the partial extinguishment of Native Title by previous non-exclusive possession acts (e.g. non-perpetual leasehold).
<i>Vegetation Management Act 1999</i>	To regulate the clearing of vegetation in a way that conserves regional ecosystems and vegetation in declared areas. The Act also aims to ensure that clearing does not cause land degradation, that the loss of biodiversity is prevented and that ecological processes are maintained.	• Provisions for the retention and maintenance of vegetation. • Implemented through regional vegetation management plans (based on regional ecosystem mapping), vegetation management codes, land declarations through local government town planning schemes, and enforcement of vegetation clearing provisions. • Regulates broadscale tree clearing applications and regional ballot systems for vegetation clearing permits.

Title	Purpose	Specific regulations and processes that affect land use choices in the Etheridge Shire
<i>Queensland Nature Conservation Act 1994</i>	The conservation of nature using strategies for the dedication, declaration and management of protected areas and wildlife and its habitat.	• Provides powers for habitat protection. • Mechanisms to implement the Act include: • 11 classes of protected areas ranging from National Parks, World Heritage and conservation areas involving private property • Seven classes of wildlife: presumed extinct, endangered, vulnerable, rare, common, international and prohibited wildlife • Mechanisms to allow Aboriginal and Torres Strait Island people to hunt and gather protected wildlife for traditional purposes • Conservation plans and codes of practice for the taking and use of wildlife for commercial/non-commercial purposes • Controls and regulations for the keeping and use of specific species of protected wildlife • 'Interim conservation orders' to conserve, protect or manage threatened wildlife, habitat or areas • Conservation agreements with landholders.
<i>Integrated Planning Act 1997</i>	To provide a framework for integrated planning and development assessment to promote ecologically sustainable management of development and its effects.	• Provides mechanisms for local strategic land-use planning, and coordinates and integrates multiple development assessment processes (state, regional and local) at the local level. • Local Government Planning Schemes, which regulate development and land use within the Shire boundary, are a key arrangement instituted through this Act. Local government planning schemes and development assessment process also provide triggers to refer local development proposals to state agencies and facilitate the implementation of legislation such as the Vegetation Management Act and Water Act.
<i>Water Act 2000</i>	To provide for the sustainable management of water.	• Water Resource Plans and Resource Operations Plans defined on a regional basis by government and with local stakeholders. Plans must take into account environmental flows. • Provides for the authorised taking of water (e.g. to collect overland flow into a dam) without entitlement (e.g. for stock watering or domestic purposes). The act also provides for the taking of water from a watercourse for watering travelling stock. • A person can take and use water from overland flow and sub-artesian water unless limited by a moratorium notice or water resource plan. • Landholders may be required to apply for water allocation licences to take water (from a watercourse, lake or spring on or adjoining the land or an aquifer under the land), and use it on any of the land, or interfere with the flow of water on, under or adjoining the land. • A land and water management plan must be approved by the Department of Natural Resources & Water (DNR&W) for the use of water for irrigation.

The *Land Act 1994* confers land allocation powers and powers to determine the most appropriate tenure type. The main forms of tenure are leasehold and freehold property. Owners of freehold land are less restricted in their land-use options. Legislation entitles them to rights to the vegetation, while the Crown retains the rights to minerals and petroleum (and fauna), and the State reserves the right to land for roads (Queensland Government 2002). Leaseholders are more restricted, as leasehold properties remain Crown land. Pastoral leases are governed by state government statutes. In the Etheridge Shire, the most common tenure regime is pastoral leasehold property. Leaseholders do not have full ownership or use rights; they are required to use the land for pastoral purposes, which include raising livestock and necessary infrastructure (e.g. fences, yards, bores). Under a pastoral lease, changes in land use are restricted. Leaseholders have the option to submit applications to transform parts of the land into a different type of tenure or for special leases, such as low-impact tourism. However, it is a lengthy process that requires extended negotiations with the State and is not guaranteed to gain approval. Leaseholders also have the possibility of changing their leases to a perpetual lease, which grants landholders rights closest to freehold property. However, there are a series of strict criteria that must be met, including the resolution of native title issues. The regulations and mechanisms for doing so are set out in the *Native Title Act 1993*.

The *Native Title Act 1993* was introduced by the Commonwealth to provide recognition and protection of Native Title. It defines processes that must be followed for Native Title to be claimed, protected and recognised through the courts. The State of Queensland enacted its own *Native Title (Queensland) Act 1993*, which is consistent with Commonwealth Native Title. The Act gave legislative recognition to an existing common law of customary Aboriginal law, that of native title. This recognition was important because it did ‘not suggest the granting of a right by government but rather accepts that the right has existed and is now recognised’ (p&e Law, no date: 27). In other words, claiming land rights is independent of native title.⁶ In addition, different Aboriginal groups can exercise their native title over the same land and native title can co-exist with non-Aboriginal proprietary rights (e.g. leasehold property rights) (p&e Law, no date). In the latter case, native title rights are outlined under Indigenous Land Use Agreements (ILUA). ILUAs include area agreements and alternative procedure agreements, processes for defining and negotiating them and impact on land use. The basis of an ILUA is the memorandum of understanding (MOU) which is an agreement between the Traditional Owner(s) and the leaseholder.

Another key piece of legislation guiding use and management of land is the *Vegetation Management Act 1999*. The purpose of the act is to regulate the clearing of native vegetation. It restricts landholders’, notably leaseholders’, rights to clear vegetation on their properties. Clearing of fence lines (10 metres on either side) and development sites (e.g. 5 hectares for a dam site, 5 metre road) are allowed without a permit.

These key pieces of legislation contain sets of working rules that govern people’s actions when it comes to choosing and undertaking land uses. The interviews also revealed further informal rules-in-use by residents in the Etheridge Shire in making decisions about their land-use activities, as well as regarding engagement in community development activities.

4.2.3.2 Informal rules

Etheridge Shire leaseholders have a set of informal succession rules that guide the selling or inheritance of the property lease. Graziers interviewed revealed that they were often guided in their decision making by the goal of keeping their businesses within the family, a response to an emerging trend of companies buying up family-run grazing businesses.⁷

⁶ Native title is not the same as land rights. Land rights are new legal rights that are created and granted under Australian law to Aboriginal and Torres Strait Islander Australians (Aboriginal Land Rights Acts).

⁷ Similar to other rangeland regions of Australia, in the Etheridge Shire family-based grazing enterprises are ageing, and succession planning has become an issue (URS Australia 2007).

Differences in cultural values and social norms guiding graziers' and town residents' attitudes towards living and working in the Shire also have had a notable impact on choices regarding both land use and community engagement. Graziers identify strongly with their land and they place value on privacy, isolation and being independent. Given the uncertain returns on investment in outback regions, graziers also expressed a generally cautious approach to risk taking. For both station and town people the norm is to interact mainly within their immediate circles of friends, family and work colleagues, and there is little mixing between these two groups.

In combination, these three sets of attributes – physical and material conditions, attributes of the community and rules-in-use – have created distinct incentives and constraints for Etheridge Shire residents and their decisions regarding land use and community activity. The interactions among these three sets of attributes and stakeholders discussed in this section are described below.

4.3 Patterns of interaction

In the IAD framework, mapping the strategic interactions among participants and rules in a given action situation is essential to identifying and understanding the outcomes of the action arena. These interactions occur within and are shaped by the specific set of physical or material conditions, community attributes and rules prevailing in the Etheridge Shire. One of the defining characteristics of the Etheridge Shire region is the relatively low levels of interaction, not only among residents but between the Shire's inhabitants and other stakeholders. The extensive size of some leasehold properties, the sparse population density, culture and norms favouring privacy and social isolation as well as the sociocultural and economic differences between station people and town people contribute to limiting the opportunities for, as well as the actual frequency of, interactions among residents of the Shire. The geographical isolation of the Shire from Brisbane and other major cities has also restricted interaction between Shire residents and, in particular, state government department staff. Within this context, interface agencies, notably the Northern Gulf Resource Management Group (NGRMG), have played a particularly important role in facilitating communication between residents and government stakeholders, as well as in providing access to information about institutional arrangements. These organisations, along with local government and citizens' action groups, have also helped foster and promote greater participation of and interactions among residents in relation to development activities in the Etheridge Shire.

4.3.1 Patterns of interactions that impact land-use decisions

4.3.1.1 Interaction with the Queensland government

4.3.1.1.1 State government policies and regulations in general

Section 4.2.3.1 outlined some of the formal institutional arrangements existing within the Shire and in the region generally. The key Commonwealth and Queensland legislative and policy frameworks impacting land tenure and natural resource management in the Shire are the *Land Act 1994*, the *Native Title Act 1993*, the *Vegetation Management Act 1999*, the *Queensland Nature Conservation Act 1994*, the *Integrated Planning Act 1997* and the *Water Act 2000*. Developed and signed within the past decade, these government policies and regulations represented a significant change for the Shire's leaseholders, as expressed in the following comment from an interview respondent:

If your grazier had been around 30-odd years ago you could pretty much do your own thing; coming to now it is becoming a lot more controlled. I can see that government intervention is going to happen more and more. We will get round droughts, floods, and fires, but the battle I think is legislation. That is my generation's battle.

One respondent felt that the driving force behind this change had been the mounting pressure on central Queensland to focus on ‘the best use of land.’ ‘Further down south [Australia] the “cowboys” have just cleared everything [and] because they have done that the government has gone hard on everyone,’ explained another respondent. For leaseholders of the Etheridge Shire, this has translated into a greater presence and enforcement of policies and regulations through reforms of existing land and natural resource management policies and legislation.

While the majority of landholders interviewed expressed concern about the increase in ‘government intervention’, they felt most frustrated by the top-down approach to policy development:

Often government are doing things and have processes in train that communities don't get involved in. Often they don't know about [policies and regulations] to start with and then when they know about it, they don't know what is the importance or value to them.

Other respondents felt that the problem was not community disinterest or shortage of information but the lack of opportunities for local input: ‘We have not really been consulted; we haven’t had any input into them, and are sort of aware of them but haven’t had much development in them.’ This was echoed by other interview respondents: ‘By the time policy comes out for community consultation, it is usually another [way] of saying policy has been formed ... it comes across as a done deal ... there is only a remote opportunity that you will change policy’.

As noted by one respondent, the community perception is that government is totally disconnected from the community:

Once upon a time all of our parents used to understand what it was like to be on a farm, did some work on a farm, had a familiarity with what it meant. Whereas today's generation that are making the decisions have absolutely no idea, and what is happening is that a lot of policies and programs are being developed without an understanding of rural areas.

Overall, respondents felt that there was inadequate government face-to-face contact with landholders.

There are so few [government officers] that have contact with landholders. Very few officers are comfortable talking to the people ... Most people prefer to work with their comfort zone ... have a meeting of like-minded people where you are comfortable, talk about it in a language that is acceptable ... Too often the crucial phase of talking to landholders is avoided.

Many noted that extension and education staff had been almost completely withdrawn from the region, so accessing and making sense of information about changes to legislation and their impacts on land management options was very difficult.

While the government had increasingly sought greater public consultation, their approach was characterised as being ‘in a meeting-type style, and they are assuming access to the web, and that people will go on the web and read a strategy. That is the government’s consultation, by making something publicly available.’

One respondent felt that the problem was that there was a ‘lack of understanding between cultures’:

The people out here in the Gulf are very different to the people at Mt. Isa, and extremely different to the people at Longreach, and, at the opposite end of the world, to the [government] people in Brisbane. So there is a lack of understanding between those cultures and those languages. It is not noticed, discussed, or dealt with.

Government language in particular was identified as a factor contributing to the lack of mutual understanding and implementation of vital institutional arrangements:

Landholders have little understanding of government policy. That has come about by language and by the way these things are written. They are just too difficult to read. For example, water resources charges. It refers you to three other Acts, so to understand this you have to go to those Acts. The drafting is deliberately complex.

One landowner, attempting to draft an Indigenous Land Use Agreement (ILUA) with the local Ewamian people, expressed frustration:

... it [Native Title Act and other documents provided by the Native Title Tribunal] was difficult to read through because it is a big jumble of collated input from different stakeholders right across the state ... I haven't gotten my head around it yet.

Respondents stated that they also had difficulty accessing information. It was stated often that you had to be 'in the know' to be informed about changes and impacts in relation to institutional arrangements. As one respondent explained, 'there are gatekeepers everywhere; it is really difficult for people to access information. You will only get the information if you ask the right questions or the right people. The average person is really disadvantaged.' This is echoed by others:

Sometimes, I think we miss out. I think that if you know someone in the Landcare office, you tend to get a lot more stuff, where if you are just quiet and no one knows you, you don't get told about these things ... everyone should be emailed about what is happening.

Additionally, interview respondents consistently expressed confusion over the nature, characteristics and implications of changes in regulations. Information gathered about these arrangements was patchy, often misinterpreted and therefore misunderstood. Many respondents freely acknowledged this confusion, pointing to it as a concern. Many had sought clarification from government agencies such as DNR&W.

Respondents often spoke of the need to have an information hub as well as support in implementing their legal and regulatory obligations effectively. For one interview respondent (a government officer), an important aspiration was to initiate processes that would facilitate the development of information bases that were bottom up and recognised community knowledge.

I think one of the faults has been that information has been built from the top down. It has been assumed that the experts or those with degrees have the information, and should share it with those who don't. The best information rests with the community. And information should be built from the bottom up.

One respondent noted that landholders also generally had difficulties communicating effectively with the government. When government representatives came to the Shire, the residents tended to 'whine' about problems and did not present their issues as an organised group. This gave the impression that they were incapable of effectively expressing their concerns. This style of communicating – or lack of communicating depending on the perspective – is in part a legacy of a long tradition and culture of 'toughing it out' on one's own and solving problems within one's own family.

For the majority of interview respondents, all of the above problems with the policy planning and implementation process resulted in land-use and management regulations that were inappropriate for the region and unusable for landholders:

There is a huge difference between what an academic or bureaucrat sitting in an office will consider workable as compared to someone [grazier, farmer] in the field. The authors of these projects are including every conceivable issue that they can think of, but the person out on the ground hasn't got the resources or the time to consider any more than his own patch. So what we are ending up with is a regulation or requirement coming out from the state government that is unreadable and unworkable to most landholders.

One respondent felt that there was a need for more ‘realistic’ regulations that reflected an ‘awareness of the region’ and took into account such things as local demographics:

Most [government] people don't have any understanding of what it means to have one person per 19 000 hectares. When you talk about land management, programs and policies ... well, that is all very well, but when you have only one person per 19 000 hectares, it doesn't apply, and you have got to do other things.

In the opinion of another respondent, the majority of government regulations were ‘destined to be written and to go on a shelf, and will never be pulled out and read ... [legislation] is going to be ineffective because even though it is complete as a policy it is inappropriate at the ground level.’

This sense of frustration was also expressed by people other than landholders of the Etheridge Shire. One staff member of an environmental organisation responsible for fostering greater dialogue between government and local stakeholders noted: ‘They [some Ministers] actually feel quite frustrated too because they feel as though they can't bring changes in because they think if they bring in radical changes that they will get voted out.’

The response of residents to these institutional problems varied. Some viewed the state policies as ‘confrontational legislation’. This led to resentment and retaliation (for example, through illegal clearing of vegetation) by landholders who felt unsupported by institutions or the changes being implemented. In other cases, landholders adopted a strategy of simply ignoring regulations. A respondent explained: ‘If this piece of policy has been wandering around the countryside for years and hasn't come through their front gate, then [landholders'] attitude is that it has nothing to do with me.’

Others expressed a sense of resignation: ‘it just all becomes too hard and it is easier to just get up in the morning and do your day's job and just hope it all goes away.’ And other landholders felt disempowered and helpless in the face of many government arrangements:

There is some thinking out there that at the end of the day you really can't influence government policy. It is something you really can't worry about, good, bad, or otherwise. The only thing you can really control at the end of the day on your property is your direct costs. If you work at controlling that well, you just pick up on the averages.

Equity emerged as an issue in this context, with respondents believing that the benefits of their hard work were generally enjoyed by urban and city people. In the opinion of one respondent, ‘The southeast corner [of Queensland] gets what they want and the rest of us just tag along.’ Another grazier interviewed felt that ‘the people on the ground don't get near as much funding, as do the people who get to talk about it.’ Several respondents expressed a frustration at the increased pressure to perform stewardship roles for their land but with little support to do so:

There is a whole quantum shift in the whole use of land. Land management now has to be considered and people can't do whatever they like, particularly now when they're starting to see, and I suppose that is another reason too, because it has only been since we have had these last spell of dry years, the last four years, that people have actually stood back and noticed, that the land isn't coming back.

All of the above problems and confusion surrounding land and natural resource policies and legislation have created a heightened sense of uncertainty, articulated most strongly by leaseholders in the Shire. Many respondents felt that they did not have the capacity or decision-making power to forward plan for their properties if they were unclear what their mandate to do so was.

The last 15 years has been spent putting in fencing and water, In one way it is good because all of your improvements are new, but without that land security you are worried about spending money, because you don't know where it is going to end up. (Interview respondent)

Many felt worried that changes to legislation could present obstacles to their aspirations, so were wary of making commitments in the short term. Some of the laws and changes in the *Native Title Act 1993* (Commonwealth), the *Native Title Act 1993* (Queensland), the *Land Act 1994*, the *Vegetation Management Act 1999*, the *Water Act 2000* and noted in the Draft Leasehold Strategy Review were seen as disincentives to ‘doing good business on land’. For example, a review process resulted in the *Land Act 1994* introducing principles of duty of care, resource sustainability and tree and vegetation management, thus putting focus on landholders in their management of leasehold lands. For many respondents, the bottom line was that the main challenge for the future was effectively negotiating these institutional arrangements.

In addition, the heightened pressure on businesses to do paperwork emerged as a strong disincentive to choosing to diversify land use, and a disadvantage in the conduct of existing business. One landholder in the Gilbert River noted that everything had to be licensed, accredited, and that business plans and auditing programs had to be established for a wide scope of activities.

There is a lot of paperwork and it takes about 3 weeks for me to do our annual reviews, and you have to send them everything. They want to know everything, like they take all of your profit and losses, your balance sheets – pages and pages. (Interview respondent)

Another landholder indicated that up to 20 % of his time, or the equivalent of one day a week, was now taken up with paperwork requirements. Most respondents noted that it was often the women on the properties who ended up doing this work. The pressures of paperwork were the most marked way in which institutional changes, such as the changes to vegetation management law and the native title act, were being tangibly felt and expressed.

4.3.1.1.2 The Land Act 1994

The possibility of renewing and/or renegotiating lease arrangements emerged as a main topic of concern and frustration among landholders interviewed in relation to their ability to pursue certain land-use activities. The process of renewing leasehold properties is complex. A person is required to have a property management plan but, recent modifications in legislation require that leaseholders use a specific, government-defined format. The problem, as identified by one landholder, that:

I don't really know what format that is ... so it is going to be similar to the clearing [permits] – they're [government] going to tell you what to do and there is not going to be any benefit to you [because] if it [a specific land use activity] is not in their format then they are not going to look at it. [Interview respondent]

Splitting pastoral leases has also become a contentious issue in recent years. The Queensland government, through DNR&W, has moved towards keeping pastoral leases as large parcels of land, while some landholders have wanted to split the property lease for distribution among family members and/or diversification of activities.

We applied to split the property into three blocks, which was approved, but unfortunately national parks had an acquisition on the property ... about 80 square kilometres of country ... one of the conditions that they set down was that they return that country at no compensation if we wanted to go ahead [with splitting the property] ... we dropped it. (Interview respondent)

With regards to renegotiating lease arrangements, landholders were aware of the importance of:

1. complying with recent water and vegetation restrictions (seen in changes to the Draft Leasehold Strategy Review, the Native Title Act, the Vegetation Management Law, and the water reform initiatives)
2. engaging in negotiations to establish Memorandums of Understanding (MOU) with Aboriginal people

3. consulting with government in relation to property management planning and conservation agreement planning.

These activities were viewed by landholders as providing leverage for negotiating enhanced lease arrangements, and making certain land-use options possible. Landholders' experiences with these three sets of laws and regulations are discussed in the sections below and section 4.3.1.3.

4.3.1.1.3 The vegetation management law

Changes in vegetation management laws came up often in the field interviews as a contentious issue. Respondents often pointed out that there had been minimal tree clearing in the Etheridge Shire region to date. As a result, the 'fairness' of restrictions on land clearing was often raised. Respondents felt that they were being 'punished' for the large-scale clearing in the south-east of the State, clearing that they generally did not agree with.

Some landholders felt their future aspirations to develop their land were inhibited by the changes in the vegetation law. Acquiring a clearing permit was a bureaucratic and lengthy process. One landholder interested in obtaining a land-clearing permit to expand his area for hay production, explained:

I put in for an application, it took one hell of a lot of work to do it, and there are so many obstacles in your path ... to actually get the clearing application correct, to their way of thinking, you have to get their vegetation management map of the area and work off that, and that map is work, for a start, but you had to do it. (Interview respondent)

The process to get a land-clearing permit is further complicated by a ballot system in which all applicants for permits are 'lumped into a basket', and permits are allocated until they run out. 'I was the 290th (applicant) out of 300, so I doubt I will get any more approval, which will absolutely wreck my [land use] program,' stated one landholder.

Many leaseholders felt that the new, more restrictive vegetation management law further eroded the few property rights they held. As observed by a staff member of an environmental organisation:

As soon as the big debate [on land clearing] started ... I started hearing more and more about wanting to clear when they were told they wouldn't have the right to clear.

However, he added, 'it's not just government coming in and imposing stuff. It is the uncertainty.'

This was echoed by another staff member who felt that:

It is really important that we understand where the farmers are coming from and what their economic realities are. But at the same time they [farmers] have to understand the ecological reality of tree clearing ... that it is a hugely destructive process, not just on biodiversity, but on soil structure and water quality.

She added that one of the challenges for communicating to graziers the necessity for land clearing regulations was that 'they are feeling more and more disempowered in terms of control of their economic futures and their markets, that they are losing control over many aspects of their day-to-day lives.'

Graziers' negative experience with attempts to revise leasehold regulations in the mid-1990s also partially explains their strong reaction against vegetation management law. Leaseholders had 'fought and kicked and came up with what they wanted for their lease of their area of land and the government turned around and said 'get lost' and people were very disempowered' (Interview respondent). Graziers in the region felt that they went through a similar process with the vegetation management law:

The community went through this complicated, long drawn-out process to say what the community wanted, and the government turned around once again and said 'get lost'. That is the reason why people are so pissed off about the vegetation management stuff in the shire now, not because they have this incredible need to clear. (Interview respondent)

There is also the added problem of misinformation about the various regulations underlying the vegetation management law. Respondents pointed out that both government staff in the area and landholders often had the wrong information, and rumours were easily sparked. 'I don't think there would be such a big problem if there was more straight information out there,' observed one local respondent.

4.3.1.1.4 The Queensland Nature Conservation Act 1992

Some leaseholders were aware of the possibility of engaging the government in conservation agreements for parts of their property. This made it possible for leaseholders to obtain rights to tourism in that area or to maximise lease renewal or upgrade opportunities. But most landholders were unaware this option existed:

I was reading a document last night [and] I started getting into some of the terms of the leases. There is a lot in there that I didn't even realise was in there. (Interview respondent)

4.3.1.1.5 The Water Act

The right to water emerged as a strong potential property rights issue for the future. Respondents expressed varying levels of contention, fear and disdain in relation to the possibility that their water allocations might be restricted, monitored or assessed. In particular, the notion of paying for water struck a sour note for many, with one respondent in the Gilbert River expressing high frustration. From her perspective, all the river water was wasted as 'all it does is run out to the sea anyway'. Water was still seen as a community resource, and the notion of having that right prescribed or restricted in any way was anathema to many.

A core part of discussions with Shire residents revolved around the nature of water uses in the region and their aspirations for future institutional arrangements. Need for water infrastructure was a dominant issue. Many leaseholders wanted to have the opportunity to put in more dams on their property. For some, this was a drought-proofing measure. For others, increased water allocation and infrastructure would help facilitate diversification, such as cropping for hay or to consolidate tourism ventures. Many in the Gilbert River wanted security in relation to water as the region has good soils and cropping potential.

The only thing lacking in this Shire is water. There are no big dams or no water supply; for any industry at all you have to be able to get water. There are different industries that could come out here, but you must have the infrastructure – everything needs water. (Interview respondent)

The Kidston Dam (since the decommissioning of the associated Kidston goldmine in 2001) was often mentioned in this context, with respondents wanting to know how this large body of water was going to be used and distributed. Regret was often expressed that issues surrounding access to this water were not resolved.

4.3.1.1.6 Other institutional arrangements

The issue of roads emerged constantly as a major theme for all interviewed stakeholders in the Shire. Concerns ranged from the need to have better access to their properties in order to facilitate tourism ventures, to some people wishing the roads stayed unsealed as this enhanced the 'outback' experience for many: 'Roads, end of story, roads. Our biggest problem out here is ... roads.' (Interview respondent).

Safety for users of the road emerged, as did the need for ongoing maintenance and infrastructure development. Many made an explicit link between road development and the potential for economic and social development in the Shire.

You have got a lot more tourists coming to the area, you have also got a lot of Shires wanting the tourists to come, but at the same time there are really not the facilities or the roads to be able to handle it. (Interview respondent)

The lack of basic social services, such as schools, hospitals, fire and emergency services and communications services was raised as a factor that prohibited residents' abilities to choose certain pathways of development. Respondents identified the lack of secondary and vocational schooling as issues; however, there was no active lobbying for better schooling opportunities in the Shire. Instead, people opt to move away or send their children to boarding school and experience the associated financial stress. This was also presented as a concern: a fear that once children leave the Shire, they do not return.

4.3.1.2 Interaction with local government

The Etheridge Shire Council has had limited success in engaging the state government and representing local interests in the development of key legislation impacting local land-use decisions, such as the *Vegetation Management Act 1999* of the Qld govt. The *Integrated Planning Act 1997* provides local governments, such as the Etheridge Shire Council, with institutional mechanisms (e.g. Government Planning Schemes) for local development proposals to be presented to state agencies and to facilitate the implementation of legislation. The state government has a protocol with the Local Government Association of Queensland which provides a venue for any issues of impact on local government to be discussed at that level: 'If the Local Government Association has some concerns they will then survey the councils to get their comment before they respond to the state government' (Interview respondent). Despite the existence of these institutional arrangements for greater local input into state policy planning and implementation, the Etheridge Shire Council has been 'very passive' in engaging this process (Interview respondent).

In general, landholders view the Council as a politically weak organisation. The Council has come under criticism, both from members within the Council and residents of the Shire. Some of the issues raised by respondents were the lack of cohesiveness within the Council, a disproportionate emphasis on planning and not on implementation of local development plans, resistance towards working jointly with other groups, and not being proactive enough in tourism. One interview respondent elaborated: 'There has been no community consultation for couple of years now.' This was expressed by another respondent who felt frustrated that proposals submitted by the Georgetown Progress Association, a local citizens' organization, were repeatedly turned down by the Council. He added, 'We want to have some input into what happens.' Some Etheridge Shire Council members felt that they were limited in their capacity to influence state policies. 'At the political level we only have dialogue if an issue arises ... There was no consultation on that new role of legislation' (Interview respondent).

The Council has tried to address some of these complaints, as well as the general dissatisfaction among residents to the State's 'inappropriate' and 'disconnected' approach to policy planning and implementation. According to one interview respondent, the Council has started to recognise the importance of 'enacting plans that we [residents of the Shire] have created' and the need for:

... creating our plans for us ... [because] we talk ... the same language, we have the same aims, and we all know our limitations. A plan at this level is in cooperation with people [as opposed to imposed upon people]. (Interview respondent)

Nonetheless, the Council faces significant challenges. These include a general lack of interest and/or time available among residents of the Shire to become more actively involved in community organisations and activities, including the Council, and to take on leadership roles:

There are the ones who have the skills and the status but won't accept being a leader in the community, and we have serious problems in the Shire with that. They don't see that as their role. [People from the grazing community selected to attend capacity-building courses] didn't use those skills for the community benefit. That was critical. That should be what those skills were used for, both [for] their own [land] and for the community, as future leaders. (Interview respondent)

4.3.1.3 Interactions with Traditional Owners and the Native Title Act

Ninety per cent of Queensland's leased land is under Native Title claim (Lyons et al. 2002, 2004).

The Etheridge Shire is the traditional country of the Ewamian people, who have long standing cultural connections to the area. Representatives of the Ewamian people who were interviewed expressed a social cultural imperative to return to country and to become more closely involved in decision-making in the Shire. Among a number of Traditional Owner groups in the Northern Gulf region, the Ewamian people have been active in engaging with pastoralist, mining, tourist and local government interests. As Elma Lingard, Chairwoman of the Ewamian Aboriginal Corporation notes, 'We all got to work together now'.

In the Etheridge Shire this has manifested itself through the development of a number of agreements between the Ewamian and other entities in the form of Indigenous Land Use Agreements (ILUA) and Memorandum of Understandings (MOU). These options are being negotiated independently of tenure (i.e. leasehold or freehold). It was noted in the Northern Gulf Management Plan that:

The Ewamian Corporation can be considered to be very successful in the ILUA negotiations. The negotiations have all been on a voluntary basis with long term benefits emanating for both Traditional Owners and Local Government/graziers. (McDonald & Dawson 2004 p.135).

Among the ILUAs developed in the Etheridge Shire were agreements between the Ewamian people and service providers such as the telecom company Telstra (National Native Title Tribunal 1999) and energy company ERGON. A number of ILUAs between graziers, mining companies, small miners and the Ewamian people have also been declared. In addition, the Etheridge Shire Council had negotiated agreements with the Ewamian that constituted the withdrawal of Native Title rights in return for a number of freehold properties (National Native Title Tribunal 2004). The 'Ewamian – Etheridge Townships Indigenous Land Use Agreement' allowed for the creation of reserves, the change of purpose of a reserve, the issuing of a lease over a reserve and the excision of a portion of a reserve. The ILUA also created a reserve for sport and recreation and set out future areas for Aboriginal cultural purposes. In return for the excision of native title, the Ewamian were granted six freehold portions of land by the Etheridge Shire Council.

Almost all of the leaseholders interviewed had, or were in the process of developing, ILUAs and MOUs with the Ewamian people. Some were doing it as a matter of principle, but the overriding incentive for invoking an MOU was that engagement in these negotiations, as well as in consultations with government in relation to property management planning and conservation agreement planning, was perceived by leaseholders as a means to enhance their chances of obtaining the desired lease renewal or upgrades to freehold tenure.

For Aboriginal interview respondents, the decision to be part of such agreements reflected ambitions for returning to country within the Shire. However, rather than rely on native title arrangements, some Aboriginal people had chosen to work within institutional arrangements to make ground with the Council and begin the process of community revitalisation through the purchase of properties in the Shire.

I want to buy some property ... you can do everything you want on the land, so that is the future I'm thinking. I got to try and convince my children and grandchildren to come and do it. (Interview respondent)

Despite native title being raised by leaseholders as an issue of concern involving a range of political and legal uncertainties, most leaseholders interviewed felt that it had not negatively impacted on their current or future land-use activities. Unlike other government regulations, notably the *Vegetation Management Act*, the ILUAs and MOUs were not perceived by landholders as significantly reducing their property rights. Nor did they feel that the Ewamian people were imposing on them certain land-use activities. One landholder explained, ‘They [Traditional Owners] don’t want to come and take our land off of us, they just want access’. Only one respondent was completely opposed to the Native Title, characterising it generally as ‘blackmail’.

These negotiations were not without difficulties and challenges. One landholder had to reach two separate agreements with the two different Aboriginal groups in the region. Reading and understanding the Native Title Act was also a daunting exercise: ‘Native title is a little scary, to understand it. Some of the legal jargon you don’t understand, what rights they really have, what rights ... you really have.’ (Interview respondent). For some leaseholders, this may act as a disincentive for negotiating ILUAs and developing MOUs. Other impediments have included opposition to ILUAs by industry associations such as AgForce:

AgForce is ... telling the pastoralists don’t do it, the agreements. So that makes it very difficult for the Indigenous people to look after the country. (Interview respondent)

Overall, leaseholders interviewed portrayed native title issues and negotiations with the local Aboriginal people in very amicable terms, reflected in a general articulation of pride at being involved in such partnerships.

We signed with the Ewamian people, we made the news, we were the first in north Queensland to do it. But it is not an issue for us to recognise that Aboriginal people were here before us, and if they want to come back here and potter around, that is no issue to us ... The further we go with it the more I am comfortable that we are going the right way with it. (Interview respondent)

4.3.1.4 Interactions with interface agencies

All respondents identified the Northern Gulf Resource Management Group (NGRMG) (currently part of the Northern Gulf NRM body) as the forum through which community issues could be heard and advanced into government arenas.

Northern Gulf Resource have been good, have been very helpful, with keeping in touch, like with the minister coming, they are obviously giving us a plug there, by getting him to come out here. (Interview respondent)

According to respondents, the NGRMG has been instrumental in helping landholders ‘get ready for what is happening [changes in land use and management regulations] ... so we can end up with better practices’ (Interview respondent). They also have helped landholders to secure environmental grants to improve land management practices. Respondents also viewed positively the regional NRM planning process and NGRMG’s role in it, highlighting the efforts NGRMG made to get community members involved in the process and giving them a ‘sense of ownership of this planning process’ (Interview respondent).

In contrast, respondents expressed disaffection with the Gulf Savannah Development Association which they variously identified as being ‘non-representative’ and ‘too political’.

The Gulf Savannah Development is too caught up in local government politics. It is just steered by local government, and the local politics involved there. It is operated by councillors and it is fine if you are a councillor and want to be a councillor. (Interview respondent)

4.3.1.5 Interaction with industry

The limited industries available in the Etheridge Shire (particularly banking and a wide range of goods, services, professionals and labour) was a factor that prohibited residents' abilities to choose certain land-based activities.

The Etheridge Shire Council has tried to attract industries, notably ones that provide essential services such as banks, to set up business in Georgetown. These efforts, however, were not successful:

When we lost our bank none of the other major banks were interested in coming in ... but the credit union was, but we had to get the charter for the credit union changed ... [but] when we tried with the credit unions the charter for credit unions didn't allow them (a credit union approached by the Council) to operate outside their particular industry. (Interview respondent)

Even if the Council had succeeded, credit unions are not able to provide any business funding, which limits landholders' land-use options: 'They will fund purchases for housing in the area but ... can't print their own cheques, so for business banking they were more expensive' (Interview respondent). With the formation of the Gulf Savannah Community Bank Steering Committee in 2006, residents were anticipating the opening of a community bank branch, under Bendigo Bank's Community Bank Franchise, in Georgetown and with it opportunities for business funding.

Access to business funds was not the only financial hardship faced by landholders. Some respondents also reported holding levels of debt that were prohibitive to the expansion of existing or new ventures. Efforts by business proprietors were further complicated by the inability to hire workers, fund employment of new initiatives or even use volunteers due to changes in employment requirements, insurance responsibilities and Fringe Benefits Tax. The following quote exemplifies this dilemma well in a discussion over the viability of developing tourist enterprises on land:

We're really interested in tourism ... building a lodge sort of style thing, bringing deer up here shortly, and sort of a hunting, safari sort of lodge, pig hunters and deer hunters. We have got like 10 million dollar public liability insurance here. We shouldn't be liable if someone is trespassing, but what can you do? We try not to employ people here for that reason. We had one employee and it cost me \$2500 a year in workers' compensation, then you have their wages, their super, and stuff like that. If we do employ people we try and get them on contract, and I think if we have to put anyone on in the future that is the way we will go. That way they pay their own workers' comp, their own super, and they are responsible for everything themselves. I think a lot of people have gone to contractors; even the banana industry is going that way now. (Interview respondent)

Insurance requirements have meant that having volunteer labourers, such as Willing Workers on Organic Farms ('WWOOFers'), is increasingly difficult. Some respondents noted that engaging volunteers is often more expensive than it is worth, as they have to not only provide living expenses for them, but transport them in and out of the regional centres to their properties.

Insurance requirements also restricted landholders' tourism activities. Even if tourist operators (some of whom were residents of townships in the Etheridge Shire) had insurance cover, if tourism activities were carried out on a landholder's property they (the landholders) were 'at the end of the line for liability' (Interview respondent). In general, insurance cover was perceived as too costly to make tourism activities economically worthwhile for landholders.

The tourism industry also made it difficult for some area residents to pursue tourism activities. One respondent recalls residents' attempts to set up their own regional tourism body but were forced to fold because 'we held meetings when it suited councils, not the tourism operators' (Interview respondent). According to him to be officially recognised as tourist operators they had to become members of Tropical Tourism North Queensland, the regional tourism organisation. Information gathered about

tourism regulation was patchy, often misinterpreted and misunderstood. One tourist operator (and landholder) felt that ‘we’re the ‘insignificant’ two % ... it is a real battle to get any information, to get correct information from the regional tourism body’.

Additionally, to attract tourists it helped to have one’s tourist operation rated every 18 months by a qualifying organisation, such as the Gorge Place Star Rating. The Etheridge Shire’s relative inaccessibility, poor quality of roads and great distances between landholdings often discouraged Gorge Place Star Rating from travelling to the Shire. For local tourism operations this meant being left out of popular tourist books, and it negatively affected their capacity to carry out tourist activities on their and.

4.3.1.6 Interactions with environmental advocacy groups

Environmental advocacy groups have on the one hand assisted landholders, and at the same time have constrained their land-use activities. They have a unique relationship and vision of the land, one that often contradicts or opposes those of landholders. One view expressed by staff of Cairns and Far North Environment Centre (CAFNEC) and The Wilderness Society was ‘third party rights’.

People like me who don’t live out there [in the Outback], but who care, want to be able to have a right say ‘okay, I don’t live in that region, but I have an interest in that region and I should be able to have rights [to say how the land is used]. (Staff of environmental group)

We need to move away from where you buy a piece of land [and] you have the right to do whatever you want with it. If you own a piece of land there are assets and values on that land which may be important to broader society. (Staff of environmental group)

Certain activities, such as cotton farming, receive strong opposition. With their access to policy-making arenas, and in some cases, active writing of policies, environmental groups offer both opportunities and constraints.

The staff of CAFNEC views overgrazing as a significant problem. Despite significant differences in opinion, the relationship between graziers and CAFNEC has been relatively good. CAFNEC attributes this to their approach of working with graziers:

You can’t just go in there and [say] ‘this is what you have got to do’... we [also] talk straight to the landholders rather than the peak bodies. When you talk to the people on the ground, that is where you find out the accurate and most information. (Staff of environmental group)

4.3.1.7 Interactions within families and informal rules

The informal rule among graziers to keep the farm as a family-run business has affected land-use choices. In some cases, family members shared a property but wanted to undertake different activities on it, such as tourism and pastoralism, and felt this had implications for succession planning. Some families were attempting to negotiate changes in their lease conditions but had significant difficulties gaining approval from the government, as in the case of these three brothers:

I’m on a perpetual lease. One of my brothers is on a pastoral lease and the other brother is on a freehold lease ... I see the biggest problem is that when there is a large property and they want to split it up, a bit each, when it comes to legal ties the lands department look at it and say, “what lease is it?” and “No you can’t do it.” (Interview respondent)

Respondents, acutely aware of the costs and uncertain returns on investment in outback regions, also expressed a general caution to risk taking. Diversification into new land-use management practices or activities was approached with interest but also with prudence. This was stated as being partly due to a general lack of information about new land-use options and associated regulations. Those who did decide to diversify did so mainly to provide more certainty of income for their families, especially given the higher costs of living in the region (particularly when sending children to a secondary boarding school).

4.3.2 Patterns of interactions that affect engagement in community development activities

The Etheridge Shire's low rural population density, sparsely distributed small townships, a tradition among graziers of living an isolated and family-based lifestyle, and sociocultural and economic differences between station and town people have resulted in limited local engagement in community development activities. Nonetheless, there are residents who have collectively organised to form a small but active number of community organisations. These include the Rural Fire Brigade and the Hann Highway Action group. Additionally, in some townships, residents have created and maintained informal networks primarily through communal activities such as barbecues at the sporting and recreation clubs and at the rural fire brigade. These informal social networks are not restricted to the towns. In the rural areas, 'We all get together quite often, at least once a month if not more, for birthdays and playgroup and things like that' (Interview respondent).

