

Project technical report
Healthy Savanna Planning Systems
Tropical Savannas Management CRC
Project 3.3.5

Findings from a review of regional NRM plans

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Acronyms

ABS	Australian Bureau of Statistics
AIMS	Australian Institute of Marine Science
ALMWG	Agriculture and Land Management Working Group
AUSRIVAS	Australian Rivers Assessment System
BMP	Best Management Practice
BDTB	Burdekin Dry Tropics Board
CAMBA	China Australia Migratory Bird Agreement (1987)
CCNRMC	Condamine Catchment Natural Resource Management Corporation (Condamine Alliance)
CDEP	Community Development Employment Projects
CORVEG	Vegetation mapping site data (Queensland)
CQANM	Central Queensland A New Millennium
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific Industrial Research Organisation
DCQ	Desert Channels Queensland Inc.
DPI	Department of Primary Industries
DPI&F	Department of Primary Industries and Fisheries
EPA	Environment Protection Authority
FBA	Fitzroy Basin Association
FNQNRM	Far North Queensland Natural Resource Management, Ltd (Wet Tropics)
GBRMPA	Great Barrier Reef Marine Park Authority
GIS	Geographical Information Systems
GLM	Grazing Land Management
GWP	Global Warming Potentials
HERBRECS	Queensland Herbarium records
ICM	Integrated Catchment Management
IEK	Indigenous Ecological Knowledge
IPA	Integrated Planning Act 1997 (Qld)
JAMBA	Japan Australia Migratory Bird Agreement (1974)
MAT	Management Action Target
NAP	National Action Plan Abbreviation for NAPSWQ (see below)
NAPSWQ	National Action Plan for Salinity and Water Quality
NCAS	National Carbon Accounting System
NCI	National Core Indicators
NGRMG	Northern Gulf Resource Management Group Inc.

NHT	Natural Heritage Trust
NLWRA	National Land and Water Resources Audit
NR&M	Department of Natural Resources and Mines, Queensland Government
NRM	Natural Resource Management
NRMSEQ	Natural Resource Management South East Queensland Inc.
NTDBIRD	Northern Territory Department of Business, Industry and Resource Development
PMP	Property management planning
QMDC	Queensland Murray Darling Committee Inc.
QMDC & SWNRMG	Queensland Murray Darling Committee Inc. & South West Natural Resource Management Group Inc.
RCGs	Regional Coordination Groups (of Qld Government agencies)
RVMPs	Regional Vegetation Management Plans
RWQPP	Reef Water Quality Protection Plan
SMART	Specific Measurable Achievable Realistic Time-bound
SEQ	South East Queensland
SEQRWQMS	Southeast Queensland Water Quality Strategy
SEQWC	South East Queensland – Western Catchments
SGC	Southern Gulf Catchments Inc.
SoE	Queensland State of the Environment Report
SIP	State-wide Investment Projects
TN	Total Nitrogen
TP	Total Phosphorus
TS-CRC	Tropical Savannas Management Cooperative Research Centre
VNCA	Voluntary Nature Conservation Agreements
WBB	Wide Bay Burnett
WHAM	Whitsunday, Hinterland and Mackay Regional Planning Project
WILDNET	WildNet, a computerised information database on Queensland's wildlife
WRP	Water Resource Planning

1. Introduction

1.1. Background to the Healthy Savanna Planning Systems project

The *Healthy Savanna Planning Systems* project is part of the Tropical Savannas CRC's regional planning theme portfolio. It was initiated in late 2003 and will run until September 2006. The overall project goal is to contribute to effective regional natural resource management policy, planning and implementation processes in northern Australia. The research involves building and applying methodologies for monitoring and evaluating regional planning arrangements and the technical content of regional NRM¹ plans.

The project team works collaboratively with regional bodies and government agencies in Queensland, Northern Territory and Western Australia. It is a research approach that is committed to supporting adaptive management. Throughout the research process, learnings are captured, innovative options for policy improvement identified, and results shared. It is driven by a strong research ethic that supports 'in-progress' or real time evaluation of NRM related planning and the participation of planners and managers in the evaluation process.

The review of regional NRM plans is a discrete piece of work that forms part of a broader benchmarking or evaluation of regional planning arrangements for natural resource management (see McDonald et al.). The broader evaluation was undertaken between late 2003 and early 2005. The principal information inputs to undertake the evaluation to date includes:

- Interviews with key informants involved in regional NRM,
- observations of regional planning forums,
- workshop with regional planners who prepared the plans
- **desktop reviews of regional NRM plans**, and
- analysis of the policy and program environment in Western Australia, Northern Territory and Queensland.

Each method provides an insight into particular components of regional NRM arrangements. These methods were then synthesised to track progress of regional planning arrangements and evaluate this progress against the criteria. This review concentrated on **plans only** and should be read in conjunction with other reports, which analyse planning and decision-making processes, especially McDonald et al. (2005).

1.2. Method to review NRM plans

Regional NRM plans and investment strategies are the 'output' of the initial phase of the regional planning process. Reviewing plans in a systematic way can tell much about the management direction and priorities in regions, information quality and integration, and planning practice.

During January and February 2005, nine 'accredited' regional NRM plans were reviewed: Northern Gulf (NGRMG), Southern Gulf (SGC), Wet Tropics (FNQNRM), Fitzroy (FBA), Queensland Murray Darling (QMDC & SWNRMG), Condamine (CCNRMC), South East Queensland (NRMSEQ), South East Queensland – Western Catchments (SEQWC), and Desert Channels (DCQ) (Table 1). An additional four *Regional Coastal Management Plans* were reviewed: Cardwell Hinchinbrook; Wet Tropical Coast; Draft South-east Queensland;

¹ Natural resource management (NRM) includes any activity relating to the management of the use, development or conservation of one or more of the following natural resources: soil, water, vegetation, biodiversity or any other natural resource, including coastal and marine areas, and World Heritage, Ramsar Wetland and other protected areas (NR&M 2003).

and Curtis Coast. This built on an earlier review in 2002-3 of regional NRM plans, existing Water Resource Plans and Regional Plans under Queensland's Intergrated Planning Act.²

Table 1 Queensland NRM regions, funding programs

Region	Program		Reviewed in this study
	NAPSWQ	NHT	
Burdekin Dry Tropics	Y	Y	No*
Burnett–Mary	Y	Y	No
Cape York		Y	No
Condamine	Y	Y	Yes
Desert Channels		Y	Yes
Fitzroy Basin	Y	Y	Yes
Gulf - Northern		Y	Yes
Gulf- Southern		Y	Yes
Mackay–Whitsunday		Y	No
Queensland Murray–Darling Basin	Y	Y	Yes
SE Queensland	WCatchment	Y	Yes
South West		Y	Yes
Torres Strait		Y	No
Wet Tropics		Y	Yes

*The Burdekin & Mackay Whitsunday regional plans were only included in the review of surface water issues in regional NRM plans (McDonald et al. this volume).

The extent to which plans addressed a range of asset 'themes' such as coastal and marine, social and economic or biodiversity outcomes were evaluated through a rational planning framework of major components 1) planning context 2) condition and trend information; 3) targets and objectives; 4) priorities and options; 5) implementation and investment tools and 6) monitoring, reporting and evaluation frameworks. Several 'asset' based reports were produced on criteria themes such as social and economic; water quality; coasts and marine; biodiversity, soil and pasture health; carbon and energy. Table 1 presents the criteria applied to the plans. For more detail on the criteria and their development refer to McDonald et al (2003; 2004). The project team has also conducted a workshop with planners and consultants engaged in regional NRM planning during 2004-5. The purpose of this workshop was to groundtruth findings from the desktop review with planners and provide an opportunity for lessons and experiences to be shared across jurisdictions and regions.

The overarching questions driving the desktop review of NRM plans are:

1. What regional outcomes (criteria) do plans address;
2. What is the quality of scientific, technical, local and other knowledge used in plans; and
3. How effectively is this knowledge applied to target setting, actions, and monitoring functions of the plans (plan components).