Nonetheless, interview respondents, particularly those residing in towns, expressed frustration at what they felt was a 'lack of community' in the region. Townships, such as Georgetown and Mt Surprise were variously characterised as 'dead', 'dying', 'lonely' and 'boring':

One of the pressures that gets me down every now and again is the negativity in the town ... This town is depressed I think, emotionally, people just aren't positive. They have just run out of energy I suppose, and it is really unhealthy here. (Interview respondent)

Female respondents in particular talked about the difficulties they saw for strengthening social cohesion, making friends and socialising in the Shire. The existence of strong family relationships and marriages were often cited as being necessary to ameliorate for a relative lack of community feeling and activities.

Engaging in community development activities, however, was also generally seen as taking up too much time that could otherwise be invested in private enterprises:

The only community things I am involved in is the rural fire brigade. The Council is a lot of time for little recognition. We are just too busy with the property and with the kids. (Interview respondent)

There is lots I would like to do, but we have expanded and bought another property. (Interview respondent)

Residents talked about the need for 'fresh blood' and an 'injection of energy' as well as for capacity building in the community to address the lack of engagement in community development activities. In particular, respondents highlighted the need to build community leadership, capacity, skills and inclination to stay and contribute to the community. Others suggested better access to, or outback-focused, training courses that could help build community aspirations.

4.4 Outcomes

4.4.1 Current land-use outcomes

In recent decades, the economic decline of pastoralism, coupled with growing public environmental awareness, increased recognition of Aboriginal rights and an associated erosion of graziers' historically strong influence in land-use policy, among other factors, have opened the doors to new legislative frameworks emphasising a broader set of values from the rangelands (McAllister & Studlar 1999, McAllister et al. 2006). This has significantly affected graziers who have been placed under increasing pressure to adapt to the demands of multiple, and at times conflicting, land use and management regulations.

At the time of field research, landholders interviewed in the Etheridge Shire remain engaged predominantly in pastoralism (for rangeland beef cattle production), with some complementing pastoralism with small-scale tourism. A few have abandoned pastoralism and set up tourism enterprises. A small group, almost exclusively freeholders, are involved in horticulture.

On leasehold properties, the majority of graziers use a range of management practices. The primary motivation for this diversification is to ensure economic viability through additional income and improved cash flows. Graziers interviewed often raised concerns about the economic future of their pastoral enterprises. This concern in the Etheridge Shire is echoed across grazing communities in Australia.

Graziers in the Etheridge Shire have responded to these challenges by adopting diverse management practices as a means to maximise the pastoral products and services, and thus income, from their properties. 'Diversification' for graziers interviewed generally means adopting a range of management practices within an existing land-use activity. For graziers engaged in pastoralism, this translated into diversifying management practices for raising cattle. This included raising 'weaners', agisting (leasing paddocks for grazing to other farmers), growing hay for drought proofing, and buying and selling cows for different markets. Drought proofing involved additional management practices to improve the drought tolerance of property, including hay/silage production for feed storage as preparation for the dry season and reducing stock numbers prior to the time stock feed deteriorates. Other management practices adopted by graziers engaged in pastoralism included feedlots and share farming.

Some graziers are attempting to diversify outside of pastoralism and to engage in small-scale tourism. These graziers also had adopted a range of different management practices, including limited unserviced camping facilities, overnight homestays and gold and gem fossicking. The majority of graziers interviewed who had developed tourism activities combined them with pastoralism. Tourism activities were usually of lower priority and received resources only when demands from the cattle business were low. Nonetheless, there are some families that have established tourism as their main income-generating activity. One example was of a family where some members ran camping, accommodation, catering, a bar and shop as well as tours, while the other members engaged in the cattle production business. In townships, some tourism operations offered accommodation and provided auxiliary services such as catering and shops and tours, mainly for pensioners and retirees who make up the majority of tourists in the Shire. As in the case of graziers involved exclusively in pastoralism, these landholders adopted a range of tourist-based management practices in order to add economic value to their existing tourism enterprise. Tourism was seen by some as an opportunity that had not fully reached its potential. Some landholders expressed an interest in expanding the range of tourism activities to include bird watching, fishing and trophy hunting. However, with the exception of a couple of families interviewed, most did not anticipate that tourism would be large scale. Rather, tourist enterprises were generally viewed as small scale, 'do-able' and within the current resources.

Thus, graziers in the Etheridge Shire have responded to the decreasing economic importance of pastoralism by attempting to adapt their existing management practices to include a wider or different range of practices (e.g. hay production) and/or additional land-use activities (e.g. tourism). Interviews with graziers, however, indicate that many had found themselves either severely restricted or unable to diversify. This was partially the result of economic constraints such as a lack of demand (for tourism) and limited access to financial capital necessary for initial investments (tourism and pastoral activities). However, land use and natural resource management regulations seem to affect graziers the most severely. Notably, the prohibition on changing lease arrangements to alter land use has severely curtailed graziers' capacity to develop tourism activities on their land. The inability to run multiple business operations, among other factors, has not only significantly constrained land-use decisions but, ultimately, also the sustainability of graziers' production systems. As a consequence, most graziers chose to either ignore or go against legislation governing their lands. Interestingly, the Native Title

Act was not perceived by the majority of graziers interviewed as restricting their ability to diversify land-use management practices and activities. Most felt that Aboriginal access to their lands had not interfered with or limited their rights to manage and use their lands. As such, many graziers interviewed had negotiated ILUAs and developed MOUs with local Aboriginal groups.

4.4.2 Current community development outcomes

The interviews with graziers and town residents of the Etheridge Shire indicated that the majority of the Shire's population was not actively engaged in local community groups or in collective activities aimed specifically at improving community wellbeing. Some residents felt frustrated at the lack of community development, services, social cohesion and social capacity; others were indifferent.

Some of the most successful attempts at getting people involved in community activities in the Shire were motivated by issues that strongly affected residents' quality of life. One notable example is the Hann Highway Action Group. The group was formed out of a concern about the safety of the road for locals and travellers, the difficulty in transporting livestock in road trains, and inadequate access to the area for tourists. Another example is the Georgetown Progress Association, which was formed by a group of Georgetown residents interested in improving the quality of life in the town. They have successfully encouraged community members to volunteer and participate in group activities that involve weed control, erosion management and rubbish removal in and around the town.

Financial support from the Etheridge Shire Council also has helped promote and sustain these local community initiatives and to create opportunities for residents to interact and build a sense of community. The rural fire brigade, a council-supported organisation with volunteer members, has become an important hub for community get-togethers through its fundraising and communal barbeques. The sporting and recreation club at Oak Park also provides a similar function through its rodeos, barbeques and fundraising events. Another community development project supported by the Council was the TerrEstrial, a complex that includes a library, internet café, tourist information centre, art display and the Ted Elliot Mineral Collection.

In addition, the Northern Gulf Regional Management Group (NGRMG) has played an instrumental role in getting stakeholders to actively contribute to land use and community development planning in the region, including in the Etheridge Shire. Representatives from industry groups, Indigenous groups, local government and environmental organisations have actively participated in the development of the Northern Gulf NRM regional plan.

At the time field interviews were conducted, there were not any local groups focused specifically on grazing and/or other land-use activities and on improving the wellbeing of the Etheridge Shire's rural population. Graziers in the Shire were members of AgForce, an industry association group, but there had not been any efforts to initiate a locally organised and locally driven group along the lines of the Hann Highway Action Group and other similar citizens' action groups. A land care group had previously existed in the Shire but was no longer active, for reasons that are not known. Interviews with landholders revealed a complex set of factors behind this lack of engagement in grazing community development activities. The longstanding tradition among graziers of operating as independent, family-based businesses, along with a pride in being able to 'tough it out', is one contributing factor. Another is a lack of time, brought on by the heavy demands of running a pastoral business and other activities, such as tourism. In their discussions about government land use and natural resource policies and legislation, graziers also expressed a general sense of powerlessness to make any effective changes to the government rules and regulations that were having the greatest impact on their land-use decisions. As such, most preferred to ignore government regulations and not deal with them until they 'come through [my] front gate' (Interview respondent). Those who had tried to comply and had attempted to get additional information generally were left with a sense of frustration and futility. As such, there are few incentives for graziers to put the time and energy into collectively mobilising to engage government

departments and other related stakeholders. On the other hand, this may limit the opportunities for graziers to influence existing government regulations, such as the renegotiation of lease arrangements and to expand available land-use options.

4.5 Evaluation criteria

There was not enough data collected to enable us to evaluate these outcomes against a set of criteria, such as community sentiment and satisfaction and economic/social development in the Shire. However, the responses of interviewees revealed a degree of frustration with and sense of being limited by current institutional arrangements. It would be useful to have direct answers to questions such as:

1. Did any residents want to undertake these options but could not; and if not, why not?
2. What other land uses would people like to undertake but cannot?

A subsequent analysis could explore the relationships between institutional arrangements, land-use choices and the outcomes of land-use choices in the Shire in a quantitative way.

4.6 Scenarios and feedbacks

4.6.1 Potential scenarios for land-use decision institutions

The constraints and opportunities raised by interview respondents point towards some areas where changes could be made in the institutional arrangements surrounding land-use decision making to better enable residents of the Etheridge Shire to make decisions that help them achieve their aspirations. These changes are expressed here in general terms.

Improvements could be made to:

- the provision of clear and timely information to all residents of the Shire about relevant institutional arrangements and the impacts of and opportunities arising from changes in legislation
- the communication of this information in a way that makes sense to residents, for example, through government-funded community facilitators
- access to broadband internet in every residence in the Shire
- opportunities for networking between people involved in the same and different land uses to share information, ideas and capacity
- the on-ground practices of the state government in providing information and services to the Shire
- the streamlining of business reporting requirements
- the opportunities for vocational training, schooling and employment
- the understanding of how instruments, such as market-based instruments, could influence pastoralists' abilities to manage their land for production and conservation outcomes
- the ease of engaging volunteer staff
- the quality of roads.

An agent-based simulation model⁸ was developed to explore the second action situation: whether residents of the Etheridge Shire decide to become involved in community development activities or not. As this was very much an experimental process, only a summary of the model and key findings are presented in Box 1 below. Methodologically, the development of an agent-based model aimed to test the potential to analyse institutional dynamics based on results by an application of the IAD framework. This point is discussed in sections 6 and 8.

⁸ For a full description of the model see Smajgl et al. (2007).

Box 1: Summary of agent-based simulation model

Three hypothetical scenarios were used to analyse the potential impacts of a new norm about engagement in community-development activities. We hypothesised that the evolution of a norm would lead to positive outcomes for the community-development goals of having roads sealed and a local high school opened. The new norm evolves through individual residents following a rule that states that they publicly and visibly reward other residents for taking part in community-development activities. As residents see their fellow community members being positively and publicly rewarded for civic-minded behaviour, they learn that such behaviour is desired and rewarded and they may choose to change their own behaviour accordingly.

The model assumes that a small number of persons in the Etheridge Shire are very active in improving the situation of the community, which matches statements made by respondents in interviews. Another group of residents of the Shire experiment with the impact of such an investment. We define the agents' *attitude* to the community as the distinguishing attribute. If the rest of the community rewards effort by individuals who experiment with investing in community development, then the activity level of these individuals remains high or rises. Quantitatively, social cohesion is modelled as the sum of time all individuals spend on community development activities.

Heterogeneous agents make their decisions about how much of their spare time they spend investing in civic activities. Investment, in this sense, can vary from articulating a positive attitude towards the community with optimistic expectations, to the organisation of community meetings. Agents learn, through a process of reinforcement, if it is worth bearing the opportunity costs of investing in the community in any of these ways. Opportunity costs can be either financial benefit, through additional effort in individually owned business, or non-financial benefit at an individual or family level (for example, personal satisfaction or pride). Agents experiment randomly with investing effort in the community and they gain knowledge about the situation.

The three scenarios were developed around a) the degree of external investment in road or school development, and b) the degree to which the community was involved in making decisions as to these investments.

Analysis of the model results suggest the following lessons:

- Without external investment and a social norm where residents are publicly rewarded for their engagement in community development activities, the level of social cohesion will remain relatively steady.
- At this level of social cohesion, and without increased tourist numbers, migration into the Shire does not increase and the population will decrease slightly.
- Community-negotiated external investment acts as a reward for engagement in community-development activities. This reward evolves through individual rules into a social norm and increases social cohesion. Increased average income through increased tourist numbers due to upgraded roads adds to this to increase migration into the Shire. Increased social cohesion sees a high school built in the Shire.
- The higher average income through increased tourist numbers is not enough on its own to trigger increases in migration to Georgetown; increased social cohesion is also required.

The results suggest that including community members in planning and decision-making processes is crucial for endogenous processes to trigger a build-up of social cohesion.

Source: see Smajgl et al. (2007) for fuller detail.

4.7 Case study lessons

This case study has documented the rules guiding and governing residents' land-use decisions and decisions of whether to engage in community development activities and has analysed how changing the rules governing these two key choices may impact on conditions in the Etheridge Shire. These two situations were chosen because they are activities for which policies can be devised to improve outcomes. One such policy was explored for encouraging residents to engage in community development activities, and this has provided insight into the potential outcomes of a new social institutional arrangement in the Shire.

4.7.1 Enabling land-use choices

Residents' land-use decisions were influenced by the *physical and material conditions* in the Shire such as the vegetation types and soil quality, the existence of tourist attractions, the quality of roads and accessibility of these attractions, the availability of labour, the state of commodity markets, access to business services, and the costs associated with production in the Shire. Land-use decisions were also influenced by *community attributes* such as previous land-use experience, work ethic, sense of history and family connections in the Shire. Similarly, land-use decisions were influenced by *rules*, including legislation about leases and land clearing, and 'informal' rules reported by interview respondents, for example, that of negotiating with Traditional Owners or local government about the conditions to be met for new lease arrangements to be granted.

Understanding the factors that influence residents' land-use decisions requires awareness of all of these factors and the interactions between them. The full dynamics of the system cannot be appreciated based on understanding one factor alone.

4.7.2 Enabling engagement in community-development activities

Residents' community-engagement decisions were influenced by the *physical and material conditions* in the Shire such as the quality of roads, access to local schools and population dynamics. Community engagement decisions were also influenced by *community attributes* such as a tendency to keep friendships and business within the family and to perceive engagement in community development activities as too time consuming. The *rules* that influenced engagement in community development activities were mainly 'informal' rules expressed through community attributes.

While there were a few opportunities for engaging in community development activities, such as the Hann Highway Action Group and the Georgetown Progress Association, interview respondents expressed that they perceived Georgetown to be a 'dying town' and that they were not inspired for the most part by any sense of community spirit. They also recognised the need to build community leadership, capacity, skills and the inclination to stay and contribute to the community. However, most of the options for doing so seemed too time consuming. Discussions with residents of the Etheridge Shire revealed some ways to improve how they engage in community development activities that could help them achieve their aspirations.

The Etheridge Shire agent-based model simulated some ways in which individual contributions to community development could build 'social cohesion' (measured as the time devoted to engaging in community development activities) through the evolution of a social norm of publicly rewarding people who engage in community development activities.

The model enabled exploration of the potential impacts of different investment and community involvement scenarios and indicated that engaging community members in negotiations about government investment in the Shire or granting some other significant public reward to Shire residents may be important for triggering the development of a social norm towards rewarding community

members for engagement in community development activities and stimulating larger individual investments in social cohesion. In turn, increases in social cohesion could impact positively on other outcomes for the Shire, such as the building of a local school.

4.7.3 Applying the IAD framework

The Etheridge Shire case study experienced a number of significant challenges throughout. First, the original research team found it difficult to apply the IAD framework in a situation where the tool had been chosen before the issue to be analysed had been identified. Second, three members of the research team left the project before its completion. Third, the research timeframe and process were inadequate to enable the depth of information required to apply the IAD framework. These challenges point to some areas where application of the IAD framework could be improved and made easier.

The IAD framework is most useful as a tool to help diagnose specific problems with institutional arrangements, which requires a good idea of the action situation that these problems will be associated with. This understanding did not exist when the original field work was undertaken; hence, it has been difficult to write the final report in a rigorous and logical manner. However, even applied in an incomplete way, the IAD framework provided a clear set of guidelines for structuring the analysis and has been helpful in pointing to some potential areas where changes might be made to institutional arrangements to improve outcomes for residents of the Etheridge Shire.

In particular the IAD framework contributed to enabling new researchers, who had not been involved in the original project design or field work to engage usefully with the data collected during the field work and make useful analytical contributions. The IAD framework provided a clear and simple set of guiding principles for these researchers to re-analyse interview data and improve the interpretation of the action situations explored in the field.

4.7.4 Lessons from the research process

Pilot studies will always be beset by considerable challenges, and there are risks inherent in undertaking any research project that seeks to develop relationships with communities and respond to their research needs. The lessons learned from this case study have informed the remaining case studies of the larger Outback Institutions project of which they are a part.

The most damaging event for the Etheridge Shire case study was the loss of key members of the research team and the breaking of relationships with community members in the Shire that ensued. Also, as other researchers had to be found to complete the case study in between their other primary commitments, this meant that the final report reached the community well after the research was undertaken, a far from desirable or acceptable outcome.

5. Participation in water planning processes: An example from Diamantina Shire

Silva Larson

In this chapter the key elements of the Diamantina Shire case study are presented. These include an outline of the factors that frame the action arena the biophysical conditions, the attributes of the community and the rules in use. A fuller description of this case study is available (Larson 2006).

5.1 Biophysical conditions

The Georgina and Diamantina river systems flow from north to south and north-east to south respectively (see Figure 22). These two rivers cross over state boundaries of the Northern Territory and Queensland and finally converge in South Australia.

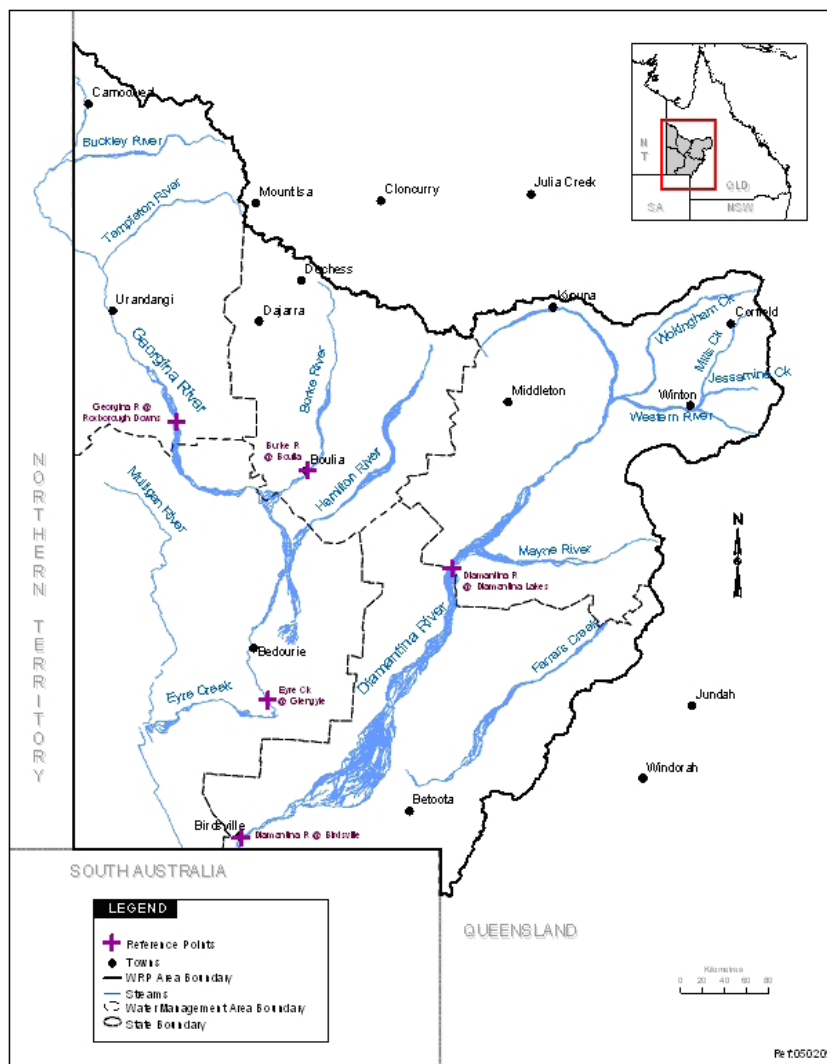


Figure 22: Georgina and Diamantina water resource planning area

Source: Map supplied by the Queensland Department of Natural Resources, Mines and Water, personal communication, 2006

The Georgina and Diamantina catchment is unique as it is a major tributary of the Lake Eyre Basin, the world's largest internally draining system, which covers an area of 1.2 million km², or about 18% of the land area of Australia. The subject of the current water planning changes discussed in this report includes the area of these catchments within Queensland state borders, which covers approximately 14% of the state's land area (Figure 22). Water resource planning in Queensland is the responsibility of the Department of Natural Resources, Mines and Water (DNRM&W).

The Georgina–Diamantina catchment falls within the semi-arid to arid climate region, with the mean annual rainfall varying between ~400 mm in the upper catchments to ~120 mm at the lower, Birdsville end of the catchments (Sheldon et al. 2003). Rainfall patterns are summer-dominant, with over 70% falling between October and March. However, the rainfall is highly variable in timing and amount. For example, *annual* decile one rainfall for the Birdsville region, based on 106 years on record, is 54 mm, while maximum *daily* rainfall for the same period is 155 mm. Monthly mean maximum daily temperatures vary from 21°C in winter months (July) to around 38°C during the summer period of December to February (BoM 2005).

The combination of high variability, incidence and total received rainfall results in river systems with extreme variation in discharge and flow duration. The river systems of the Lake Eyre Basin are typically ephemeral, subject to an alternating flood and dry cycle. Misconceptions about the aridity of the area appear to be as old as the records. Archibald Meston wrote in 1895 in the *Geographic History of Queensland*:

The whole Western country is a network of rivers, creeks, waterholes and billabongs, all subject to tremendous floods, the main rivers spreading miles on both sides of their channels, and submerging the adjoining country in a wide torrent of muddy water, sweeping all before it (as reproduced in Nolan 2003:9).

This certainly is true in the summer months of the 'wet' years. However, for the majority of the time, the rivers do not flow.

According to the Water Planning Group report (Water Planning Group 2003a), there was no discharge recorded at the Georgina River gauge at Roxborough Downs for 60% of the time on record (Figure 23 presents data for Roxborough Downs gauge collected between 1967 and 1988). The flow duration curve suggests that flows at this gauge were less than 1000 megalitres per day (ML/d) for 90% of time on record (Figure 23).

Similarly, the flow duration curve for the Diamantina River at Birdsville gauge indicates that there was no discharge from the river for 50% of the time. The flow duration curve presenting data collected between 1949 and 1988 (Figure 24, from Water Planning Group report 2003a:10) suggests that flows at this gauge were less than 1000 ML/day 75% of the time during the period of record.

As an example of high flow variability in the catchment, Figure 25 illustrates a hydrograph of Diamantina River flows at Birdsville, for the period 1889–2001 (from Sheldon et al. 2003: 58). The intermittent nature of the flows, with flows recorded between 0 and 15 000 gegalitres/year (1974 floods), can be observed in this figure.

There are no major regulating structures or areas of extensive water extraction along the rivers and creeks of the Georgina-Diamantina catchment. They are among the few remaining unregulated rivers of Australia (Sheldon et al. 2003).

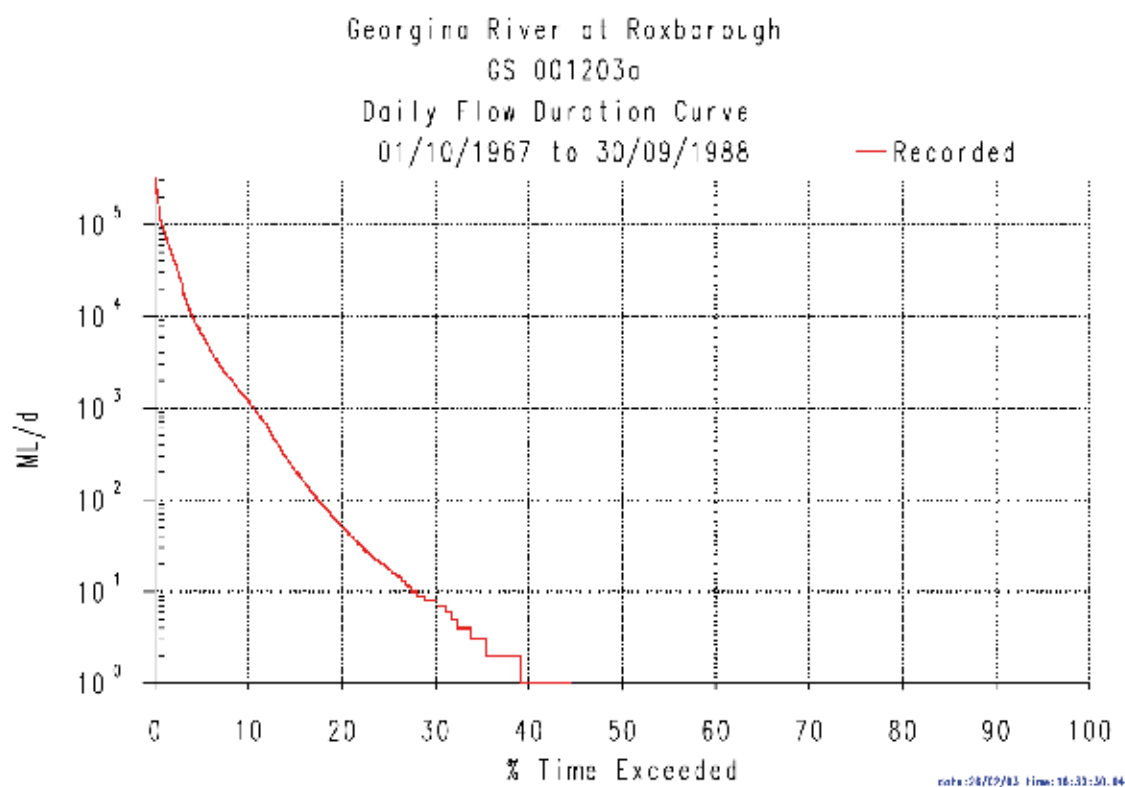


Figure 23: Flow duration curve for the Georgina River at Roxborough Downs

Source: Water Planning Group 2003a

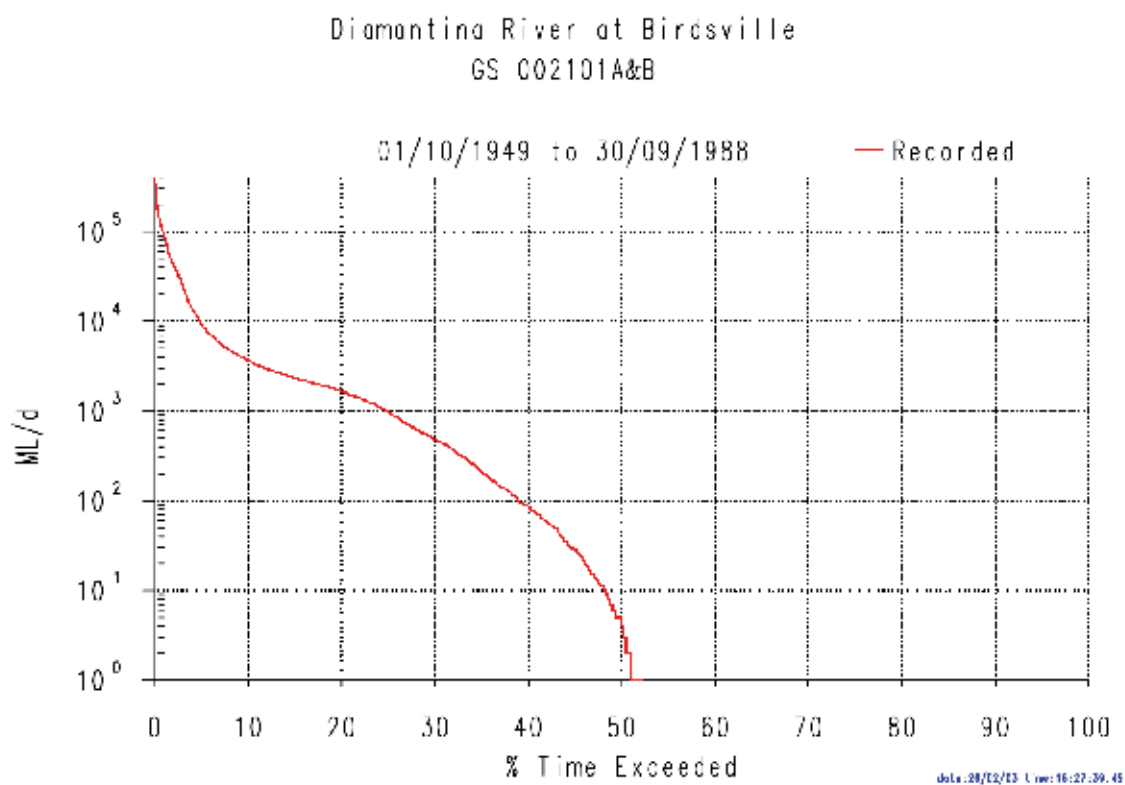


Figure 24: Flow duration curve for the Diamantina River at Birdsville

Source: Water Planning Group 2003a

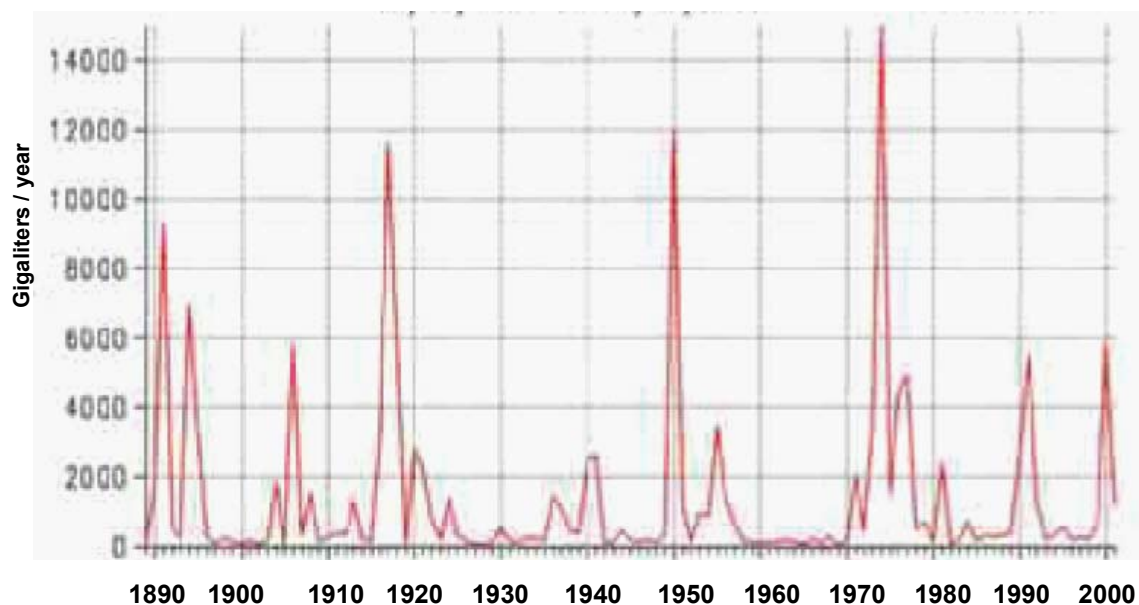


Figure 25: Hydrograph model of annual flows, Diamantina at Birdsville for the period 1889–2001

Source: Sheldon et al. 2003

The Georgina-Diamantina catchment contains a wide variety of ecosystems and biogeographic regions. These include sandy and stony deserts, Mitchell grass downs, channel country, floodplains, ephemeral lakes and wetlands. The dynamics of these ecosystems are determined by variable drought and flood cycles that are an intrinsic property of their arid and semi-arid environments. Native animals and plants inhabiting the rivers are well adapted to the flood-drought variability. The ecological integrity of many dryland rivers, particularly in lowland areas, depends upon periodic flooding and drying.

The high flow periods provide a vector for lateral exchange of materials and energy between the channel and floodplain environments. These lateral exchanges are of particular significance in Australian dryland river systems (Walker et al. 1995). Large floods are important to floodplain environments for connecting distant waterholes, flushing wetlands, transferring sediments and other materials such as nutrients between channel and floodplain environments and allowing access to floodplain environments for aquatic species.

Large floods cover vast areas and can be of long durations. The longer durations allow for a longer breeding season and greater productivity for grazing. Moderate floods are also important, in particular for recruitment between large-flood breeding events. However, they also play an important role in maintaining habitat quality which indirectly affects the success of future breeding events (Scott 1997, 2001).

During the dry periods, dryland rivers typically consist of a series of isolated pools. Low flows in dryland rivers also serve a number of important ecological functions, such as maintenance of diverse habitats, provision of short-term connections between otherwise isolated sections of the river and the top-up and sustaining of permanent waterholes (Carpenter et al. 2005).

The Channel Country bioregion, which characterises most of the Georgina-Diamantina catchment, is estimated to contain 56 ecosystems (Lake Eyre Basin Coordinating Group 2000), with eight riparian and floodplain bioregional ecosystems considered endangered or of concern (Sattler & Williams 1999). The region is of very high ecological and conservation value, hosting a number of rare, threatened and endangered species of flora and fauna. There is also increasing evidence that the Lake Eyre Basin wetlands are major foci for water-bird activity on the continent (Roshier et al. 2001), and 21 wetlands in the catchment have been classified 'of significant conservation value' (Sheldon et al. 2003).

Currently, the unique ecology of the Georgina-Diamantina catchment is protected through 12 parks and reserves within or partly within the catchment, representing about 3.1% of the total catchment area. Some of these are jointly managed as multi-use reserves; for example, the Simpson Desert Regional Reserve.

The scope of the *Water Resource (Georgina and Diamantina) Plan 2004* (WRGDP) is limited to surface flow, overland flow and hydraulically connected groundwater. The plan does not include the most significant and only reliable water resource in the region, which is the Great Artesian Basin (GAB). The GAB is a deep sub-artesian resource that is one of the largest artesian groundwater basins in the world. It underlies approximately one-fifth of Australia and extends beneath arid and semi-arid regions of Queensland, New South Wales, South Australia and the Northern Territory. The GAB is regulated under separate institutional arrangements and subject to a separate water resource planning process. The GAB covers an area of 1.7 million km², with an estimate stored volume of 8700 million megalitres of water. It currently provides an estimated 570 000 megalitres of water per year and is a main source of drinking water for stock, domestic use and industrial water in the region (Great Artesian Basin Consultative Council 1998).

5.2 Attributes of the community

This section presents the key characteristics of the communities of the Georgina-Diamantina water planning area, followed by a summary of the important socio-economic indicators for the Diamantina Shire.

5.2.1 Georgina-Diamantina water planning area

Six local governments are responsible for administering the Georgina-Diamantina water planning area, including the shire councils of Boulia, Diamantina, Winton, McKinlay, Cloncurry and Mt Isa. Of these, only Boulia and Diamantina Shires are fully contained within the Plan area. The main town centres within the Plan area include Winton, Boulia, Bedourie, Birdsville and Camooweal.

In 2001, the estimated total resident population of the Plan area was 2519, representing a population density of 0.009 persons per km². The largest centre within the catchment is Winton, with an estimated population of 900.

Aboriginal residents comprise 16% of the total population in the Plan area. The Georgina-Diamantina area is associated with a rich and diverse history, and Aboriginal groups regard the entire river system as an integral part of their culture. Historically, waterholes played an important role as sacred sites for holding ceremonies, as well as being meeting places and sources of food and water. Waterholes are central to many of the 'Dreamtime' stories – Aboriginal people's creation stories – and Aboriginal groups continue to use these sites for ceremonies (Department of Natural Resources and Mines 2003).

The regional economy of the Plan area is based largely on agriculture and mining, with tourism and public sector employment being the other major contributors. The overall unemployment rate for the region is lower than that for Queensland (Water Planning Group 2003b).

The pastoral industry is the dominant agricultural activity, with much of the available land used for beef cattle grazing and wool production from sheep grazing. Tenure in the Georgina-Diamantina catchment is dominated by extremely large pastoral leases and mining operations (Water Planning Group 2003b). The Water Planning Group report (2003b) estimates that approximately 54% of the working population are directly or indirectly employed in the agricultural industry, creating more than \$60 million of total gross annual value of production.

Approximately half a million visitors pass through Queensland's Channel Country each year, contributing more than \$80 million to the Queensland economy (Water Planning Group 2003b). Local estimates are that up to 40 000 tourists pass through Birdsville – population 100 – each year (Shire and local tourism operators estimates, personal communication).

Mining in the Georgina-Diamantina catchment is a key contributor to the state economy, with significant regional reserves of gold, copper, silver, lead, zinc, gypsum and opals. Mining activity is estimated to contribute over \$1.1 billion to the Queensland economy each year (Water Planning Group 2003b).

The dollar values of the three major industries presented here should be taken as an indication only, as they do not necessarily refer to regions within the same boundaries, and might be collated from data in different financial years.

The major use of water for economic production is associated with the pastoral and mining industries. Other significant water uses in the catchment include small-scale irrigation for drought preparedness, industrial use and town water supplies (Water Planning Group 2003b).

5.2.2 Diamantina Shire

The Diamantina Shire's 94 832 km² (5.5% of the Queensland land area) are fully contained within the Georgina and Diamantina catchment.

The estimated resident population of the Diamantina Shire for 2004 was 306. The total Shire population decreased at a rate of approximately 2% per year during the period 1999–2004 (down from 338 persons in 1999). This contrasts with the 2% growth rate for the State over the same period (Office of Economic and Statistical Research 2005).

Despite this trend, the Department of Local Government and Planning forecasts slight growth in the Shire population of 0.1% per year, to 334 persons in 2026; compared with the expected State population growth of 1.5%. The age group of 0–14 years is expected to decrease the most, by -1.7%, while the 65+ group is expected to increase by 4.6% (Table 8).

Table 8: Projected growth rates for select age classes in Diamantina Shire and Queensland, 2026

Age group	Diamantina Shire	Queensland
0–14 years	-1.7%	0.5%
15–39 years	-1.0%	0.9%
40–65 years	1.6%	1.7%
65+ years	4.6%	3.7%
All years	0.1%	1.5%

Source: Office of Economic and Statistical Research 2005

At the time of the 2001 Census, there were 105 persons in the Diamantina Shire who stated that they were of Aboriginal descent. These persons comprised 32% of the Census enumerated population, compared with 3.1% for all of Queensland.

Data from 1998 (Office of Economic and Statistical Research 2005) indicates that the majority of business in the Shire fell into the 'Agriculture, forestry and fishing' sector, followed by the 'Accommodation, cafes and restaurants' sector. Table 9 provides numbers and percentages of persons employed in each sector.

The total gross value of agricultural production in the Shire for the 1998/99 financial year was \$3.6 million. Livestock disposals accounted for 100% of that amount, which also represented 0.2% of Queensland's total agricultural production.

The overall unemployment rate in the Diamantina Shire at the time of the 2001 Census was 3.4%, compared with 8.2% for Queensland. The labour-force participation rate for the Shire was 77%, higher than that recorded for Queensland (63%). 'Labourer and related worker' was the occupation with the largest number of employed persons (25% of employed persons).

Table 9: Employment by industry, Diamantina Shire, 2001

Industry	Region		Queensland		Specialisation ratio (b)
	number	per cent	number	per cent	
Agriculture, forestry and fishing	85	32.9	76 532	4.9	6.8
Mining	3	1.2	19 286	1.2	0.9
Manufacturing	6	2.3	167 380	10.7	0.2
Electricity, gas and water supply	0	0.0	12 359	0.8	0.0
Construction	37	14.3	111 209	7.1	2.0
Wholesale trade	3	1.2	79 718	5.1	0.2
Retail trade	19	7.4	239 615	15.3	0.5
Accommodation, cafes and restaurants	14	5.4	88 381	5.6	1.0
Transport and storage	9	3.5	77 587	4.9	0.7
Communication services	0	0.0	23 016	1.5	0.0
Finance and insurance	0	0.0	44 562	2.8	0.0
Property and business services	9	3.5	153 864	9.8	0.4
Government administration and defence	18	7.0	75 048	4.8	1.5
Education	22	8.5	118 896	7.6	1.1
Health and community services	9	3.5	151 029	9.6	0.4
Cultural and recreational services	12	4.7	37 341	2.4	2.0
Personal and other services	9	3.5	57 662	3.7	0.9
Non-classifiable economic units	0	0.0	7 452	0.5	0.0
Not stated	3	1.2	27 927	1.8	0.7
Total	258	100.0	1 568 864	100.0	1.0

Source: Office of Economic and Statistical Research 2005

According to the Australian Taxation Office (Office of Economic and Statistical Research 2005) the mean taxable income of taxpayers in the Diamantina Shire for the 2002/03 financial year was \$40 984. This figure was \$3338 more than the equivalent Queensland figure (\$37 646).