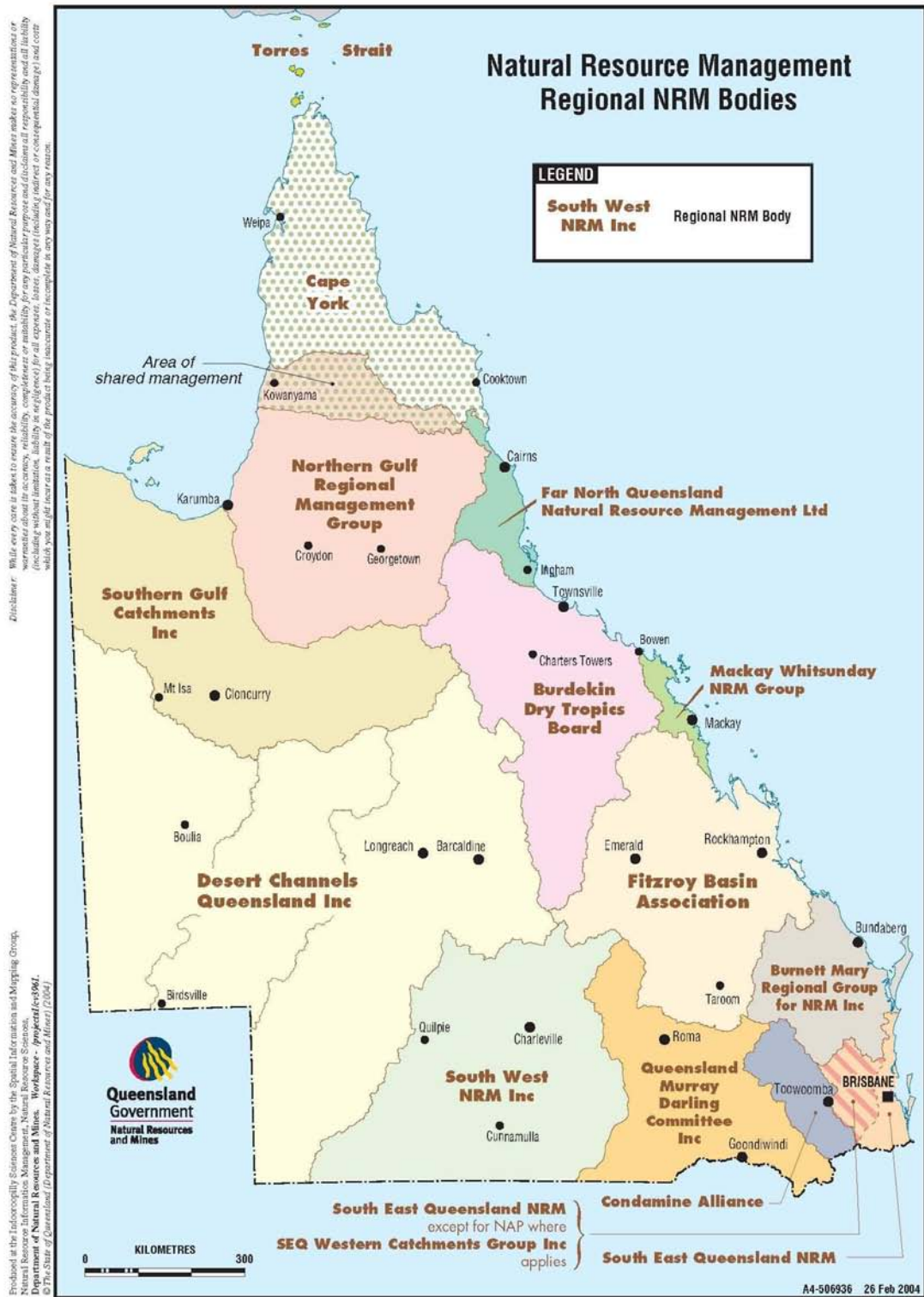
The plan review process allows current planning practice to be assessed and the development of plan 'quality' or progress from the earlier 2002/3 reviews to be tracked. Successful approaches and constraints to regional plan development, including regional examples can also be identified. These examples and general trends support lesson sharing between planners, regions and jurisdictions for adaptive management, such as the NRM planners workshop organised by the project team that was discussed earlier. As a key method in the broader healthy savanna planning systems benchmarking process – the

² McDonald, G. et al. 2004 *Evaluating Regional Resource Management Plans*, Paper prepared for CSIRO/CIRM Symposium on *Regional Natural Resource management Planning: the challenges of evaluation as seen through different lenses*, Brisbane, 15 October 2004); Taylor and Robinson (2005) *Experineces and lessons: NRM Planners Workshop*, Healthy Planning Systems Project, TS-CRC, Wednesday 9 March.

reviews as contribute to identifying key themes for case study selection in the 2005-6 phase of the evaluation.

At a broader level, the reviews contribute to a better understanding of the practicalities of regional natural resource planning. This includes opportunities and difficulties faced in the Queensland context that are relevant to other jurisdictions and planning experiences. Equally importantly, this review contributes to the debate about current shifts in policies and programs that reflect a global trend towards devolved regional approaches.

Figure 1: Natural Resource Management regions and regional bodies in Queensland



Source: Department of Natural Resources and Mines, Qld - February 2004

Table 1. Revised plan evaluation criteria for regional landscape outcomes January 2004

Themes	Plan evaluation criteria for desired regional planning outcomes
Social & economic outcomes	1. Population, employment and service provision supporting healthy savanna towns and communities
	2. Physical infrastructure is appropriate for savanna communities & environments
	3. Indigenous values (including cultural heritage) are recognised and protected
	4. Non-indigenous cultural heritage and landscape values are recognised and protected
	5. Costs and benefits of resource management shared equitably
	6. Economic viability of enterprises and industries is improved
Capacity outcomes	7. Inclusive participation and active involvement in groups and networks is maintained
	8. On-going learning, skills development and training is supported
	9. Access to and use of technical information is improved
	10. Regions are able to respond positively to external change pressures and internal variability
	11. Institutions are aligned for regional sustainability
Catchment & River Health outcomes	12. Soil and water salinity levels are maintained or improved
	13. Water quality in freshwater streams and lakes is maintained or improved
	14. Environmental flow requirements of streams maintained
	15. Groundwater levels and quality is maintained or restored
Estuary & coastal outcomes	16. Water quality in estuarine and marine waters is maintained or improved
	17. Downstream impacts (connectivity) considered
	18. Impacts on physical coastal processes are managed
Carbon & energy outcomes	19. Regional net carbon emissions are minimised
Biodiversity outcomes	20. Landscape structure and complexity are maintained
	21. Ecosystem diversity is maintained
	22. Species diversity is maintained
	23. Ecosystem integrity is maintained
Soil & Pasture Health outcomes	24. Soil condition and health maintained
	25. Pasture condition and health are maintained

2. Coastal and marine issues in regional NRM and coastal management plans

Michelle Walker and Ann Peterson

2.1. Introduction

Coastal and marine management matters are an important component of regional NRM plans. The Natural Heritage Trust Bilateral Agreement (2004) between the Australian and Queensland Governments states that investments in coastal activities will be part of the broader investment in natural resource management. Additionally, these investments must be consistent with the State Coastal Management Plan and regional plans under the Queensland coastal legislation and assist in achieving outcomes for reef protection. The *Guidelines for Regional Natural Resource Management Planning in Queensland* (NR&M 2003) that have been developed from the Bilateral Agreement state the need for regional NRM bodies to include coastal and marine management matters in their regional NRM plans because of the interconnected nature of the resource issues and problems. Thus, relevant Australian and/or Queensland government policies and frameworks in relation to coastal, reef, water and marine issues need to be reflected in, and in many cases, contributed to by the regional NRM plans. This includes legislation (e.g. *Coastal Protection and Management Act 1995*), statutory instruments (e.g. State Coastal Management Plan and regional coastal management plans) and policies (e.g. *Reef Water Quality Protection Plan*, *South East Queensland Regional Water Quality Management Strategy* and biodiversity strategies) (Figure 1).

The purpose of this section is to review:

1. The effectiveness of accredited regional NRM plans in addressing the 'Estuary and Coastal' outcomes, which are reflected in the following criteria, as identified in McDonald et al. (2004):
 - Water quality in estuarine and marine waters is maintained or improved (criteria 16);
 - downstream impacts (connectivity) are considered (criteria 17); and
 - impacts on physical coastal processes are managed (criteria 18).
2. The coastal and marine aspects of several additional criteria within the accredited NRM plans including:
 - Landscape structure and complexity are maintained (criteria 20);
 - ecosystem diversity and integrity are maintained (criteria 21 and 23); and
 - species diversity is maintained (criteria 22).
3. The three approved regional coastal plans (Curtis Coast, Cardwell-Hinchinbrook and Wet Tropics) and the draft Regional Coastal Management Plan for South East Queensland against the 25 plan evaluation criteria in McDonald et al. (2004). This is necessary, as much of the specific regional direction for coastal planning within Queensland stems from the regional coastal management plans.

In addition to plan content, the Joint Australian and Queensland Steering Committee has required regional NRM groups to demonstrate effective representation of coastal and marine stakeholders prior to accreditation as regional bodies for the purposes of investment.

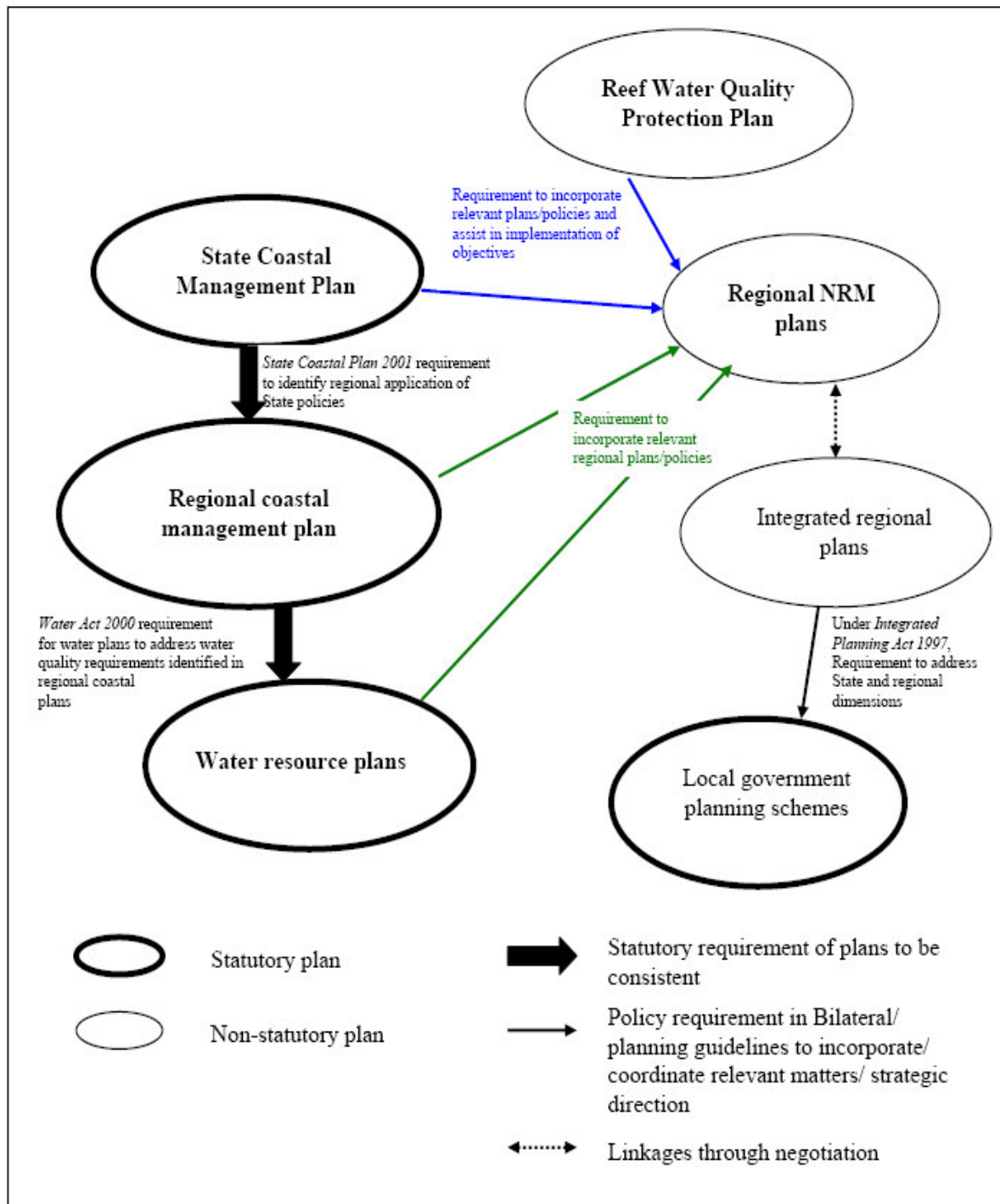


Figure 1: Relationships between plans and policies relating to coastal management issues

2.2. Regional and State level planning contexts

The *State Coastal Management Plan - Queensland's Coastal Policy* (State Coastal Plan) (Environmental Protection Agency 2001) describes how the Queensland coastal zone will be managed, including areas and activities in coastal catchments that can have an impact on coastal resources and values. Regional coastal plans must be consistent with the framework of the State Coastal Plan and identify coastal management districts³. *The Reef Water Quality Protection Plan* (The State of Queensland and Commonwealth of Australia 2003) provides direction for the regional NRM plans in reef catchments regarding targets for water quality in waterways that flow into the Great Barrier Reef World Heritage Area.

The regional NRM plans generally acknowledge the State Coastal Plan's direction and, if relevant, the regional coastal plans (e.g. the NRM plan for the Wet Tropics and the NRM plan for Fitzroy Basin). Where regional coastal plans under the *Coastal Protection and Management Act 1995* (Coastal Act) have not been developed, the regional NRM plans refer to other relevant coastal planning processes (e.g. the NRM plan for Southern Gulf identifies the Karumba Regional Coastal Plan, National Oceans Office's North Regional Marine Plan and the Kowanyama Coastal Plan).

A clear statement of the relationship between the regional NRM plan and relevant regional coastal plans and/or State Coastal Plan has been included in some NRM plans. A good example is the NRM plan for the Fitzroy Basin (FBA 2004). Table 1 (FBA 2004, p. 13) identifies specific links from the State and regional coastal plans to the relevant section of the NRM plan. It also includes compliance with the State Coastal Plan and Curtis Coast Regional Coastal Management Plan as a performance indicator for the estuary, coastal and reef habitat section. However, a clear indication of how compliance will be measured is not stated and is likely to be difficult to achieve.

The NRM plan for the Wet Tropics (FNQNRM 2004) makes the following statement regarding water resource plans: 'For water quantity, the Plan defers to the statutory powers of the Water Resource Planning process in the *Queensland Water Act*, which has a thorough process for determining sustainable water use, and includes provision for environmental flows. There are however supporting actions that need to be taken including commitment to water use efficiency in both rural and urban areas.' (p.114). A comparable statement would have been appropriate regarding the NRM plan's relationship with the two relevant coastal plans (Wet Tropical Coast and Cardwell-Hinchinbrook regional coastal plans). However, management action targets identified in the NRM plan for Wet Tropics (FNQNRM 2004) specifically link to the regional coastal plans, for example: 'supplement EPA *Regional Coastal Management Plans* with reporting on condition of all extant coastal habitats above highest astronomical tide.' (p.62).

2.3. Planning information base

The focus of the regional NRM plans is on the biodiversity aspects of coastal resources and management. A major source of data (e.g. in the NRM plan for SEQ and SEQ Regional Coastal Plan) is the biodiversity planning assessments, which identify the biodiversity values of remnant units, both terrestrial and marine, and their conservation significance. The 'diagnostic criteria', which are available in digital coverage, include significant habitat for 'at risk' species, ecosystem value, remnant size, relative size of ecosystem, condition, ecosystem diversity and context and connection. The 'other desirable criteria' are based on expert interpretation of non-uniform data and include, among others, corridor links. The collation of this data represents a significant information base, to support planning and decision-making. However, other information in the NRM plans is predominantly descriptive and lacks clear data regarding resource condition and trends. While background reports (information papers, condition and trend reports) may contain a more thorough assessment of coastal resources and values, the

³ Coastal management districts are regulatory areas that primarily identify the part of the coastal zone in which the State Government, through the EPA, becomes involved in assessing certain types of coastal development as set out in the Coastal Act.

NRM plans themselves do not provide a comprehensive coverage of the condition and trends in coastal and marine resources. In most cases, this reflects the gap in current knowledge.

Threats to coastal and marine assets are commonly identified in the regional NRM plans. In some cases, statements regarding threats, as well as condition and trend information are not sourced making it impossible to review the original material.

Information included in the NRM plans is, at times, of a general nature rather than region specific. For example, the predicted impacts of climate change in the NRM plan for SEQ (identified in the Supporting Document) fail to include the results of more detailed research that has been undertaken in the region/sub-regions.

The regional coastal management plans include good descriptive and spatial data on biophysical values (e.g. vegetation, geology, biodiversity and acid sulfate soils) as well as socio-political data (e.g. tenure, landscape and Indigenous cultural values). However, socio-economic profiles and information regarding social values associated with the coast and its resources are limited. In general, the condition and trend information is poor and in some cases, this reflects the state of data availability. Where good data exist, these are not always sourced and included (e.g. the Wet Tropical Coast Regional Coastal Plan does not reference the *State of the Great Barrier Reef World Heritage Area 2003* report, the regional coastal plans reference the *State of Environment, Queensland 1999* report without including region specific information that is available).