The main advantages of living in the Shire were perceived by participants in the study as beautiful landscapes and good lifestyle for families with small children. The main difficulties perceived were lack of high school facilities and other support facilities (recreation, health, etc.), poor road conditions and the high cost of travel, both within the region and to other parts of Australia.

5.3 Rules in use

The *Water Act 2000* of the Queensland Government was prepared as a result of the 1994 Water Reform Agreement. The Water Act requires that all catchments in Queensland develop Water Resource Plans, the subordinate legislations of the Act. The Resource Operations Plans are then developed to implement Water Resource Plans.

The Water Resource (Georgina and Diamantina) Plan ('the Plan') was prepared as a statutory requirement under the *Water Act 2000* and came into force on 6 August 2004. The objective of the Plan is stated as:

... a framework for the allocation and sustainable management of surface, overland flow water and hydraulically linked groundwater in the plan area, and to meet future water requirements, including the protection of natural ecosystems and security of supply to water users.

The second part of the planning process was the development of the Georgina and Diamantina Resource Operations Plan. This process took place during the August 2004 – August 2006 period and is not the focus of this report.

Several other key pieces of legislation are relevant to the water-planning processes in the Georgina-Diamantina catchment, such as the *Lake Eyre Basin Agreement Act 2001*, the *Integrated Planning Act 1997*, the *Environmental Protection Act 1994*, the *Native Title Act 1993* and the *Mineral Resources Act 1989*.

The *Water Act 2000* is also linked to the National Strategy for Ecologically Sustainable Development (section 11(b)), the Environmental Protection Act and the Environmental Protection (Water) Policy 1997 (Part 7). The DNRM&W is therefore required to develop plans for water allocation that protect environmental values of waters while allowing for sustainable development.

A communal set of norms and rules has evolved over time and operates in parallel with the formal set of rules. These will be discussed more fully in the following sections.

5.4 Action arena

This section presents the following building blocks of the Institutional Analysis and Development (IAD) framework, as they apply to the Georgina-Diamantina catchments water planning processes: Participants (section 5.4.1) and Action situation (section 5.4.2). Interactions are further discussed in section 5.5.

5.4.1 Participants: Key stakeholders

Water planning in Queensland is the responsibility of the Department of Natural Resources, Mines and Water (DNRM&W). The Department retains all decision-making powers within the process (Figure 26), as it is the organisation responsible for administration of the *Water Act 2000*.

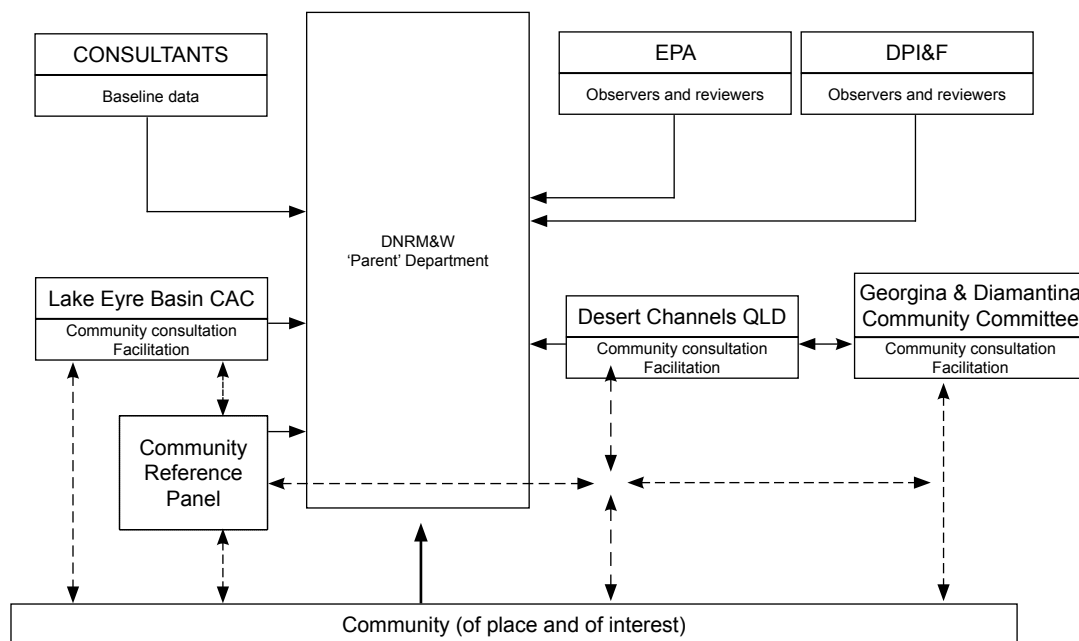


Figure 26: Key stakeholders in the Water Resource (Georgina and Diamantina) planning process

CAC=Community Advisory Committee

Several other state government departments and agencies, in particular the Department of Primary Industries and Fisheries (DPIF) and the Environmental Protection Agency (EPA), have a strong interest in water-management issues, such as allocation of water for agricultural production purposes and protection of environmental, social and cultural values, respectively. These agencies are allocated the ‘observer’ and the ‘reviewer’ roles in the process and have no decision-making power. The DNRM&W ensures that the views of other agencies are being considered and that there is all-of-government support for the plans before they are formalised.

Independent consultants are engaged during the planning process to collect and present baseline information on all aspects related to the resource, such as physical, biological, social and economic characteristics and the potential impacts of policy change on them. However, no independent Strategic Environmental Assessment (or equivalent) process is triggered by the planning process.

Natural resources management (NRM) and planning in Australia is facilitated by NRM bodies that act as interface agencies between the government and the public. Desert Channels Queensland Inc. is such an interface agency, covering the Queensland section of the Lake Eyre Basin. This agency is charged by the community and government with ‘ensuring a sustainable social, economic and environmental future for the region’ and operates via three implementation groups covering the region: Georgina-Diamantina Catchment Committee, Cooper’s Creek Catchment Committee, and Desert Uplands Build-Up and Development Strategy Committee.

The Georgina-Diamantina Catchment Committee (GDCC) is a community-based group ‘dedicated to the sustainable management of the natural resources of a unique part of Australia’s Outback’. The Georgina-Diamantina Strategic Plan (2000) lists key natural resources–related issues of importance to the region. The Georgina-Diamantina planning process is tied to several of the key objectives listed in this plan:

- managing surface and ground water for both ecological and production outcomes
- improving pasture management practices, particularly during drought
- avoiding further pollution or degradation of land and water resources

- seeking alternative or multiple land use opportunities
- protecting aquatic and terrestrial ecosystems
- preserving the rich and unique diversity of plants and animals
- safeguarding economic viability and local employment opportunities.

In parallel to this process, the Lake Eyre Basin Community Advisory Committee (CAC) covers the natural resources issues and stakeholder interests from the multi-jurisdiction point of view (Figure 26).

Local stakeholders were involved in the rule-creation process in several ways (Figure 27). The Community Reference Panel, a participative body formed as a statutory requirement of Queensland's *Water Act 2000*, includes members from catchment communities as well as representatives of the State and Commonwealth governments. In addition, a Community Awareness Program, comprising a series of workshops, information sessions and public meetings in population centres within the Plan area, was organised to raise community awareness of the water planning process, as well as to receive stakeholders' input on issues relevant to the process. The Resource Operations Advisory Group was also formed to provide advice on the issues during the resource operations planning process. This consultative body was formed at the discretion of the DNRM&W, as there is no statutory requirement for this type of stakeholder engagement during the resource operations planning process.

5.4.2 Action situation: Water planning process

The water planning process described in this report is an 'action situation'. Action situations are typically integrated within a wider set of rules and action situations.

In the case of the Georgina and Diamantina planning processes, both the *Water Resource (Georgina and Diamantina) Plan 2004* and the *Georgina and Diamantina Resource Operations Plan 2006* are collective-choice level rules. The vertical integration of the Plan with the different levels of the institutional analysis is presented in Figure 27.

A set of constitutional-choice level rules, for example the Water Act, is modified very infrequently. The collective-choice level rules, such as the Water Resource Plans and the Resource Operations Plans, are modified slowly over time (in this case, every 10 years). Operational level action situations are 'played' on a day-to-day basis. The allocation outcomes will, in the end, be determined not only by the set of collective-choice level rules in use, but also by the physical variables of the resource and the actions of the community taking part in the operational level action situations (Figure 27).

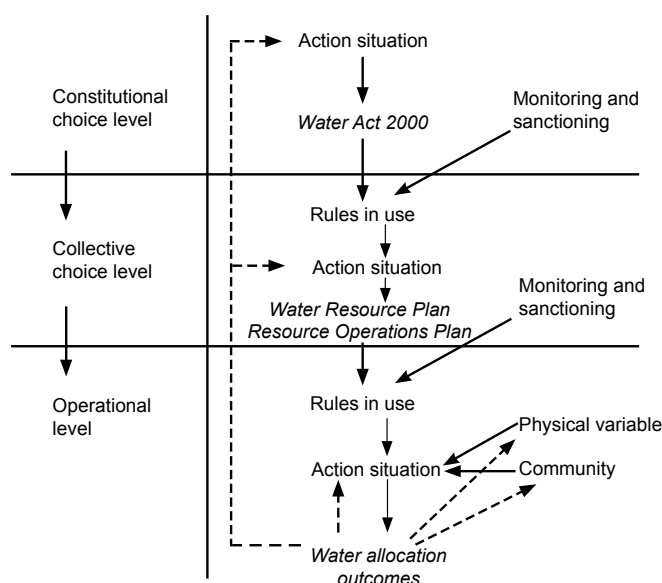


Figure 27: Levels of rule creation in the Queensland water planning process

5.5 Patterns of interaction

The consultative part of the *Water Resource (Georgina and Diamantina) Plan 2004* planning process was the key formal mode of interaction between the participants in the action arena. The Community Reference Panel, Community Awareness Program, public meetings and informal discussions were used as methods of interaction between participants in the action situation.

Following the release of the draft Water Resource (Georgina and Diamantina) Plan in 2003, public submissions were invited (Water Planning Group 2004). During that period, the DNRM&W held 17 public meetings across the catchments in two rounds: one in November 2003, following the release of the Plan; and one in March 2004, before the close of submissions (Water Planning Group 2004).

In total, 18 submissions to the Draft WRGDP were received (Water Planning Group 2004). It can be observed from Figure 28 that the majority of the submissions were received from groups with an interest in grazing, followed by interstate interests and environmental and community interests. Several submissions also represented more than one interest group.

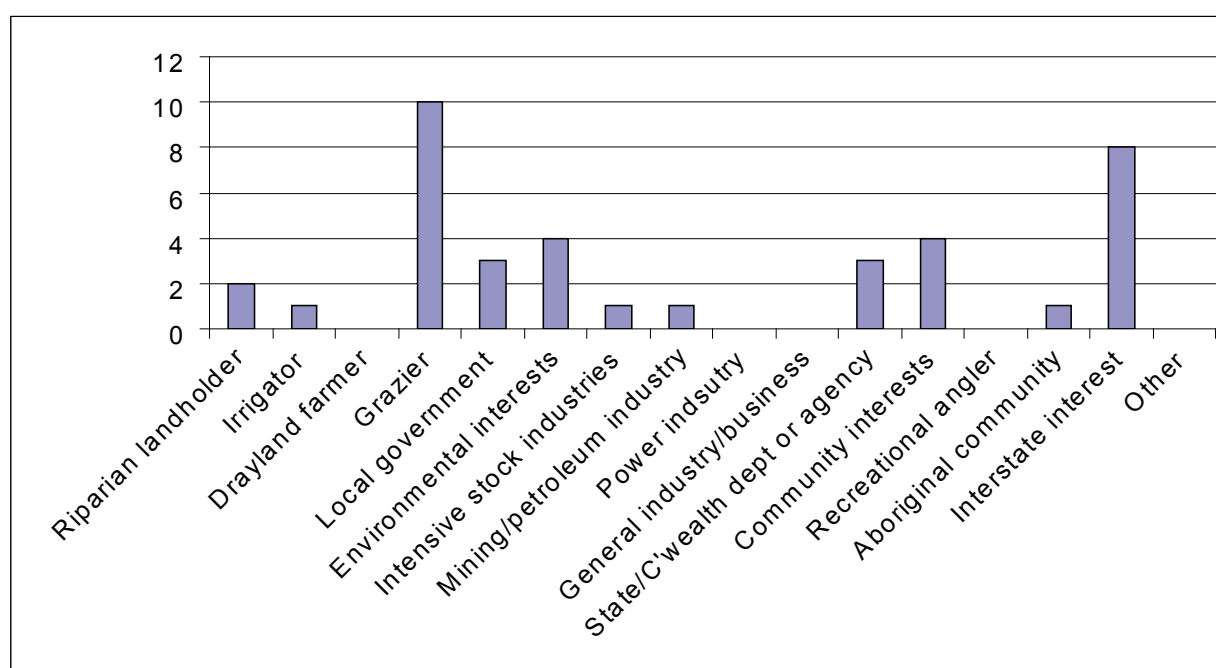


Figure 28: Number of submissions to the draft WRGDP, by interest group

Source: Water Planning Group 2004

Two key areas of concern could be identified in the submissions. One included calls for enhanced protection of in-stream habitats and waterholes, and in particular the importance of the maintenance of flows that connect waterholes. The other key subset of submissions dealt with the need for further and more explicit recognition of interstate interests and for integrated monitoring programs across the Lake Eyre Basin.

The specifics of the submissions and consequent updates to the final WRGDP are summarised in the *Georgina Diamantina Water Resource Plan – Consultation Report* (Water Planning Group 2004). Table 10 presents a summary of the key issues raised, such as concerns related to trans-boundary water flows, levels of consultation during the planning process, lack of data, potential environmental impacts and monitoring.

Other consultation activities similar to those conducted for the development of the WRGDP were also conducted during 2005–06 by the DNRM&W to develop the Resource Operations Plan.

Table 10: Summary of the issues raised in stakeholders' submissions to the Water Resource Plan

Draft plan topic	Number of items raised	Issues raised on the topic
Description of the Georgina and Diamantina Catchments	3	No appreciable change in flooding patterns should occur as a result of the Plan
Assessment of the ecological conditions	10	The Plan did not go far enough in its attempt to protect the natural environment of the catchments
Economic and social profile of the Plan area	12	The draft Plan would affect current levels of economic development by threatening grazing enterprises and the tourism industry in Qld and SA. The threat will be in the form of changing flow regimes, flooding cycles and increased periods of no flow Some submissions suggested that additional allocations should be used to enhance the development and lifestyle of those living in the communities
Cultural significance of the catchments	1	Cultural significance of the system should be elevated so that the process takes into account concerns of the Traditional Owners
Community consultation process	10	Concerns that landholders in SA were uninformed about the process and that the consultation process needed review
Lake Eyre Basin Intergovernmental Agreement	5	Need for the Minister to consult with Commonwealth and State governments when considering a review of the Plan or other changes, including 'projects of state significance'
Water resource planning process	13	Concerns regarding the level of consultations Concerns regarding the level of data associated with the hydrological assessment
Resource operational planning process	11	Need for the additional water allocation of 12 000ML to be allocated in a fair and equitable manner across the catchments There was no provision in the Draft Plan to stop a large percentage of total water allocation from being abstracted at a single location Extraction caps for sub-catchments were suggested
Total annual volume of water extractions	11	Additional restrictions need to be placed on the management of overland flows Uncertainty over the total volume of overland flows that could be taken under the Plan provision
Stock and domestic requirements	9	In favour of increased regulation Need for management of town water supply
Provision for mining or other projects of state significance	8	Concern about the wording of the Plan section that gives substantial discretion and decision-making power to the Minister and Chief Executive
Provision for irrigation and other industrial use	8	Concern over the level of water proposed for extraction Concerns over DNR&W ability to monitor and regulate water take
Minimum share of unallocated water	4	This approach might result in increased water take due to utilisation of the full share for fear of losing future water allocations
Future decisions	6	Impacts of the increase in allocations need to be continually monitored and assessed

DNR&W = Department of Natural Resources, Mines and Water

SA = South Australia

Qld = Queensland

5.6 Outcomes

In sections 5.1–5.3, the basic factors that frame the action arena were described, and in section 5.4 the analysis of the action arena in which the institutional interactions took place was described. The actual patterns of interaction in that arena were described in section 5.5. This section presents the findings of the Outcomes analysis. The section first presents a summary of the types of rules included in the draft Georgina & Diamantina Resource Operations Plan (GDROP). Section 5.6.2 then presents analysis of the Plans in relation to the Ostrom's Design Principles. A summary of the perceived information provision and importance of other organisations related to natural resources management overall is presented in section 5.6.3.

5.6.1 New rules created

The draft GDROP is a collective-choice level set of rules that specifies rules to be applied at the operational level. This section presents analysis of the *types* of rules used in the draft Plan.

The draft GDROP specifies four categories of water and corresponding sets of rules and release mechanisms:

- Category A water: large volume units (200 megalitres/lot) of water for any use, with auction as the method of release
- Category B water: small volume units (10 megalitres/lot) of water for any use, with tender or fixed price as the method of release
- Water for ‘projects of state significance’, released at the discretion of the Chief Executive (the DNRM&W) following an application by the project proponent
- Town water supply, released at Chief Executive’s discretion, following an application from the local government in the area.

Analysis of the types of rules applicable to the water allocations specified in the plan is presented below.

5.6.2 Boundary rules

Entitlement to apply for water allocation is specified in the draft GDROP as that defined under section 206 of *Water Act 2000* of the Queensland Government, in other words:

- For Category A and B water:
 - per section 206 (1): ‘An owner of a parcel of land, or the owners of contiguous parcels of land...’ and
 - per section 206 (4):
 1. the State
 2. a local government
 3. a water authority
 4. a resource operations licence holder
 5. an interim resource operations licence holder
 6. a petroleum tenure holder (under specified conditions)
 7. an entity prescribed under a regulation.
- For ‘projects of state significance’: the proponent of the project
- For town supply water: a local government within the plan area.

The boundary rules proposed in the draft GDROP appear specific and clear. The rules are based on one of the two following characteristics: the appropriator’s relation to the resource itself and other related resources, or the appropriator’s attributes. The requirement for the pre-existing relationship to the resources effectively means that non-landholders will likely not be entitled to bid for water allocations.

5.6.3 Position rules

There appear to be two general positions in future operational-level water allocation action situations. One position is that of the ‘applicant’. The actual rules of the applicant’s position are specified for each relevant water category, and all applicants must first comply with the relevant boundary rules. The other position is that of a legislator or ‘Chief Executive’, a decision-making position.

5.6.4 Choice and scope rules

Choice rules specify actions; that is, what a participant ‘must, must not or may do’ (Crawford & Ostrom et al. 2005). Scope rules are similar to choice rules, as they also deal with ‘must, must not and may do’ options; however, scope rules do not deal with action but rather specify outcomes.

Part 4 of the draft GDROP deals with the conditions of new water licences and is a combination of choice and scope rules. Division 1 of the Plan determines conditions for use and take of water and the limits on the take of water (flow access conditions and flow reference points); while Division 2 sets conditions for taking overland flow (conditions of taking, maximum rate of take, storage volume and mean annual diversion).

One of the examples of choice rules in Part 4 is section 70 – Use of water. Section 70 specifies actions that must not be taken (‘A water licence that is issued for water that was originally purchased as category B unallocated water must not be used on the same lot plan as a water licence issued for water that was originally purchased as category A unallocated water’) (Draft GDROP, section 70 (1)(a), emphasis added).

In section 72 – Limits on the take of water, point (1) specifies a choice rule of a temporal nature: ‘A condition is to be applied to a licence that prohibits the taking of water in any water year from 1 August until flow at the reference point has occurred.’ Weight here is put on achievement of the outcome; that is, achievement of target minimum flows.

Choice rules are supplemented by several scope rules, such as those specifying the protection of key waterholes (section 71 – Conditions for the take of water from a waterhole). This section specifies that conditions will be imposed on a water licence to ensure the protection of significant waterholes and wetlands, as listed in Attachment 5 of the draft GDROP, by forbidding the extraction of water from below the natural ‘cease-to-flow level’ of a waterhole.

5.6.5 Payoff rules

Payoff rules assign external rewards or sanctions to particular actions; that is, they involve paying or receiving something of potential value. They therefore directly affect costs and benefits of an action or outcomes for actors in an action situation (Crawford & Ostrom 2005).

Pricing of water for Category A and Category B water is discussed separately in the draft Plan. Category A water will be allocated through auction, with the bidding process determining the price. Price for Category B water will be determined by public tender at the first instance and by fixed price set by the Chief Executive later on.

Penalties, fines and sanctions for rule-breaking behaviour are specified in the constitutional level of the *Water Act 2000* of the Queensland Government, which states that the unauthorised taking of water is illegal. When a water-licence holder removes more than their allocated amount of water they will receive an infringement notice, which includes a demerit point against their licence and a fine based on the volume of unauthorised water used. Current levels of fines are listed publicly on the internet. ‘How is compliance to be achieved?’ and ‘Will the application of sanctions be effective?’ are some of the questions that will need to be considered and answered at the operational level, once it comes into existence.

5.6.6 Information rules

There appear to be no rules regarding obligations, permissions or prohibitions to communicate between the participants holding the same position in potential future operational-level action situations. A few rules regulating communication between ‘applicant’ positions and Chief Executive positions do appear in the Plan, such as the rule that ‘the minimum price (of category A unallocated water) must not be made public’ (section 26 (1) (b)) or the rule that “If an expression of interest for category A unallocated

water is received in a water management area, the Chief Executive must publish a notice inviting all interested parties to apply to register to bid for the category A unallocated water available in the water management area' (section 23 (1), emphasis added).

5.6.7 Aggregation rules

Aggregation rules as used in this report refer to the decision-making powers.

Lack of aggregation rules in the draft GDROP has repeatedly been criticised by stakeholders during field work interviews. This lack of aggregation rule is manifested, in their view, in expansive rights granted to the Chief Executive position in decision making.

5.7 Evaluation criteria

As discussed in the previous sections, outcomes from an action situation are a function of interactions between participants within the action situation. The evaluations of the Outcomes depend to a great extent on the evaluative criteria used by participants or the external evaluative criteria of the system (society) they operate within. Ostrom (2007) argues that Outcomes are a function of physical outcomes, external valuation and participants' intrinsic valuation.

Data collected during the fieldwork part of the case study provide insights into the intrinsic valuation applied by local stakeholders in relation to the consultative part of the process (interactions – section 5.7.1) and the rules created (outcomes – section 5.7.2). Interviews were conducted with stakeholders from Diamantina Shire only, and therefore represent opinions and interests of communities inhabiting the lower reaches of the Diamantina and Georgina rivers only. Consultations with the stakeholders from the upper reaches of Georgina and Diamantina rivers are likely to have produced different intrinsic valuations.

The interviews were conducted during the period August–October 2005 and therefore reflect the perceptions on interactions and outcomes of the *Water Resource (Georgina and Diamantina) Plan 2004* and not the Georgina and Diamantina Resource Operations Plan.

5.7.1 Intrinsic valuation of Interactions

This section presents aspects of the intrinsic valuation of interactions (consultation process) expressed by the community at large and by the Aboriginal population.

5.7.1.1 Intrinsic valuation of interactions by community at large

Community committees (such as Lake Eyre Basin Community Advisory Committee and the Desert Channels and Georgina Diamantina Community Committees) and the Community Reference Panel were viewed by the local stakeholders as the key vehicles for interaction during the planning process. The Committees were seen as representing a 'reasonable blend of people', from current economic sectors and geographic locations (representation throughout the catchments from both towns and country).

The consultation process was perceived as being dominated by two extreme points of view. One group favoured additional water allocations being as high as possible in the upper reaches of the Diamantina and Georgina, including Burke, rivers. This point of view was regarded as being 'based on economics', where the preferences of the landholders in the upper reaches were driven by security and the protection of investment ('to be sure they protect what they have') concerns.

The other group lobbied for the 'natural river'. This point of view was mainly coming from representatives from the lower reaches of the Georgina and Diamantina. The key desired outcomes of this group have been summarised as 'the less interference the better'; 'natural processes are good'; and 'community wants more water to flow through; as much as possible'.

Overall community perception of the Plan proponent, the DNRM&W, is that the Department is ‘strongly pro-development’ while ‘community wants more natural processes to rule’. The additional allocations originally proposed in the draft *Water Resource (Georgina and Diamantina) Plan* were decreased in the final *Water Resource (Georgina and Diamantina) Plan 2004* as a result of the consultation process.

There was a concern about the fact that attendance at the meetings and overall participation continued to drop throughout the process. Comments were made that ‘people are spread too thin as there are too many meetings’ and that it is ‘hard to decide which ones to attend.’

Several procedural and capacity issues have also emerged. The stakeholders criticised the consultation process as being ‘run in order to satisfy regulatory requirements but not really to ensure participation’, citing unsuitable meeting times and places, and short comment times as examples.⁹

The overall capacity of the Shires to deal with water issues was also questioned. Lack of resources, both human and financial, to deal with issues of water education, awareness and wasteful use were perceived as key constraints the Shire faces in its attempts to improve water efficiency.

The community has also expressed a desire for a process that would allow them to choose their own paths for future development, rather than having pre-determined decisions imposed on them.

5.7.1.2 Intrinsic valuation of interactions by Aboriginal stakeholders

The concern that Aboriginal interests were under-represented and that Aboriginal people might not be satisfied with the process were voiced by several stakeholders and were therefore further investigated.

Some of the main criticisms voiced by Aboriginal stakeholders were:

- feeling of being invited only to support others’ point of view; ‘so the minutes say ‘indigenous population was represented’ feeling of being used
- the points made by Aboriginal representatives ‘never got into the minutes’; ‘Name in the minutes was the only input’
- feeling that their presence made no impact; ‘What Aboriginal representatives had to say did not make any difference’
- people dropped out as ‘the attitude was that whatever happens must suit us too’
- ‘all white requests are reasonable; all Aboriginal requests unreasonable.’

The criticism of the workshops organised by the Department mainly related to the inappropriateness of the language and methods used. The workshops organised were not ‘at the mob level’ and did not give a true opportunity for all Aboriginal people to participate. The interviewees were of the opinion that there should be a special process for Aboriginal people where they would be comfortable to express their opinions, ‘to say what they think’; and then ‘that can be taken into a big picture’. The overall comment on the workshops was that they were ‘too high-tech’ for Aboriginal people, that ‘people sat there like glazed apples’ as the content presented was ‘hard to understand’; and that the other participants in the process and the mediator were using ‘words the size of America’. It appears that most of the families did not attend the workshops as they felt intimidated by the level of conversation.

This gap is also apparent in the comments about the submission process: ‘Mob can hardly read the plans. Where do we even get the plans from?’; ‘Company managers (mining and grazing companies) are directed to read and submit (comments on the draft Plan) and are paid to do it. No one will finance or help Aboriginal people to prepare a submission.’

One of the Aboriginal interviewees summarised the consultation process like this: ‘Once it comes back as a rule, they say “you had a chance to input”, but in reality, we did not have any chance at all.’

⁹ The comments are based on the Water Resource (Georgina and Diamantina) planning process; the author is aware that the consultation process and the perceptions thereof have improved during the Resource Operations planning.

5.7.2 Intrinsic valuation of outcomes

This part of the interview concentrated on the allocation process as a ‘new rule’ or a final output of the planning process. The key point of discussion was the perceived outcomes of the new-rule creation, and the perceived potential future impacts on the region. Several distinct types of concerns were put forward and are discussed in the sections below. All of them, however, are centred on one main theme: the importance of floods to the viability of the lower Diamantina and Georgina region.

5.7.2.1 Economic concerns

In general, the opinion of the pastoralists in the region was that ‘What is good for the environment is good for us’. They stressed the heavy reliance of their production cycles on natural floods of the Georgina and Diamantina rivers (‘Pastoralists depend on floods’; ‘Rivers feed us’; ‘Lower reaches of the rivers depend on nature, live with nature’).

As discussed in sections 5.1 and 5.2, the production system of the lower Diamantina and Georgina rivers depends on the floods, as they revitalise the pastures by bringing both water and nutrients to the soils. Therefore, the economic interest of the pastoralists in the area is to maintain the waters in the river (maintain the floods), rather than to extract them. The flood years are viewed as ‘good’ ones, the years that allow for maximisation of the profits. The floods are perceived as crucial for the continuation of farming and for wealth creation.

A key determinant that was frequently brought up in discussions was the size and economic viability of the farms. It was repeatedly pointed out that farms in the lower reaches of the Georgina and Diamantina were large and economically viable and they therefore could ‘afford to be good’ (i.e. active in conservation programs, such as recent registration of the parts of the North Australian Pastoral Company (NAPCO)–owned Marion Downs with the Land for Wildlife program (Environmental Protection Agency 2002)).

It was stressed on several occasions that the Diamantina and Georgina catchments were different from coastal regions in that ‘seasons dictate management and not the other way around where farm management dictates seasons and activities’ and that one ‘cannot escape the weather or landscape’. The region is viewed as ‘too big and too raw’ to impose ‘humans’ over it.

There was also a general consensus that most of the graziers in the region ran their cattle numbers conservatively and that they were aware of the environment. Communication technology, availability of transport and the fact that the majority of properties in the region were owned by large stock companies that could easily move cattle to another property were seen as key factors facilitating improved stocking rates (‘if they (earlier generations) had stock on and it went dry, stock had to stay on; now with phones and cars it is easier to send cattle out’). The community was also proud of the effort many graziers in the region had put into sustainable management of the Great Artesian Basin water, through capping of the artesian bores, piping and dam rehabilitation (‘artesian levels are rising, some springs are starting to flow again’).

The perception of the tourist operators in the region was similar: ‘If we lose floods we will lose tourists’. The perception was that what drew tourists into the region was the amazing dynamic of the desert transformed by floods and the ecosystems that developed around these floods, such as the proliferation of the bird life and flowers. Like the graziers, the tourist operators ‘did very well’ during the last flood (in 2000/01).

The mining sector was perceived by local stakeholders as needing to be ‘controlled and monitored’ as ‘they tend to have their own rules’. The mining sector was perceived as the major water user in the region, and was held responsible for poor water management and a decrease in the artesian water

levels. Although mines in the region relied mainly on groundwater, apprehension was expressed by most stakeholders about the impacts of the opening of new mines in the region – seen as the reason for reserving a water allocation for ‘projects of state significance’ in the current Plan.

5.7.2.2 Environmental concerns

The number, seriousness and variety of environmental concerns voiced by interviewees, concerns related to the additional water available for allocation as a result of the planning process, were notable. Similar concerns were voiced by all sections of the community: town residents, Aboriginal people, pastoralists, tourism operators and service providers.

The overall mood expressed might be summarised as ‘it is nice to let the river run’ and ‘the more the better’. Other related comments include ‘People want to leave country as it is’ and that ‘we survived this long (without state interventions or “improvements” to the system), we must be doing something right’.

The main concern of the interviewees was that additional allocations of water in the upper reaches of the rivers would have negative effects on the ecosystem, in particular on the lower reaches. The link between ‘ecosystems’ and ‘removal of water’ was made by all interviewees and it was stressed by several that ‘environmental values are important to people’ and that ‘people are aware of the environment; they are very concerned about impacts; they understand and appreciate the country’.

The region has extremely low rainfall, and therefore depends on flood waters to bring seasonal changes in water flows and a resulting change in ecosystems. The sentiment therefore was that: ‘The way the river runs now should not change’; ‘Lower Diamantina needs floods’; ‘Floods feed the country’; ‘We want water in the river, we want floods’; ‘Floods are not too often but they should flow’; and ‘there should be no water taken out in the first place’.

Also interesting was the resistance to ‘improvements’. The ‘Cotton thing’ (attempts to introduce intensive irrigation system for cotton production in neighbouring Coopers Creek catchment in the 1980s and 1990s) was often mentioned: ‘it put a few people off; and hopefully it will stay that way’. It was also pointed that ‘People want to leave country as it is’. The climatic and landscapes features are accepted as they are, as a given externality, and ‘there is no need to discuss that’.

The floods were perceived as important not only to the ecosystems, but also for the wellbeing of the regional population. ‘Floods change everything and everyone, even people – everyone is happy’; ‘Birds are important to people, just seeing them come with floods’.

It was also perceived that water management should be enhanced by ‘better conservation practices upstream rather than taking away what we need here’.

However, the current proposed level of allocations at Winton area ‘should not present a threat to people in lower reaches’. Diamantina Lakes are seen as the key regulating water body in the region, and the need for monitoring indicators of potential changes on Brighton Downs and Davenport Downs was seen as an indication of what might happen in the lower Diamantina.

Another concern expressed was that of water quality. Water quality was perceived as ‘perfect now’ and the community was very concerned about pesticide and herbicide pollution associated with extension of cropping enterprises in the upper reaches. ‘Do we know the impacts?’ and ‘Do these things cumulate?’ were some of the questions that will be further explored in the precautionary principle discussion below.

5.7.2.3 Precautionary principle concerns

Additional areas of concern expressed by a majority of interviewed stakeholders could best be grouped as ‘Precautionary principle concerns’. The ‘Precautionary Principle’ is one of the key principles of sustainability, stipulating that:

If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. (Natural Heritage Trust of Australia Act 1997)

The precautionary principle permits a lower level of proof of harm to be used in policy-making whenever the consequences of waiting for higher levels of proof may be very costly and/or irreversible. (European Environment Agency 1999)

Typical examples of the precautionary-principle concerns expressed during the interviews – concerns about potential currently unforeseen impacts that water withdrawals might cause in the future – included:

- ‘People do not know the science behind all this. Does the government?’
- ‘We do not know how it works, but we feel that this is a right thing to do (maintain the natural system), we do not want to interfere with nature.’
- ‘Ecosystems here are very vulnerable, and very understudied.’
- ‘We do not know what is going to be affected.’
- ‘There are cycles – how long can certain species go on without water? Do we know?’¹⁰
- ‘People are worried when someone wants to mess with the environment.’
- ‘Ecology of the area is understudied. Who should do something about it?’
- There is an ‘Awful lot we do not know and should not experiment with.’
- ‘Rare for scientists to come to the region, they do not know what is going on in this region; most of their ‘findings’ and conclusions are based on other parts of Australia and not on data collected in this region.’
- ‘This is a unique system and data translated (from the coastal regions of Australia) has little meaning in local conditions.’
- ‘This is a fragile show, good soil but not enough water; too much pressure would break it.’
- ‘Country mainly looks after itself.’
- ‘This is a very fragile country; we have learned how to live with it.’
- ‘If we push it too hard it will break on us.’
- ‘You get one good season in 4–5 years, you can’t flog it.’
- ‘In 125 years (of the graziers’ settlement of the region and the observance of the conditions) water has gone past Big Red five times – even 1% increase in allocations might make a difference there!’¹¹
- ‘Committees are spending millions to bring nature back to the way it was ... why not keep it as it is in the first place?’
- ‘We do not know enough about the environment as it is.’

Lake Machattie was brought forward as an example of the unpredictable nature of the region. Local stakeholders observed that between 1938 and the early 1970s they ‘only saw Machattie full once’. Yet the Lake subsequently filled with water and attracted pelicans from thousands of miles away following both the 1974 and 2000 floods.

5.7.2.4 Concerns over issues of equity

A strong sense of equity was also present in all sectors of the community. The two main axes of equity were perceived as upper versus lower reaches of the river; and rich and powerful versus the poor:

¹⁰ Several species in the desert environment, such as burrowing frogs, bury themselves and hibernate between the floods, and can be observed emerging almost immediately after water passes over their hiding places (Nakamarra 2005, Tyler 1997).

¹¹ Big Red is an Australian icon, a large red sand dune some 40 km west of the township of Birdsville.

- ‘People down bottom end need the water; that is common sense.’
- ‘People up top should not be taking it all away.’
- ‘It is not fair to take the water out; people need it down there.’
- ‘People with most money end up with everything.’
- ‘They have power and influence; they buy more and more water’.

Another concern repeatedly voiced was about the extent of the powers granted to the Chief Executive position in the draft Plan. ‘Chief executive has a lot of powers’; ‘Lots goes through him in the Plan’; ‘(the Plan) needs a Board or other more transparent, less biased system’ were some of the concerns about lack of transparency and concentration of the power perceived in the Plan.

5.7.2.4 Specific concerns of Aboriginal participants

One of the key concerns about the planning process outcomes expressed by the Aboriginal population interviewed in the Diamantina Shire was that ‘no one wants to take culture seriously’. The Aboriginal cultural value of the water was not restricted to the specific geographical locations of spiritual significance – ‘special places on the river’ – but also encompassed the very presence of the water (intrinsic value). There was a concern that the Aboriginal people appeared not to be recognised as using water; their stories, their culture, the important place water plays in those, did not receive sufficient acknowledgment (‘The water is blood line of the Aboriginal people and culture in this part, there is no recognition of that in the Plan’). They argued that ‘All water was created by serpents, spirits and ancestors of Aboriginal people, the water and landscape are here because they were created by Aboriginal ancestors’ and that ‘Once water is gone from river Aboriginal people lose everything, food, culture, home – it is not just water!’

Although the historical Aboriginal traditions were mainly gone and were not practised any more, the Aboriginal people in the area expressed a desire to preserve things that were still there. The example of the places they would be interested in preserving were the remains of the traditional camps on permanent waterholes of the region. The concern was that ‘Cattle are tramping over the camps and historic sites when accessing water; would be good to see the sites fenced-off’.

Current use of the water by Aboriginal people is mainly through fishing and camping (on Monkira Station, Diamantina Lakes or Glengyle). During visits to the sites the stories are told, and entire families engage in activities such as hunting and grub collection.

In conclusion, the Aboriginal people were disappointed with the planning process as ‘Mob wanted to see something come out of it, and nothing came out of it’. It appeared that two main outcomes were hoped for. One desired outcome was a greater understanding of and respect for the cultural values of water to Aboriginal people in the region (‘everyone to begin to understand Aboriginal people and how they see the land; to understand how the land and people of Australia were created’). The other desired outcome voiced was for Aboriginal people to have specific set allocations that could be used for business development purposes (‘Maybe there should be a clause (in the Plan) saying: ‘water available for Aboriginal business opportunities’ or something like that’).

5.7.2.6 Monitoring

Lack of robust monitoring arrangements and provisions was seen by stakeholders as one of the main design failures of the new Plans.

- ‘How is this going to be regulated?’
- ‘Who will control ‘topping up’?’ (of the water storage infrastructure on farms)
- ‘If there is only one major operator it will be controllable, but if system grows, it might become a major issue; who will enforce a complex system out here?’

- ‘It will have to be based on trust at the end.’
- ‘They have opened a can of worms.’
- ‘How do we know which areas are to be affected by take? How big is allocation compared to total water? How do you assess the flows? Water here meanders, there are pools of water – it does not necessarily flow ...’
- ‘You want to be sure you are measuring it accurately.’
- ‘How are they going to monitor river flows and on farms uses?’

Enforcement is particularly difficult due to the extremely large area of the catchments and the properties and poor to no accessibility to most parts of the properties.

5.8 Design principles applied to the case study

The analysis of design principles as they applied to the Georgina and Diamantina water planning process presented in this section was based on both the outcomes of the planning process and on the community perceptions.

This section of the report reflects on the design principles of enduring institutions, as discussed by Ostrom (2005). Although Ostrom’s work is related to common-pool resources, many of the design principles appear relevant to the current discussion. It is interesting that several of the design principles were identified by stakeholders (participants) as important, or concerns were expressed about them.

Design principles as they apply to the *Water Resource (Georgina and Diamantina) Plan 2004* and the GDROP are discussed here.