2.4. Targets and objectives

One of the matters for targets identified by the Australian Government in the *National Framework for NRM Standards and Targets* is the integrity of estuarine, coastal and marine habitats (NRM Ministerial Council 2002). Targets and actions in regional NRM plans are required to demonstrate how they are consistent with, and contribute to, agreed Australian and Queensland government strategies and policies (where applicable) such as coastal plans and strategies (NR&M 2003).

In the NRM plans reviewed, targets address a wide range of coastal-related matters including: habitat and species protection, pest species management, changes in land use, improved community understanding coastal issues, and improved recognition of cultural values of coastal assets to Indigenous Traditional Owners (see Table 1). However, some of the plans don't always address the key threats identified to the assets via targets (e.g. (1) the plan for Wet Tropics (FNQNRM 2004) identifies key threats to coastal asset as including maritime incidents including groundings however targets focus on port land use (p.62) which is important but are silent regarding maritime transport risks and incident management; (2) the plan for Northern Gulf (NGRMG 2005) identifies introduction of marine pests e.g. from ballast water discharges, as an important threat but does not include a specific target to address this issue at this stage. The plan for Northern Gulf (NGRMG 2005) does include a target to set further targets in relation to marine habitat management; (3) the plan for Southern Gulf Catchments (SGC 2004) identifies climate and climate change as being a key issue however is silent regarding target/s to address the issue).

Table 1 Summary of coastal and marine issues and targets in regional NRM plans

Regional NRM plan	Main coastal and marine issues identified	Matters addressed in targets	Comments
<p>Wet Tropics</p> <ul style="list-style-type: none"> dealt with in Biodiversity section with some links to Water Resources 	<ul style="list-style-type: none"> sediments and nutrients from catchment to GBR overfishing, marine habitat modification habitat loss maritime incidents pest plants and animals inappropriate land/sea uses e.g. associated with urban development, aquaculture, tourism and recreation 	<ul style="list-style-type: none"> improved knowledge/data on ecosystems fisheries habitat protection connectivity between freshwater and marine environments community involvement in monitoring of extent and condition minimise habitat loss from port expansion minimise habitat loss from coastal and marine developments local government capacity industry specific mitigation of impacts improved community understanding of issues cooperative management of resources 	<ul style="list-style-type: none"> identified link with regional coastal plans is good very specific compared with need to cover broader sustainable mgt of marine ecosystems limited to removal of physical barriers e.g. barrages could better link to regional coastal plans does not address maritime incidents associated with port activities EPA absented itself as potential partners despite clear role in coastal protection and mgt Not target, statement Definition of 'coastal industries' unclear – limited to rural industries? Or inclusive of, for example, boat building industry? Good Focused on traditional owners, recognises importance of coastal resources for traditional owners
<p>Northern Gulf</p> <ul style="list-style-type: none"> good separation of elements of coastal management; some unnecessary repetition of issues/condition and trend information (data or gaps) not clearly provided; some sections overly descriptive 	<p>Three themes:</p> <p>1. Coastal management</p> <ul style="list-style-type: none"> Ports and shipping – ballast water mgt Potential impacts of increasing tourism Transport requirements if additional mineral resources exploited Overfishing e.g. 	<ul style="list-style-type: none"> improve knowledge of resources and impacts of human activities involvement of coastal Indigenous communities in resource mgt engage coastal communities in managing ghost nets 	<ul style="list-style-type: none"> some gaps in current set of targets – possibly addressed when further targets are developed MAC15 repeated as MAC16 MATs are necessarily big and broad due to potential issues,

Regional NRM plan	Main coastal and marine issues identified	Matters addressed in targets	Comments
<p>rather an analysis of key matters</p>	<p>brown tiger prawn and impacts on bi-catch species</p> <ul style="list-style-type: none"> • Marine debris e.g. ghost nets <p>2. Marine biodiversity</p> <ul style="list-style-type: none"> • Habitat destruction • Marine debris • Traditional harvest • Animal-boat collisions • Feral animal impacts on significant species • Climate change <p>3. Sustainable use of marine resources</p> <ul style="list-style-type: none"> • Oil and chemical spills • Operational discharges to marine environment • Release of toxic compounds • Marine pest incursions from ballast water and hulls 	<ul style="list-style-type: none"> • develop further targets • habitat protection • species protection • pest control • develop further targets • determine impacts of fishing activities • raise awareness of impacts of marine debris • improve understanding by land managers of land-coastal connection and potential impacts of activities on coastal ecosystems • increased understanding by land managers of importance of Traditional Owner • develop further targets 	<p>however management actions unlikely to be comprehensive enough to meet targets</p> <ul style="list-style-type: none"> • No specific targets looking at potential impacts of climate change on habitats, coastal processes (theme above) or sustainable use of resources (below) • Focus on actions e.g. marine debris reduction that meet general community, fishing interests and Indigenous community aspirations • No targets for management of ballast water and marine vessels re: pest species
<p>Southern Gulf Catchments</p> <ul style="list-style-type: none"> • Very thorough treatment of issues • Clear statement re: priority actions identified by community 	<p>1. Coastal population growth</p> <ul style="list-style-type: none"> • Towns and settlements • Tourism • Waste disposal <p>2. Land management and use</p> <ul style="list-style-type: none"> • Grazing and other agricultural uses • Acid sulfate soils • Water quality and sediments • Aquaculture • Exotic species • Mining <p>3. Altering natural flow</p> <ul style="list-style-type: none"> • Changes to overland flows and 	<ul style="list-style-type: none"> • Identify existing knowledge and current gaps • Undertake coastal habitat assessment project • Develop partnerships with key agencies • Develop partnership with agencies and Traditional Owners re: Land and Sea Centre and future coastal mgt program • Assess current mgt practices and take action regarding unsustainable activities • Undertake social 	<ul style="list-style-type: none"> • Very thorough in addressing range of issues and setting targets. • Targets silent regarding climate change and sea level change matters.

Regional NRM plan	Main coastal and marine issues identified	Matters addressed in targets	Comments
	wetlands <ul style="list-style-type: none"> • Water extraction 4. Marine management and use <ul style="list-style-type: none"> • Shipping and boating activities • Marine debris • Fishing and hunting • Exotic and displaced marine species 5. Climate and climate change <ul style="list-style-type: none"> • Sea level changes • Cyclones 	and economic assessment of coastal and marine resources <ul style="list-style-type: none"> • Identify important areas for fisheries e.g. Fish habitat areas • Assess sustainable yields for fish species • Initiate wetland and migratory wader bird protection measures • Enforce fisheries legislation • Promote sustainable fishing practices • Investigate feasibility of aquaculture • Support development of regional coastal mgt plan • Initiate procedures for marine pest species detection • Collaborative efforts re: marine debris management/reduction • Determine riverine input into coastal ecosystems 	

2.5. Priorities and options

Overall, the regional NRM plans have good documentation of priority setting including criteria and descriptions of processes to identify priority issues, threats, assets and management actions/targets (e.g. Section D in the plan for Wet Tropics). In the plan for Fitzroy Basin (FBA 2004), the community is explicitly identified as being directly involved in identifying priorities. However, certain aspects of coastal and marine assets – namely conserving specific species – were consistently given the lowest priority despite the NRM plan and regional coastal plan identifying key threats to these assets (e.g. species loss and high numbers of species being ‘at risk’ were identified as a major concern). NRM plans could consider improving the transparency in priority setting and integration of key concepts both within and between plans.

In relation to the regional coastal management plans, any options that may have been considered were not documented. Priorities within the plans have been driven by the requirements of the *Coastal Protection and Management Act 1995* and the State Coastal Plan (e.g. the identification of areas of state significance for social and economic resources, cultural

heritage resources and natural resources) and by the region-specific context and issues (e.g. priorities for shoreline erosion management and rehabilitation of coastal resources). However, the determination of these priorities and the technical information that supports this priority setting process were not documented. There was no evidence of a comparative assessment of a range of options to achieve the plans' policy outcomes or an assessment of specific proposals.

For example, the NRM plan for SEQ identifies several regional ecosystems as being 'endangered' or 'of concern' (e.g. forest red gums and vine thickets) while the SEQ regional coastal plan focuses particularly on coastal wetland ecosystems, rather than a multi-scaled approach that considers a range of threatened coastal lowland ecosystems. Clarification of priority setting would enhance the regional coastal planning process.

The SEQ regional coastal plan is notably different to the three northern regional coastal plans regarding priorities and options. In SEQ, 16 of the State Coastal Plan's 48 policies have been selected for inclusion in the plan, along with two additional policies addressing non-tidal waterways and algal bloom management. In at least three cases, despite the State Coastal Plan requiring regional coastal plans to identify priority areas or a policy position for the region (e.g. shoreline erosion management, cultural heritage and scenic landscapes), the SEQ coastal plan is 'silent'. A lack of consistency with the State Coastal Plan and a lack of transparency in prioritising policies for inclusion or exclusion are of concern.