5.8.1 Clearly defined boundaries

Boundaries of the resource system and the boundaries to the allocation volumes appear to be clearly defined. Individuals/legal entities with the right to apply for the harvest of resource units also appear clearly defined. Furthermore, the overall resource (waters of the Georgina and Diamantina catchments) is subdivided into five clear boundary regions (water management areas): Upper Georgina; Lower Georgina, Burke and Hamilton, Upper Diamantina, and Lower Diamantina. Each boundary region has a clearly set amount of water available for allocation within the region. The set of rules applied to the Plan area is enforceable separately within each region.

5.8.2 Proportional equivalence between benefits and costs

The cost-benefit ratio of the newly proposed rules is one of the points of concern for the community. The concern is that a balance of the costs (both to the resource user through the purchase of the water and to the community at large through the loss of related water services) and the benefits (private ones to the resource users via sale of produce and public ones to the community via creation of additional employment, for example) might be difficult to achieve under the new rule conditions. The costs of resource units to the resource user are not known, as water might be purchased either as category A, by auction, or Category B, by public tender process. Due to the lack of specific data and lack of time and funds required to undertake a data collection program, the potential costs and benefits to the environment and society were difficult to determine during the planning process.

Furthermore, stakeholders expressed concerns related to the ‘fairness of the system’. Equity concerns have already been discussed (section 5.7.2.4), and focused mainly on the inter-regional equity of water availability in upper versus lower reaches of the river.

5.8.3 Collective-choice arrangements

This design principle requires that the majority of individuals who are affected by the resource regime are authorised to participate in making and modifying the rules.

Constitutional-level legislative requirements ensure public participation in the creation of choice-level rules, and these were observed via the public participation process that accompanied the creation of the Plans.

Provisions for public participation in rule making between the choice level and operational level are specified in the draft Resource Operations Plan. Sections 134 to 140 of the draft Plan provide for the following types of amendments to the Plan:

- Amendments not requiring public notification (such as correction of minor errors, change of monitoring requirements, change of method for determining conditions on overland flow licences)
- Amendments requiring public notification but without prior publication of a notice of intent (such as flow at the 'Eyre Creek at Glengyle' reference point or introduction of new reference points)
- Amendments that require public notification: All the amendments that are not detailed in the current Plan will need to follow the same public consultation process that is required for the development of the new resource operational plan, that is, public notification of the intent to make an amendment, public comment submission on intent, public notification of the details of the draft amendment, public comment submission on the draft amendment, and final approval or cancellation of the proposed amendment.

5.8.4 Monitoring

The enforcement of the rules is critical for achieving a robust governance system. This design principle, or rather the perceived lack thereof, has created extensive apprehension among stakeholders involved in the Georgina Diamantina planning processes. Specific concerns expressed during the submissions process for the *Water Resource (Georgina and Diamantina) Plan 2004* are summarised in Table 10 of section 5.6. Concerns over monitoring were also repeatedly voiced during interviews, and these are presented in more detail in section 5.7.

The draft GDROP specifies types of data the Chief Executive must measure or collect and make publicly available, such as water quality and flows, water quality and water use and data on future consumptive demands for water and water-use efficiency. The draft Plan also specifies that the Chief Executive may use data collected from meters and other flow-measurement devices to support water-resource assessment and reporting and that ecological performance and monitoring of biological indicators will also be performed. Based on this information, the Chief Executive must make an ongoing assessment of trends. The report detailing water use and monitoring will be produced annually by the Minister for NRM&W and will be made publicly available.

However, no details on how the monitoring program was expected to operate, including budgets and responsibilities, were included in the plans.

5.8.5 Graduated sanctions and conflict-resolution mechanisms

Conflicts related to the GDROP might arise between different stakeholders bidding for the same resource (participants holding the same position) or between applicants and administrator (participants in different positions). However, there appear to be no specific conflict resolution mechanisms in the draft GDROP.

Creation of the accessible, local, rapid, low-cost conflict resolution mechanism might be highly beneficial in this case, in particular in relation to clarification of rule interpretations and for maintenance of trust.

5.8.6 Minimal recognition of rights to organise

This design principle refers to the acknowledged right of the resource users to self-organise. No such right appears in the draft, where all resource users are treated as individuals. However, it would be interesting to observe the informal rules and institutions that are likely to emerge to reach informal agreement on use and management of water in the Plan area.

Inclusion of self-organising rules would potentially benefit the Plan. In particular, literature suggests that self-organisation can create great benefits for the monitoring and enforcement of the rules. This point appears particularly important as the majority of stakeholders interviewed voiced their concerns over the government's ability to effectively monitor implementation of the Plan.

5.8.7 Nested enterprises

The key benefit of the nested approach is in providing smaller scale organisations with access to knowledge, information, extension facilities and other services. Most stakeholders in the region were operating within the nested system, both within the industry sector (mining organisation, grazing companies, conservation groups) as well as within the nested system of government support (local, State and Commonwealth).

5.9 Information and organisations

As discussed in section 2.2, information rules are one of three types of rules used to complement the changes induced by change in the main rule. This section presents some stakeholder comments on both provision of information directly linked to this planning process, as well as formal and informal organisations they typically use as information providers.

5.9.1 Provision of information in the water planning process

The exchange of information in this water planning process was two-fold. The organised (formal) information dissemination process was run by the proponent of the rule change, the DNRM&W. Information flowed informally among participants and between participants and the local community at large.

This informal voluntary exchange of information was typical of smaller systems. Although this system (Georgina and Diamantina catchment) is large in geographic terms, it is small in terms of human capacity, the number of potentially affected people and the number of participants, and therefore exhibits many of the characteristics of smaller systems.

The provision of information needed for meaningful participation and informed decision making was viewed by stakeholders as sufficient, even as overwhelming at times. However, the general consensus was that participants relied on and acted more on their personal beliefs than on the information provided.

Concerns were also expressed about limited and untimely advertising of the meetings and the fact that Council was used as the key information dissemination point for the population at large, potentially introducing a selection bias.

In terms of information sources, the internet was seen by most as very important for information gathering. In addition, the majority of grazing properties in the area are owned by stock companies. For those properties, the key information provider and decision maker is the company

5.9.2 Informal institutions

Historic networks and general meetings were used to disseminate information related to this planning process. No specific informal arrangements had been put in place by the community to deal with this issue. It appeared that the Georgina Diamantina planning process was not regarded as sufficiently significant to warrant a major community response.

The sense of the community members not involved in grazing was that graziers were usually the ones participating in all the processes. The reason for this was perceived as two-fold: the town people admit that most of the natural resources issues are linked to the land and therefore ‘they do not concern us as we are not owners of the land’; at the same time, it was perceived that comments by the town people would not be welcomed by graziers, NRM bodies and agencies (‘Would anyone want to listen to us anyway?’). Therefore, all the natural resources management processes were viewed as heavily dominated by mining companies and pastoralists.

It was generally accepted that ‘graziers try to do what is best for the country and try to look after it’. Community norms and informal enforcements appear to be somewhat under-developed, probably due to the vastness of the area and consequent difficulty in imposing any type of monitoring (‘The land is too large to notice what people are doing. Only fires are noticed.’).

The general attitude towards the rules, both formal and informal, appeared to be heavily related to the presence of enforcement mechanisms (‘They whinge, but they do it, especially if enforcement is there. If there is no enforcement they will not do it.’).

The Great Artesian Basin (GAB) is seen as the major source of water in the region, and in particular of stock and domestic water. Therefore, the GAB water-planning process that is underway is perceived by stakeholders to be far more significant for the livelihoods and wellbeing of the region than the Georgina-Diamantina planning processes.

5.9.3 Other formal groups and organisations

Local stakeholders had mixed ideas about the importance of formal institutions related to natural resources management in general (not necessarily to this water planning process) and the presence of formal groups and organisations in the local area.

In terms of government institutions, the Department of Primary Industries and Fisheries (DPI&F) and the local council (Diamantina Shire Council) were deemed as ‘most visible’ and ‘pro-active’. DPI&F was also praised for its newsletter and extension services (‘They come to mind as a group that is involved in this kind of stuff’).

The Desert Channels NRM body was described as ‘not really present’, while the Department of Natural Resources, Mines and Water, the proponent of the water planning process, was ‘never seen’.

Landcare and farmers associations were also seen as not active. Landcare has been perceived by some as ‘too green’ and ‘a bit ignorant on what is going on here’.

The Natural Heritage Trust, the Australian Bush Heritage Fund, the Environmental Protection Agency and the Queensland Parks and Wildlife Service were named as ‘legitimate’ groups/agencies that should have more influence in government natural resource management–related decision-making processes.

The main perceived reason for little involvement and interaction between the community and the interface agencies and other bodies was lack of time on behalf of community members to be involved in all the activities. The reasons were voiced as ‘no critical mass’; ‘too few people in the community’; ‘many people sit on several committees’; and the community being ‘flat out with things to do’. There was no perceived change in terms of historic community – interface agencies involvement.

Several of the stakeholders also voiced concerns that ‘bodies’ (interface agencies created under the National Heritage Trust – NHT programs) were government organisations and therefore potentially biased. The system in place was ‘not a good idea’ and the preference was voiced for ‘someone independent’ to collect baseline information and perform monitoring and other studies.

Several stations have opened access to scientists and conservation groups, and studies of wetlands, waterholes, waterfowl, soil moisture retention and floodplain monitoring were listed as examples of current on-station activities by scientists.

5.10 Case study lessons

The Institutional Analysis and Development (IAD) framework (Ostrom 2005, Ostrom et al. 1994) was applied in an Outback Australian setting in this case study of a current water policy reform effort.

The formation of rules in the field setting depends to a great extent on the biophysical structure of the resource being regulated and the shared norms of the community to which they are going to apply. The shared norms of the community to which rules are going to apply were therefore investigated. Furthermore, the rules in use determine the scope of the situations and actions that can be taken. As we can see from the development of natural resource management in Australia (McKay 2005), and as expected from the studies elsewhere (Ostrom 2007), one of the first challenges is to accept that the resource is limited.

This section discusses learnings related to the first case-study research question, which aims to investigate ‘How do the components of the IAD framework and the design criteria apply to this case-study and to outback regions in general?’ The discussion then focuses on the second case-study research question: ‘Does the use of the IAD framework add value to the planning process?’ The institutional analysis approaches and the opportunities for further research are discussed there. This section also briefly touches on alternative approaches and frameworks for water planning.

5.10.1 Exogenous variables

The exogenous variables are key determinants of any Action Arena. The term ‘Exogenous Variables’ is used here, as it is the term used in the IAD framework. However, this term is rather misleading as the variables listed are not only endogenous to the action arena, but are also key determinants of the action arena, interactions that take place in the arena, and outcomes.

Economic and socio-demographic baseline data is typically the kind of data most readily available to the decision makers, making financial values of the resource easier and quicker to establish. Situation-specific baseline information on ecological, social and cultural values is typically not readily available in the peripheral regions, and the collection of such baseline data is both costly and time-consuming (Larson & Larson 2007). The trade-offs between the timeline for baseline data collection and the timeline for completion of the planning process therefore tend to bias the information towards the financial values and benefits and away from social, ecological and cultural values and benefits. Furthermore, this lack of site-specific baseline information prevents creation of benchmarks that should be used for monitoring and mitigation of the potential impacts in the future.

The key variables for this case study that might also be applicable to other outback regions could be summarised as follows.

5.10.2 Biophysical conditions

The large area proposed to be covered by the Plans and the extremely variable nature of the hydro-meteorological characteristics of the resource under regulation are key biophysical characteristics of this planning process. These types of biophysical conditions are typical of the outback, yet differ from other planning regions in Queensland. Large planning areas and variable hydro-meteorological conditions have the potential to impact on the future performance of the plans.

5.10.3 Attributes of the community

Diamantina Shire, the local community investigated in this case study, has several important characteristics. Some of the community attributes of the Shire, such as low population density and dominance of agricultural land use, are similar to other Shires in the catchments and the outback in general.

Although Georgina and Diamantina catchment – and, similarly, other outback regions – are large in geographic terms, they are relatively small in terms of human capacity, number of potentially affected people and number of participants. Therefore, they have a potential to exhibit some of the characteristics typical for ‘small systems’.

5.10.4 Rules in use

Australian society at large is experiencing a change in paradigm for water usage. The new paradigm is leading simultaneously towards demands for higher financial returns from water use and higher ecological, social and cultural benefits from water. The pragmatic details of how both of those goals are to be achieved, the individual and societal costs and benefits that are associated with those goals and the distribution of costs and benefits warrant further investigation.

5.10.5 Evaluative criteria

The assessment of the outcomes of any action situation depends to a great extent on the evaluative criteria used by participants. Data on the intrinsic valuation of the Interactions and Outcomes were collected during the field study. Field-study data collection was performed only with the stakeholders from the Diamantina Shire, (in the lower reaches of the Diamantina and Georgina rivers). Given the differences between the exogenous variables of lower versus upper reaches of the rivers, the evaluative criteria applied by the stakeholders in the upper reaches of the river are expected to differ. However, most of the key findings of the case study would be applicable to a wider outback situation and are discussed here in that context. There are common questions that are fundamentally important for any planning and decision process, such as: Who are the stakeholders for the Georgina and Diamantina catchments planning processes? Should opinions and concerns of all Queenslanders or all Australians be considered? And, does the wider good of the Australian economy outweigh the local costs? However, these questions will not be discussed in this report as it is primarily concerned with the specifics of outback regions and the consultation issues that are unique to those regions.

The key concerns of stakeholders, discussed in detail in Chapter 1, were in the area of economic benefits, environment, equity issues and monitoring. The stakeholders also appeared deeply concerned about the creation of rules based on limited sets of baseline information, particularly bearing in mind the fragility of the desert and semi-desert environments. The following paragraphs investigate some of the concerns raised. These are potentially relevant to other outback regions.

5.10.6 Exogenous trigger for change

As in many other countries (Saleth & Dinar 2004, 2005), this institutional change is more a result of purposive government-initiated reform programs than evolutionary processes. The reform programs often have specific objectives and timelines for achieving them. A trade-off between the amount of information available for the making of decisions and the time required to collect that information is often made.

5.10.7 Flow of information

Lack of information available to stakeholders is often cited as one of the important shortcomings of planning processes. However, in this study, the opinion of the stakeholders was that there was 'too much information' and that therefore it was difficult for them to process it all. The stakeholders have also stated that their decisions and opinions were based largely on existing values and beliefs rather than on information gathered during this particular process. Even when process-specific information was sought, it was obtained via social networks rather than using 'officially' available information.

5.10.8 Linking local and scientific knowledge to policy making

The previous two points indicate that making the link between local knowledge and scientific knowledge in the outback regions is very important, as action arena-specific scientific knowledge is typically limited and there is often no time to conduct rigorous scientific studies. Local knowledge and scientific knowledge are different and only partly substitutable. Local knowledge might provide valuable insights and information even when scientific knowledge is abundant, but particularly so when the scientific knowledge is limited.

Furthermore, it appears that most of the local stakeholders' decisions are based on local knowledge; this is another reason why it needs to be well understood by other stakeholders and planning process proponents.

The linking of science, local knowledge and policy making would also provide a valuable cornerstone for an effective and robust monitoring system. From the logistics point of view, monitoring in outback regions could be enhanced if parts of it were performed by community members. The engagement of community members could be greatly improved by inclusion of local knowledge into the knowledge base of the monitoring plan.

5.10.9 Capacity of both communities and agencies

Vast areas of the outback have very sparse populations, and few government agency personnel. They therefore lack social and human capital and the financial capital required for building this type of capacity. Increasing social and human capital within vulnerable sections of society is particularly challenging as it requires a significant investment of effort and resources. Aboriginal engagement in particular needs special attention and planning.

In the case of the sparse human and agency capacity, the individual person occupying any given 'position' becomes very important as he or she brings into the Arena important personal attributes. Lack of distinction by actors between the 'position' and the person holding that position is common in small systems.

5.10.10 Types of rules created

The *Water Resource (Georgina and Diamantina) Plan 2004* and the Georgina and Diamantina Draft Resource Operations Plan have resulted in the creation of a new set of rules for water resource users. Most types of IAD rules were employed in the planning process. Boundary, position, choice, scope, payoffs and information rules are either specified in the Plan or referred to in the relevant sections of the *Water Act 2000* of the Queensland Government, which is a constitutional level rule in use.

Concerns were, however, expressed by the stakeholders on the apparent lack of aggregation rules related to decision making. This is manifested, in their view, in expansive rights granted to the Chief Executive position in decision making. Concerns over the rights of the Chief Executive might partly be a result of the apparent misunderstanding of the term. The Chief Executive, as referred to in the water planning process, does not necessarily refer to the person holding the position of the Chief Executive (such as Director General of the DNRM&W, who is responsible for administering the *Water Act 2000* of the Queensland Government), but rather it refers to the DNRM&W and the position held by the Department.

The rules assigning appropriators a right to a specific quantity of a resource are used infrequently in irrigation systems. They are used more frequently in situations where the quantity of the products (resource) available, as well as the quantity harvested, are much easier to measure and are more predictable (e.g. forest products, (Agrawal 1994)). To assign an appropriator a specific quantity of a resource unit requires that those making the assignment know the total available units. In water resources, the total available units can only be known in a situation where water is stored from one season to another in a groundwater basin or dam and reliable information about the quantity of water is available (Blomquist 1992, Schlager et al. 1994).

Particularly interesting findings of the analysis of the types of rules used in the Plans were the existence of both the season-based choice rule (prohibition of withdrawals between August 1 and the occurrence of pre-determined flows at the monitoring stations) and the scoping rule (conditions for the take of water from a waterhole).

Both category A and B water will be accessible only under the flow conditions. This flow rule has been incorporated into the Plan as a result of the consultation process and was an issue put forward by both local stakeholders and the government (EPA).

Choice rules state how many resource units appropriators may obtain from the resource. The rules may be based on allowing harvesting during a particular season or on an appropriation formula. Many forest resources, for example, are closed to all forms of harvesting during one portion of the year and open for extraction by all who meet the boundary rules during an open season.

Season-based choice rules and scoping rules are typically found in community-devised rule sets, and rarely in those devised by legislators. This is probably because monitoring and enforcement of such rules are much harder than for other rules. Furthermore, the type of knowledge and understanding of the resource required for the creation of effective scope rules and the season-based choice rules is often difficult for the legislators to acquire. These rules are a good example of where local knowledge might have created better outcomes. Exclusions from specific geographic zones or during specific seasons are often vital for the sustainable use and maintenance of the resource.

One interesting finding mentioned earlier (Ostrom 2005, Ostrom 2007) is that *no particular rule* has a statistically positive relationship to performance across resource types, ecological zones and communities. On the other hand, the absence of *any* boundary or choice rule was found to be consistently associated with poor performance. Relying on only a *single type* of rule for an entire set of common-pool resources in a large region was also found to be negatively related to the resource performance.

Water allocation outcomes at the operational level will depend on the interactions of the players in the operational-level action arena. However, based on the existing body of research, we can hypothesise that a good combination of rules used in the new Plans will provide a better chance of reaching the sustainable water use objectives of the Plan.

5.10.11 Design criteria

Ostrom (2005) presents a discussion on the design principles required for design of ‘robust’ institutional systems. Carlson and Doyle (2002:2538) define ‘robustness’ as a ‘maintenance of some desirable system characteristics despite fluctuations in the behaviour of its component parts or its environment.’ This definition, however, suggests questions such as ‘desirable by whom?’ and ‘desirable for what?’

Several of the design principles of enduring institutions (Ostrom 2005) were identified by the stakeholders as important, or concerns were expressed about them. It would therefore be interesting to investigate further whether the set of design principles identified for common-pool resources is in fact a set of local knowledge, or ‘people’s design principles’ that are applicable in any communal rule-creating situation, whether the resource is common pool or not. Or is it that, in this case, because water has been seen as a common pool resource for so long, a set of rules around its use have evolved naturally? Or is it that stakeholders view the value of water as being greater than just its economic value, for example, via irrigation? Rather, water has a wider set of values, such as providing services for maintenance of biodiversity, amenity, cultural values – all of which exhibit characteristics of the common pool resource in their own right.

Several of the design principles can be identified in the draft GDROP. Some of them, such as cost-benefit ratio, would need to be monitored and balanced in the future if the Plan is to achieve maximum results. Some other principles, such as monitoring, sanctions, conflict-resolution and the right to self-organise, could improve the quality of the Plan if developed further.

The design criteria that appear particularly relevant to the outback regions are briefly discussed here.

5.10.12 Clearly defined boundaries

Reducing the number of users but opening the resource to outsiders or ‘strangers’ willing to pay a licence fee is frequently recommended in the policy literature (Ostrom 2007). However, this recommendation introduces appropriators who lack a long-term interest in the sustainability of a particular resource. Furthermore, the number of strangers using the resource may reduce the level of trust among participants. This reduced level of trust in turn increases enforcement costs substantially (Ostrom 2007). Given the vastness and low population of the Outback regions, the increase in the number of users and opening of the resource to the strangers might be of particular significance.

5.10.13 Monitoring

It is not surprising that monitoring has emerged as one of the key concerns of the stakeholders.

The draft GDROP specifies types of data the Chief Executive must measure or collect and make publicly available, such as water quality and flows, water quality and water use and future consumptive demands for water and water use efficiency. The draft Plan also specifies that the Chief Executive may use data collected from meters and other flow measurement devices to support water resource assessment and reporting, and that ecological performance and monitoring of biological indicators will also be performed. Based on this information, the Chief Executive must make an ongoing assessment of trends. The report detailing water use and monitoring will be produced annually by the Minister for Natural Resources, Mines and Water and will be made publicly available.

However, no details on how the monitoring program is expected to operate, including budgets and responsibilities, are included in the plans. The plans do not provide for comprehensive environmental and social monitoring, or for a management and mitigation system to be developed before plan implementation. Furthermore, most of the information used to date in the formation of the plans is based on hydrological spot monitoring of flow volumes without measure of lateral exchange. It could be argued that this approach might result in a conclusion that there is no impact on the system although the loss of lateral connectivity has occurred and has resulted in the loss of biodiversity and declines in numbers.

As discussed earlier, lack of site-specific baseline information that could be used as a benchmark for monitoring and mitigation of potential impacts in the future is a characteristic of many outback regions. Early development of a comprehensive and agreed monitoring system would likely enhance the trust of the stakeholders in outback regions and improve perceptions regarding agencies' ability to equitably and efficiently manage the resources. Application of the 'precautionary principle' and greater integration of local knowledge into overall knowledge systems also appear to be prudent.

5.10.14 Minimal recognition of rights to organise

Minimal recognition of rights to organise is one of the design principles that appears absent from the draft GDROP, as all resource users are treated as individuals. However, it would be interesting to observe the informal rules and institutions that might emerge to reach informal agreements on the use and management of the water in the Plan area.

Inclusion of self-organising rules could potentially benefit the Plan. In particular, literature suggests that self-organisation can create great benefits for the monitoring and enforcement of the rules (Ostrom 1990, Ostrom 1998, Ostrom 2005). This point appears particularly important, as the majority of stakeholders interviewed have voiced their concerns over the government's ability to effectively monitor implementation of the Plan. As an example, existence of a community-based body with perceived legitimacy to undertake pre-specified monitoring tasks could create benefits in the outback regions by both decreasing the costs of monitoring and enhancing compliance.

6. Changing the rules about water allocation in the Katherine Daly region: Issues and potential outcomes

Anna Straton, Scott Heckbert, Alex Smajgl and John Ward

This chapter describes the testing of a new institutional arrangement for the allocation of water in a tropical savanna setting. It undertakes research that is in the broader policy context of the National Water Initiative, a national program of water reform of which one of the key goals is ‘the expansion of the trade in water resulting in more profitable use of water and more cost-effective and flexible recovery of water to achieve environmental outcomes’ (National Water Commission 2005). What this signifies is the expanding use of a new institutional arrangement for the allocation of water entitlements across Australia. This is a constitutional-choice level change that will filter down to influence several levels: both the collective-choice level of how water trading will take place in the specific Katherine–Daly region and how decisions are made about this; and also the operational level of the day-to-day decisions made by growers about water use and trading.

While the allocation of water entitlements through trading has been taking place in other parts of Australia for up to two decades, little is known about the potential impacts of the trading of water entitlements sourced from a tropical river system and in a tropical savannas setting. This chapter describes the linkages between the three levels of rules governing how water is to be allocated. It also analyses the potential impacts for the Katherine–Daly river system in the Northern Territory (NT) of Australia using the Institutional Analysis and Development (IAD) framework.

6.1 The institutional setting

6.1.1 Constitutional-level changes

The new rules of the National Water Initiative (National Water Commission 2005) create the institutional setting for the collective-choice level arena of how water will be allocated, used and managed in specific regions of the country, including for the Katherine–Daly region, and how decisions about this are to be made.

6.1.2 Collective-choice level rules

The development of the collective-choice level rules, in the form of a water resource management strategy, is taking place in the context of high public interest in the allocation, use and management of the Katherine–Daly River system. The institutions used with stakeholder groups to enable deliberation and planning for the region are the Daly Region Community Reference Group and Aboriginal Reference Group (ARG) and now the Daly Region Management Advisory Committee (DRMAC). Participants in this process include government and non-government actors (including representatives of Aboriginal language groups in the region), non-Aboriginal landowners, commercial and recreational fishing representatives and a conservation representative. Some government representatives are in the position of ‘advisor’; others are both advisors and ‘managers’. The non-government participants are in the position of advisor and ‘user’.

All participants must decide among a range of actions that include making different statements of advice; choosing to agree or disagree with others’ statements; and taking action outside of the DRMAC and ARG, such as making public statements. According to the IAD framework, these actions would be chosen in the light of information that each participant possesses about how their actions influence the outcome, the control they have over this linkage and the costs and benefits assigned to actions and outcomes.

While it is too early in the life of either committee to observe the outcomes of this process, it is possible to make some predictions based on issues that have been raised about the composition and process of the DRMAC and ARG to illustrate ways in which this process may influence the operational level action arena:

- The issue of who can be involved and play a role in the DRMAC is determined by the boundary rules of the committee. The NT Horticultural Association (NTHA) expressed concern that the composition of DRMAC ‘excludes critical stakeholders’, which may compromise the ability of the Committee to achieve its goals (Northern Territory Government 2004a). The ability of growers to have some input into the process may be a critical factor that determines the extent of their engagement with a new water trading system. As has been found across the world, unless local communities are supportive of a project, there is significant potential for failure in implementation (Rahnema 1992).
- The position of advisor, created through a position rule, highlights the potential mismatch between duties and rights. While the DRMAC and the ARG are now charged with the responsibility to advise the NT Government on a range of issues relevant to the Katherine-Daly region, including water allocation, they do not have the legal right to make any decisions. The mismatch between duties and rights is cited as a factor that may diminish the robustness of common-property regimes (Ostrom 2005).
- It is currently unclear how actions will influence outcomes. There is some evidence, however, that the access of different participants to information about how actions influence outcomes may vary. First, it has been widely acknowledged that there is not enough scientific information about how certain water use options may impact on the social, economic and environmental health of the region. Second, some stakeholder groups have expressed the concern that government participants do not share information as readily as they would like.
- This lack of shared information and the non-statutory nature of the committees affects on the degree of control that participants have and thus on the actions they have available to them and will choose to take.
- The complexity of the situation means that very little is known about the costs and benefits of various actions.

In combination, these issues with the development of a water resource management strategy (a collective-choice level action situation) will likely impact on the operation of the National Water Initiative (an operational-level action situation). There are several preconditions that are necessary for the effective functioning of a cap and trade system such as that proposed by the National Water Initiative (Ward et al. 2006). These include:

- a. credible and reliable science to establish a threshold level to signal the environmental target
- b. wide agreement about the nature and extent of the resource and about the environmental target
- c. monitoring schemes that are cost effective, transparent, consistent and credible to all participants
- d. a clear link between land management actions and resulting environmental outcomes
- e. regulatory agencies with jurisdiction to monitor and audit compliance and enforce individual breaches
- f. low transaction costs of monitoring, gathering information, enacting the exchange and enforcement in comparison to the potential benefits gained
- g. adequate and effective administrative institutions
- h. political feasibility in developing transferable, enforceable and tradeable private property rights, and in minimising government intervention.

Lack of attention to even just one of these preconditions in the Katherine–Daly region may be enough to restrict the effective functioning of a water trading system at the operational level.

6.1.3 Operational-level interactions and outcomes

Meetings held in mid-2005 with staff from NRETAS, the Department of Primary Industry, Fisheries and Mines, the NT Horticultural Association and the NT Agricultural Association revealed that there was interest in research that could explore the potential impacts of a new water trading institutional arrangement on the ground through the analysis of a set of different institutional policy scenarios. These meetings formed the basis of a collaborative relationship for the project between the research team and these organisations.

The remainder of this chapter will analyse how the constitutional-choice level rule change will play out in guiding the day to day water decisions made by growers and the resulting outcomes, as implemented through the collective-choice level process and as impacted by the physical/material conditions, community attributes and rules at the operational level.

6.2 Approaches and methods

6.2.1 The research approach

Trading in water entitlements involves the coming together of buyers and sellers in a water market. Each market has its own patterns of interaction between buyers and sellers. These patterns are influenced by the physical, material and ‘community’ context, the responses of people to this context and to market signals, and by the ‘rules in use’ or working rules that define, firstly, how a market is set up, and, secondly, how people interact in the market. These factors combine to provide the structure of the situation in which people come together to interact. Changes in any of these factors could lead to a different outcome.

This study was concerned specifically with how irrigating growers in the region might respond at the operational level, first, to a market where there previously was none, and second, to different market scenarios. The new institutional arrangements were evaluated empirically, based on:

- their impact on total groundwater extraction by irrigating growers
- total profit in the region from irrigated horticulture
- the volume of water entitlements demanded, supplied and actually purchased in the market
- the revenue from sales of water entitlements
- the amount of water restrictions that may have to be imposed on growers in particularly dry years
- the equity of distribution of profit between growers
- how many growers decide to stop irrigation-based farming based on the outcomes of the new institutional arrangements.

Discussion with irrigating growers in the region revealed a number of other criteria against which they would be evaluating the impacts of water trading, although we are unable to report on these through the modelling exercise performed for this case study.

The Institutional Analysis and Development (IAD) framework was used to analyse the responses of irrigating growers in the Katherine-Daly region to different possible rules for a hypothetical water market. In doing so, this research analysed how these behaviours, guided and governed by different institutional arrangements, might lead to different outcomes for the Katherine-Daly region. As there has been little economic research of this sort done with irrigating growers in the tropical savannas of

northern Australia, the IAD was chosen as an analytical structure with which to focus the research on human behaviour. The analysis was further focused on the behaviour of irrigating growers in the Katherine region who extract water from the Tindall aquifer.

6.2.2 Methods

Information on the regional physical/material conditions, the attributes of the community (including the thoughts and opinions of growers) and the rules of water allocation was gathered through desk-top literature reviews; semi-structured interviews with growers, industry representatives and government agents; and discussion in three water-trading simulation workshops. This information was used to gain insight into the structure of the situation that irrigating growers faced both now and in the future given the institutional arrangement on trial.

Market analyses are often based on assumptions about the behaviour of buyers and sellers. This was not considered appropriate for this study as little was known about the behaviours of irrigating growers in the region. Rather, economic experiments were undertaken to directly elicit the responses of irrigating growers from the region to different market arrangements. This technique can be used to analyse people's decisions in a controlled-decision environment that is similar to the economic and biophysical features of a hypothetical market in a particular catchment (Whitten et al. 2002).

The experiments took place through three water-trading simulation workshops with 35 attendees in total. Each participant was given their crop's watering requirements, their marginal value of water and predicted and actual rainfall for a hypothetical farm (based on existing farms in a catchment in the Border Rivers region of Queensland). Participants were asked to make monthly water use and trading decisions given a specific set of trading rules.

The impact of different market-design options specified by staff from NRETAS on the evaluation criteria stated above was analysed using an 'agent-based model'. Agent-based modelling can be used to test how different options for the design of an instrument can impact on some chosen outcomes, as with a water- or emissions-trading scheme (Smajgl et al. 2008). This kind of modelling is based on the behaviour of the agents. In this model growers are the 'agents', and their behaviour is modelled based on the behaviours observed in the workshops. This combination of experimental economics and agent-based modelling was used to analyse the patterns of interaction between irrigating growers as buyers and sellers of water entitlements in a market and to reveal potential outcomes of this new institutional arrangement.

Other data collected in the interviews and at the workshops included growers' thoughts and opinions about water trading; bore metering; licensing; the role of the central water manager, the Controller of Water Resources; and other matters important to their day-to-day decisions. This data may be used to help evaluate the outcomes of the new institutional arrangement as it is implemented.

Predicting the feedback impacts of a water market on additional grower behaviours was beyond the scope of the study.

6.3 Physical/material conditions and community attributes in the Katherine-Daly region

The Katherine-Daly River system is a set of tropical river sub-catchments in the monsoonal tropics of the NT (Figure 29). The Daly River has the fourth largest discharge of tropical rivers occurring between Cairns and Broome, being an average annual outflow of 6 730 gigalitres (NGIS Australia 2004). Its vast underground aquifers ensure relatively reliable flows of good quality water during the dry season, (Northern Territory Government 2003) which, combined with its high-potential soils (Begg et al 2001), are leading to the consideration of further agricultural development in the region (Hristova & Murti 1998). This hydrological regime also contributes to the unique ecological nature of the Daly River

system (Blanch et al. 2005), its cultural significance for both Aboriginal people and non-Aboriginal people living in the region (Jackson 2004), and to the existence of habitats that support significant biodiversity and conservation values (Blanch et al. 2005, Hatton & Evans 1998).

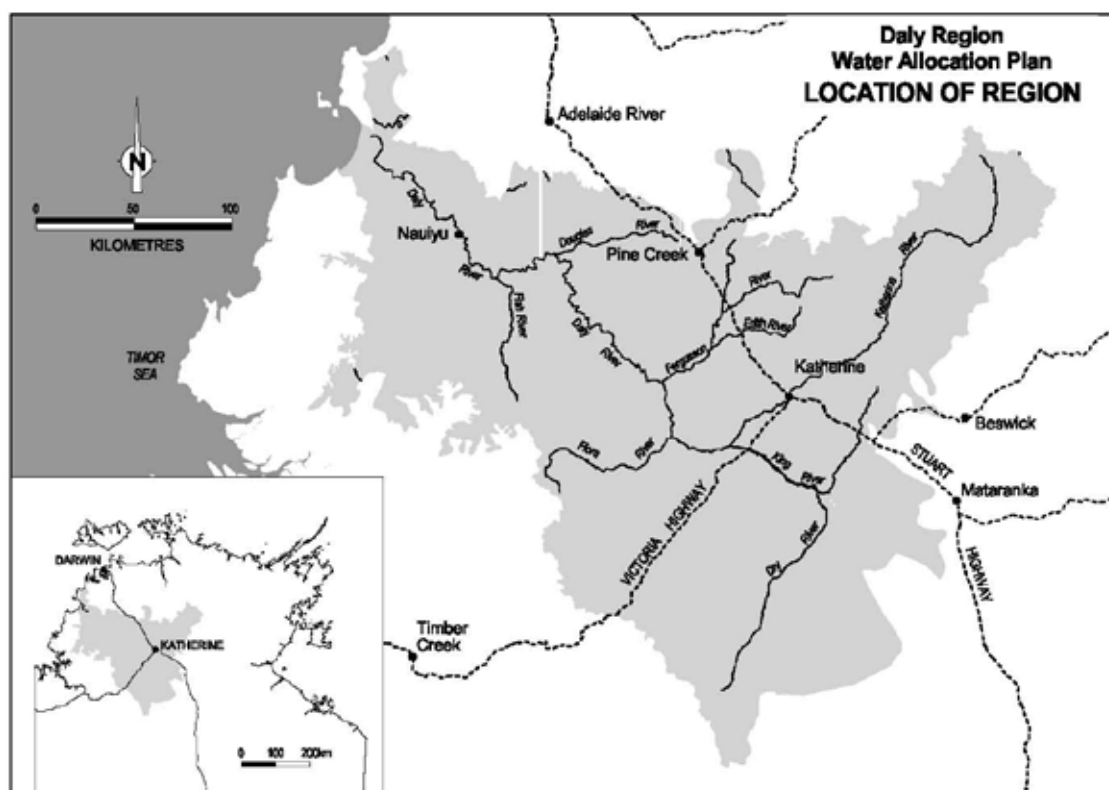


Figure 29: Map of the Katherine-Daly River region (Northern Territory Government 2004b)

The core agricultural enterprises undertaken in the region are cattle production on improved pastures (including breeding and agistment), hay and seed production, agroforestry (cabinet timber trees) and horticulture (including mangoes, melons, vegetables and citrus). Assuming the 2003 rate of development, all forms of agricultural production are tipped to increase significantly; for example, estimates of growth in the region's production are that horticulture production will increase from \$15m to \$60m annually (Northern Territory Government 2003).

Attitudes in the horticulture industry towards water trading seem relatively consistent. Interviews with irrigating growers revealed that most are generally cautious and sceptical about water trading systems, especially of the application in northern Australia of systems developed for southern rivers. Growers do, however, want security of licences, more transparent and simplified licensing processes and more scientific information for use in policy making to underpin any investigation of water trading in their region. Growers expressed concern about the ability of water markets to protect environmental flows and also about the potential for uneven or unfair competition in a water market from large farms without the same owner relationships to the land or goals as smaller or family-owned farms. Some growers stated that a water market represented the possibility of making individual profit from what they see as a community resource. This is evidence of a social norm that may influence the degree to which growers in the region participate in a water-trading system.

These conditions combine to create an environment where some kind of instrument is required to help allocate water to the most efficient uses in the face of increasing demand and restricted supply, yet there is great caution about how this is to be designed and implemented. This cautiousness may structure the patterns of interaction in a water market by influencing the extent to which the water market is used by irrigating growers and the pattern of bids that buyers and sellers make as they experiment with the

market. These patterns of interaction in the water market will then influence the actual outcomes in terms of how much water is extracted, how much water is traded, and whether any growers decide to exit the industry, for example.

6.4 Rules in use

6.4.1 Current rules

Water allocation in the Katherine–Daly region is guided first by the ‘80:20 rule’, which stipulates that extraction from surface water flows and from aquifers is limited to 20% of river flow at any time in any part of a river and 20% of annual recharge extracted from aquifers annually (Faulks & Kirby 2004). Allocation to individual licence holders is then made based on the applications submitted by growers. Staff from NRETAS will input the monthly volumes of water requested to a hydrological model of the Katherine–Daly system (Knapton 2006) to determine if the additional volume would push extraction beyond the 20% allowed. Licences are then either granted or denied. At the time of writing, there were 18 recorded groundwater extraction licences and 41 applications awaiting consideration.

6.4.2 New rules

The new institutional arrangements under consideration are combinations of the following, which represent realistic policy options for the NT Government:

1. Granting pending applications for water entitlements: One policy question is of the impact of granting the additional 41 licences. If granting these additional licences means that the 20% cap is overshot in particularly dry years, pumping restrictions may need to be allocated to licence holders to ensure extraction remains below the 20% limit.
2. Implementing a water trading system: As a signatory to the Intergovernmental Agreement on a National Water Initiative, the NT Government has committed to expand the trade in water. Another policy question is of the impact of water trading in the Katherine area on the Tindall aquifer.
3. Allocating pumping restrictions to growers is a way of enforcing the 20% cap of the 80:20 rule. There are two different ways under consideration: to allocate pumping restrictions to all growers equally or to allocate pumping restrictions disproportionately between existing growers and newly licensed growers.
4. Restricting trading in water entitlements between growers on the east and west sides of the Katherine River. This policy is under consideration because pumping from the Tindall aquifer on either side of the Katherine River may have significantly different impacts on surface water flow in the river system.

These combinations result in the following scenarios for simulation and analysis:

Scenario 1 is of the current ‘baseline’ situation where there is a cap at 20%, but it is not enforced; there is no trading of water entitlements; and there are 18 licence holders, meaning that no pending applications for water entitlements have been granted.

Scenario 2a: All pending applications for water entitlements have been granted, resulting in 59 licence holders; the 20% cap is not enforced; and there is no trading of water entitlements.

Scenario 2b: The 5 largest applications for entitlements have been granted, resulting in 23 licence holders; the 20% cap is not enforced; and there is no trading of water entitlements.

Scenario 3: All pending applications for water entitlements have been granted, resulting in 59 licence holders; the 20% cap is enforced and trading of water entitlements is allowed. All growers face equal pumping restrictions if extraction exceeds the 20% cap.

Scenario 4: All pending applications for water entitlements have been granted, resulting in 59 licence holders; the 20% cap is enforced; and trading of water entitlements is allowed. The 18 original licence-holders face no pumping restrictions and the remaining 41 licence-holders face equal pumping restrictions if extraction exceeds the 20% cap.

Scenario 5: All pending applications for water entitlements have been granted, resulting in 59 licence holders; the 20% cap is enforced; and trading of water entitlements is allowed. All growers face equal pumping restrictions if extraction exceeds the 20% cap. No trading is allowed between growers on the east and west sides of the Katherine River.

Scenario 4 is an extreme version of a policy option. It is more likely that both existing growers and newcomers would face pumping restrictions, but these would be distributed unequally between the two groups in some way so as to offer the original licence holders greater certainty.

One critical point to emphasise in the consideration of scenarios is that caution is required to interpret the quantitative results from this style of modelling. This caution applies to all of the modelled scenarios presented in the following sections.

This is because agent-based models are models of complex adaptive systems, which are characterised by sensitivity to initial conditions and by non-linearity and feedbacks (Holland 1998). Sensitivity to initial conditions means that all of the scenario results depend on the way the model has been set up and the data used to simulate, as an example, crop prices, or aquifer recharge. Any new data about crop prices or aquifer levels and/or dynamics will impact on the scenario results. This means that this model cannot be used to ‘pinpoint’ or predict specific outcomes.

Instead, the results of this type of modelling are best interpreted through comparisons of multiple scenarios, and the differences between each set of outcomes. Therefore, we compare the results of one scenario with those of another where only one policy option has changed and all other parameters are held constant. In other words, we do not intend to present predictions of a given outcome at a specific time, but rather compare the outcomes of simulations where one component has been altered to show how the system responds to this change.

6.5 Patterns of interaction

6.5.1 Model design

The ‘Tindall Aquifer Water Trading Model’ simulates growers living in the vicinity of Katherine and who extract from the Tindall aquifer as ‘agents’ engaged in irrigated horticulture. These growers are assumed to all produce a mango crop (this is due to a lack of data for other crops). The model is based on the last 22 years of rainfall data for the region, hydrological models of the Tindall aquifer¹² (Knapton 2006, Puhlovich 2005), actual property sizes and groundwater licences currently existing in the Katherine region and mango production costs and prices (White 2004). It assumes that the preconditions for an effective cap and trade system exist. The behaviours of the agents in the model are based on those revealed in interviews and observed in the simulation workshops. The model considers water allocated to horticultural uses, and does not consider water allocated to the public water supply, industrial or other uses. For a full technical description of the Tindall Aquifer Water Trading Model, see Heckbert et al. (2006).

Agents in the model have a farm with a number of hectares of a mango crop. They each face given rainfall and costs associated with getting their mangoes to market. Farms differ in their number of hectares of mangoes, location in the Katherine area of the Tindall aquifer, water entitlements and

12 The model of the aquifer used in the Tindall Aquifer Water Trading Model was based on general aquifer dynamics as reported in Puhlovich (2005). The Puhlovich model has since been replaced with a new model Knapton (2006), in which the general dynamics are similar, but the finer details of these dynamics have been modified. The Tindall Aquifer Water Trading Model may generate different outcomes for each scenario based on this new model. This could be an area of future research.

whether they already have a licence or have their application pending approval. Each agent – grower – decides how much water they will need in a month (based on published crop water requirements), and compares it to how much water entitlement they have on their water licence in that month. If they have more entitlement than they need, they offer the remainder for sale on the water market; if they do not have enough for what they need, they attempt to buy the remainder on the water market.

The price that agents are willing to pay or willing to accept for a unit of water entitlement is based on their marginal value for water and a ‘mark-up’, which represents how real-world buyers and sellers deviate from their marginal value when making bids in a market. Buyers’ marginal values are based on the difference between their projected profit if they were to buy the water entitlements they need and projected profit without these extra entitlements. Sellers’ marginal values are based on the difference between their projected profit using all of their water entitlements and projected profit using only the water they need. The mark-ups used in the model are based on the bidding behaviour of participants revealed in the simulation workshops.

The water market is modelled as a double call market where potential buyers randomly access an offer to sell and compare the price on offer with their willingness to pay, or bid, for water entitlements. Buyers buy water entitlements if the amount they are willing to pay is higher than or equal to the seller’s offer. All agents’ water entitlements are adjusted to account for the outcomes of the water market and they then use the water on their mangoes. Profits are based on revenue from the sales of mangoes (volume of produce harvested and taken to market) and water entitlements, and the costs of water entitlements purchased, labour costs and other variable and semi-fixed costs. Profit is constrained by the availability of rainfall, water entitlements and labour.

Finally, the model simulates growers observing the outcome of their own, and others’ decisions, learning from this and then adapting their behaviour, which feeds back into their decision in the next period.

6.6 Results and evaluation against criteria

The total amount of groundwater available for extraction by irrigators (‘available extraction volume’; ML) and annual rainfall (‘total annual rainfall’; mm) across all scenarios are shown in Figure 30, as is the volume of groundwater actually extracted for Scenario 1 (‘total annual extraction’; ML). Based on historical rainfall data, there is an initial period of abundant rain in years 1–6, followed by a number of dry years (approximately years 7–14) where rainfall levels do not sufficiently fill the aquifer. Rainfall again becomes generally abundant from years 15 onward with another dry year in year 19. The available extraction volume increases and decreases with the wet and dry seasons of each year, and trends in line with rainfall.

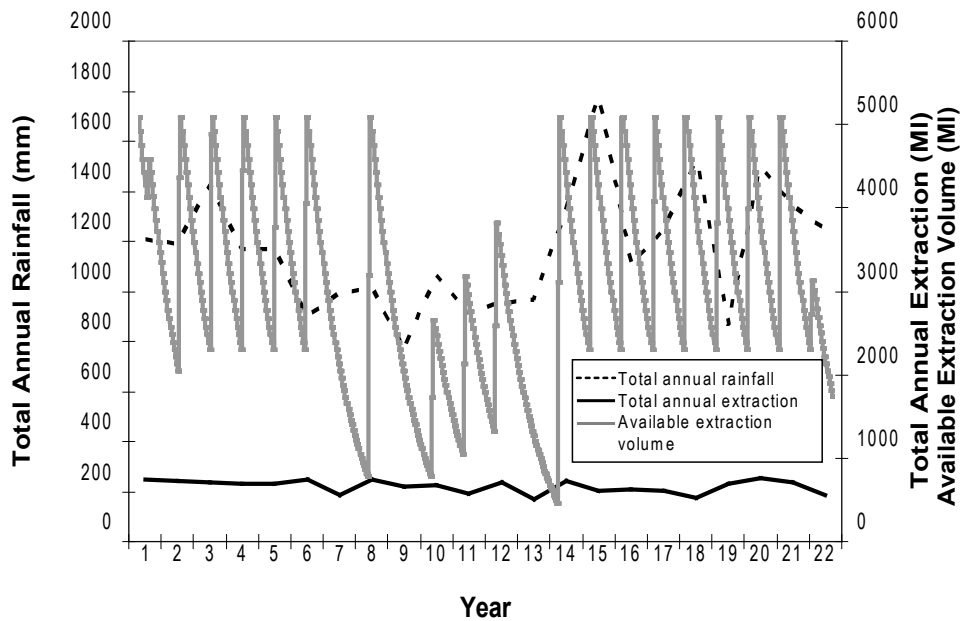


Figure 30: Groundwater available for extraction (20% of annual aquifer recharge) and rainfall for all scenarios, and total groundwater extraction by simulated agents, Scenario 1

The forecasted mango price ('average mango price') for all scenarios and total profit for Scenario 1 ('baseline profit') over the 22-year simulation run are illustrated in Figure 31. The downward trend in profit is explained partially by forecasted prices (White 2004). Once the price trend is accounted for, profit levels as simulated by the model are affected mainly by rainfall, water availability and labour availability. The lower profit values in the middle years of the simulation correspond to a period of dryer years. By the time rainfall increases in the later years, the lower price keeps total profit depressed.

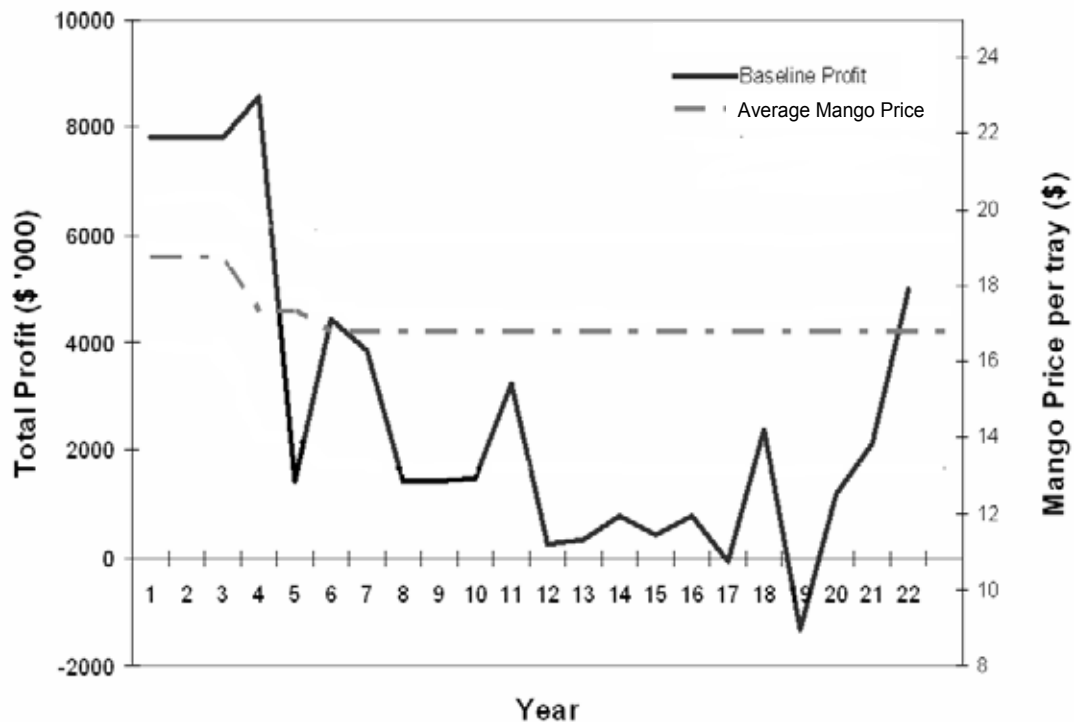


Figure 31: Mango prices and total profit, Scenario 1

There are a number of stories that emerge from comparison of outcomes for the different scenarios.

The first story is that even with the current volume of water allocated to growers, extraction from the Tindall aquifer was simulated to overshoot the 20% limit in a few dry years in the middle of the 22-year simulation. Growers in this baseline scenario would thus be required to limit their pumping by up to 50% of their entitlement in these years (Figure 32). Granting all 41 pending applications ('grant and trade') results in extraction exceeding the 20% limit in some months of every year of the simulation. This translates to pumping restrictions for growers in every year, which is a significant risk to bear.

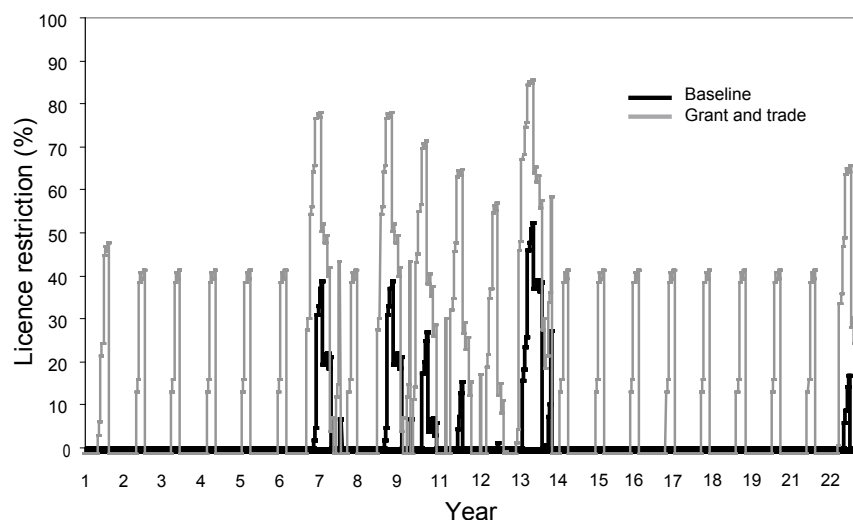


Figure 32: Percentage by which licences will be restricted, Scenarios 1 and 3

The way in which pumping restrictions are allocated to grower groups does impact on how effectively the 20% cap can be enforced. When pumping restrictions are borne by all growers (Scenario 3), the 20% cap can be maintained (see the convergence of the curves in the troughs; Figure 33), while extraction can sometimes overshoot the 20% limit when only newcomers bear pumping restrictions (Scenario 4; Figure 34, see where the curves do not converge at the troughs). This is because even without the 41 newcomers, original licence holders already face pumping restrictions in some years. If these growers don't have to restrict their pumping, then extraction will exceed 20% of aquifer recharge in these years whether or not the newcomers are restricted.

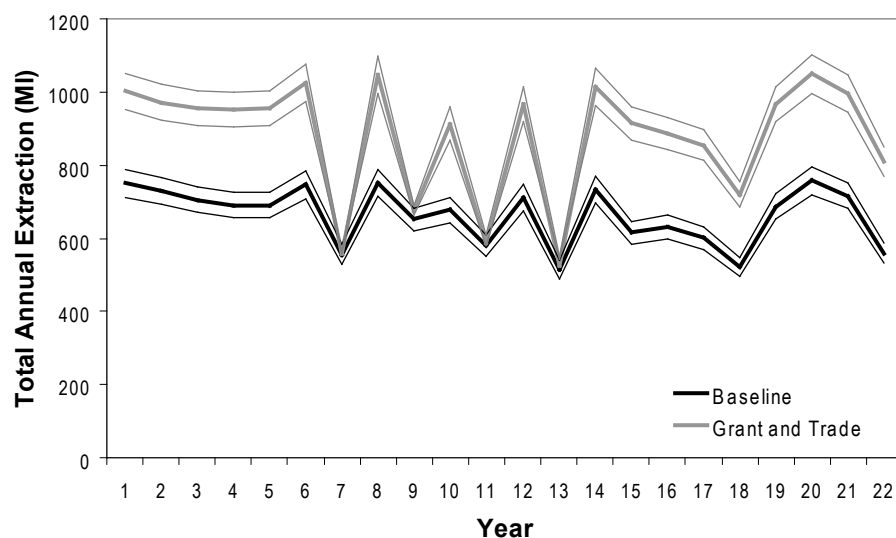


Figure 33: Convergence to the 20% limit under Scenarios 1 and 3

Note: Mean values with confidence intervals at $\alpha=0.05$

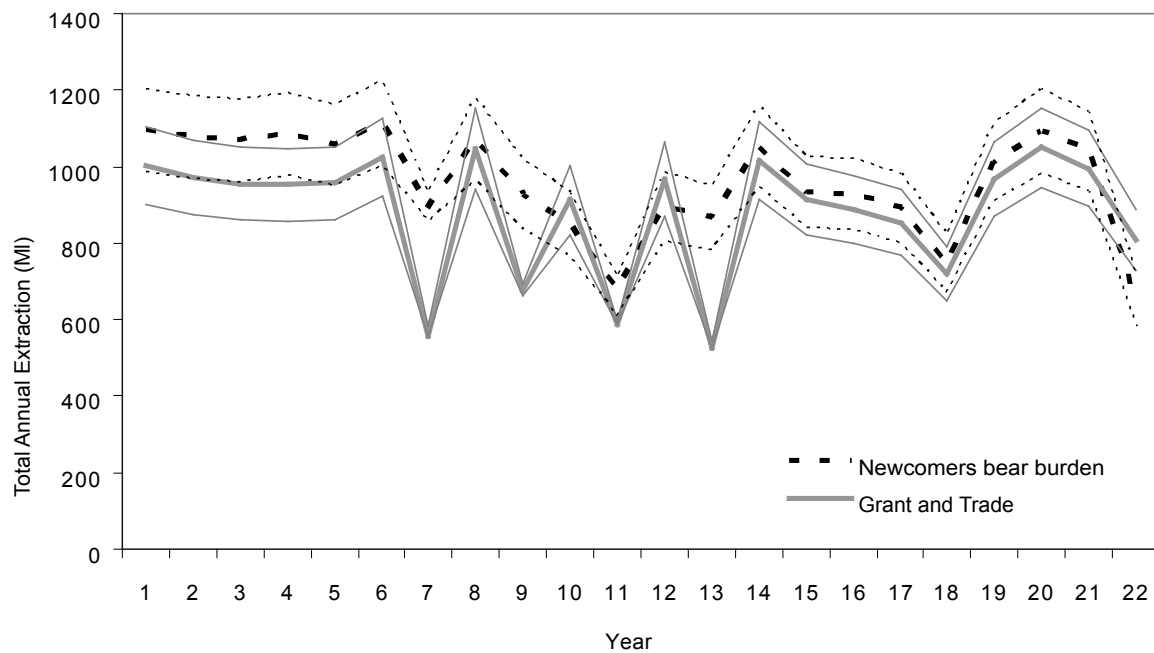


Figure 34: Convergence to the 20% limit under Scenarios 3 (grant and trade) and 4 (newcomers bear burden).

Note: Mean values with confidence intervals at $\alpha=0.05$.

The second story is that there is a labour constraint that impacts on profit with or without pumping restrictions. Besides being influenced by the mango price and availability of water, total profit from mango production in the region as simulated is also influenced by the number of hectares under production and the availability of labour to ensure fruit harvesting and sale. See Heckbert et al. (2006) for technical description of the labour market operation. Total profit is not significantly different when pumping restrictions are not imposed and there is no water market, compared with Scenario 3, when there are pumping restrictions and a market. This indicates two things:

1. the downward influence of pumping restrictions on profit is offset by the revenues generated by sales in the water market, suggesting that the water market instrument is capable of helping growers to manage the risks they face with the potential for pumping restrictions; however, the amount of water traded and the actual value of trading is quite low.
2. there is a lack of labour in the region such that even if as much water can be used as desired, growers still cannot find enough labour to get their crops harvested and to market.

This labour constraint is demonstrated by a further simulation exercise – the third story. The model assumes there are 4,500 labourers available during the harvest season (based on discussions with staff from the NT Horticultural Association). White (2004) reports that economic losses (including direct and indirect benefits) associated with a shortage of labour across the Northern Territory range from \$5.8 million to \$26.1 million. In order to determine the impact of labour availability within the study region, the situation of 4 500 labourers is compared with the situation where there is an unlimited amount of labour. Figure 35 shows total profit in Scenario 1 ('baseline') compared with profit levels when there is unlimited labour. The distance between the two trajectories represents economic losses due to labour shortfalls. As shown, these losses can reach up to \$7.4 million (year 17).

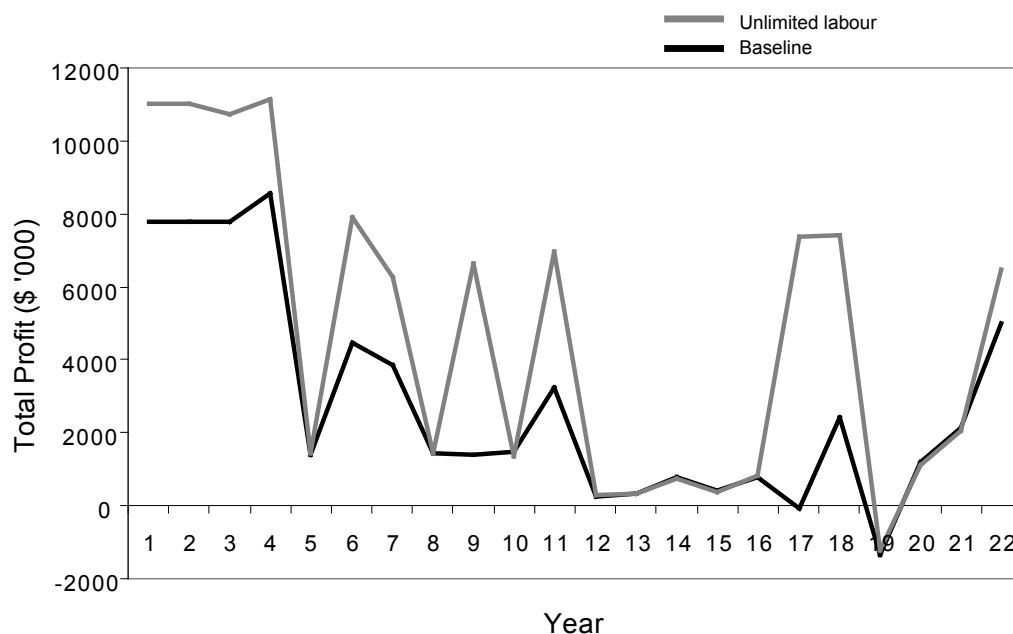


Figure 35: Total profit, Scenario 1, compared with profit levels possible with unlimited labour

Figure 36 depicts the total volume of water purchased on the market (ML) and the bids, either to buy or to sell, made for water (note: this is not the equilibrium price). As would be expected, the volume purchased is higher when bids (as an indication of price) are lower and vice versa. The spike in average bids made for water in the early years reflects that growers are learning about the water market and testing it out. Similarly, the lower volumes purchased in years 2–4 indicate that growers are learning about the market in these years and increase their purchases as they become more familiar with its operation. The lower points of volume purchased in years 10, 11 and 13 correspond to drier years, indicating that growers are trading less in these years.

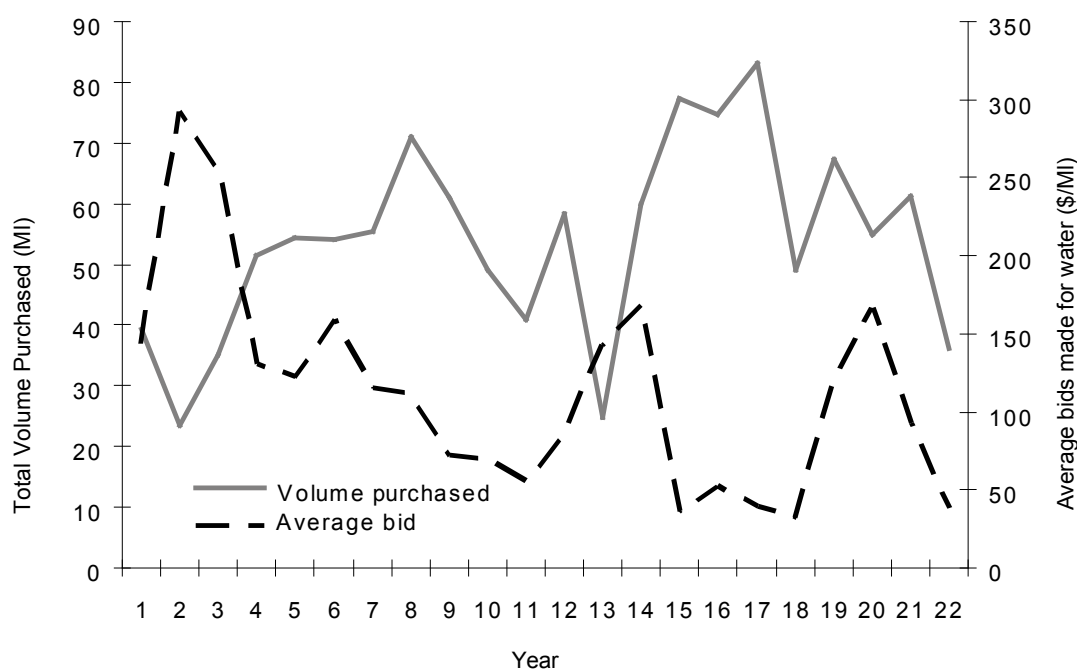


Figure 36: Volume purchased on the water market and average bid per ML of water, Scenario 3

The total volume purchased never exceeds approximately 80 ML. Total use of the Tindall aquifer for agriculture is 14 122 ML, which is approximately half of all water from the Katherine–Daly system that is used for agriculture. The total volume purchased is less than 1% of this amount.

Figure 37 illustrates the actual value of trading. Market activity in water entitlements yields revenue ranging from less than \$2 000 in year 18 up to approximately \$10 000 in year 14. In year 14, this equates to approximately less than 1% of total profit from mango production.

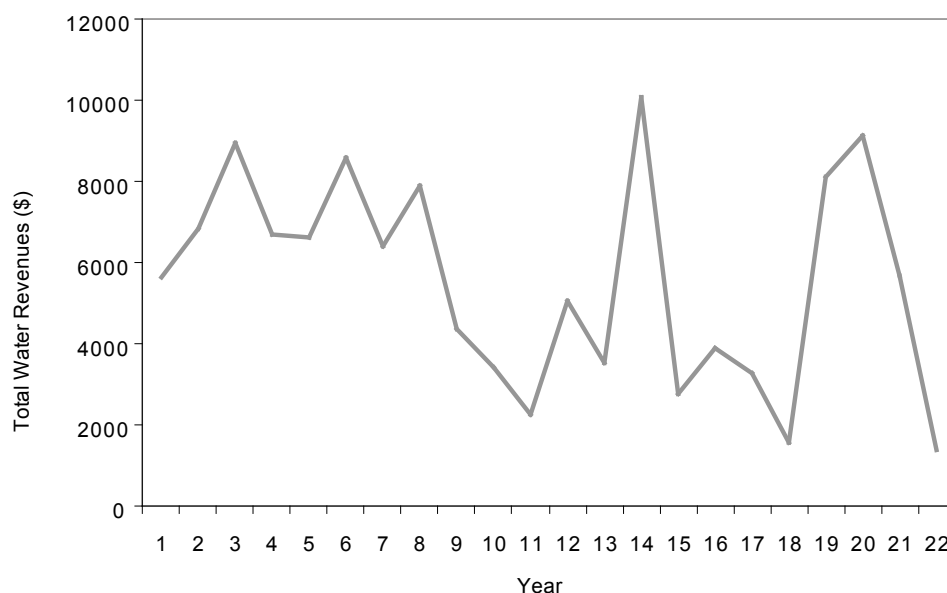


Figure 37: Revenues realised from activity in the water market, Scenario 3

Another story that emerges from this is that the demand for water entitlements is significantly larger than the actual volume traded. Figure 38 depicts the volume of water demanded and supplied (averaged for each month) in the water market under Scenario 3. The model simulates that up to 2 300 ML will be offered for supply (year 18) and a maximum of approximately 1 250 ML will be demanded (year 13), while the maximum volume actually purchased is approximately 80 ML. The actual volume traded is lower than that demanded because growers will not purchase water unless it is available at the time they need it and the price is equal to or less than their marginal value of water. This result indicates that water is often offered for sale at times that do not match buyers' needs and that the price buyers are willing to pay does not often match the price sellers are willing to accept.

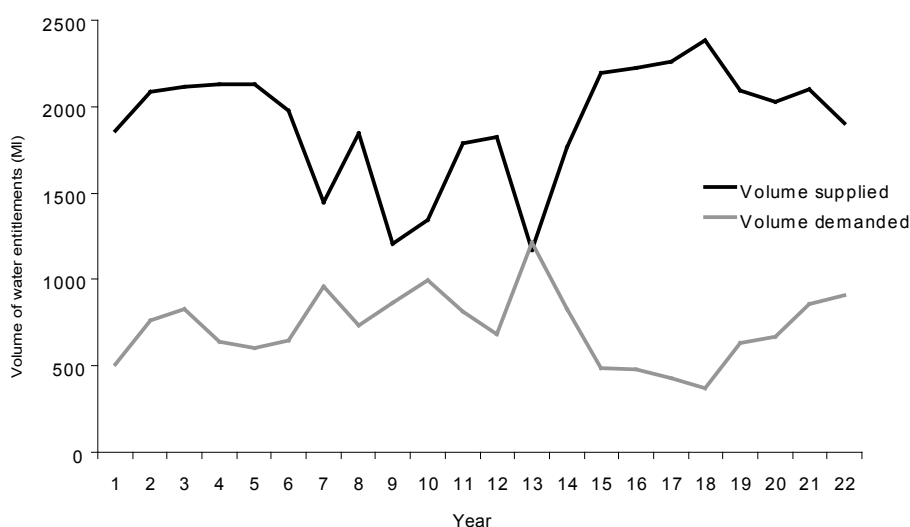


Figure 38: Average volume of water entitlements demanded and supplied within the water market, Scenario 3

This outcome gives us insight into the potential value of trade. If all crops in the model were not simulated as mangoes, which require irrigation at the same time (approximately August–December), the likely purchases of water entitlements would increase to be closer to the actual volume demanded because all growers would not be looking to use their water at the same time. As such, the potential value of trade could reach up to \$220 000 based on the prices for water entitlements simulated by the model.

One other outcome to note is that the volume of water purchased on the water market is lower in Scenario 5 when trading is not allowed between growers extracting from the east and west sides of the Katherine River than for Scenario 3 when trading is allowed. This is likely to be because there are fewer opportunities for buyers and sellers to match up.

The fourth story told by the simulations is about the impact of the water market on the equity of distribution of profit amongst growers. Figure 39 depicts this distribution of profits between farms for a typical year (year 16, Scenario 3), showing the average profits of different categories of farms. Farms are categorised as small, medium and large according to White (2004), where small farms have less than 2 000 trees (44 farms, or 74%), medium farms have 2 000–9 999 trees (11 farms, or 19%), and large farms have greater than 10 000 trees (four farms, or 7%).

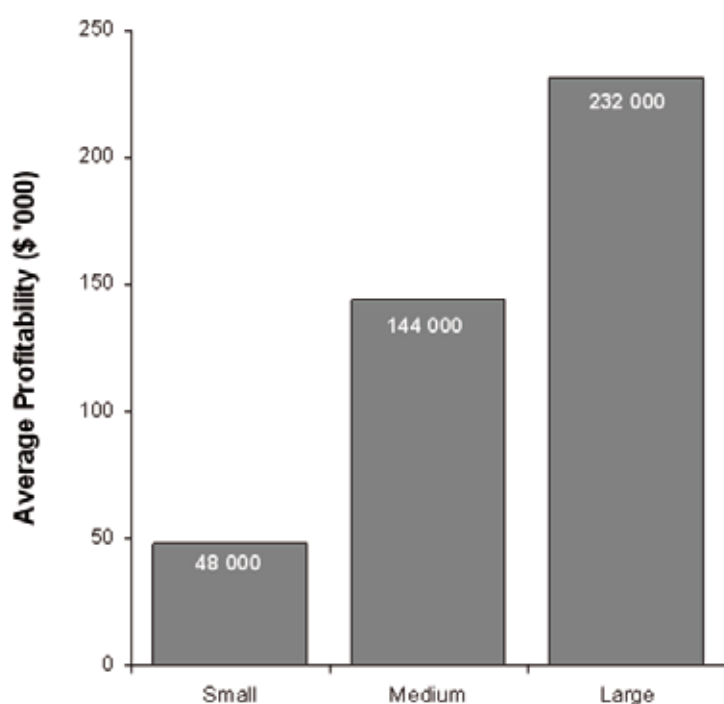


Figure 39: Average profitability by farm size for a typical year, Scenario 3

The Shannon Diversity Index¹³ reports on the distribution of profit within the population of growers. A larger index value corresponds with a more even distribution across agents. Figure 40 shows that for both Scenarios 3 ('grant and trade') and 4 ('newcomers bear burden'), the distribution of profit across growers is uneven from year 2 to year 6 and thereafter fluctuates around approximately 0.15.

¹³

$$S = \sum_i \frac{\pi_i}{\sum_i \pi_i} * \left(1 - \log \left(\frac{\pi_i}{\sum_i \pi_i} \right) \right)$$

, where π is profit [\$] realised at the end of harvest.

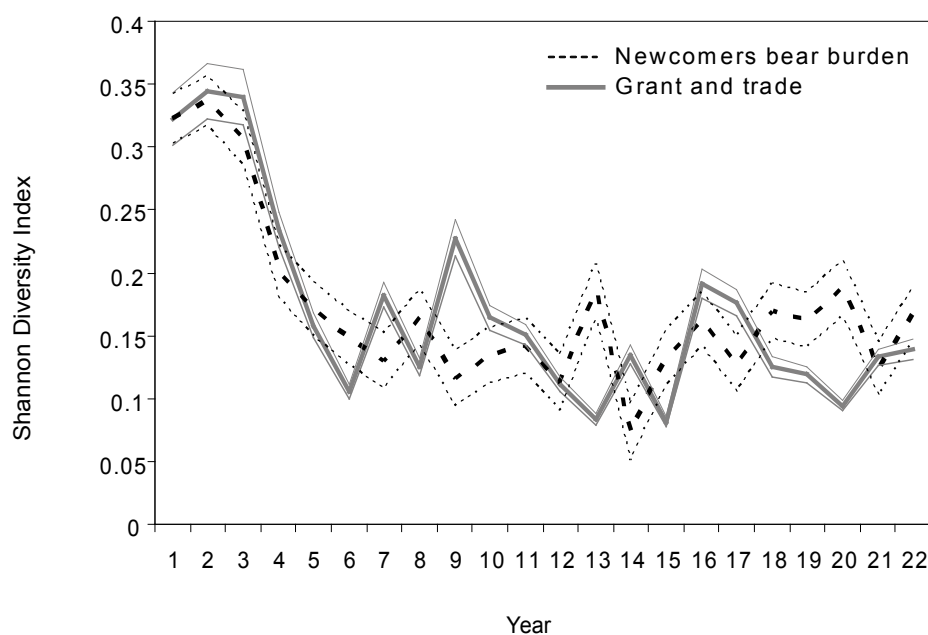


Figure 40: Shannon Diversity Index of profit, Scenarios 3 'grant and trade' and 4 'newcomers bear burden'

Note: Mean values with confidence intervals at $\alpha=0.05$.

The final major story is about the behaviour of growers in adapting to changing circumstances. The granting of all pending applications and implementation of a water market combine to result in eight or nine growers choosing to exit the industry after observing their profits (Figure 41) as opposed to two growers choosing to do so in the baseline scenario.

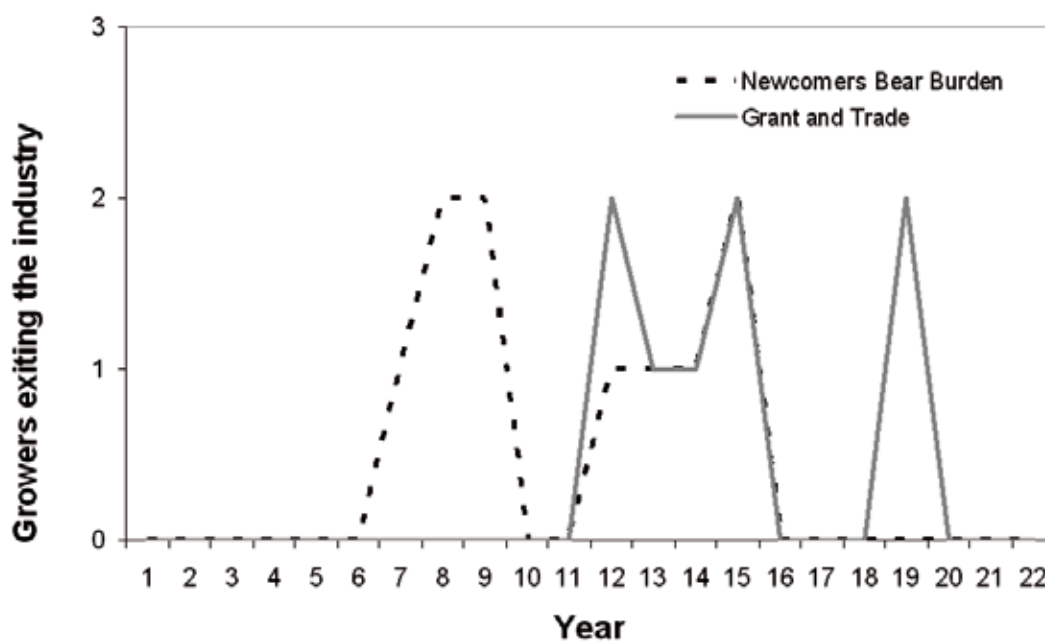


Figure 41: Number of growers who seek off-farm income, Scenarios 3 ('grant and trade') and 4 ('newcomers bear burden')

These results have been simulated based on a particular hydrological model of the Tindall aquifer and data for current licensed entitlements as reported by the NRETAS. The scenario results may be different with different input models and data.

In summary, even without the granting of more licences, there is a need for the 20% cap to be enforced. The cap will help to manage risks to the environment and non-extractive values of the Katherine–Daly River system. Enforcement of the cap through pumping restrictions imposes a significant risk on growers, and a water market may be one instrument that can assist growers to manage this risk. Subsequent questions are how pumping restrictions would be communicated to growers and enforced, and how much notice would be given to growers about when pumping restrictions will be required.

6.7 Conclusions

The simulation of scenarios using experimental economics and the Tindall Aquifer Water Trading Model has given insight into how a new set of rules in the form of a water market and various market designs might play out in the Katherine–Daly region. The increasing demand for the water of the Tindall aquifer, in the face of the 20% cap and the policy imperatives of the National Water Initiative, assert that a new institutional arrangement is required.

This research has highlighted where certain rules will enable or inhibit the intended outcomes of water trading. For example, the model simulations have brought to light the fact that allocating pumping restrictions unequally across growers will have different impacts on total extraction and the enforceability of the 20% cap. The simulations also raise the issue of the potential impacts of this new institutional arrangement for water allocation on the distribution of profits between different farm sizes and the potential for some growers, in observing their profits, to respond to changing conditions by choosing to leave the industry. This may have an impact on the broader community and social dynamics in the Katherine–Daly region.

Our inability to model more than one type of crop due to a lack of data availability has given a somewhat distorted view of how effectively the market might operate as an instrument for allocating water to uses with the highest marginal value. In the real world of the Katherine–Daly region, not all growers are producing mango crops, and so not all would need to buy water entitlements at the same time, nor would they want to hold on to their water entitlements at the same time. The different temporal water requirements of different crops may mean that the potential value of the water market as calculated in the results section is realised. The better matching of sellers' bids to buyers' marginal values for water, too, may evolve as growers learn about the market through time.

The IAD framework has been useful for focusing this research on how the interactions between formal rules (the National Water Initiative), human behaviours (growers' bidding strategies) and the economic, social and ecological realities of the situation structure the way in which this new institutional arrangement may play out. In particular, the use of the IAD framework to analyse the collective-choice and operational levels and how these link together and with the constitutional-choice level has provided insight into how the dynamics at the operational level are a response to those at the collective-choice level, and those at the collective-choice level are a response to those at the constitutional-choice level.

7. Institutional analysis of the Alice Springs water resource strategy

Yiheyis Maru and Michael LaFlamme

7.1 Physical conditions

Alice Springs is located at the centre of arid and semi-arid zones that cover about 70% of the Australian continent. Home to the Arrernte people for thousands of years, the site of Alice Springs was chosen for European settlement in 1870, mainly due to the presence of water. Alice Springs is now a town of 28 000 and is very transient at multiple temporal and spatial scales. The 2006 census data indicate that Alice Springs has large mobile and stable groups of residents (ABS 2007). Approximately one-third of the population changes residence annually, with half of that group moving within Alice Springs or the NT. Over five years, 40% remained at their same address, while half of those changing residence stayed in Alice Springs or in the NT. This census data is complemented by 2005 surveys of the undercounted Alice Springs town camps, whose 39% mobile population increases their average population (Foster et al. 2005). In 2005, an average year, Alice Springs also received 465 000 tourists who stayed 1.8 million nights, resulting in an average of 5066 tourists per day or 21% of the resident population (Tourism NT 2006). These large transient and resident sub-populations bring diverse experiences in water allocation and use.

The median rainfall is 286 mm/year but is also variable, with annual totals varying from a minimum of 60 mm (1928) to a maximum of 903 mm (1974). Due to temperatures during the maximum rainfall season that average near 40°C, the evaporation rate is 3000 mm/year. Due to variable rainfall and high evaporation rates, there are no permanent surface waters but one intermittent river, one creek, and several waterholes.

Water is one of the critical resources that determines the sustainability of this desert town. The primary sources of water for Alice Springs are the surrounding deep and shallow aquifers shown in Figure 42. Recharge of these aquifers is limited (Table 11) and the water is currently used mainly for town domestic water supply, business, stock and horticulture.