2.6. Implementation and investment

In most cases, the regional NRM plans have generic implementation sections and do not specifically identify implementation of coastal and marine matters. The NRM plan for Southern Gulf (SGC 2004) has however, a specific section on implementing coastal and marine actions.

Implementation is a poor aspect of the regional coastal plans. The plans identify in general terms the parties involved in managing the coast and its resources. The plans are not specific regarding management actions and resource condition targets or the quantum or source of funds to be allocated. Some guidance to implementation is provided through identification of key coastal sites that geographically identify management issues. Coastal resource maps (in combination with the policies) play an important role in supporting the plans' implementation. In practice, the achievement of most of the plans' outcomes rely on mechanisms other than the regional coastal plans (e.g. planning schemes, development assessment or non-statutory/voluntary mechanisms). How these outcomes will be achieved, by whom, when and with what funds, are absent from the plans.

Additionally, in SEQ it is unclear how implementation of the coastal plan will occur when there are conflicting policies in relation to wetland protection as areas of state significance (natural resources) and the expansion of Brisbane Airport and the Gateway Arterial Duplication (identified as areas of state significance [social and economic]). For the 22 policies in the State Coastal Plan that are without a region-specific context or policy in the SEQ coastal plan, it remains unclear as to the spatial application of the policy, who is responsible for its implementation and how this will be undertaken.

2.7. Monitoring, evaluation and reporting

Reporting objectives and timing are clearly identified in the NRM plans reviewed in relation to resource condition and management action targets. Monitoring and reporting the level of pressures or management responses is being undertaken by regional NRM bodies through State of the Region reporting (referred to directly in some plans). This reporting will support future iterations of the regional NRM plans.

Monitoring and evaluation is a poor aspect of the regional coastal plans. Policy 2.10.3 is very weak in all three approved plans. In all cases, the coastal plans defer to the default legislative requirement to review regional coastal plans every seven years, but there is a lack of statements relating to how the plans will be monitored or what the review processes will be.

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3. Surface water in regional NRM plans

Geoff McDonald, Michelle Walker and Sonja Heyenga

3.1. Introduction

This review looked at regional natural resource management (NRM) plans prepared by regional NRM bodies in Queensland under the guidelines of the National Action Plan for Salinity and Water Quality (NAPSWQ) and the Natural Heritage Trust (the Trust)⁴. The review focuses on how the regional NRM plans addressed water quality and water supply, the criteria for which are explained in McDonald et al. (2004).⁵ They are:

Water quality:

- Soil and water salinity levels are maintained or improved (criteria 12); and
- water quality in freshwater streams and lakes is maintained or improved (criteria 13).

Water supply

- Environmental flow requirements of streams is maintained (criteria 14); and
- groundwater levels and quality is maintained or restored (criteria 15).

For the purpose of this review the discussion of NRM plans is divided into three groupings of regions, namely *Reef Catchment regions*, *Inland regions* and *Southeast Queensland (SEQ)*. Due to the institutional, policy imperative and biophysical differences between these broad areas, these groupings provide a more meaningful analysis and comparison of how water related outcomes are addressed through the NRM plans in those groupings.

3.1.1. Water quality and approaches to management

Impacts from human activity have resulted in increased sediment, nutrient and toxin discharges and resulting concentrations in surface, underground and adjacent marine water bodies. These in turn have had impacts on the suitability of water for human and agricultural uses and in particular, on the ecological health of rivers, bays and significant national assets such as the Great Barrier Reef lagoon. A minimum set of matters for which water quality targets and indicators are required was defined under the NAPSWQ and Trust agreements between State and Australian Governments. These matters included nutrients (nitrogen and phosphorus), salinity, sediment (or suspended solids) and river health (DEH 2002). Addressing these matters through the resource planning is by no means straightforward. For example, the Australian Water Quality Guidelines note:

“There are few data for tropical water bodies and site- or ecosystem-specific reference data need to be collected for tropical ecosystems. The approach recommended in these Guidelines (studies of site-specific biological or ecological effects to develop local trigger values) is also especially appropriate in ecosystems that demonstrate such a high degree of variability in physical and chemical stressors (e.g. wet and wet-dry tropics)”. (ANZECC 2004, p.64).

⁴ Plans were reviewed from Queensland NRM regions of the Wet Tropics, Northern Gulf, Southern Gulf, Burdekin, Fitzroy, Mackay Whitsunday, Condamine, Qld Murray Darling Basin and Border Rivers, Desert Channels and South East Qld.

⁵ It is also important to note that the review assessed the accredited plans only and did not review the many supporting background technical reports prepared in the planning process or the general technical literature available for regions.

These reservations notwithstanding, in 2000 ANZECC published water quality guidelines for tropical Australia (ANZECC 2004). Neither the national nor the Queensland water quality strategies provide what might be termed resource condition targets (SMART targets) as to what water quality conditions can be realistically achieved and how. To that extent these water quality guidelines are *aspirational* in nature only and relate to intended use in the long term. This in turn creates significant difficulties or inconsistencies with the requirement for planners to set SMART targets at regional scales within limited timeframes.

3.1.2. Water supply and approaches to management

Traditionally, the term “water resources” is associated with the need for sufficient, reliable and long-term supply of urban, industrial and rural water without considering the maintenance of flows for environmental values such as ecology, recreation and aesthetics. The advent of water resource planning in Queensland under the *Water Act 2000*, instituted a comprehensive approach to sustainable use of water resources, including environmental flows. The challenge for regional NRM plans was to identify how the two types of plans might be complementary - what is the value added by the non-statutory NRM plan alongside the statutory resource allocation plan, the Water Resource Plan (WRP). Incorporating groundwater management within water resource modelling, planning and regulatory processes is occurring more slowly and with some difficulty than surface water management.

Tropical water resources however are not well understood. A recent scientific forum concluded that ‘the long held perception that the tropics hold abundant water resources for exploitation may be a myth produced by overly simplistic audit systems. There is no question that the region carries a large volume of runoff, but inadequate gauging networks and hydrological data mean that estimates of sustainable water yields, where they are available, are likely to be unreliable and may not account for the typically large seasonal and inter-annual variability’ (Gehrke et al. 2004, p7).

3.2. Evaluation of Current Plans

3.2.1. Regional and State level planning contexts

All regional NRM plans present a clear statement of the importance of Queensland and Australian Government programs for maintaining healthy rivers and catchments and present a range of tables and diagrams describing them. The degree to which that dependence is important varies substantially across Queensland and the precision with which plans deal with them also varies considerably.

With regards to sustainable use of water resources, including provisions for environmental flows, most plans defer to the *Water Act 2000* and associated water resource / resource operation plans which exist for the major regulated rivers. While the Department of Natural Resources and Mines (DNR&M) has a program to prepare WRPs for most of the State’s exploited rivers, many rivers in the north and southeast, where water extraction is occurring, as yet do not have the benefit of a WRP. In some cases these were in progress and NRM plans foreshadowed their completion in targets and actions.

In regions where WRPs do not exist, a number of NRM plans defer to WRPs in preparation, notably the Gulf regions where the *Gulf Water Resource Plan* has been in preparation since 2004. In these and other cases where WRPs are scheduled (eg Wet Tropics or Maroochy), there is little incentive in the regional NRM plan to address water allocation issues in this edition of their plan. Even though the NAPSWQ/Trust programs focus on sustainable use of land and water resources, regional bodies have no power or responsibilities for water allocation. In other regions, the plans promote the preparation of WRPs or in a few cases their amendment (eg improved analysis of groundwater in the Pioneer WRP).

Regional NRM plans also list their dependence on other relevant water policies and programs:

- The plan for the Desert Channels region, for example, lists national and cross state policies including the *Lake Eyre Basin Intergovernmental Agreement Act* (DCQ 2004).

Furthermore, it acknowledges that some targets and actions for bore capping within the Great Artesian Basin are outside the DCQ area of influence.