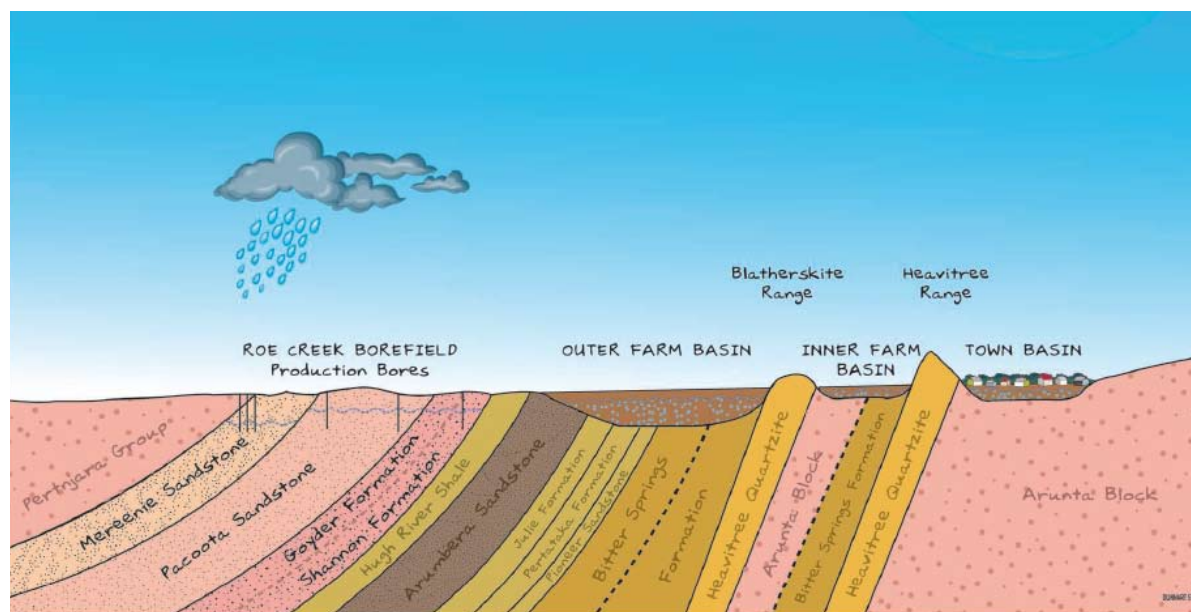


Figure 42: Irrigation water is provided by alluvial aquifers in the three basins

Note: The public water supply is from deep aquifers in the Roe Creek borefield

Source: Northern Territory Government 2004b

Table 11: The water budgets of the Alice Springs aquifers

2005 Current Development	ALLUVIAL AQUIFERS - salinity under 1,00mg/L (except Town Basin)			AMADEUS BASIN ROCK AQUIFERS -salinity under 1,000 mg/L			TOTALS
	Town Basin (<2000mg/L)	Inner Farm Basin	Outer Farm Basin	Eastern Amadeus Mereenie	Eastern Amadeus Pacoota	Eastern Amadeus other aquifers	
Total Recharge ML/yr	1200	430	810	6200	800	80	9520
Evapotranspiration ML/yr	160	50	200	4000	0	0	4410
Outflow ML/yr	40	310	500	2200	800	80	
	to Inner Farm Basin	to Outer Farm Basin	to Eastern Outer Farm Basin	to Mereenie beyond strategy area	to Pacoota beyond strategy area	to Eastern Outer Farm Basin	
Current Extraction ML/yr	740	70	110	7700	1365	100	10.085
Current aquifer storage (ML)	2540 ML	800 ML	100 000 ML	5 200 000 ML	400 000 ML	300 000 ML	6 003 340
Under 1000 mg/L TDS							

Source: Northern Territory Government 2004c

To reduce uncertainty of this critical resource at the national level, the Council of Australian Governments created the National Water Initiative (NWI) to:

... increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction (Council of Australian Governments 2004:1).

One of the eight key components of the NWI is to develop community partnerships to engage water users and other stakeholders in achieving the objectives of this agreement by:

1. improving certainty and building confidence in reform processes
2. enabling transparency in decision making
3. ensuring sound information is available to all sectors at key decision points. (Council of Australian Governments 2004:20).

The Northern Territory Water Act (Northern Territory Government 2004c) was written to implement the NWI. The Department of NRETAS staff interpreted the Act to enable public involvement in the early stages of local planning. This decision was supported by the Minister, which resulted in the formation of a steering committee to develop a draft water resources strategy for Alice Springs. For this study, we reviewed literature and interviewed nine people involved in drafting this strategy.

7.2 Exploring the action arena

The action arena has two components: the action situation and the participants. For this study, the action arena of interest is the actors and interactions that contributed to drafting the Alice Springs Water Resource Strategy (ASWRS) (Figure 43). The major actor in this action arena is a steering committee with representatives from different sectors of the Alice Springs community. The focal action situation is the context and interactions of the Steering Committee that deliberated on the allocation of water and developed the draft ASWRS. The draft ASWRS is submitted to NRETAS for final editing, and then to the Controller of Water, the Minister, and upon his or her discretion, the Cabinet. The final ASWRS will

then be implemented with the advice of a separately constituted local review panel, the Alice Springs Water Advisory Committee. The ASWRS will be reviewed in five years, and a new water allocation plan will be designed every ten years.

Considerable power lies with the Minister or his/her delegated Water Controller. Under the Northern Territory Water Act (Northern Territory Government 2004c) public participation in both development and adoption of a water strategy is at the discretion, and thus depends on the goodwill of, the Minister or the Controller.

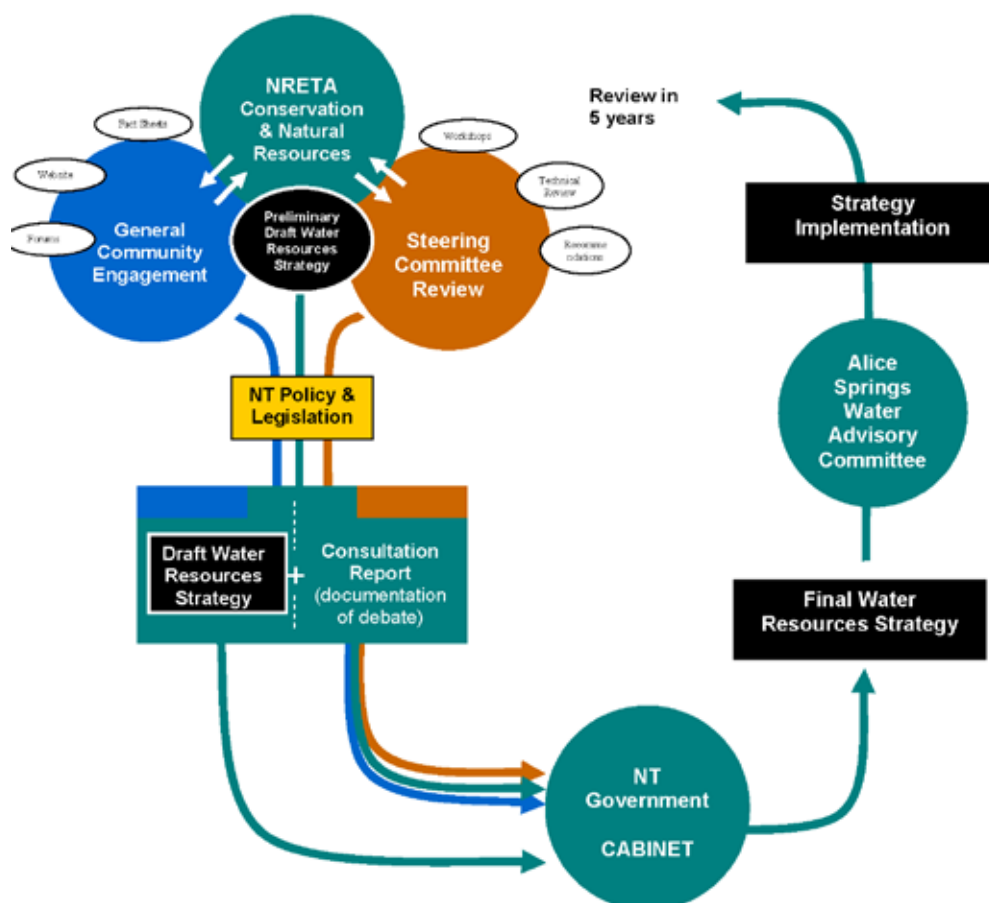


Figure 43: NRETAS Community Consultation Process

Source: Northern Territory Government 2005a

7.3 Linked action situation

Goodwill and commitment, mainly by local NRETAS staff, led members of the public and the Steering Committee to develop a draft ASWRS, following the process described in Figure 43. However, the action arena has nested and linked action situations where the outcomes of the Steering Committee and public meetings form only part of the draft strategy document. This nesting and linking of action situations is important because of its influence on the power (opportunity and control) distribution among the Steering Committee members and other actors of the action arena. In the series of linked action situations, final decision making is disproportionately concentrated at higher nodes. This is a major institutional constraint on establishing effective polycentric governance of Alice Springs water resources that would allow greater involvement of locals in the decision-making processes.

7.4 Participants

Local NRETAS staff sought extensive involvement of the Alice Spring community, and intensive input from the Steering Committee. Terms of reference for the Steering Committee were to:

- assist with determining water allocations and beneficial uses under the Water Act
- review the draft strategy and the community consultation report to be incorporated into a submission to the Minister and Cabinet
- provide advice on the proposed membership and operating arrangements for a ministerially appointed Water Advisory Committee (WAC) for Alice Springs to represent the interests of Alice Springs water users throughout the life of the strategy.

Steering Committee membership was determined by the Department and based on requirements for representation of local sectors and on skills relevant to local water resource usage in and around Alice Springs. The proposed structure was endorsed by the responsible Minister and each organisation nominated a representative (Table 12). All members of the Steering Committee indicated they were comfortable with the Committee's composition.

Table 12: Steering Committee participants

Skills	Name	Representation
Scientific	Mark Stafford Smith	Desert Knowledge CRC
Community	Ald. Murray Stewart	Alice Springs Town Council
Environmental	John Brisbin	Arid Lands Environment Centre
Public Water Supply	Alan Whyte	Power and Water Corporation
Aboriginal	Patrick DuPont	Central Land Council
Commercial*	Don McDonald	Chamber of Commerce and Industry
Horticultural Industry	Vin Lange	NT Horticultural Partnership Group

Source: Northern Territory Government 2005b

* The only change on the original proposal for organisational representation was the substitution of the Regional Development Board to the Chamber of Commerce and Industry. This was because regional development boards generally were under review, and, by the time we were ready to call for nominations of representatives, had gone into recess.

The degree of public representation varied substantially among the seven members of the steering committee. The horticulture and environment group actively engaged with their constituents. In contrast, the commercial involvement (through the Chamber of Commerce) and engagement with Aboriginal residents was limited.

7.5 Examining interaction patterns

Our analysis of interaction patterns focuses on the Steering Committee members, the public and NRETAS staff. Ideally, these patterns of interaction should build trust and reciprocity that help resolve social dilemmas and reduce the uncertainty of outcomes (Fehr & Gächter 2000).

7.5.1 Information

The NRETAS team was a hub for information among the participants (Figure 44). Background information on water issues in Alice Springs was presented through fact sheets, diagrams, maps, media and a preliminary draft Water Resources Strategy, all of which were available on the NRETAS website. At community meetings, NRETAS also presented its community engagement principles and consultation questions, which it developed to help the public provide informed advice. One of the NRETAS employees who organised the process for drafting the ASWRS stated:

We looked at past efforts of the NT government to do community consultation, particularly with some of these submission forms. We looked at the types of questions they asked, and we thought, well all of these questions are irrelevant really, they're asking questions that either lead people into some sort of an answer, or they're questions about things we can't change ... or they're questions that people are very unlikely to have the information or the knowledge or background to give their opinion on in a meaningful way.

Their analysis resulted in seven key consultation questions:

1. What principles and values should underpin decisions made in the ASWRS?
2. How long do we want/expect the Amadeus aquifer water supplies to last?
3. What are the beneficial values and uses for water around Alice Springs?
What values should be protected?
4. How adequate are the proposed water allocations for the Amadeus aquifers?
5. What guidelines and rules, should apply to water licensing and trading?
6. What should be the role and who should be a member of a Water Advisory Committee?
7. What key projects should be undertaken through the ASWRS Work Plan?

The community engagement process began with two public forums that were also attended by some Steering Committee members:

- 22 October 2005: 'Myths, Facts and Future of Alice Springs Water' focused on presenting background information about water issues and the ASWRS to the public and was attended by 45 people.
- 29 October 2005: 'Water Use & Sustainability' focused on facilitating feedback against the key consultation questions and was attended by 22 people.

In the community forums, attendees were given new information about Alice Springs water and were engaged in discussion to identify their preferences. For example, at the second forum, 'Water Use & Sustainability', attendees were presented scenarios concerning 'the maximum allowable volume of water available over a ten-year period (the life of the strategy)' (Northern Territory Government 2005b).

Nine options were presented, expressed as a multiplier of the current usage rate, from current use x7 to current use x0.13, and as an estimate of the life of the aquifer, from 100 years to forever. Ten of the 13 responses clustered around the current use rate. Yet when asked, 'In your opinion, do you think it is acceptable to take water from the Amadeus rock aquifers at a rate that will one day cause the aquifer to run out of accessible and useable water?' 14 of the 19 responses identified the need to sustain the aquifer indefinitely, which requires use at a much lower rate than the current use rate. Statements on values about the relative importance of conservation and economic growth strongly emphasised conservation, with a priority on public participation in decision making.

A lot of people said this in the community consultation: Why don't we have water restrictions, in the centre of Australia where we have one of the lowest rainfalls in the country and we're the only place in the country where we can waste as much water as we like, without any kind of problems? But unfortunately those sentiments weren't able to be incorporated into the policy.

Both the community forums and an independent survey (McGregor Tan Research 2005) concluded that community values are not supported by sufficient information to enable the public to be active participants in the water resource action arena and so have control over the outcomes they desire. This supported the decision by NRETAS to increase information available to the public, although the information presented was uncertain.

Information about the key exogenous variable – the amount of water – was highly uncertain. I think the picture we got was, we were talking to trusted sources – the government and the scientists -- and they were saying: 'here's the best we know, and here's the things we don't know.' And what they didn't know was a fair amount.

An extensive media campaign was developed by NRETAS staff to further increase public awareness and involvement in the consultation process, but the campaign was not implemented by the agency.

There's a lot of inertia in that culture of the department toward making decisions the way they always have, which is through this hierarchical system, these bottlenecks of people who have the power to make decisions, and we copped a lot of criticism from the Minister's advisors, particularly, because of our media campaign...but we only got to the first step and the Minister's office put a media block on it.

7.5.2 Interaction

Immediately after the public forums, the Steering Committee began its series of six meetings shown in Table 13.

Table 13: Schedule of the Steering Committee

Date	Meeting focus
Meeting # 1. 3 November 2005	Introduction to the preliminary draft ASWRS, critical discussion of beneficial uses
Meeting # 2. 10 November 2005	Critical discussion of maximum allowable yield, water allocations and licensing and trading guidelines
Meeting # 3. 17 November 2005	Decisions and recommendations on beneficial uses and licensing and trading guidelines
Meeting # 4. 25 November 2005	Decisions and recommendations on water allocations
Meeting # 5. 1 December 2005	Dialogue and recommendations on the ASWRS, a WAC and a work program
Meeting # 6. 15 December 2005	Review of updated draft ASWRS, cabinet submission and community consultation report

Source: (Northern Territory Government 2005b)

At the first meeting, the definitions of beneficial use in the NWI were challenged by the Steering Committee.

The matters that were presented to the committee for deliberation, and the framework we had to analyse them in, were somewhat artificial and it was hard for us to get our heads around them at first. I don't think ultimately it was the best framework for us to deliver local solutions. But that was not a variable we had control over. By that I mean the concept of 'beneficial uses'; that came from the National Water Initiative; that was something we couldn't mess with because it was common to the whole national initiative ...It says you can't use water for aquaculture but you can use water for horticulture. We looked at them at first and thought, both are largely private enterprises, largely for profit and for export. And those are the commonalities of those uses. And we don't necessarily have a concern about those activities taking place, unless they take place in a very ineffective manner that returns no value to the community. Those are our major concerns. But those concerns aren't served well by a simple categorisation of usage type, rather than quality of usage or other attributes of usage. So we found no place in the framework to lodge those concerns efficiently, in terms of process.

At the second meeting, Steering Committee members were asked to stand on a timeline to show their position for resource sustainability (Figure 44). Some participants focused on increasing the sustainability of the town, while others attempted to compute a strategy to increase the sustainability of their constituent group.

Steering Committee members chose a maximum allowable yield of 1.4 times the current usage rate, which was significantly different from NRETA policy at that time of 4.8 times the current usage rate.

The outcome wasn't an artificial result of how NRETA presented the options. The Steering Committee didn't just pick the midpoint between extremes presented, but was quite clear and consistent about choosing a specific conservative value ... there were conscious and thoughtful discussions on the trade-offs between sustained water supply and having water for inhabitants indefinitely, and sustaining the economy of the town in the sense of having sufficient going on that there was a reason for people to want to live there to use the water in the first place!

Participant interactions were guided by a set of formal and informal operational-level rules to increase the probability of consensual outcomes from the action arena.

We were heavily dependent on the quality of the people around the table. There was no mechanism you could have put into place to ensure a better outcome, I think, other than the mechanism of choosing good people and hoping they are in a good mood that day and you get a good outcome.

The reality was there wasn't a great deal of difference between myself – and I was saying we should be using more than anyone else – and the environmentalist. There was only a little, when you look at the big picture. And I think I took a very conservative view in terms of water use...I also believe there's a lot of knowledge gaps right now in terms of the length, depth and breadth of the aquifer, and the recharge of the aquifer, and I believe that we can't be taking too much until we fill those knowledge gaps.

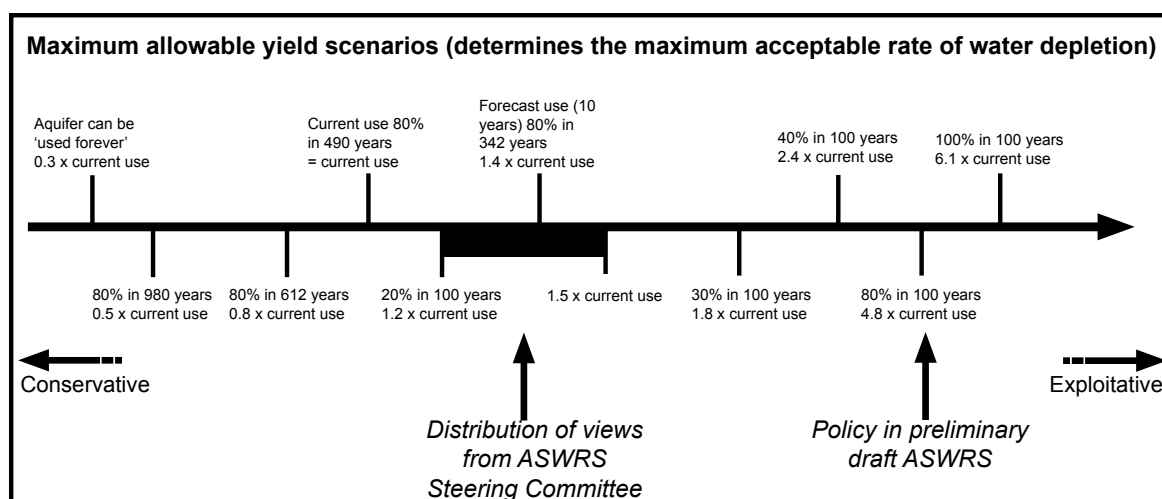


Figure 44: Comparison of NRETA and Steering Committee water use scenarios
Source: (Northern Territory Government 2005b)

7.6 Tension

As in other common-pool resource situations, the tension between collective long-term outcomes and short-term organisational (individual) interests was the reason for social dilemmas in the Steering Committee. Both NRETA staff and members of the committee continually reflected on the importance of rules in addressing this conflict.

Certainly the representative for the horticulturists would like a little bit more water allocated to horticulture, but he was being realistic. I think people were working together genuinely rather than trying to fight against each other. People were trying to come together cooperatively to produce an outcome people would feel reasonably happy about at the end of the day. It wasn't like open conflict, it was pretty cooperative, the process.

Through this reflection, the IAD design principles (described more fully below) began to emerge. These principles began to be expressed in the Steering Committee interactions as:

1. their right to organise
2. to develop clear rules for resource use
3. proportionally valuing the benefits of each use
4. establishing local-level rules
5. nesting institutions in layers
6. establishing a WAC to monitor rules
7. establishing realistic sanctions for local water use
8. developing low-cost conflict resolution processes.

The major challenges to the IAD design principles were uncertainties that arose from the limited responsibility of the Steering Committee to draft a strategy without the right to make the final decision to implement it, and threats from the power differentials among members of the committee.

As far as a community representative process ... there was [an organisation] in the meeting room with us that has all the influence and power in a single entity.

The major licensee is the Power and Water Corporation. The Steering Committee attempted to develop rules for that licensed entity to reflect community values of resource sustainability.

Saving water as part of their licence needs to be one of their major targets: water reduction, water efficiency and per capita reduction. We mentioned in one meeting the possibility of putting some kind of restriction on the extraction license. Twelve hours later a note came from Darwin: We accept no conditions whatsoever on our extraction licence. But in our cover letter recommendations, the committee said we really should consider putting some kind of conditions on that extraction licence. But I don't know how to sort the power differentials, from the position of the committee.

The Power and Water Corporation responded by presenting its own dilemma: a dual role that presented a conflict of interest between private and public good within one organisation.

Power and Water is in the business of selling power and water in a commercial sense. Even though we're a government-owned corporation we have to pay a dividend to our Minister and we have to have a positive rate of return. So for us to be going out and promoting water conservation; we're actually potentially losing revenue. So unless somebody says, Here's some money for you to run the water conservation programs or to offer rebates or to put in rainwater tanks or all the good things that people want, unless we are given that money or we're allowed to undertake that work by pushing our tariffs up, then why would we do it? Why would any commercial business do that?

Other Steering Committee members identified this as a threat:

In a sense they get a chance to double dip. They can act like a business, an independent business. At the same time they can play a role as if they're a government agency, and so they will juggle between the two, whatever is in their best interest.

The regulatory body, NRETAs also recognised it as a risk:

The question about relative input and power is one that lies a little bit outside the Steering Committee in that once they'd sort of reached the end of their work and provided all of that input, one of the members, the Power and Water Corporation, then engaged with us directly in a very detailed fashion about their view ... presumably in the hope that more of it would prevail. And that's always a risk when a participant is also a government agency.

7.7 Outcomes

The discussions among the general public, submissions of stakeholders and the intensive deliberations of the Steering Committee had significantly amended an NRETA preliminary strategy and led to two broad outcomes:

1. A strategy – the penultimate draft ASWRS
2. Suggestions on the structure and functions of a Water Advisory Committee.

As an outcome, the draft strategy and the suggested advisory committee are to reduce problems of uncertainty and opportunistic behaviour inherent in existing institutions and structures of water resource management. However, these uncertainty-reducing measures are only theoretical, because there is no certainty in the adoption of the strategy or the structure and functions of the advisory committee, as they are subject to the discretion of the Minister or his/her delegated Water Controller.

7.8 Institutional statements

If the strategic outcomes are accepted, then water allocation in Alice Springs will change. In addition to what the (WAC) suggested in the ASWRS, the other strategic outcome is a set of key institutional statements which broadly encompass rules, norms and shared strategies. These statements relate to the definitions of sustainable maximum yield, of unallocated water and of beneficial use (Northern Territory Government 2004c) and were developed from the public forums, submissions and intensive deliberation of the Steering Committee.

The broad institutional statements include:

1. Water use should deliver sufficient environmental, social and economic benefits to Alice Springs to validate depletion of the water resources.
2. The needs of future generations should be considered by extending the life of the non-renewable Amadeus aquifers through conservative water use (Northern Territory Government 2005a: 1).

The Committee had taken these two broad statements further and decided unanimously that:

1. A policy for maximum allowable yield of 80% depletion in 100 years is not acceptable.
2. The maximum allowable yield should be 'conservative' and should not allow for large and increasing amounts of currently unallocated water (Northern Territory Government 2005a).

The Steering Committee also expressed its concern about the relevance to local conditions of the beneficial use categories prescribed in the Water Act (Northern Territory Government 2004b). They suggested that they be applied flexibly as management tools.

That is quite a shift in policies for allocation in terms of determining what a sustainable yield is. Also, how we approach the allocation of alluvial aquifers is quite a departure from the existing Northern Territory policy.

These institutional statements are designed to create expectations that regularise human behaviour in water allocation, and thus reduce uncertainty in the resource. The IAD framework presents a method for analysing these statements to determine their effectiveness in reducing uncertainty. This method is to parse these statements using the ‘institutional grammar’ in Table 14. Parsing categorises statements to determine their role as strategies, norms or fully fledged rules.

Table 14: The five components of institutional grammar

ATTRIBUTES	A holder for any value of a participant-level variable that distinguishes to whom the institutional statement applies
DEONTIC	A holder for the three modal verbs: ‘may’ (permitted), ‘must’ (obliged) and ‘must not’ (forbidden)
AIM	A holder that describes particular actions or outcomes in the action situation to which the deontic is assigned
CONDITIONS	A holder for those variables that define when, where, how and to what extent an AIM is permitted, obligatory or forbidden.
OR ELSE	A holder for the institutionally assigned consequence for not following a rule.

Source: Adapted from Ostrom 2005

Institutional statements include strategies, norms and rules. Strategies contain Attributes, Deontic and Aims; Norms add Conditions; and Rules have all five components.

Examples of the key institutional statements are re-stated below using this IAD syntax. None is a rule yet. They are either a shared strategy with no specified conditions and sanctions, or a norm with no specified sanction, that is, consequences.

- The Water Controller should make all beneficial uses to ‘encourage flexibility for innovation and good ideas’ (a strategy).
- The Water Controller must make sure that allocation shall not exceed 80% of the maximum allowable yield from the Amadeus Aquifer over 320 years (a norm).
- The Water Controller must also make sure that the depletion rate shall not exceed 25% of the maximum allowable yield from the Amadeus Aquifer in the first 100 years (a norm).
- The Water Controller, together with water-allocated entities, must make sure the Alluvial Aquifer Management Zones shall be used for the following beneficial uses and values: environmental, cultural, industrial, agricultural and rural, stock and domestic uses (a norm).
- The Water Controller together with other water-allocation entities, must make sure the Roe Creek Management Zone is used for the following beneficial uses and values: Public water supply and rural, stock and domestic uses (a norm).
- The Water Controller together with the entities with water allocation must make sure the Rocky Hill/Ooraminna Management Zone must be used for the following beneficial uses and values: environmental, cultural, agricultural and rural, stock and domestic uses (a norm).
- The Minister or delegated Water Controller will declare all waters (excluding existing agricultural entitlements) with salinities under 500 mg/L for beneficial use as public water supply (a norm).

Restating the sentences following the syntax of the institutional grammar helps to compare the institutional statements in use in a variety of settings. Moreover, the addition or subtraction of components switches institutional statements from one type to another, providing a tool to evolve strategies or norms into rules, when required. (Ostrom 2005: 214).

Of course, there is no guarantee the strategy and the restated institutional statements will be accepted.

Who knows what happens to it from now? We have no ownership over it at this point. The committee has done its draft, we have signed off on it and it's gone. It's not like the minutes have to have our approval in the final version. We don't get to see the draft that comes back before it gets signed into law.

7.9 Structures

As per the *Water Act 1992* of the Northern Territory Government, NRETAS developed a preliminary draft of the establishment and role of a WAC.

1. The Minister may:
 - a. in writing establish, and appoint the members of, a WAC for Alice Springs Water District
 - b. prescribe the powers and functions of a WAC.
2. The WAC:
 - a. shall consist of such members as the Minister thinks fit and the members shall hold office at the Minister's pleasure
 - b. shall advise the Water Controller on the effectiveness of the water allocation plan in maximising economic and social benefits within ecological restraints
 - c. shall carry out any other functions that the Water Controller may from time to time direct the Advisory Committee to perform.

The Steering Committee suggested amendments to the structure and function of the proposed WAC to make it empowered, effective and representative of the diverse community sectors. Functions suggested include oversight to effective implementation of the work programs related to water allocation in ASWRS.

As stated in the *Water Act 1992* of the Northern Territory Government the role of the WAC is restricted to advising on water allocation issues. However, for the critical and non-renewable water resource of Alice Springs, oversight of allocation and use as an integrated function is of paramount importance for efficient and effective management of the resource.

7.10 Evaluation criteria

Evaluation focuses on valuing the outcomes of the action situation, and the relationship between outcomes and the processes of achieving those outcomes.

The evaluation criteria detailed below for the ASWRS measure key outcomes and processes:

- **Efficiency:** *the relationship between water allocation and associated benefits in Alice Springs.*
The proposed strategy provides allocation that benefits the viability of the town economically, socially and environmentally. However, because Alice Springs' groundwater is non-renewable, managing allocation separately from use is less effective. Indeed, if effective water allocation is not accompanied by significant water use efficiency and demand management measures, its benefit will be in doubt. Most local residents surveyed recognized they could reduce their water use with little hardship; however, most also considered that they did not have excessive use. The Steering Committee attempted to address this dilemma by changing the definition of 'beneficial use' to identify the contribution of a specific allocation of water to sustainability.
- **Equity:** *fairness between individuals' different contributions and benefits, considering different abilities to pay.*
Many residents surveyed recognised that the price of water does not reflect its real cost, and are willing to follow new rules if they are fair. The proposed two-tier pricing system will maintain a baseline of low water costs for all residents, with increased costs only for those who choose to use more.

- **Adaptability:** *the ability of individuals to learn from experience and adapt to new circumstances by maintaining a system's performance (robustness) or by shifting to a new stable domain (resilience).* The *Water Act 1992* of the Northern Territory Government provides for adaptability through institutions that require re-evaluation of the water strategy every five years and an overhaul every ten years to develop new institutions based on new information. However, there is no process for local residents to access that information when available and to change relevant institutions.
- **Accountability:** *the responsibility of officials to limit their ability to engage in opportunistic behaviour.* The Steering Committee asked for accountability from the Water Controller, the Power and Water Corporation and any major user. The Steering Committee also recommended an accountable but empowered WAC for Alice Springs. As well, local residents stated in the survey that accountability, through increasing their participation in decision making, was a high priority.
- **Conformance to general morality:** *the presence of rules that improve relationships over time, such as rewarding kept promises over free riding or cheating.* The Steering Committee, in its design of the WAC, was explicit about rules that clearly linked restrictions on water allocation to benefits for all. Local residents also expressed their willingness to accept water restrictions if everyone else did.
- **The need for trade-offs:** the comparison of rules using performance criteria within and between levels.
I think the major advantages, from my point of view, of having gone through that process was two-fold ... they did come up with some additional recommendations about the way in which we would make judgement in the future when a new application for a water entitlement came to the Department, and some of those involved greater rigour in terms of the future Water Advisory Committee being able to call for advice from a broader range of professionals [... they] introduced the concept that when the Controller of Water Resources ultimately makes a decision under the Act, the reasons for that decision and the reasons for any difference with the advice that came out of the Water Advisory Committee should be documented and made public.

Evaluative criteria can also help make the costs and benefits of trade-offs more explicit, and enable the design of clear rules. Throughout the ASWRS process, the following tradeoffs emerged:

- Changing current norms versus maintaining current norms. Current norms suit current lifestyle practices, in contrast to a 'DesertSMART' set of practices
- Accurately valuing future uses vs. discounting future uses
- Accurately assessing the probability of future water quantity, cost and availability versus maintaining current uncertainties about those probabilities
- Developing and enforcing low-cost operational-level sanctions for minor local violations versus the current practice of enabling only high-cost collective and constitutional-level court-issued sanctions for major offences.

7.11 Scenarios

Scenarios focus on uncertainties as drivers of change. The Steering Committee identified three areas of uncertainty that are likely to influence future change. No Institutional Change describes the continuation of current conditions with current uncertainties; User Transience describes change in *user behaviour* driven by the current high immigration rate of users from states with water restrictions, who wish to reduce uncertainties; and development of Local Governance Skills is driven by changes in *rules* as suggested by the Steering Committee, to reduce uncertainty about resource allocation.

7.11.1 No Institutional Change

In this scenario, the driver is path dependence – there are no institutional changes, and the WAC has an advisory role without the authority or budget to design and enforce rules. This is the scenario that emerges from implementing articles of the *Water Act 1992* of the Northern Territory Government that provide for discretionary decision making.

7.11.2 User Transience

The driver is the large transient population, which over five years nearly equals the size of the resident population. Water restrictions and lower per capita use in other states and overseas have educated interstate migrants who are proposing conservation in Alice Springs:

Years and years ago ... the people who came to town were spraying more water than the locals were, you know, green gardens and rose gardens and vege gardens and hosing cars out in the driveway and all that. And now my observation is that the people coming from interstate have actually turned that over and they're the ones that are lobbying when they arrive here to say, 'Why is this? Why is Alice Springs using all this water and why have we got green everywhere? This is criminal because over in Sydney we have water restrictions; why aren't there water restrictions in Alice Springs?'

Scenarios focus on engaging transient and resident groups in designing strategies to change user behaviour within the 'no institutional change' scenario.

7.11.3 Local Governance Skills

The driver in this scenario is the need for local governance, and the scenarios are around developing institutions (e.g. WAC) that allow for local leadership and adaptive learning about resource availability and usage strategies. However, existing decision making is highly centralised and provides few arenas for local residents to develop the skills to design institutions and manage resources in a changing socio-ecological environment:

Why didn't more people come out? We ran workshops on water waste, energy and the built environment, and consistently pulled 40–50 people. People feel disempowered and uninterested, so they don't show up.

IAD analysis recommends beginning with low-cost, lower-level actions – such as informed participation in NRETAS decisions through watchdog groups – that can build capacity for local governance (Ostrom 1990).

7.12 Validity of the IAD Framework

7.12.1 Internal

The IAD analysis of the ASWRS can be internally validated by asking if this framework accurately identified and measured the important institutions and processes (independent variables) that led to the important outcomes (dependent variables) shown in Table 15. Water allocation in Alice Springs is a complex system, but IAD analysis shows that this system is composed of 'universal components organized in many layers' that result in 'the diversity of regularized social behaviour that we observe at multiple scales' (Ostrom 2005).

Table 15: Institutions, processes and outcomes identified by the IAD framework

Universal components	Diverse behaviours
Physical conditions	Significant uncertainty in data about resource quantity, quality and future extraction costs
Attributes of community	Community with little accurate information on water costs and usage patterns; unrestricted water usage. No local resource governance; transient population
Rules	Constitutional- and collective-level rules allow discretionary decision making, sharing of responsibilities but not rights. No rules for local decision making
Action situation	The Steering Committee formed by NRETAS and Ministerial discretion is a novel locus for several linked action situations that affect resource allocation. Resource allocation outcomes are contingent on interactions between the different action situations
Participants	Steering Committee members are chosen from diverse sectors of the Alice Springs community
Patterns of interaction	Steering Committee analysed rules and interactions of all linked action situations; achieved consensus on key decisions internally, while recognising that outcomes are contingent on decisions in other action situations.
Outcomes	A draft water allocation strategy and an empowered WAC
Evaluative criteria	Primarily the need for trade-offs

Identifying those universal components is critical for understanding the important elements of a system that remain over time to sustainably manage the inevitable diversity of behaviours and institutions in common-pool resources.

7.12.2 External

The IAD analysis of the ASWRS action arena can be validated externally for generalisability by asking if participants used the elements of the IAD framework to analyse their processes and outcomes – actual and potential – as provided in Table 16. This study provides evidence that IAD concepts were consistently used by participants to describe the key processes and outcomes of the ASWRS.

Participants at different levels had different viewpoints in the IAD framework, and external analysis can help integrate those viewpoints into a more accurate image of the action arena. These different views were the result of social dilemmas that created conflicts of interest between the benefits to an individual and shared benefits. Social dilemmas are at the heart of our discourse about institutions (Ostrom 2005).

Table 16: Participant-identified elements that matched the components in the IAD framework

Universal components	Diverse behaviours
Physical conditions	Non-recharging aquifer determines lifespan of town
Attributes of community	Transient, uninformed and disempowered local residents with unrealised conservation desires
Rules	Local governance inhibited by collective- and constitutional-level rules
Action situation	Steering committee composed of knowledgeable, skilled stakeholders
Participants	Representative of all community groups and NRETAS staff
Patterns of interaction	Effective group process leading to consensus, with few disagreements
Outcomes	A resource allocation strategy and an empowered and funded WAC to enable local resident decision making
Evaluative criteria	All criteria: efficiency, equity, adaptability, accountability, morality and trade-offs

One Steering Committee member who reviewed this paper also said that IAD can provide a framework for planning:

A prior analysis, particularly identifying areas of rules at constitutional and collective levels, could have considerably helped the Steering Committee ensure that it was giving due weight to all aspects ... and perhaps an analysis near the end would have helped to check comprehensiveness.

Although IAD was not used as a framework to examine processes and develop a draft ASWRS, the Steering Committee members and other interviewees used each component of the IAD framework separately and in subsystems, but did not use all components as a unified system as shown in Table 15. This indicates the value of IAD as a conceptual framework.

7.13 The IAD design principles

All of the IAD design principles repeatedly emerged during the Steering Committee discussion and analysis of their action arena, creating additional validation. They captured the main challenges to resource sustainability identified by Alice Springs Steering Committee members.

7.13.1 Clearly defined boundaries

The boundary of a resource, and hence of the action arena, is fundamental to sustainability. Uncertainty is always present regarding resource quality and quantity, and the only sustainable way to address uncertainty is to define current boundaries based on currently known quantities, and to change those boundaries as the degree of certainty increases. The alternative, to allow boundaries to be undefined based on uncertain resource levels, is to increase the vulnerability of the resource to exogenous variables.

The resource boundary is not clearly defined, and the boundary can be changed at the discretion of non-users. The current bore field, the number of bores in the current field size and their pumping rate are controlled by Power and Water. The cost of pumping water, hidden subsidies and limits on water are determined by Power and Water. As a corporation, Power and Water has an inherent conflict of interest, since it is a public utility that receives increased income in the short term from aquifer depletion, which thereby decreases the long-term sustainability of the town. The rights to harvest, through definitions of beneficial uses, can also be changed at the discretion of the individual who is the current Controller of Water, with Ministerial approval. Also, there is an additional bore field that has not been developed, with an uncertain but lower quality and quantity of water.

One of the things they wanted to change was from demand management to water efficiency but I think that's a bit of a cop-out. Demand management implies managing demand, probably reducing demand, whereas [with] water efficiency you can develop new uses of water where you use an enormous amount. You can have a turf farm and water it efficiently, and use an incredible amount of water...and one of their underlying concerns was: Who is responsible for demand management? Should it be them, who are a business, a corporation? Should it be NRETAS, who are the regulator? Who should be responsible? And there's definitely a logjam there. They have a conflict between their need to make money and that issue of demand management. They really need to work it out.

7.13.2 Proportional equivalence between benefits and costs

Rules related to fully subtractible resources must be based on discounting. Inputs related to money are hidden by subsidies, making accurate decision making impossible. As a result, the values of inputs are disconnected from resource valuation. Therefore, how do you accurately value 10 000-year-old water? It can be by market forces, but there is no real market: water in Alice Springs is used as an incentive to attract and retain people from other ecoregions, which is a form of contingent valuation. One method for accurate pricing may be to place the resource on a continuum of age and renewability with the costs of other water supplies in Australia.

There is no accurate information about resource availability to determine allocation. Valuation of water is based on the discretion of the Water Controller: there is no market or other valuation based on cost benefit to users. In addition, lack of information renders many costs invisible or biased by discounting.

7.13.3 Collective-choice arrangements

Most water users should be able to democratically make and modify their rules, to be able to respond to changing local circumstances and design locally meaningful rules. Discretionary decision making by a few users tends to benefit only them. Users should thus advocate strongly for permanent changes in collective-choice rules.