- Regions within the Queensland Murray Darling Basin (Condamine and Queensland Murray Darling Committee) note obligations under the Murray Darling Basin Agreement. For the Condamine Alliance, this links well with the Condamine Catchment Strategic Plan and the Eastern Downs Regional Planning Advisory Committee issues/data gaps relating to water supply, disposal of stormwater, industrial water and sewage.
- Regions with reef catchments (Wet Tropics, Burdekin Dry Tropics, Fitzroy and Mackay-Whitsunday⁶) have a major commitment to the *Reef Water Quality Protection Plan (RWQPP)*, which states that regional NRM plans will be a major delivery mechanism for the RWQPP (The State of Queensland and Commonwealth of Australia 2003). The plans for the Fitzroy, Burdekin and Mackay Whitsunday generally provide detailed statements on how they address these requirements of the RWQPP in the form of tables on linkages between the RWQPP and the goals, resource condition targets and management action targets. All three plans show how the individual resource condition targets correspond to the strategies and actions of the RWQPP. Others plans are less explicit.
- The most complex regional NRM plan, Southeast Queensland (NRMSEQ 2004), had to contend with a number of significant local and regional planning instruments, in particular the Moreton Bay Waterways and Catchment Partnership and the SEQ Regional Organisation of Councils and their strategies. More recently the Office of Urban Management released a statutory plan including an infrastructure plan with widespread implications for the SEQ region in these matters. The plan for the SEQ region also clearly articulates its relationship to the *Southeast Queensland Water Quality Strategy (SEQRWQMS)*.

While most plans pay homage to Queensland and Australian Government policies and programs, especially the *National Water Quality Management Strategy* (ANZECC 2004), many struggle to show the precise and practical nature of the links between their plans and these statutory instruments (see for example Taylor 2004). In some cases the references are basically lip service as required, for example one plan states that 'this NRM Plan aims, where possible, to be consistent with other plans and strategies' but then the plan does not detail how it fits in with other plans and strategies. All it says is that 'the plan seeks to build on existing plans and work with the organisational context established'.

The plans for the Northern Gulf (NGRMG, 2004) and the Southern Gulf (SGC, 2004) regions provide a good overview of the international, Commonwealth Government and Queensland policies, agreements and strategies affecting the water and waterways in the region, but in the final analysis, many of these documents were not particularly effective in guiding priorities and actions for their regions.

3.3. Condition and trend

3.3.1. Inland Regions

All plans emphasise the lack of detailed data on aspects of the resource condition and trend and as a consequence focus on more generic threats and management issues that lack spatial and quantitative specifics. For example, the plan for the Desert Channels region states that 'the limited information base indicates considerable natural variation due to the extreme variability in catchment flows. Turbidity and salinity can be naturally high in some of the region's streams. Given the size of the region, and available resources, a region-wide monitoring system is unlikely in the near future. Development of robust water quality targets (flowing water) for the region will be the subject of a management action' (DCQ 2004, p.67).

The Southern Gulf region was particularly poorly supplied with condition and trend information as only limited research has been undertaken across the region to determine water quality of surface waters. As a consequence, the discussion of the condition and trend of inland water resources is very limited, comprising only two small paragraphs (SCQ 2004). Research projects

⁶ Cape York Plan was not reviewed.

are currently underway but have not yet delivered any findings⁷. The plan also includes a table summarizing issues and gaps in knowledge about inland waters. The need for a monitoring program for water quality is emphasized.

In all inland regions there is a major issue with protection and management of groundwater resources resulting from the trends in declining groundwater pressure (e.g. in Artesian Basin). However, the plan of the Burdekin region does not yet describe the condition and trend of groundwater because of the lack of adequate data and information about the depth and quality of aquifers. The plan also identifies that 'this lack of data represents a major gap in the knowledge needed to assess the risk of dryland salinity' (BDTB 2005, p.112).

The plan for the Queensland Murray Darling region splits water quantity from riverine floodplain and water quality (includes wetlands, aquatic ecosystems). Overall, catchments of the Queensland Murray Darling region have good condition and trend data for nitrogen, phosphorus, algal blooms and pesticide levels for the Condamine Balonne system due to previous planning (Condamine Balonne Water Committee Water Quality Management Plan 2001).

All plans noted the impact of drought on water management and that water extraction can rapidly increase relative to flow/resources during these periods. Several plans have also suggested actions for managing climate variability addressing drought or its impacts on water supplies (see Taylor this volume, p.51).

3.3.2. Reef Catchment Regions

Many major projects have assessed the water quality of the reef catchments' rivers, including NLWRA (2000), regional growth management frameworks (e.g. FNQNRM 2010, WHAM 2015, CQANM, WBB2020), State of the Rivers Assessments, Productivity Commission Report (2003), Reef Taskforce (Baker 2003), AIMS river monitoring data, the Great Barrier Reef Water Quality Action Plan (GBRMPA 2001), and recent studies by Hunter (2003) and Brodie et al. (2003). The latter reports, in particular, provide regional and catchment specific assessments of the condition and risks created by the regions' rivers and provide spatially specific assessments of catchment conditions, modelled area specific hillslope erosion rates and the risks to downstream areas, river reach specific estimates of bed load and bank erosion, nutrient pathways and high resolution riparian zone assessments for some river sections.

The quality of the data, however, is patchy and not always of much use at the regional scale. For example, the AUSRIVAS and NLWRA audit is too coarse, and in some cases misleading when interrogated or applied at subregional scales. Despite all this work, the current knowledge about loads and ambient levels of water quality, the causes of water quality decline and consequent impacts are subject to wide error bands. Nonetheless, all plans in reef catchment regions use modelling results and recommendations from these reports.

In the Fitzroy region, the condition of water quality has been assessed with respect to the indicators of turbidity, total nitrogen and phosphorous, pesticides and nuisance algal blooms as part of a major regional overview (FBA 2004). However, the assessment is not reported in detail and does not refer to major water quality reports (i.e. Furnas, Brodie, Baker, Productivity Commission) within the NRM plan itself.

For salinity, information is patchy and mainly confined to local knowledge about the location of salt affected areas. A better understanding of salinity risk, groundwater flow systems and effects of land use changes is necessary and some regions (Fitzroy and Burdekin for example) state the need for improved dryland salinity risk assessment.

The plan for the Burdekin region identifies threatening processes critical to the maintenance of surface water and groundwater. They are linked to land and water management and include inappropriate grazing management, flow regime alterations and contaminants to groundwater (BDTB 2005). Most information is taken from the NLWRA assessment 2002 and a catchment

⁷ i.e. DNRM – Technical Advisory Panel to the Gulf Water Resources Plan and Land and Water Resources Research – Northern Rivers Project.

condition study undertaken by Roth in 2002. The AUSRIVAS program has carried out episodic monitoring of river health at a few sites in the region. However, a State of the River Condition report, as produced for other catchments across Queensland, has not yet been carried out for the Burdekin region.

3.3.3. SEQ

While SEQ is well supplied with water resource and water quality information, even there, according to the plan, major gaps in groundwater knowledge, modelling and monitoring made a region-wide assessment virtually impossible (NRMSEQ 2004, p.100). As a consequence, the plan for the SEQ region notes the need for more detailed investigations of current groundwater use and quality of the Brisbane River, Logan-Albert region and the Gold and Sunshine Coast in order to make more adequate quality assessments of the current groundwater conditions.

3.4. Targets and objectives

3.4.1. Inland Regions

An important commonality of most NRM plans is that the basis for target setting was often hindered due to the existence of several **constraints**, including the lack of adequate data and understanding of resource condition or the likely impact of different intervention options. For example, the plans for the Northern and Southern Gulf state that the development of resource condition targets was constrained by four major factors, including:

- The lack of information on aquatic assets in most parts of the regions and the need to address this deficiency as a basis for demonstrating either maintenance or improvement of current status;
- the fact that livestock management and agricultural practices are the dominant land uses and thus threatening processes;
- the fact that riparian weeds are the major influence on riparian condition, and may be related to, or decoupled from, land management practices, depending on the circumstance; and
- the notion that natural changes occur so regularly in variable savanna environments that for some indicators, expected condition is hard to define.

Most other NRM plans were faced with similar constraints. The lack of sufficient data and information, in particular, meant that resource condition targets in the majority of NRM plans could not be set in detail. Not surprisingly, the assessment of NRM plans showed that initial efforts predominantly focus on developing sufficient data and analysis in order to establish adequate targets. For instance, the Condamine Alliance sets interim targets for determining number and diversity of native fish, macro invertebrates and other aquatic species in watercourses. With regards to salinity, most regions set targets to maintain EC levels consistent with ANZECC guidelines until defined salinity targets are set.

Actions and targets for the Northern Gulf and the Southern Gulf regions are necessarily vague given the lack of prior planning and research. Also, quantitative benchmarks for resource condition targets do not exist at this stage. For example, the plan for the Southern Gulf region describes two parallel exercises that were used to derive targets, including a community engagement process and an assessment of the best available scientific evidence.

A further commonality across plans within inland regions relates to the determination of sustainable extraction levels for groundwater resources. For instance, the QMDC NRM plan states that 'specific Resource Condition Targets will be developed for groundwater quality and quantity, including water pressure in Great Artesian Basin, by 2007' (QMDC & SWNRM 2004, p. 148).