Steering Committee members stated they would be ‘greatly disappointed’ if their recommendations were not accepted by the Minister. Participants consistently stated they want user participation to be valued in the decision-making process through these actions:

1. NRETAS submits the draft as submitted by the committee.
2. The Minister approves the draft as submitted by the committee.
3. The Minister empowers the proposed WAC with a budget, staff, stipends and authority.
4. The WAC develops user sanctions and water-licensing requirements.
5. The WAC empowers a separate organisation to promote conservation measures.
6. Power and Water ‘fills the science gaps’ through a transparent process.
7. Power and Water and NRETAS develop and maintain a transparent process for making decisions and sharing information.

7.13.4 Monitoring of Rules

Establishing clear restrictions on water allocation and usage is a necessary first step in extending the life of the aquifer. This is followed by procedures for monitoring those rules and actually enforcing them. Monitoring and enforcing rules is strongly associated with increased resource sustainability.

The primary duty of the Water Allocation Committee is to establish rules for water allocation and to develop procedures for monitoring and enforcing those rules equitably. The institutions for water allocation are a major achievement of the Steering Committee, in response to the current absence of such restrictions. NRETAS monitors only major violations in licenses, while other monitoring is by users who are accountable only to themselves.

There’s certainly a lot more that can be done about increasing efficiency in horticulture, pastoral and domestic use around town as important prerequisites. We talked about imposing license conditions on Power and Water to say that to ensure your license to extract the current water you need to reduce use over time, and there are various different ways, and that would require Power and Water to roll out a water efficiency program if that was a licence condition. And so far they haven’t been good at meeting that licence condition, but it’s there and it’s sending a message that we can’t just use more and more and more water each year.

7.13.5 Graduated sanctions

Graduated sanctions are important to involve most users in conditionally cooperating with low-level informative rules such as monthly reports comparing household water usage. They are then motivated to monitor other users’ behaviours and to support restrictions against major licensees.

Local residents want conservation-related sanctions on water usage (e.g. DesertSMART), and if the rules are enforced fairly, they are willing to follow them. However, appropriators currently violate existing rules and enforcement is costly.

I mean, the Act allows for specified penalties for non-compliance; however, there is no infringement notice ... On the spot, there’s no capacity for those easy penalties, we have to actually construct a case and take it to court and that’s an impediment to using the formal penalties under the Act for minor matters or small matters. In fact the only ones under the Act so far that have been taken to prosecution have been significant pollution events.

7.13.6 Conflict-resolution mechanisms

Efficient conflict-resolution mechanisms enable participants to easily identify the rules governing water allocation and usage, to identify conflicts between rules and behaviours and to inexpensively resolve those conflicts. The presence of clear rules linked to low-cost mechanisms can more easily standardise practices and increase resource sustainability. These collective-choice rules can be developed by users, such as through the proposed WAC. Without such a process, resolving resource conflicts has high transaction costs, because rules are difficult to identify, are technically unclear, and access to decision-makers to address conflicts is only through lengthy bureaucratic processes.

Currently, the operational-level water allocation and usage rules desired by local residents do not exist.

Local residents are concerned about the lack of usage rules, which promotes highly variable usage among individuals and conflicts with their shared interest in a sustainable resource. Usage rules are strongly desired that apply to all users and licensees.

Maybe through another consultative group we could have that impact. That group would be saying, as a community we would have a common set of principles of usages and conservation. To have them implemented, they would need to interface with Power and Water at a mechanical level, to enact that mandate, and that's a can of worms nobody even got close to.

7.13.7 Minimal recognition of the right to organise

There is a major unmet opportunity for users to devise restrictions on water allocation and use and also to create an action situation to interact around those restrictions. This opportunity was identified by Steering Committee members in their drafting of an active role for the WAC, but that decision must be enforced by informed citizens. All local actions require that government choose to support the right of users to organise and participate in the decision-making process.

Regarding the WAC, I think the Steering Committee was a good model for how that could work ... I think it should have an independent chair, that's what we agreed to, that the chair wouldn't be a government person. It was also agreed that the government's role in that group would be as providing information and not be voting or decision-making members of that group, so there might be a couple of department people that sit on the group and provide the background information, but when the group votes or comes to a decision, that they step out of that process – to have some independence from government, that is important. I don't know that it's in the Act that it has to be that way, but that's what the Steering Committee felt was a good approach. And another thing they felt was important was they had executive support, and they do have a budget because they're very busy, and having sitting fees.

7.13.8 Nested enterprises

The functions of appropriation, provision, monitoring, enforcement, conflict resolution and governance must exist at the local level with user control, and there must be monitoring of the effectiveness of that process at the collective-choice level.

Currently, the opposite situation exists. Users are attempting to monitor governance activities at the collective-choice level, with incomplete and imperfect information. At the same time, they have the experience and skills for governance at the local level, but with no authority.

Members are concerned that decisions on water appropriation, conflict resolution and governance are made by one person at the collective-choice level who is susceptible to influence. They wish to have increased access to those collective-choice rules, and increased operational-level control, and they

recognise the need for each level to monitor the other. Therefore the IAD design principles provide evidence of the need for Alice Springs to be a node in a nested enterprise, or a polycentric decision-making system.

If that committee is local and representative, there's a good chance they will make good decisions. There's always that tension – if it is stacked with real estate agents and fruit growers, and they make an idiotic decision but it's local – we want to have the power for somebody at a higher level to override it and do the right thing. But then you have the opposite situation, if the local people make the wise choice and the idiotic proponents go to the administrator and they override it for the wrong reason. So which do you pick? All of our constituents have been around long enough and are clever enough to see that it's the same either way. It can be exploited either way. We didn't have a solution to that problem.

7.14 Case study lessons and Recommendations

During the period of this study, there have been several community involvement processes developed and led by NRETAS (e.g. Steering Committee, WAC, Alice Springs Water Efficiency Study, Water Use in Alice Springs), by the Arid Lands Environment Centre (DesertSmart Road Map) and by other community organisations involved in water allocation and use.

These processes and IAD analysis of the Steering Committee process support our finding that Alice Springs has the capacity for local governance of its water resource, as a node in a polycentric system.

Local decision making using the IAD design principles can provide institutions that help responsible entities address the key issues of water sustainability in Alice Springs by:

- defining beneficial uses to sustain local quality of life with lower per capita usage
- identifying licence requirements that reduce per-capita use and allocation
- resolving the public private conflict in water supply and demand management
- developing institutions for local water governance to replace the goodwill of discretionary and centralised decision making.

The team that developed the community consultation process required the goodwill of NRETAS staff and decision makers. This was not required by the *Water Act 1992* of the Northern Territory Government, but the goodwill made possible an interpretation of the Act that enabled additional public consultation. This goodwill is threatened by the frequent turnover of both local residents and NRETA staff. This turnover also threatens the corporate memory and detailed resource knowledge of NRETAS staff. This transience significantly increases the transaction costs for decision making and perversely supports centralised decision-making by individuals with the longest tenure in the system.

As a result, key action arenas not allowed are: local resident decision making; managing rewards and sanctions for increasing effective water supply through conservation; developing licence requirements for Power and Water to decrease water consumption or water allocation; or empowering the WAC to sanction waste of water. All of these action arenas enable interactions between demand and supply. These interactions were specifically separated by NRETAS so that the Steering and Advisory committees were empowered to advise only on supply.

Participants consistently stated they will most highly value increased user participation in the decision-making process. Benefits would include:

- decreased transaction costs for sanctions, because they would be implemented by social peers
- decreased NRETAS responsibility for decisions
- NRETAS responsibility for collecting data on the resource and for managing operations.

There are currently no institutional incentives to change the existing decision-making structure. The Steering Committee expectations lie within the terms of reference, and NRETAS staff have officially emphasised the limited positional power of committee members in order to minimise expectations for decision making. Despite these NRETAS efforts, committee members have reached consensus on significant initiatives to increase user impact on decision making. Those initiatives are also supported by the public outreach and opinion research. That consensus, its public support and the underlying value of sustaining Alice Springs for centuries are the major incentives for government to support the intent of the draft ASWRS.

Governance of operational-level decisions by local users is a key requirement for sustainable resource use. Because the town of Alice Springs depends for its existence on limited supplies of groundwater, the most important institutions are the rules determining the length of time the resource and the town will be sustained. There has been substantial difference on those rules between current decision-makers and current resource users supported by the intent of the National Water Initiative.

There is adequate capacity for Alice Springs to be a local decision making node in a polycentric resource governance system in the NT. However, the major challenge is that centralised decision-making processes need to be updated to enable local, adaptive decision making by appropriators as part of a polycentric system. The norms and reward systems differ between appropriators and regulatory/policy staff, so water shortages affect these groups differently and decision making is susceptible to individual opportunism that threatens shared sustainability. There is no set of rules for decision making for water allocation and use in Alice Springs. Relevant agencies are not fully accountable to local residents and to the resource, due to discretionary decision-making processes.

This study report has presented the complexity of managing common-pool resources such as water. The IAD framework helps local residents understand that complexity arises from the interactions among universal principles with diverse local contexts. Understanding those principles can help improve management of critical common-pool resources.

8. Discussion and lessons learnt

Alex Smajgl

Chapters 4–7 analysed institutional arrangements by applying the IAD framework to four case studies in the outback of Australia. This chapter takes a cross-comparative perspective and synthesises findings across the four case studies. In a second step the methodological perspective is discussed and the utility of the IAD framework for analysing institutional arrangements in Australia is analysed.

8.1 Cross-study synthesis

The discussion in Chapters 4–7 on case-study specific findings shows that four major findings are shared by at least three of the four case studies:

1. centralised power
2. discretionary power
3. decoupled rights and responsibilities
4. opaque information flows and lack of transparency in decision making.

In all four case studies it was noted that decision-making power was centralised and was located outside of the local community. Chapters 4–7 outlined case-study specific outcomes. In all cases the distance from administrative centres was a significant descriptor for the action arena while the communities' capacity to participate in decision-making processes varied across case studies. Field work in all cases pointed out that with increasing distances transaction costs rise. With low population densities (in three out of four case studies), it seems a likely response in an evolving governance structure to centralise decision making. The historical context provides an additional explanation, as the colonial past defined a governance scheme in a top-down approach – a feature that is commonly brought up by Desert Knowledge-related research.

The second finding common to three of the four case studies shows that the consideration of local knowledge and end-user perspectives in decision-making process as is considered in process-related rules. But such an involvement of the local community is mostly not mandatory. This defines a significant degree of uncertainty regarding potential involvement in processes on the collective choice and operational level for local communities, such as Alice Springs.

While the 'default' situation of decision making is centralised and involvement of local communities in decision making is discretionary, most of the case studies are charged with providing knowledge to external decision makers. All case studies show how such a high demand for information by external, usually government, agencies is perceived as a significant burden for the community. Facing these responsibilities in contributing to decision-making processes, communities are not given corresponding rights in making decisions.

The fourth shared finding in all cases is that local communities pointed out the lack of transparency in the decision-making processes. While local knowledge is demanded, the information flow is perceived as a one-way process, and reasons for decision-making outcomes are not clearly communicated. Stakeholders across case studies stated that it was unclear:

- how information provided by the local community was used
- what criteria would be or had been used by decision makers.

These shared findings led in all four cases to high levels of frustration in the local community. The perception of being disempowered seems to define, in some cases, a reinforcing cycle: the default situation of decision-making power is centralised, and local communities are responsible for contributing significant amounts of local understanding, while the right to genuinely participate in decision-making processes depends on the goodwill of higher tiers of governance. In cases such as Alice Springs community representatives were frustrated because of uncertainty on final decision-making processes, and, in cases such as Etheridge Shire, elevated levels of frustration led to disengagement due to resignation. In both cases the capacity of the local community to make decisions is reduced. Such a reduction of decision-making capacity reinforces the legitimisation of centralised decision-making rights as the default position. The case studies presented in Chapters 4–7 give the picture of an institutionally inferior situation. With such a potential for improvement, the strategy to invest in community capacity in order to break the reinforcing cycle is a promising option.

Three of Ostrom's design principles (Ostrom 2005) seem highly relevant in the context of Australia's outback:

- collective-choice arrangements
- minimal recognition of rights to organise
- nested enterprises.

The collective-choice principle specifies that the majority of individuals should be able to participate in installing new rules and modifying existing ones. As described above, all the case studies violate this principle. The second principle listed refers to the right to self-organisation by the community of resource users. Case-study results showed that the communities do not perceive such rights. The design principle referring to nested enterprises attempts to link knowledge with rights and responsibilities.

Considering research findings across the four case studies, these three principles seem most relevant, and applying these principles seems likely to lead to improvements in outcomes for institutional arrangements in outback communities. But these principles require local capacity to participate in institutional processes. While Alice Springs seems to have this capacity (coupled with a transience problem), all other case studies were characterised by varying degrees of limitations. In all four cases, levels of frustration are very high and a lack of positive learning experience by community members reduces capacity to participate in institutional processes. Thus, the key element appears to be investing in local capacity by pressing more genuine rights to this level.

8.2 The utility of the IAD framework

The IAD framework has been applied to case studies in at least 21 countries (Ostrom 1999, Ostrom et al. 1994). This level of application alone is a strong indicator of the impact the IAD framework has on applied institutional research. Applications of the framework cover the constitutional, the collective choice and the operational level (Chmielewski 1995, Lam et al. 1997, Ostrom 1986, Schlager 1990, Schweik et al. 1997). The framework proves to be applicable not just across tiers of governance and various countries, but is also applied to various natural-resource-use scenarios. Additionally, applications of the IAD framework offer material for a meta-analysis that aims to identify patterns, which leads to (1) an improved theory of common-pool resources, and (2) case-study independent principles (Ostrom 1990; Schlager 1990, 1994; Tang 1992).

A general assessment of the IAD framework or a comparative discussion regarding other frameworks (Edwards & Steins 1998, Oakerson & Walker 1997) lies outside the scope of this work. The aim of this research is to test the utility of the IAD framework in the Australian outback.

The discussion of the utility of the IAD framework is structured in four steps:

1. The exact boundaries of the assessment are defined, which is necessary as the IAD framework is comprised of varying components in published applications.
2. Assessment criteria are specified.
3. Limitations of the underlying case-study-based research are outlined.
4. The utility of the IAD framework is discussed, based on the Australian experience documented in this study.

8.2.1 IAD framework and its components

Discussing the efficacy of a tool requires specifying the exact extents of the tool, especially if the tool is used including or excluding various peripheral elements. ‘The framework’, as it is applied in literature, involves different elements. The conceptual model shown in Figure 1 is a central component, while:

- the definition of institutions
- the typology of rules (Ostrom et al. 1994)
- the multi-level framework (Kiser & Ostrom 1982)
- the grammar of institutions (Crawford & Ostrom 1995)
- the design principles (Anderies et al. 2003; Gibson et al. 2000; Ostrom 1990, 1992, 2005; Sarker & Itoh 2001; Wittayapak & Dearden 1999; Yandle 2002)

are not always subsumed as part of the IAD framework.

For the purpose of this analysis we take the framework to comprise the conceptual model (Figure 1), the definition of institutions, the typology of rules and the multi-level approach. Elements such as the design principles and the grammar of institutions are discussed separately.

8.2.2 Assessment criteria

Ostrom (1999) points out the difficulty of assessing the value of a framework and provides a set of nine assessment criteria:

- Does the framework provide a coherent language for identifying universal elements of theories attempting to explain an important range of phenomena?
- Does the framework help scholars identify the similarities and differences of diverse theories as well as analyse the relative strengths and weaknesses of theories in explaining particular types of phenomenon?
- Does the framework stimulate new theoretical developments?
- Does the framework help organise empirical research in those areas where well-specified theories are not yet formulated?
- Does empirical research drawing on the framework lead to new discoveries and better explanations of important phenomena?
- Can the framework be applied to multiple levels of analysis in empirical research?
- Does the framework encourage integration across other disciplines?
- Is the framework consistent with other frameworks initially developed to focus on a particular level of analysis
- Does the framework perform better than others in a similar range of applications?

Instead of attempting a general assessment of the IAD framework this study is focused on four criteria, which in parts constitute requirements for cross-comparative analysis:

1. Is the framework sufficiently general to be used across diverse contexts, levels and issues?

2. Is the framework sufficiently precise to provide clear guidance in order to allow cross comparability?
3. Does the framework add analytical value?
4. Is the framework compatible with other methodologies?

The first criterion demands a generic character in order to provide a tool that is useful for various situations. Such a characteristic is the foundation for cross-case-study analysis, which would allow empirical research to feed back into theoretical understanding of institutional arrangements. A good example for such meta-case study learning are the design principles (Gibson et al. 2000, Ostrom 2005).

The second criterion reflects on the difficulty of applying frameworks in an empirical context and, more importantly, on the potential for inadequate precision. While a framework can be useful for a specific context with a specific research team, results would have to be repeatable by other research teams in the same context. The contextualisation of the reality of a situation provided by a framework would need to be precise enough to guide researchers with various backgrounds in order to achieve a comparable application.

The specification of the third criterion depends on the research focus. Generally, four types of contribution can be linked to an institutional analysis:

1. A structured description of status quo
(What do we face?)
2. A cross-comparative analysis
(What can we learn by comparing two or more case studies?)
3. Development of potential solutions for the relevant context
(What could we do?)
4. Analysis of potential consequences of options for institutional changes
(What if we did what we could do?)

Following Ostrom (1990, 2005) the core application area is the initial understanding of a situation from an institutional perspective. This excludes questions 3 and 4 from the core application domain of the IAD framework. Therefore, the assessment is mainly performed against the background of questions 1 and 2. Within this domain of research questions, the value of a framework depends on how it adds value to the analytical understanding. It can be assumed that a framework has a higher value if it helps to reveal aspects that are not obvious.

While the focus of the IAD framework analysis is research questions of type 1 and 2, a framework can add value by being compatible with other methodologies that endeavour to answer research questions in 3 or 4. This compatibility is thus defined as a fourth criterion for discussing the utility of the IAD framework.

8.2.3 Research limitations

The following discussion of the utility of the IAD framework has to be put into perspective, as the research documented in Chapters 4–7 faced a range of limitations.

Firstly, the research teams were not extensively prepared how exactly to apply the IAD framework. Instead, every team developed between their researchers a coherent understanding of the framework within that specific team. Over a period of one year, two meetings were used to discuss the understanding of the IAD framework and Ostrom et al. (1994). This was used as a common platform for defining terminology of the framework.

Secondly, all four teams applied the IAD framework for the first time and did not bring previous experience with the framework into the case study. This led in some cases to a ‘retrofitting’ approach; while the framework was discussed, field work was undertaken loosely. Therefore, in some sections case study descriptions read as if the results were retrospectively fitted to the needs of the framework.

Thirdly, the cross-comparative intention was based on a case study approach, selecting two case studies in Queensland and two case studies in the Northern Territory, of which one in each state is located in a savanna region and one in a desert region. Figure 18 shows how an institutional and a bio-physical gradient form the informational basis of the case study selection process. This approach opened the possibility for comparing institutional arrangements and their outcomes, (1) based on similar bio-physical conditions but different rules in use; and (2) based on similar rules in use but different bio-physical conditions of outback communities. In other words, outcomes could be explained by biophysical variables framing the action arena or by institutional attributes.

Community attributes defined according to the IAD framework provide a third set of discriminatory variables. Inherently, the cross-comparative case study approach assumed certain homogeneity of outback communities or assumed a lower explanatory power of community attributes. The case study results show that all four case studies fall into the category of remote outback communities, but that community attributes make their diversity significant and relevant to policy recommendations.

This additional dimension underlines the limitations of this project based on four case studies. Instead of a comparative analysis based on the findings of the IAD framework, the diversity of contexts provided a heterogeneous set of findings.

Fourthly, during various phases of field work, stakeholders influenced the action arena. For instance, in the Etheridge Shire case study the initial choice of the case study region was triggered by a representative of a tourism association whose interest is the development of tourism activities around Georgetown. The scoping study revealed that most local community members do not perceive limitations on tourism-related issues. Instead, the action arena was defined around social cohesion, road infrastructure, education, succession and involvement of the local community in governmental planning and decision-making processes. Therefore, power relationships of different stakeholders and the resulting dynamics created potential for serious impediments in applying the IAD framework.

These four aspects define critical limitations of the research approach and have to be taken into account when discussing the utility of the IAD framework in the Australian case studies.

8.2.4 Utility of the IAD framework in outback case studies

For the outback context, experiences with the IAD framework are mixed. Regarding IAD terminology, the documented four case studies applied the ‘conceptual model’ based on the definitions of institutions and the typology of rules. In the Etheridge Shire case study, the IAD framework was applied to the operational level with strong links to the collective-choice level. In the Daly River case study, the IAD framework was applied to the collective choice level and the operational level with some focus on the link between these two levels. The Diamantina Shire case study, as well as the Alice Springs case study, applied the framework to the collective choice level and framed the analysis in the relevant constitutional context. Additionally, these two case studies applied the IAD framework and the institutional design principles.

The research process involved stakeholders in all four cases, as each case study aimed to improve the understanding of the institutional arrangement. Team members shared their experiences in workshops that were held during and after applying the IAD framework.

8.2.4.1 Applicability of IAD framework across diverse issues and levels

The experience documented in Chapters 4–7 indicates that the IAD framework is sufficiently general to be applied across diverse issues and levels. The case study reports involved four research teams working in very different contexts. Table 17 gives an overview of the context and level of applications of the IAD framework. Responses from the four research teams were very positive regarding the clarity and suitability of the framework. The terminology used by the framework was perceived to be coherent and easy to understand across the four case studies. Based on these characteristics, teams were able to effectively communicate about their research goals and research plans.

Table 17: Overview on applications of IAD framework

Case study	Context	Level of IAD framework application			Design principles
		Operational	Collective choice	Constitutional	
Etheridge Shire	Land use	Focus	Considered		
Diamantina Shire	Water use		Focus		Explicit
Daly River	Water use	Considered	Focus		
Alice Springs	Water use		Focus		Explicit

The results from the land-focused application (Chapter 4) of the IAD framework are limited, but drawing the conclusion that the IAD framework is not suitable for such a focus is unjustified. Instead, the results emphasise a well-specified action arena as a crucial prerequisite to apply the IAD framework. The dynamics of this specific case study created sub-optimal circumstances: the stakeholder-driven process defined the first focus as institutional barriers to land-use change or multiple land use options, particularly tourism opportunities, in a currently grazing-dominated context. However, the local community classified this first narrow definition of the action situation as inappropriate and driven by a minority of stakeholders. Chapter 1 explains the action arena as having a broad context of land use and land management with some links to water use.

Clearly identifying ‘the problem’ in the given context is a necessary prerequisite for applying the IAD framework. Contextualising, for instance, exogenous variables depends on a precise definition of the action arena. If the definition of the action arena changes during or after data gathering, field work interview material that has been collected is likely to miss the focus of the framework application. Obviously, this concern describes a methodological prerequisite and not a weakness of the methodology itself.

8.2.4.2 Precision of the IAD framework

While researchers emphasised the clarity and accessibility of the framework, the actual documentation of case study applications (Chapter 1–7) shows significant diversity of interpretations. The conceptual building blocks of the IAD framework are interpreted quite differently. Researchers involved in the four documented case studies argued that the stakeholder-driven process required a context specific interpretation of framework terminology. Chapter 1–7 shows that, comparing the four case studies, similar field work results were placed under different components of the framework. For instance, while one team placed aspirations of stakeholders under ‘patterns of interaction’, similar material is listed in another case study under ‘outcomes’ or ‘participants’. Similarly, agreements between negotiating partners are in one case study identified as an ‘outcome’ while in others as a ‘pattern of interaction’.

Such a degree of freedom in applying the IAD framework shows that the potential for comparing case studies based on the same framework is not straightforward. While the IAD framework proved from a case study perspective to be very effective (see Chapter 1), the cross-case-study comparison faces the problem that correlations between two or more system components (based on the framework) cannot

be drawn easily. It is very likely that a stricter coordination of the four research teams in regards to aligning the exact understanding of the framework components would have improved the cross-comparative potential.

If, for instance, an observed ‘attribute’ leads across case studies to specific ‘patterns of interaction’, lessons could be drawn for the Australian context. Also, if certain ‘patterns of interactions’ can be observed across case studies, then how ‘outcomes’ vary would inform practitioners and researchers.

Researchers across case studies recognised the limitations for comparative analysis due to the interpretational freedom. In response, the IAD framework was discussed as being too theoretical and that it was suggested that a user manual would help make applications comparable. It remains open as to whether such a step would keep the framework flexible and generic enough to be applied to various contexts.

According to this discussion, interpretational degrees of freedom in applying the IAD framework limited the analysis across case studies. Nevertheless, as section 8.1 summarises, lessons across case studies were identified. Thus, the application of the IAD framework allows the identification of contextual research findings that can be used in a comparative approach although conceptual components are used differently. This capacity and the given limitations lead to the question about how the framework adds analytical value beyond pointing out obvious characteristics of the analysed situation.

8.2.4.3 Analytical added-value of the IAD framework

Tools and methods can be evaluated in regards to the value they add to a research process. If research findings were not obvious at the beginning of a research project and a framework helped reveal these results, the analytical value added by the approach is significant.

In order to capture the value adding of the IAD framework, discussions with the research teams were held prior to field work and after field work was finalised. The discussion was facilitated by two cross-case-study workshops, phone calls and emails. Findings listed in Chapters 4–7 were identified and discussed very early in the process, even prior to the application of the IAD framework. In particular, the understanding of research teams that decision-making power is centralised and discretionary was identified prior to applying the IAD framework. This might suggest that the IAD framework adds a low level of analytical value to the research process and that its strength lies in structuring the descriptive stages of the research.

Discussions revealed that such a conclusion cannot be made, as in all cases research teams formed an early opinion on *causality* in a given context. For instance, the centralisation of power as a driver for outcomes that are not highly valued by local stakeholders was identified as an ‘institutional problem’ across case studies. However, the IAD framework ‘forced’ researchers to run through all relevant system variables instead of jumping to conclusions. This allowed, for instance in the Etheridge Shire case study, the discovery that exogenous variables such as community attributes did not provide the requirements for decentralising decision-making rights.

Similarly, scoping work for the Etheridge Shire case study led to early expectations by the research team regarding institutional causality. Triggered by a few stakeholder contacts, the link between existing property rights regimes and limited degrees of multiple use shaped the action arena. Applying the IAD framework to the institutional context of Etheridge Shire revealed that such an assumption has to be put into perspective. Therefore, the framework added analytical value to the research undertaken by forcing researchers to think carefully about institutional causality.

This shows clearly that the power of the framework in guiding researchers (despite the level of interpretational freedom they retain) leads to significant analytical properties of the IAD framework. By forcing researchers to capture ‘the bigger picture’, *causality* is based on a broader foundation, which potentially increases the validity of the research undertaken.

8.2.4.4 Compatibility with dynamic methodology

Section 8.2.3 identified that the assessment of the IAD framework depends on the purpose of its application. Four types of contribution are listed and the discussion above is based on questions 1 and 2. Research questions of type 3 aim for institutional solutions, which can be based on understanding the context (i.e. by applying the IAD framework) and, for instance, on the design principles. Chapter 1 shows that the framework and the design principles together provide an effective toolbox for identifying promising avenues of institutional change.

Two of the case studies documented above show the requirement of what-if capacity in the institutional context. The Daly River region faces the question about consequences of a market for tradable water quotas. The Etheridge Shire context included strategies already identified by stakeholders.

Such a requirement to scope out potential impacts of institutional changes was a challenge for the IAD framework. The static-comparative properties of the IAD framework limited its effectiveness in a dynamic research context. However, linking the structuring value of the framework to animating methods such as agent-based modelling proves to be a promising approach, especially if current weaknesses of agent-based modelling regarding capturing contextual factors are balanced by using, for instance, field experiments.

The game-theoretical characteristics of the IAD framework (Ostrom et al. 1994) requires a clear definition of players relevant to a situation. This meets fundamental requirements of quantitative modelling approaches such as, for instance, agent-based modelling. Similarly, the differentiation between exogenous and endogenous variables defines an advantage that feeds into an additional modelling step.

Experiences during the two case studies that involved agent-based modelling emphasised that defining the methodological approach early in a research process allows fine tuning of field work. While the general approach of the IAD framework allows an agent-based model to be defined adequately, the calibration of such a model in regards to individual strategy choices, motivations and cognitive processes demands an additional level of specification. However, the framework has proven to be highly compatible with agent-based modelling as a specific means to animate institutional arrangements in what-if scenarios.

9. Implications and recommendations

Anne Leitch

9.1 Underlying design principles and research findings

The previous chapter looks at a synthesis of findings across the four case studies, as well as the application and utility of the IAD framework (summarised in Table 18). It was noted in these case studies that there are four common major findings that are contributing to high levels of frustration in the local community: centralised power; discretionary power; decoupled rights and responsibilities; and opaque information flows and lack of transparency in decision making. Thus frustration reduces the capacity of the community to be involved in the decision-making process, and so the perception of being disempowered becomes a self-reinforcing cycle. Additionally, there is a default situation of centralised decision-making power, yet local communities do not have the right to genuinely participate in decision-making processes even though they are responsible for contributing significant amounts of local understanding.

The previous chapter also identifies three of Ostrom's design principles that seem highly relevant for the context of the Australian outback:

- **Collective-choice arrangements** which specify that the majority of individuals should be able to participate in installing new rules and modifying existing ones. The research found that all the case studies violate this principle.
- **Minimal recognition of rights to organise** which refers to the right to self-organisation by the community of resource users. The research found that the communities involved in the study do not perceive such rights.
- **Nested enterprises** which attempts linking knowledge with rights and responsibilities. All case studies had limited value placed on local knowledge and limited two-way flow of information and power.

Here we discuss the implications of these research findings and the application of these three principles for policy makers, natural-resource managers and researchers to improve the outcomes of institutional arrangements in outback communities.

Table 18: Linking the findings to Ostrom's design principles

Finding	Relevant to case study	Relevant design principles
Inadequate consultation principles and processes	Diamantina Shire Alice Springs Katherine Daly	Collective-choice rules Boundary rules Information rules Recognition of rights to organise
Lack of capacity and/or interest to be involved – Lack of positive learning experience by community members	Etheridge Shire	Collective choice rules
Same people 'wearing many hats', resulting in community burn-out	Diamantina Shire Etheridge	Information rules
Concern over fairness and lack of conflict resolution mechanisms	Diamantina Shire Alice Springs Katherine Daly Etheridge Shire	Proportional equivalence between costs and benefits Graduated sanctions
Minimal recognition of role of community in understanding and managing their resource	Diamantina Shire Alice Springs Etheridge Shire	Recognition of rights to organise Boundary rules Collective-choice rules
Low capacity to monitor the resource or its users	Diamantina Shire	Monitoring Boundary rules Collective-choice rules
Lack of accessible useful information or shared information exchange of (and respect for) 'expert' knowledge	Diamantina Shire Etheridge Shire Alice Springs Katherine Daly	Information rules Recognition of rights to organise Choice rules
Incomplete baseline Information about resource	Alice Springs Diamantina Shire Katherine Daly Etheridge	Boundary rules Monitoring Information rules
Changing attitudes to water – regionally (and nationally)	Diamantina Shire Alice Springs Katherine Daly	Payoff rules

9.2 Implications and recommendations

9.2.1 Institutional change to devolve centralised power

In all four case studies it was noted that decision-making power was centralised and located outside of the local community. The centralised governance structure has arisen as a combination of a colonial past in combination with a dispersed and low population spread over large distances. Public participation relies on institutional goodwill that potentially can be withdrawn. This situation has been exacerbated by communities having a variable capacity to engage in decision-making processes.

For all case studies the centralised power is reinforced by the constitutional-choice level, which plays an important role in how the collective choice-level is constrained or enabled. For example, the Northern Territory defined the *Water Act 1999* with the Department of Natural Resources, Environment, the Arts and Sport (NRETAS) as the relevant governmental entity in the Northern Territory. The constitutional-choice level institution, such as the Northern Territory *Water Act 1999*, allows public participation in water resource planning and decisions at the discretion of the minister or the controller of water (Environmental Defender's Office 2005). With their goodwill, participation can be used to promote involvement of citizens in developing a water resource strategy. However without institutional support, that goodwill can be withdrawn.

One suggestion is that polycentric governance could offer an alternative institutional arrangement. In the early development of the IAD framework in the 1950s, Vincent Ostrom and colleagues developed the concept of polycentricity in response to the trend toward centralisation of government for presumed efficiency. He argued that differentiated authorities and jurisdictions defined a polycentric order ‘as one where many elements are capable of making mutual adjustments for ordering relationships with one another within a general system of rules where each element acts with independence of other elements’ (Ostrom 1972:21). A key attribute of polycentricity is the capability of individuals to ‘organize elements in a polycentric order, initiate self-enforcing arrangements and alter basic rules’ and governance can occur ‘so long as no single set of decision makers is able to gain dominance over all decision-making structures ... A polycentric political system will be one where each actor participates in a series of simultaneous games and where each act has the potential for being a move in simultaneous games’ (Ostrom 1972:21).

One key finding is that the diversity of rules is so vast that ‘those most directly affected can use trial and error (as well as limited design) to adapt rules over time ... rather than relying entirely on analysis and searching for optimality’ (Ostrom 2005:28).

Piecemeal improvement of the system can help, but for long-term sustainability, the whole institutional system needs to be improved. A functional institution such as an empowered advisory group, as suggested by the Steering Committee of the Alice Springs Water Resource Strategy, is a good start towards a local node in a polycentric governance of water allocation and use in Alice Springs. Such empowerment would require institutional changes to make rule changes pertinent to water management in Alice Springs.

Recommendations

Policy makers	Managers	Researchers
Consider a suite of constitutional and institutional changes to decentralise power. This requires long-term collaboration of all groups within a region.	Support development of a functional regional institution to coordinate negotiated solutions to regional problems.	Conduct research into the influence of individuals (and their mental models) in decision making and institutional change.
Assess political feasibility in developing transferable, enforceable and tradeable private property rights and in minimising government intervention.	Support communities to be able to handle increased decision making through supporting, monitoring and providing feedback on capacity-building initiatives.	Undertake participative research to determine how communities can move from a piecemeal institutional system to one that is holistic and strategic.

9.2.2 Improve local capacity to participate

It is important for effective resource management in the Australian outback that the majority of individuals who are affected by the resource regime are authorised – through policy and on-ground support – to participate in making and modifying rules. Most of the resource users should be able to be involved in the process of making and modifying the rules, should be able to respond to changing local circumstances and design locally-meaningful rules. Discretionary decision making by a few stakeholders tends to benefit only those involved. Often public involvement is limited to consulting and informing citizens about the actions of government. A match between duties and rights is cited as a factor that supports the robustness of common-property regimes (Ostrom 2007).

As decision-making powers are distributed more widely among stakeholders, there is a requirement for effective and equitable engagement processes that produce genuine collaborations among stakeholders who represent different community interests within regions. There is also an important need to ensure that those who have a direct or indirect stake in the resource actually have the opportunity to be involved and are not excluded by thoughtless design of processes.

Also, if the ‘rights to organise’ are not respected a selection bias can be introduced depending on who sets up the engagement and how they identify and invite stakeholders.

The key element appears to be investing in local capacity to accept rights in institutional processes. Currently this is not the case for either the Northern Territory or Queensland case studies. For example, in the Diamantina Shire there was little structure around the requirements for the consultation process of the Water Resources plan, concerns were expressed by stakeholders about the level of consultation and it was suggested that the consultation, process should be reviewed.

Similarly, in the Alice Springs case study one of the major challenges was uncertainties that arose from the limited responsibility of the Steering Committee to draft a strategy without the right to make the final decision to implement it, and threats from the power differentials among members of the committee. In the Katherine Daly – also under the Northern Territory *Water Act 1999* – the Aboriginal Reference Group (ARG) and now the Daly Region Management Advisory Committee (DRMAC) are charged with the responsibility to advise the NT Government on a range of issues relevant to the Katherine – Daly region, including water allocation, but they do not have the legal right to make any decisions.

A related issue is the assumption that different individuals or groups involved in engagement will have equivalent capacity to represent their constituents. This is not always the case; for example, in Alice Springs it was noted that the degree of public representation varied substantially among the members of the steering committee.

Design processes could include consideration of:

- who is involved and their roles
- who else should be involved
- their representativeness and capacity to be representative
- the information required and its accessibility (in terms of understanding as well as availability)
- clarity over the extent of control or level of influence participants are able to have over the process and outcomes
- detail of linkages between actions and outcomes – remembering that these may not always be either obvious or straightforward
- consideration of capacity (ability, resources, time required) for outcomes to be implemented
- consideration of how often this situation is likely to be repeated (once, a specific number of times, or indefinitely).
- outlining how costs and benefits are described and analysed.

Recommendations

Policy makers	Managers	Researchers
Ensure clearly defined resource boundaries based on credible and reliable science to establish a threshold level to signal what the environmental targets are for all resource users. Clarify roles and ensure transparency of operations of controlling bodies. Develop policies that legitimise the role of the community. Develop and facilitate capacity-building programs (for the individual, groups and institutions) within the community that build community leadership, capacity, skills and inclination to stay and contribute to the community. Base capacity-building programs on a 'soft systems' approach that recognises the roles of a wide range of players and different types of knowledge and expertise, not only scientific or technical knowledge. Develop and implement (fund) capacity-building activities that recognise value, and accommodate people's differences, including different values and aspirations, e.g. strategies to build the capacity of key individuals (i.e. leadership) as well as key stakeholder groups. Develop community engagement processes tailored for conditions of the Australian outback (see design process above) – most regions have large travel distances and low population density.	Support resource users to come to a wide agreement about the nature and extent of the resource and about the environmental target. Build networks among resource users to increase trust and facilitate information sharing around data, processes and best practices Support all sectors within regions to develop their own planning and management capacity Support all sectors to develop their own capacity-building strategies and identify their own skill and training needs Provide clear and timely information to all residents of the Shire about relevant institutional arrangements and the impacts of and opportunities arising from changes in legislation. Improve the on-ground practices of state agencies in providing information and services Improve local opportunities for vocational training, schooling and employment. Support programs that facilitate provision/access to broadband internet.	Provide reliable, accurate and accessible information on resource boundaries and limits Provide information and trial new ideas for institutions and processes that support remote and sparsely populated communities to effectively manage their resources Support development of new conceptual models for incorporating social and economic information around measuring capacity for change of communities within regions. These can inform regional negotiation processes as well as assess the impact of policy change Important focus for future research is moving from analysis of components of the institutional systems to the analysis of the links, dynamics and drivers between the components. Develop understanding of how instruments such as market-based instruments could influence pastoralists' abilities to manage their land for production and conservation outcomes.

9.2.3 Improve transparency of the decision-making process

The exchange of information both to inform the process and to engage resource users is often variable, and the size of the resource pool is an important determining factor. However, it is generally important that the rules surrounding information provision are formalised to generate a 'fair exchange', adequate and accessible information, as well as trust in the information-exchange process.

While the 'default' situation of decision making is centralised and involvement of local communities in decision making is discretionary, in both Queensland and Northern Territory case studies the local citizens are responsible for providing local information and knowledge to externally located decision makers. All case studies show how such a high demand for information is perceived as a significant burden: local knowledge is demanded yet the information flow is perceived as a one-way process, and the reasons for decisions are not clearly communicated.

What is needed to help focus future interactions is improvement in the transparency in the decision-making processes as well as feedback about how the information provided by the local community is used, and what criteria are used by decision makers.

Recommendations

Policy makers	Managers	Researchers
Link policy making with local knowledge and science which would support development of more acceptable policy options as well as robust monitoring programs. Provide feedback about how the information provided by the local community was used as well as what criteria would be, or had been used by decision makers. Develop an information 'hub' to support implementation of legislative and institutional responsibilities.	Work with local community to determine appropriate and acceptable exchange of information/communication Develop information bases that are bottom-up and recognise community knowledge. Provide accessible and appropriate information for use by the community and managers for decision making. Ensure a reporting system that establishes a clear link between land management actions and resulting environmental outcomes. Build networks among resource users to increase trust and facilitate information sharing around data, processes and best practices. Employ a range of communication processes to ensure that those not directly involved in the process are kept informed of progress and have the opportunity to become involved.	Investigate impact of information flows on: • levels of participation of community members • sustainable outcomes • management practice.

9.2.4 Improving fairness of the process

It is important for the process and outcomes to be viewed as fair by participants. Fair systems – or systems that are perceived to be fair – tend to have better participation and appear to produce well-maintained and sustainable resources (Travick 2001, Trosper 2002). When participants view interactions as unfair, they may change their strategies even when they are receiving positive outcomes (Fehr & Gächter 2000).

Relating user inputs to the benefits they obtain from the resource is a crucial element in establishing, and being seen to establish a fair system, or a system that is perceived to be fair.

For example, in the Diamantina Shire the cost benefit of the proposed ratio of the newly proposed rules is one of the concern points for the community. The concern is that a balance of the costs – both to the resource users through the purchase of water and the wider community through the loss of related water services – and the benefits – might be difficult to achieve under new rule conditions. Benefits are seen to be both private (to the resource users via sale of produce) and public (to the community via creation or addition of employment, for example). Similarly in Etheridge Shire, many respondents believed that there was increased pressure to perform stewardship roles for their land but little support to do so, which meant that the benefits of their hard work were generally enjoyed by urban and city people.

In contrast, in the Northern Territory case studies the complexity of the situation means that it is difficult to accurately determine the true costs and benefits and how they will accrue for public and private advantage. In Alice Springs for example, the rules related to fully-subtractible resources must be based on discounting to optimise the resource extraction. Inputs related to money are hidden by subsidies, making accurate decision making impossible. As a result, the values of inputs are disconnected from resource valuation, which raises the question: how do you accurately value 10 000-year-old water? It can be by market forces, but there is no real market; water in Alice Springs is used as an incentive to attract and retain people from other ecoregions, which is a form of contingent valuation. One method for accurate pricing may be to place the resource on a continuum of age and renewability with the costs of other water supplies in Australia. In addition, the Steering Committee considered that there is no accurate information about resource availability to determine allocation. Valuation of water is based on the discretion of the Controller of Water; there is no market or other valuation based on cost benefit to users. In addition, lack of information renders many costs invisible or biased by discounting.

Recommendations

Policy makers	Managers	Researchers
Develop policy processes that appreciate values of all stakeholders, especially local stakeholders.	Make hidden costs subsidies more transparent to the public/local stakeholders.	Develop methods for accurate pricing of water. Better understand changing attitudes, including increasing demands for higher financial returns from water use as well as increasing demands for higher social, ecological and cultural benefits from water. Further investigation is needed about how these goals can be achieved in parallel, as well as the individual and societal costs and benefits (and distribution of these) associated with these goals.

9.2.5 Ensure processes can accommodate a variety of viewpoints and can manage conflict

Ideally, an atmosphere of trust – one that accommodates a diversity of viewpoints – will support users to develop adaptive and sustainable institutions. However, conflict is to be expected at some level, and so access local, rapid and low cost conflict resolution mechanisms is highly beneficial for clarification of the rule interpretations and maintenance of trust.

Structuring negotiation over resource allocation problems can reduce potential regional conflict almost immediately and can facilitate the incorporation diverse viewpoints and help manage conflict.

Currently in the Northern Territory, the operational-level water allocation and usage rules desired by citizens do not exist. Therefore, the conflict is between citizens and the collective-choice rules. Resolving those conflicts has high transaction costs for users, because those rules are difficult to access and are technically complex, and access to decision makers to address conflicts at that level is only through a series of gatekeepers, such as lengthy bureaucratic processes. Citizens are concerned about the lack of usage rules, which promotes highly variable usage among individuals that conflict with their shared interest in a sustainable resource. Usage rules are strongly desired that apply to all users and licensees.

In Queensland there is also the potential for conflict to arise over the resource – either between different stakeholders bidding for the same resource, or between applications and administrator – for example, in the Diamantina Shire there are currently no specific conflict resolutions mechanisms in the draft GDROP (Larson 2006).

Recommendations

Policy makers	Managers	Researchers
Ensure provision for structuring negotiation over resource allocation problems, as this can help incorporate a range of aspirations and viewpoints and reduce conflict. Set up networks and processes for transparency and responsiveness on the part of government to create trust and long-term relationships which would benefit individuals, communities and institutions with an interest in the region.	Develop processes that will accommodate diverse viewpoints. Provide a range of facilitation skills, techniques and processes to support negotiation and capacity building. Support networks and processes for transparency and responsiveness on the ground in the region to create trust and long-term relationships which would benefit individuals, communities and institutions with an interest in the region.	Develop process technologies and decision-support tools that can be used to structure negotiation and are applicable to a wide range of natural resource conflicts.

9.2.6 Ensure accessibility of information

Communication processes, which relate to the exchange of information both to inform the process and to engage resource users, are often variable, and the size of the resource pool is an important determining factor. However, it is generally important that there are formal channels for communication as well as informal channels, in order to generate adequate and accessible information as well as trust in the process.

Typically, in smaller systems information exchange is informal, which may or may not be sufficient. Given the relatively few actors in a small system (especially given the frequently large geographic dispersal in the outback) too much information, or information provided in inappropriate ways, may also ‘burn them out’ in terms of the level of engagement or volume of information they may be required to process.

For example, Etheridge residents had difficulty accessing information and it was often stated that you had to be ‘in the know’ to be informed about changes and impacts in relation to institutional arrangements. Additionally, government agencies were seen as increasingly disconnected from the community, with government language in particular identified as a factor contributing to the lack of mutual understanding and implementation of vital institutional arrangements.

Recommendations

Policy makers	Managers	Researchers
Better link local knowledge and science with policy making, which would support development of more acceptable policy options as well as robust monitoring programs.	Ensure communication is formalised to generate adequate and accessible information as well as trust in the process. Work with the local community to determine appropriate and acceptable level of exchange of information and communication.	Coordinate and engage with the needs of the community in mind and to generate research findings that meet their needs yet do not ‘burn out’ the local community.
Policy documents need to be available in plain language: terms used should be simple and clear and, where necessary, the relationship between terms explained.	Provide accessible and appropriate information to support decision making.	
	Ensure that information provided is in an accessible format and language with minimal jargon.	
	Build networks among resource users to increase trust and facilitate information sharing of data, processes and best practices.	

9.2.7 Recognise the local context

The outback context generally means low populations and broad geographic spread. It can also have implications for the types of personalities that live in these regions and how they are able to engage and implement policy: people who live in isolated regions may have a different capacity and response to engagement processes. Relative remoteness can also result in lack of baseline data.

Recommendations

Policy makers	Managers	Researchers
Be aware of potential ways in which outback regions may function differently from ‘more settled’ regions where most policy is made and tested.	Capacity building and skill and training analyses need to be tailored to suit regional situations, not based on a one-size-fits-all approach.	Provide baseline data through long-term commitment and investment by researchers and their funders.
	Provide resources to participants to engage in the process (e.g. reimbursement for travel, time to participate and also to conduct representative activities)	
	Aim to minimise transaction costs of monitoring, gathering and exchanging information, and enforcement, when compared with the potential benefits gained.	

9.2.8 Establish effective monitoring

For robust governance, there firstly needs to be some clear guidelines for resource allocation and usage, and secondly some mechanism to enforce these rules, and when necessary, to inflict sanctions. Monitoring of the resource users in some direct or indirect way is crucial to ensure compliance. Monitoring of the resource itself is also crucial to ensure its long term sustainability.

The collective-choice level provides a useful level for monitoring the overall system: the functions of appropriation, provision, monitoring, enforcement, conflict resolution and governance need to exist at the local level with user control, and it is best if the monitoring of the effectiveness of that process is at the collective-choice level.

However, effective monitoring needs to be a two-way street. As well as government commitment and input, there also needs to be a ‘leap of faith’ by the local community, which needs to support and engage the monitoring program, which requires investment in relationships to build trust and increase capacity.

For stakeholders in the Diamantina Shire, monitoring is one of the key concerns, as the draft plan outlines a number of specific types of data to be collected and how these should be used to support assessment and monitoring of the resource condition (Larson 2006). However, the plans do not include operational details for monitoring, such as budgets and responsibilities.

Currently, in Alice Springs NRETAS monitors only major violations in licenses, while other monitoring is by users who are accountable only to themselves. These practices are based in part on a history of uncertain data on the water supply, and in part a desire to maintain a public image of ‘abundant water’ to attract industry.

Beyond monitoring the resource use and users, there also needs to be a gradual increase in the severity of sanctions imposed on rule breakers. Typically, this escalates from a minimal one, for example a warning with no costs attached for first time rule breakers, through to severe ones that lead to fines and/or loss of access to the resource.

Graduated sanctions are important to involve most users in conditionally cooperating with low-level informative rules, such as monthly reports comparing household water usage. They are then motivated to monitor other users’ behaviours, and to support restrictions against major licensees.

For example, in Alice Springs citizens (through DesertSMART) want conservation-related sanctions on water usage, and are willing to follow those rules if they are enforced fairly; however, appropriators currently violate existing rules because enforcement is costly.

However, in Etheridge Shire, residents perceived that actions by a few ‘cowboys’ has meant that there has been greater control exerted by government resulting in a greater presence and enforcement of policies and regulations through reforms of existing land and natural resource management institutional arrangements.

Recommendations

Policy makers	Managers	Researchers
Ensure early development of a comprehensive and negotiated monitoring system to enhance trust and improve perceptions about agencies’ ability to equitably and efficiently manage the resource. Ensure regulatory agencies have jurisdiction to monitor and audit compliance and enforce individual breaches.	Apply the precautionary principle and greater integration of local knowledge. Set up monitoring schemes that are effective, transparent, consistent and credible to all participants and can be implemented. Ensure a reporting system that establishes a clear link between land management actions and environmental outcomes. Ensure there are effective incentives that support local participation in monitoring schemes. Ensure these incentives are well communicated and transparent.	Collect essential baseline data on which to base monitoring plans. Design and test monitoring schemes that are effective, affordable, transparent, consistent, credible and can be implemented. For some regions, several operational-level questions still need to be investigated for effective implementation of the Water Resources plan, such as ‘How will compliance be achieved?’ and ‘Will the applications of sanctions be effective?’

References

- ABS. 2004. *Etheridge*. Australian Bureau of Statistics. Available at: <http://www.google.syndicatedsearch.com/u/AustralianBureauOfStatistics?q=etheridge&domains=abs.gov.au&sitesearch=abs.gov.au>
- ABS. 2006a. 'Australian deserts, Climatic aspects deserts,' in *Year Book Australia. 2006*. Australian Bureau of Statistics. Canberra.
- ABS. 2006b. *Regional population growth, Australia*. Catalogue No. 3218.0. 2004–05. Australian Bureau of Statistics. Canberra.
- ABS. 2006c. *Census of Population and Housing: Selected Education and Labour Force Characteristics for the Statistical Local Areas, Queensland 2001*. Australian Bureau of Statistics. Available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2017.32001?OpenDocument>
- ABS. 2007. 'Basic Community Profile: Postal Area 0870', in *2006 Census Community Profile Series*, ABS, Canberra.
- AdvanceCairns. 2004. *AdvanceCairns 2004 Business Plan*. AdvanceCairns, Cairns.
- Agforce. 2007. *Agforce Queensland: Advancing Rural Queensland*. Agforce. Available at: <http://www.agforceqld.org.au/>
- Agrawal A. 1994. 'Rules, Rule Making, and Rule Breaking: Examining the Fit between Rule Systems and Resource Use.' In E Ostrom, R Gardner & J Walker (eds.) *Rules, Games, and Common-Pool Resources* (pp. 267–282). University of Michigan Press. Ann Arbor.
- Anderies JM, Janssen M and Ostrom E. 2003. 'Design Principles for Robustness of Institutions in Social-Ecological Systems.' In *Joining the Northern Commons: Lessons for the World, Lessons from the World*. Anchorage, August 17–21.
- Begg GW, Van Dam RA, Lowry JB, Finlayson CM and Walden DJ. 2001. *Inventory and risk assessment of water dependent ecosystems in the Daly basin, Northern Territory, Australia*. Supervising Scientist Report 162. Supervising Scientist. Darwin.
- Blanch S, Rea N and Scott G. 2005. *Aquatic Conservation Values of the Daly River Catchment, Northern Territory, Australia, 211 WWF-Australia*. Charles Darwin University and the Environment Centre NT. Darwin.
- Blomquist W. 1992. *Dividing the Waters: Governing Groundwater in Southern California*. ICS Press. Oakland.
- BoM. 1988. *1301.0 – Year Book Australia*. Australian Bureau of Statistics. Available at: <http://www.abs.gov.au/Ausstats/abs@.nsf/Previousproducts/Feature%20Article151988?opendocument&tabname=Summary&prodno=1301.0&issue=1988&num=&view>
- BoM. 2005. *Climate Data Online*. Australian Bureau of Meteorology. Available at: <http://www.bom.gov.au/climate/averages/>
- Bortolussi G, McIvor G, Hodgkinson JJ, Coffey SG Holmes CR. 2005. 'The northern Australian beef industry, a snapshot: 1. Regional enterprise activity and structure.' *Australian Journal of Experimental Agriculture* 45(9): pp. 1057–1073.
- Bromley D. 2006. *Sufficient Reason: Volitional Pragmatism and the Meaning of Economic Institutions*. Princeton University Press. Princeton.
- Brown KM and Slee RW. 2004. *Exploring the relationship between common property, natural resources and rural development: the case ofcrofting common grazings*. In Aberdeen Research Consortium. Aberdeen.
- CAFNEC. 2006. *Cairns and Far North Environment Centre*. CAFNEC. Available at: <http://www.cafnec.org.au/>

- Carlson JM and Doyle J. 2002. 'Complexity and robustness.' *Proceedings of the National Academie of Science* 9(1): pp. 2499–2545.
- Carpenter SR, Pingali PL, Bennett EM and Zurek MB. 2005. *Ecosystems and Human Wellbeing: Senarios: Findings of the Scenarios Working Group*. Island Press. Washington DC.
- CAT. 2006. *Centre for Appropriate Technology*. Centre for Appropriate Technology. Available at: <http://www.icat.org.au/>
- Chmielewski P. 1995. 'Mountain Commons in the Tatras (New Institutional Approach).' *Polish Sociological Review* 3(3): pp. 241–261.
- Coleman J. 1973. *The Mathematics of Collective Action*. Aldine Publishing Company. Chicago.
- Council of Australian Governments. 2004. *Intergovernmental Agreement on a National Water Initiative*. Council of Australian Governments. Available at: http://www.coag.gov.au/meetings/250604/iga_national_water_initiative.pdf
- Crawford SE and Ostrom E. 1995. 'A Grammar of Institutions.' *American Political Science Review* 89(3): pp. 582–600.
- Crawford SE and Ostrom E. 2005. 'Classifying Rules'. In E.Ostrom (ed.), *Understanding institutional diversity*. Princeton University Press. Princeton.
- DAFF (Department of Agriculture, Fisheries and Forestry). 2006. *About DAFF*. Available at: <http://www.daff.gov.au/about>. Date accessed June 13, 2009.
- Davies J and Aboriginal Legal Rights Movement Inc. 2005. 'Centre and margin – Native title, risk and benefit sharing in multiple use landscapes of desert Australia'. In *Property rights – the key to achieving ecologically sustainable development in Outback regions*. CSIRO Sustainable Ecosystems. Townsville.
- Deadman P. 1999. 'Modelling individual behaviour and group performance in an intelligent agent-based simulation of the tragedy of the commons.' *Journal of Environmental Management* 56(3): pp. 159–172.
- DEH (Department of the Environment and Heritage). 2006. *About DEH*. Available at: <http://www.deh.gov.au/about>. Date accessed June 13, 2009.
- Department of Land and Water Conservation. 1998. *Submission to IPART on rural bulk water pricing*. Government of New South Wales. Sydney.
- Department of Local Government and Planning. 2007. *Population and Housing Fact Sheet*. Queensland Government. Available from http://www.dip.qld.gov.au/resources/map/population-housing-factsheets/etheridge_shire_council.pdf.
- Department of Natural Resources and Mines. 2003. *Indigenous Issues Paper: Georgina and Diamantina Draft Water Resource Plan*. Queensland Government. Brisbane.
- Dietz T, Ostrom E and Stern PC. 2003. 'The struggle to govern the commons.' *Science* 302(5652): pp. 1907–1912.
- Dinar A, Howitt RE, Rassenti SJ and Smith VL. 1998. 'Development of water markets using experimental laboratory experiments.' In KW Easter (ed.) *Markets for Water: Potential and Performance* (pp. 259–275). Kluwer Academy. Norwell.
- Drum F and Gunning-Trant C. 2008. *Live Animal Exports: A profile of the Australian Industry*. ABARE. Research report 08.1 for the Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.
- Edwards VM and Steins NA. 1998. 'Developing an analytical framework for multiple-use commons.' *Journal of Theoretical Politics* 10(3): pp. 347–383.
- Environmental Defender's Office. 2005. *Legal and policy frameworks for water management in the Northern Territory*. Report prepared for NSW Environmental Defender's Office. Sydney.

- Environmental Protection Agency. 2002. *Marion Downs joins Land for Wildlife network. Queensland Government*. Available at: <http://www.epa.qld.gov.au/projects/media/index.cgi?offset=16>
- Etheridge Shire Council. 2006. *Community Newsletter*. Etheridge Shire Council. Available at: http://www.etheridge.qld.gov.au/council/mayors_message.shtml
- European Environment Agency. 1999. 'Environment in the European Union at the turn of the century'. *Environmental assessment report No 2*. European Environment Agency. Copenhagen, Denmark
- Ewers GR, Evans N and Hazell M. 2002. 'OZMIN Mineral Deposits Database'. *Geoscience Australia*, Canberra. Available at: <http://www.ga.gov.au/bin/htsq?file=/oracle/geomt/geomt2.htsq&datasetno=3393>
- Fargher JD, Howard BM and Burnside DG. 2003. 'The economy of Australian rangelands — myth or mystery?' *The Rangeland Journal* 25(2): pp. 140–156.
- Faulks JJ and Kirby S. 2004. *Water use within the Daly region*. Government Department of Infrastructure, Planning and Environment. Darwin.
- Fehr E and Gächter S. 2000. 'Cooperation and Punishment in Public Goods Experiments.' *American Economic Review* 90(4): pp. 980–994.
- Foster D, Mitchell J, Ulrik J and Williams R. 2005. *Population and Mobility in the Town Camps of Alice Springs, a report prepared by Tangentyere Council Research Unit*, DKCRC Report 9, Desert Knowledge Cooperative Research Centre, Alice Springs.
- Frey B. 1997. *Not just for the Money: An Economic Theory of Personal Motivation*. Edward Elgar. Cheltenham, England.
- Friedman D and Sunder S. 1994. *Experimental methods: a primer for economists*. Cambridge University Press. New York.
- Gibson CC, Ostrom E and McKean MA. 2000. 'Forests, People, and Governance: Some Initial Theoretical Lessons.' In CC Gibson, MA McKean and E. Ostrom (eds.) *People and Forests: Communities, Institutions, and Governance* (pp. 227–242). MIT Press. Cambridge, Massachusetts.
- Great Artesian Basin Consultative Council. 1998. *The Great Artesian Basin. Conservation and utilisation of a valuable groundwater resource*. Great Artesian Basin Consultative Council. Brisbane.
- Greiner R, Stoeckl N, Stokes C and Herr A. 2003. *Natural resource management in the Burdekin Dry Tropics: social and economic issues*. CSIRO. Townsville.
- Gulf Regional Planning Advisory Committee. 2000. *Gulf Regional Development Plan*. Queensland Department of Communication and Information, Local Government, Planning and Sport. Brisbane.
- GSD (Gulf Savannah Development). 2006. *About Gulf Savannah Development Inc. – General Overview*. Available at: <http://www.gulf-savannah.com.au/gsd-inc.html>. Date accessed June 13, 2009.
- Harrison G and List J. 2004. 'Field Experiments.' *Journal of Economic Literature* 42(4): pp. 1009–1055.
- Hatton T and Evans R. 1998. *Dependence of ecosystems on groundwater and its significance to Australia*. Occasional Paper 12/98, Land and Water Resources Research and Development Corporation. Canberra.
- Heckbert S, Straton A and Smajgl A. 2006. *Tindall Aquifer Water Trading Model: Technical report and Scenario Results*. CSIRO Sustainable Ecosystems. Darwin.
- Holland JH. 1998. *Emergence: from chaos to order*. Oxford University Press. Oxford.
- Holland JH. 1992. *Adaptation in Natural and Artificial Systems: An Introductory Analysis with Applications to Biology, Control and Artificial Intelligence*. MIT Press. Cambridge.
- Holland JH and Miller JH. 1991. 'Artificial adaptive agent in economic theory.' *American Economic Review* 81(2): pp. 365–370.

- Holmes J, Charles-Edwards E and Bell M. 2005. *Population dynamics in rural and remote Queensland Brisbane*. Queensland Centre for Population Research, School of Geography, Planning and Architecture, The University of Queensland? Brisbane.
- Hristova V and Murti S. 1998. *Natural resources and development in the Daly River-Sturt plateau region of the tropical savannas of the Northern Territory*. Office of Resource Development. Darwin.
- Jackson S. 2004. *Preliminary Report on Aboriginal perspectives on land-use and water management in the Daly River region, Northern Territory*. Report to the Northern Land Council. CSIRO Sustainable Ecosystems and the Northern Land Council. Darwin
- Kiser LL and Ostrom E. 1982. 'The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches,' In E Ostrom (ed.) *Strategies of Political Inquiry* (pp. 179–222). Sage. Beverly Hills, California.
- Kiser LL and Ostrom E. 2000. 'The three worlds of action: A metatheoretical synthesis of institutional approaches.' In M McGinnis (ed.) *Polycentric Games and Institutions* (pp. 57–88). University of Michigan Press. Ann Arbor.
- Knapton A. 2006. *Regional Groundwater Modelling of the Cambrian Limestone Aquifer Systems of the Wiso Basin, Georgina Basin and Daly Basin*. Department of Natural Resources, Environment and the Arts. Darwin.
- Lake Eyre Basin Coordinating Group. 2000. *Georgina Diamantina Catchment Strategic Plan*. Lake Eyre Basin Coordinating Group in collaboration with DCQ. Longreach.
- Lam WF, Lee M and Ostrom E. 1997. 'The Institutional Analysis and Development Framework: Application to Irrigation Policy in Nepal.' In DW Brinkerhoff (ed.), *Policy Studies and Developing Nations: An Institutional and Implementation Focus* (pp. 53–85). JAI Press. Greenwich Connecticut.
- Larson S. 2006. *Analysis of the water planning process in the Georgina and Diamantina catchments: An application of the Institutional Analysis and Development (IAD) framework*. CSIRO Sustainable Ecosystems, Townsville and Desert Knowledge CRC, Alice Springs.
- Larson S and Larson S. 2007. 'An index – based tool for ranking of social impacts of the hydropower project alternatives in the pre-feasibility stage of the project.' *Energy, The International Journal* 32(6): pp. 943–947.
- Lyons K, Cottrell E and Davies K. 2002. *On the Efficiency of Property Rights Administration in Queensland*. Queensland Government, Department of Natural Resources and Mines. Brisbane.
- Lyons K, Cottrell E and Davies K. 2004. *A Summary of the Paper 'On the efficiency of property rights administration'*. Queensland Government, Department of Natural Resources and Mines. Brisbane.
- Macleod ND. 2002. 'Watercourses and riparian areas'. In: S McIntyre, JG McIvor and KM Heard (eds) *Managing & Conserving Grassy Woodlands*. CSIRO. Collingswood, Victoria.
- Marshall C and Rossman G. 1999. *Designing Qualitative Research: 3rd Edition*. Sage Publications. Thousand Oaks.
- McAllister I and Studlar DT. 1999. 'Green versus brown: Explaining environmental commitment in Australia.' *Social Science Quarterly* 80(4): pp. 775–792.
- McAllister RRJ, Gordon IJ, Janssen MA and Abel N. 2006. 'Pastoralists' responses to variation of rangeland resources in time and space.' *Ecological Applications* 16(2): pp. 572–583.
- McDonald GT and Dawson SJ. 2004. *Northern Gulf region*. Natural Resource Management Plan Tropical Savannas CRC and NGRMG Ltd. Georgetown.
- McGregor Tan Research. 2005. *Water Use in Alice Springs*. Northern Territory Department of Infrastructure and Planning. Darwin.
- McKay JM. 2005. 'Water Institutional reforms in Australia.' *Water Policy* 7(1): pp. 35–52.

- McKeague PJ. 1977. *Etheridge Shire Handbook*. Queensland Department of Primary Industries. Brisbane.
- Murphy JJ, Dinar A, Howitt RE, Rassenti SJ and Smith VJ. 2000. 'The design of "smart" water market institutions.' *Environmental and Resource Economics* 17(4): pp. 375–394.
- Nakamarra JL. 2005. *The Frog Icon*. Jinta Fine Arts. Available at: <http://www.jintaart.com.au/iconography/frogicon.htm>
- National Native Title Tribunal. 1999. *Telstra-Ewamian tower agreement seeks registration*. Available at: http://www.nntt.gov.au/News-and-Communications/Media-Releases/Pages/Telstra-Ewamian_tower_agreement_seeks_re.aspx.
- National Native Title Tribunal. 2004. *Ewamian-Etheridge Townships ILUA (QI2003/048)*. URL: http://www.nntt.gov.au/ilua/1079336180_2452.html. Date accessed: December 2, 2007.
- National Native Title Tribunal. 2006. *National Native Title Tribunal*. Available at: <http://www.nntt.gov.au/>
- National Water Commission. 2005. National Water Initiative. Available at: <http://www.nwc.gov.au/NWI/index.cfm>
- NFF (National Farmers Federation). 2007. *National Farmers Federation*. Available at: <http://www.nff.org.au/>
- NGIS Australia (Northop Gruman Integrated Systems). 2004. *Australia's Tropical Rivers – Data Audit*. Land and Water Australia. Canberra.
- Nolan C. 2003. *Sand Hills and Channel Country*. Diamantina Shire Council. Bedourie, Queensland.
- Norris A and Low T. 2005. *Review of the management of feral animals and their impact on biodiversity in the Rangelands: A resource to aid NRM planning, Pest Animal Control CRC Report 2005*. Pest Animal Control CRC. Canberra.
- Norris RH, Prosser I, Young B, Liston P, Bauer N, Davies N, Dyer F, Linke S, Thorns M. 2001. *The assessment of river condition (ARC) of Australian Rivers*. CSIRO. Canberra.
- North DC. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge University Press. Cambridge.
- NGRMG (Northern Gulf Resource Management Group). 2001. *Northern Gulf Regional Strategy*. Northern Gulf Resource Management Group. Georgetown, Queensland.
- NGRMG (Northern Gulf Resource Management Group). 2006. *About us*. Available at: <http://www.northerngulf.com.au/about.html>. Date accessed June 13, 2009.
- Northern Territory Government. 2003. *Agricultural development in the Daly Basin*. Statement to Daly Region Community Reference Group meeting #1, Northern Territory Government Department of Business, Industry and Resource Development. Darwin.
- Northern Territory Government. 2004a. *Northern Territory of Australia Water Act*. Northern Territory Government. Darwin.
- Northern Territory Government. 2004b. *Daly Region Information*. Department of Infrastructure, Planning and the Environment. Darwin.
- Northern Territory Government. 2004c. *Northern Territory of Australia Water Act*. Northern Territory Government. Darwin.
- Northern Territory Government. 2005a. *Alice Springs Water Resource Strategy 2005 – Preliminary Draft, vol I & II*. Northern Territory Department of Natural Resources, Environment and the Arts (NTG NRETA). Available at: <http://www.alicewaterplan.nt.gov.au>

- Northern Territory Government. 2005b. *Alice Springs Water Resources Strategy 2005 – Draft Community Consultation Report*. Northern Territory Department of Natural Resources, Environment and the Arts (NTG NRETA). Available at: <http://www.nt.gov.au/nreta/naturalresources/water/aswrs/whatothersay.html>
- NRW. 2006. *Vegetation Management Act 1999*. Queensland Government. Available at: <http://www.nrw.qld.gov.au/vegetation/legislation.html>
- Oakerson R and Walker ST. 1997. 'Analyzing Policy Reform and Reforming Policy Analysis: An Institutional Approach'. In D.W.Brinkerhoff (ed.) *Policy Studies and Developing Nations: An Institutional and Implementation Focus* (pp. 21–51). JAI Press. Greenwich, Connecticut.
- Office of Economic and Statistical Research. 2005. *Local Government Area Profile. The Diamantina (S) Region*. Queensland Government. Brisbane.
- Office of Economic and Statistical Research. 2002. *Queensland Regional Profiles*. Queensland Government. Brisbane.
- Ostrom E. 1986. 'An agenda for the study of institutions.' *Public Choice* 48(1): pp. 3–25.
- Ostrom E. 1990. *Governing the Commons: the Evolution of Institutions for Collective Action*. Cambridge University Press. Cambridge.
- Ostrom E. 1992. *Crafting institutions for self-governing irrigation systems*. Institute for Contemporary Studies Press. San Francisco.
- Ostrom E. 1998. 'Institutional analysis, design principles and threats to sustainable community governance and management of commons.' In E Berge and NC Stenseth (eds.) *Law and governance of renewable resources: Studies from Northern Europe and Africa* (pp. 27–53). International Center for Self-Governance (ICS) Press. Oakland.
- Ostrom E. 1999. 'Institutional Rational Choice: An assessment of the Institutional Analysis and Development Framework.' In PA Sabatier (ed.) *Theories of the Policy Process* (pp. 35–71). Westview Press. Boulder, Colorado.
- Ostrom E. 2005. *Understanding Institutional Diversity*. Princeton University Press. Princeton.
- Ostrom E. 2007. 'Multiple Institutions for Multiple Outcomes.' In A Smajgl and S Larson (eds.) *Sustainable Resource Use: Institutional Dynamics and Economics* (pp. 23–50). Earthscan. London.
- Ostrom E, Gardner R and Walker J. 1994. *Rules, games, and common-pool resources*. The University of Michigan Press. Ann Arbor.
- Ostrom V. 1972. *Some Problems of Institutional Analysis*. Colorado State University. Environmental Resources Center, Fort Collins.
- p&e Law. 2005. *Property rights governing outback landscapes*, CSIRO Sustainable Ecosystems, Townsville.
- Parker P, Letcher R, Jakeman A, Beck MB, Harris G, Argent RM, Hare M, Pahl-Wostl C, Voinov A and Janssen M. 2002. 'Progress in integrated assessment and modelling.' *Environmental Modelling & Software* 17(3): pp. 209–217.
- Peel MC, Chiew FHS, Western AW and McMahon TA. 2000. *Extension of unimpaired monthly streamflow data and regionalisation of parameter values to estimate streamflow in ungauged catchments*. Report to the National Land and Water Resources Audit. University of Melbourne, Centre for Environmental Applied Hydrology. Melbourne.
- Pitt MW and Wynne R. 1994. *Proposed regional adjustment and recovery program for South West Queensland and Western Division of New South Wales*. NSW Department of Land and Water Conservation. Sydney.

- Plott CR and Porter DP. 1996. 'Market architectures and institutional test-bedding: an experiment with space station pricing policies.' *Journal of Economic Behaviour and Organisation* 31(12): pp. 237–272.
- Puckridge JT, Walker KF and Costelloe JF. 2000. 'Hydrological Persistence and the Ecology of Dryland Rivers.' *Regulated Rivers: Research and Management* 16 (Lowland Rivers Issue): pp. 385–402.
- Puhlovich A. 2005. *Groundwater modelling of the Tindall Limestone Aquifer*. EWL Sciences Pty Ltd for the Northern Territory Government Department of Infrastructure, Planning and Environment. Darwin.
- Queensland Government. 2002. *Allocation, regulation and management – three approaches to resource sustainability*. The Government of Queensland, Department of Natural Resources and Mines. Brisbane.
- Queensland Government Planning. 2004. *Population and Housing Fact Sheet – Etheridge Shire*. Queensland Government. Brisbane.
- Rahnema M. 1992. *The Development Dictionary*. Zed Books. London.
- Roshier DA, Whetton PH, Allan RJ and Robertson AI. 2001. 'Distribution and persistence of temporary wetland habitats in arid Australia in relation to climate.' *Austral Ecology* 26(4): pp. 371–382.
- Saleth RM and Dinar A. 2004. *The institutional economics of water. A cross-country analysis of institutions and performances*. Edward Elgar Publishing. Cheltenham, UK.
- Saleth RM and Dinar A. 2005. 'Water institutional reforms: theory and practice.' *Water Policy* 7(1): pp. 1–19.
- Sarker A and Itoh T. 2001. 'Design principles in long-enduring institutions of Japanese irrigation common-pool resources.' *Agricultural Water Management* 48(2): pp. 89–102.
- Sattler P and Creighton C. 2002. *Australian Terrestrial Biodiversity Assessment*. National Land and Water Resources Audit c/o Land & Water Australia On behalf of the Commonwealth of Australia. Canberra.
- Sattler P and Williams R. 1999. *The Conservation Status of Queensland's Bioregional Ecosystem*. Queensland Environmental Protection Agency. Brisbane.
- Schlager E. 1990. Model Specification and Policy Analysis: The Governance of Coastal Fisheries. Ph.D. Dissertation. Indiana University, Indiana. Political Science.
- Schlager E. 1994. 'Fishers' Institutional Responses to Common-Pool Resource Dilemmas.' In E Ostrom, R Gardner and J Walker (eds.) *Rules, Games, and Common-Pool Resources* (pp. 247–266). University of Michigan Press. Ann Arbor.
- Schlager E, Blomquist W and Tang SY. 1994. 'Mobile Flows, Storage, and Self-Organized Institutions for Governing Common-Pool Resources.' *Land Economics* 68(3): pp. 249–262.
- Schweik CM, Adhikari K and Pandit KN. 1997. 'Land-cover change and forest institutions: A comparison of two sub-basins in the southern Siwalik Hills of Nepal.' *Mountain Research Development* 17(2): pp. 99–116.
- Scott A. 1997. *Relationships between waterbird ecology and river flows in the Murray-Darling Basin*. CSIRO. Canberra.
- Scott A. 2001. 'Waterbirds. Rivers as Ecological Systems: the Murray-Darling Basin.' In WJ Young (ed.) *Rivers as Ecological Systems: The Murray-Darling Basin* (pp. 259–286). Murray-Darling Basin Commission. Canberra.
- Sheldon F, Balcombe S, Brunner P and Capon S. 2003. *Ecological and Geomorphologic Assessment for the Georgina-Diamantina River Catchment, Stage 1*. Centre for Riverine Landscapes, Griffith University, Nathan Queensland.
- Shogren JF. 2006. 'Valuation in the Lab.' *Environmental and Resource Economics* 34(1): pp. 163–172.

- Smajgl A and Larson S. 2007. 'Institutional dynamics and natural resource management.' In A Smajgl and S Larson (eds.) *Sustainable Resource Use: Institutional Dynamics and Economics* (pp. 3–19). Earthscan. London.
- Smajgl A, Nursey-Bray M, Vella K and Herr A. 2007. 'Building Institutional Incentives in Dying Communities.' In A Smajgl and S Larson (eds.) *Sustainable Resource Use: Institutional Dynamics and Economics* (pp. 220–239). Earthscan. London.
- Smajgl A, Heckbert S, Ward J, Straton A. 2008. 'Simulating impacts of water trading in an institutional perspective'. *Journal of Environmental Modelling and Software*, 24 (2), 191–201.
- Smith VL. 2002. 'Method in experiment: rhetoric and reality.' *Experimental Economics* 5(2): pp. 91–110.
- Stafford Smith DM and Morton SR. 1990. 'A framework for the ecology of arid Australia.' *Journal of Arid Environments* 18(3): pp. 255–278.
- Stewart JB, Smart RV, Barry SC and Veitch SM. 2001. *1996/97 Land Use of Australia – Final Report for Project BRR5*. National Land and Water Resources Audit. Canberra.
- Straton A, Heckbert S, Smajgl A and Ward J. 2006. *Institutions for water trading and policy-making in the tropical savannas: a case study of the Katherine-Daly River region*. CSIRO Sustainable Ecosystems & Cooperative Research Centre for Tropical Savannas Management. Darwin.
- Tang SY. 1992. *Institutions and Collective Action: Self Governance in Irrigation*. ICS Press. California.
- Taylor J, Brown D and Bell M. 2006. *Population Dynamics and Demographic Accounting in Arid and Savanna Australia: Methods, Issues, and Outcomes* (Rep. No. 16). Desert Knowledge Corporate Research Centre, Alice Springs.
- Tesfatsion L. 2002. *Agent-Based Computational Economics*. The Economics Working Papers Archive. Available at: <http://ideas.repec.org/p/wpa/wuwpco/0203001.html>
- Tesfatsion L. 2003. 'Agent-Based Computational Economics: Modelling Economies as Complex Adaptive Systems.' *Information Sciences* 149(4): pp. 263–269.
- Thackway R and Cresswell ID. 1995. *An interim bioregionalisation for Australia: a framework for setting priorities in the national reserve system cooperative program*. Nature Conservation Agency. Canberra.
- Tourism NT. 2006. *Tourism Infrastructure Framework: Strengthening the Position of Alice Springs Tourism, April 2006*, Tourism NT, Darwin, accessed 2 January 2007 at http://www.tourismnt.com.au/nt/system/galleries/download/Industry/DD_Project_ASP_Framework.pdf.
- Travick PB. 2001. 'Successfully governing the commons: Principles of social organisation in an Andean irrigation system.' *Human Ecology* 29(1): pp. 1–25.
- Trosper RL. 2002. 'North-west coast indigenous institutions that support resilience and sustainability.' *Ecological Economics* 41(2): pp. 329–344.
- Tyler MJ. 1997. *The Action Plan for Australian Frogs*. Wildlife Australia. Canberra.
- URS Australia. 2007. *Unpublished Report prepared for the WEST 2000 Board and the Department of Land and Water Conservation*. URS Australia Pty Ltd. Perth.
- Walker KF, Sheldon F and Puckridge JT. 1995. 'A perspective on dryland river ecosystems.' *Regulated Rivers: Research and Management* 11(1): pp. 85–104.
- Ward J, Tisdell J and Whitten S. 2006. 'Experimentally testing institutions and policy instruments to coordinate groundwater recharge in the Coleambally Irrigation Area.' Presented at the 3rd World Congress of Environmental and Resource Economists, 3–7 July 2006. Kyoto, Japan.
- Water Planning Group. 2003a. *Georgina and Diamantina Water Resource Planning: Hydrology Report*. Queensland Department of Natural Resources and Mines. Brisbane.

- Water Planning Group. 2003b. *Social and Economic Report of the Draft Georgina and Diamantina Water Resource Plan*. Queensland Department of Natural Resources and Mines. Brisbane.
- Water Planning Group. 2004. *Georgina Diamantina Water Resource Plan Consultation Report*. Queensland Department of Natural Resources and Mines. Brisbane.
- Wheeler MF and Peszynska M. 2002. 'Computational Engineering And Science Methodologies For Modeling And Simulation Of Subsurface Applications.' *Advances in Water Resources* 25(8–12): pp. 1147–1173.
- White K. 2004. *The Northern Territory Mango Industry: a socio-economic perspective*. Horticulture Division, Primary Industry Group, Northern Territory Government Department of Business, Industry and Resource Development. Darwin.
- Whitten S, Bennett J, Moss W, Handley M and Phillips W. 2002. *Incentive measures for conserving freshwater ecosystems: review and recommendations for Australian policy makers*. Environment Australia. Canberra.
- Wilcox DG and Cunningham GM. 1994. 'Economic and ecological sustainability of current land use in Australia's rangelands.' In SR Morton and PC Price (eds.) *LWRRDC Occasional Paper Series No. 06/93*. Land & Water Resources Research & Development Corporation. Canberra.
- Wilderness Society. 2006. *Wilderness Society*. Available at: <http://www.wilderness.org.au/>
- Williams WD. 1981. 'Inland aquatic systems: An overview.' In A Keast (ed.) *Ecological Biogeography of Australia* (pp. 1079–99). Dr W. Junk. The Hague.
- Williamson OE. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York. Free Press, New York.
- Wittayapak C and Dearden P. 1999. 'Decision-Making Arrangements in Community-Based Watershed Management in Northern Thailand.' *Society & Natural Resources* 12(7): pp. 673–691.
- Yandle T. 2002. 'The challenge of building successful stakeholder organisations: New Zealand's experience in developing a fisheries co-management regime.' *Marine Policy* 27(2): pp. 179–192.

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