3.4.2. Reef Catchment Regions

All of the NRM plans developed for reef catchments have included targets to set water quality targets by June 2005, as required by the RWQPP⁸. For example, the plan for the Burdekin

⁸ A project is underway to assist regional bodies by providing improved precision in SedNet modelling and scenario testing – to be completed by June 2005. This can assist the setting of targets in revised plans given it was not available in time to comply with RWQPP commitments. It is not clear how the regions will use this new information given that some catchments (eg the Herbert and the Burdekin) already have modelling at the proposed resolution.)

region states that 'by 2005, adopt interim quantified water quality targets for the key parameters of turbidity, dissolved oxygen, salinity, nutrients, pesticides and herbicides' (BDTB 2005, p.116). In fact, the RWQPP has been used in most cases as the context for water quality target setting. Several NRM plans for reef catchments affirm that water quality targets have been developed in consultation with the RWQPP's goals and objectives.

Similarly to the NRM plans developed for inland regions, most reef catchment NRM plans found that the basis for target setting was often hindered due to the existence of constraints. The plan for the Burdekin region, for example, mentions a number of constraints encountered when setting targets, including lack of available data, lack of monitoring coverage and lack of community capacity (BDTB 2005). Due to these deficiencies, appropriate periods of monitoring and further research are required to establish baselines and trends.

All reef catchment regions focus management action targets on practices (i.e. ground cover, soil erosion and sediment control). There is also particular emphasis on increasing community awareness of causes and impacts of declining water quality, and increasing participation in monitoring activities.

Despite the rejection of the targets in the *Great Barrier Reef Water Quality Action Plan 2001* and the lack of timely and appropriate advice in guidelines, all regions came to the conclusion that targeting inputs or practices (i.e. emission proxies) is the only practical option at present, given the limitations of existing information and emission models and the restrictive conditions under which load and ambient targets would be cost-effective. There has been no consistent guidance, except from the Productivity Commission Report and to some extent the Baker Report, on this critical issue.

Interesting differences have been observed in how regions intend to set water quality targets. In the Wet Tropics NRM region, an adaptive approach based on reverse engineering emissions proxies from improved adoption of BMPs is proposed. Similarly, the plan for the Fitzroy region is based on a combination of implementing the contract based neighbourhood catchments program, together with monitoring and modelling in selected priority catchments and in rivers to synthesise understanding and progressively refine condition targets. The end results may converge.

3.4.3. SEQ

The plan for the SEQ region builds on the *SEQ Regional Water Quality Management Strategy* (SEQWQMS) and the work of the Moreton Bay Partnership, especially in relation to point source pollution. The plan provides a detailed list of draft water quality objectives established in SEQWQMS, listing targets for freshwater, riparian zones, tidal estuaries and Moreton Bay. Resource condition targets focus on improving river conditions by restoring vegetation to achieve canopy shade, maintaining bank vegetation to minimise erosion and managing livestock access. With regards to freshwater, targets are set for annual median turbidity, annual median chlorophyll, and annual median TN and TP (NRMSEQ 2004).

As seen in the reef catchment regions, management action targets predominantly concentrate on practices, especially on increasing community awareness and participation in NRM activities (eg. preparation of property management plans, development of farm management systems). Importantly, the SEQ region intends to set and meet its water quality targets through an adaptive management approach. The plan recognises that the developed targets will need revisions, particularly to fill gaps as information becomes available.

3.5. Priorities and options

3.5.1. Inland Regions

All NRM plans reviewed discuss priorities and include some discussion about the development of regional investment strategies. For example, the plan for the Queensland Murray Darling / Border Rivers region has identified 'key regional issues' which lead to 'prioritised management actions', which in turn lead to the regional investment strategy. Within this plan QMDC & SWNRMG indicated that a social and economic assessment had been undertaken of management action targets and actions (Cavaye 2004), which informed the RIS development in

terms of ameliorating potential economic impacts where possible through including financial offsets. However, the plan is missing a description of how key regional issues and management actions have been prioritised.

Other NRM plans provide a more in-depth description of the priority setting process. For instance, the Condamine Alliance (2004, p.122) notes that 'identification of draft priority issues for action was the culmination of a range of prioritisation activities with community and technical input'. The plan also specifically mentions that tradeoffs between social, economic and environmental benefits were considered as part of this prioritisation process.

Due to the absence of adequate baseline data, the priority actions in the Gulf regions were to collect data and develop an understanding of riparian and wetland condition, water quantity and water quality needs. These are connected to a longer-term commitment to set quantitative targets in 3-5 years time. Importantly, the plan for the Southern Gulf region recognises that it is necessary to prioritise which are the most critical projects to support since not all projects and proposals can be funded. The plan thereby acknowledges that it is critical to establish a prioritised program, which will ensure that investments are focused on those areas, which will generate the most substantial and lasting outcomes. Also, the plan concedes that some activities need to be undertaken first to provide the foundation for later initiatives.

Interestingly, the plan for the Southern Gulf also describes the various planning stages undertaken to identify priority issues (i.e. meetings with the community, matrix assessment, assessment of scientific evidence, review of parallel plans elsewhere, scoring process). The plan for the Northern Gulf region, on the other hand, provides a two-step multi-criteria analysis that was used to first prioritise issues (assets x threats) and then actions. In addition, the plan uses a network analysis (Bayesian belief networks) to calculate significance and risks of activities necessary for achieving management action targets. In comparison to other NRM plans, the process of identifying priorities has been explained in quite a lot of detail for both Gulf regions.

3.5.2. Reef Catchment Regions

In all NRM plans for reef catchment regions, the discussion of water resource targets is divided into two sections, water quality and water availability. Overall, water quality targets have been assigned much greater priority than water availability targets (see discussion in *Regional and State level planning context* on role of NRM plans and Water Resource Plans).

All reef catchment regions used some variant of multiple criteria analysis to prioritise actions. Although what was prioritised varied from region to region, water quality ranked in the top few issues in all cases. For example, water quality management action targets were all given the highest priority (Priority 1a) in the plan for the Fitzroy region (FBA 2004).

In the Burdekin region, the prioritisation process occurred during three stages of the NRM planning process (BDTB 2005). Stage one was prioritisation by a technical and scientific panel. Stage two was sub-regional prioritisation of issues. Stage three was resource condition target prioritisation. Specific criteria were used in all three stages of the prioritisation process for a multiple criteria analysis and provided a transparent framework for the prioritisation of issues. In comparison to the other plans, the plan for the Burdekin region outlined the process of finding priorities with the greatest amount of detail. It concluded that collection of data on groundwater was a key priority.

Overall, modelling and monitoring results provided data suitable for determining key catchments and hot spots for priority action. However, given that targeting inputs or practices is the only practical option at present, the absence of emission proxies for land use practices made prioritising actions difficult and contentious.⁹

3.5.3. SEQ

Similarly to other plans, the plan for the SEQ region refers to a multi-criteria analysis that was conducted to guide prioritisation for investment. However, this multi-criteria analysis is not

⁹ See R&D Needs/Gaps in the Reef Catchments Identified at the CIRM – State Government Agency Workshop, February 2005.

described in any greater detail. For instance, even though groundwater monitoring has been identified as a major priority in SEQ, the process of how groundwater monitoring was identified as a priority is not described.

3.6. Implementation and investment

NRM planning and implementation activities will occur on a number of different levels throughout the regions. Several plans acknowledge that the work of community groups, industry and local and state governments will remain the backbone of implementation activities while the NRM bodies will be the conduit for delivery of investment to the regions' stakeholders. The purpose of investment plans is to guide investment in strategic and priority activities outlined (in varying levels of detail) in the NRM plans. Investment plans have not been reviewed in this report. However, most NRM plans set out priority management action targets to be funded through specific regional programs and the creation of links to other programs (i.e. Water Resource Plans, Coastal Catchment Initiative projects and Envirofund).

The plan for the Fitzroy region is one of the largest and best funded plans in Queensland and provides a representative example of how plans are structured for implementation. The water quality and water availability actions developed for the Fitzroy region are presented under four themes, to be implemented as part of an integrated program (FBA 2004). The themes are:

- Research and monitoring - Building Knowledge.
- Capacity building - Sharing Knowledge.
- Improved regional arrangements - Planning, Governance and Partnerships.
- On-ground works – financing incentives for on-ground change.

For example, the first theme, 'Building Knowledge', focuses on further research actions and includes the collection of data on total nitrogen, total phosphorous, total suspended solids and electrical conductivity in order to set targets at local, sub-regional and regional scales within five years. Another suggested action for implementation is to improve the understanding of relationships between flow characteristics, groundwater interaction, water quality and in-stream ecosystem health within five years.

The second theme, 'Sharing Knowledge', aims to increase awareness and the sharing of information about current water quality and water availability issues. Key actions of the plan are to increase community awareness of causes and impacts of declining water quality, and to foster participation in monitoring activities. With regards to water availability, a suggested action to be implemented is to achieve 90% awareness of water use efficiency initiatives amongst irrigators within 2 years.

The third theme, 'Planning, Governance and Partnerships', seeks to enhance collaborative actions including local and state government, industry and group planning. A priority action of the plan is therefore to develop a regional water quality and flow monitoring and reporting system, which will be shared between statutory and non-statutory planning activities in the Fitzroy region within 2 years. With regards to water availability, the plan has developed quite an extensive list of actions, focusing mainly on the development and implementation of water resource plans.

The fourth theme, 'On-ground Action', involves the adoption of sustainable practices and incentives for on-ground works aimed at conserving ecosystem function. Concerning water quality, the plan suggests incorporating local water quality targets in priority neighbourhood catchment planning as a key action for implementation. In relation to water availability, the plan again makes several suggestions for implementation, including achieving that 70% of irrigators participate in water use efficiency programs within 2 years.

As mentioned before, a number of regions make a commitment to an adaptive management approach, recognising that adaptive management is an important part of the planning and management process. For example, in the plan for the Southern Gulf region this is anchored to the ANZECC recommendations, although the specifics of the implementation of the approach

are vague (SGC 2004). Nonetheless, overall most plans do not make any explicit statements about how adaptive management is going to be implemented.

3.7. Monitoring, evaluation and reporting

3.7.1. The overall program

All NRM plans reviewed have routinely included a section on monitoring and evaluation, usually giving some background information on the benefits of monitoring and the components of a monitoring program. Importantly, all regions have allocated high priority to water quality-monitoring programs in order to improve the understanding of water quality from catchment through to field scales. In particular in information-poor regions, priority was given to the establishment of a monitoring system at an early stage to collect baseline information to guide the refinement of resource condition targets and trends.

Nonetheless, most monitoring provisions are very general, not making specific comments on how monitoring programs are going to be implemented in the region. A large contributor to this deficiency was the confusion about to what extent regions would be responsible for monitoring. In most plans, it was assumed that the regional body is responsible for monitoring management actions and local resource conditions to inform management practices, while Queensland and Australian Government agencies are responsible for long term monitoring of marine water quality and water quality in major streams. The regional community may participate in these processes. The plan for the SEQ region also acknowledges that poor coordination in data collection has been a long-standing issue. Reasons for poor coordination are the complex management arrangements, and a table with various monitoring programs currently conducted across SEQ is provided, many focussing on water quality. The issue of complex management arrangements can be applied to some extent in all regions.

3.7.2. Activities

As discussed above, water quality and water flow monitoring activities have been identified as priority short-term management actions in most plans. Monitoring will focus on resource condition (mainly undertaken by QLD Government), management actions (undertaken by regional body) and financial activity (undertaken by regional body). Importantly, the plans for all regions have commitments to short-term and tactical monitoring of smaller waterways, sub-catchment to farm drain scale projects, event monitoring and monitoring to show impacts of improved management practices.

In many plans, there was no defined monitoring program but rather the commitment to establish stakeholder monitoring programs within a certain time frame. For example, the plan for the Fitzroy region asks for the implementation of 'an integrated and coordinated multi-stakeholder monitoring program to assess water quality by 2008' (FBA 2004, p.127). Monitoring will focus on resource condition, management actions, capacity building and financial activity. The role of the local community in monitoring activities is frequently mentioned in all plans. For example, the plan for the SEQ region states that 'coordinated community monitoring is a cost-effective way to gain a broad temporal and spatial picture of water quality issues' (NRMSEQ 2004, p.227). However, only few plans provide specific guidance on community monitoring activities. This is an area of uncertainty given the previous high profile given to Waterwatch and other programs.

Also, all regions flag the need for increased investment into modelling and monitoring efforts. These are needed for improved accuracy in water quality management and in making better connections between management actions and responses in the resource condition, improvements in information flow and access arrangements. There is a major role for catchment, industry and community groups in this process and the investment strategy recommends funding for this purpose.

3.7.3. Indicators

Plans varied markedly in defining water quality indicators. Many plans provide tables of potential indicators for monitoring asset condition (for example in the plan for SEQ), which state that these indicators will be used to measure performance or progress towards a desired condition.

The plan for the SEQ region comments that the indicator framework to be developed will aim to report on the same indicators as those used by the Queensland and the Australian Governments in their State of the Environment Reporting. More specifically, the National Core Indicators, developed by ANZECC (2000), will be utilised as widely as possible. Furthermore, the resource condition indicators developed by the Monitoring and Evaluation Working Group (MEWG) will be utilised. The plan also notes that it may sometimes be necessary to alter existing indicators. Where no appropriate indicator can be found in either list, an 'indicator deemed to reflect the impact of the pressure on the asset will be specifically developed' (NRMSEQ 2004, p.229).

Similarly, the plan for the Fitzroy region states that the National Core Indicators (NCIs) are the highest order indicators. In addition, indicators were selected from the *Queensland State of the Environment Report (SoE) 1999* in cases where the NCIs were not applicable to a pressure. If no appropriate indicator could be found in either NCI or SoE, an indicator deemed to reflect the impact of the pressure on assets has been used (FBA 2004, p.129).

The plan for the Southern Gulf region remarks that a large number of indicators have so far been identified, which will be refined during the early implementation phase. The plan also states that it will include a balance of quantitative, qualitative and process indicators (Earth Tech 2004). A comparison of the three indicator types is provided in a useful summary table.

3.8. Conclusion

Regional bodies faced an enormous task to systematically address arguably the most important natural resource, water, and its availability and quality to meet a range of competing economic, social and environmental needs. They built on an information base that was substantial but in many cases inadequate for the rigorous task of defining conditions and optimal interventions within the NAPSWQ/Trust frameworks.

Very few plans could define resource condition targets for water that met program expectations, despite the major efforts to collect new information for regional overviews and to assimilate the available science. The collected information was patchy and the science behind cost-effective management change incomplete.

Regional bodies did have Landcare, Integrated Catchment Management and a range of government programs to build on, but these were often fragmented or lacked the incisiveness required by the new process. Not all potentially important partners, such as local governments or the EPA, gave wholehearted support or filled their responsibilities to an integrated approach to catchment and river health (see McDonald et al. 2005).

The role of communities in monitoring water quality is not clear in most plans and has yet to build on past programs such as Waterwatch and ICM monitoring programs. Despite these difficulties, a lot of innovative and catalytic work resulted in the plans, or occurred in parallel in the activities of regional bodies and their partners, including:

- There has been a substantial increase in our understanding of the condition of catchments and rivers;
- there is greater clarity and acceptance of the suite of actions that each stakeholder group needs to take; from an improved focus for science, programs for capacity building of individuals, industries and institutions, on-ground works which emphasise sustainable landscape management and coordinated catchment monitoring activities;
- clearer roles emerged for community based activities in supporting the statutory water supply and water quality program implementation, from awareness raising to on-ground works beyond statutory provisions;
- cooperative explorations of the necessary links between property scale management and the impacts on catchments and rivers and how farm management practices could assist; and
- clearer frameworks for landholder and industry engagement in strategic and priority actions now exist.

With the time and resources to succeed the plans are the first really integrated and rigorous step in delivering improved catchment and river health working alongside the necessary statutory programs. The key requirement is that communities, regions and governments see this as an ongoing adaptive process and not an immediate solution.

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4. Community stakeholder knowledge in regional NRM plans

Cathy Robinson

4.1. Introduction

This section examines how well community stakeholder knowledge is captured and integrated in regional NRM plans to set, implement and evaluate progress towards NRM targets. While the stated goal of regional NRM regional planning seeks to enhance the condition of the natural resources in the region, regional NRM plans must also promote community ownership and direction for NRM targets, actions and measures of success. The *Guidelines for Developing a Regional Natural Resource Management Plan in Queensland* (NR&M 2003) recognise these distinctive features to regional planning and indicate that without meaningful opportunities for regional communities to contribute to “defining the problems, setting targets and developing solutions” it will be unlikely that regional NRM plans can be successfully implemented. As the Board Directive at the outset of the NRM planning process for the Southern Gulf firmly state (SCG Book 2, 2005, p.1, emphasis added).

We want a planning process and Plan that first and foremost engages the people of the region. It must also meet government accreditation requirements – but **if it does not capture the interests and aspirations of the community, the process and Plan will have failed.**

This section reviews how well community stakeholder knowledge is captured and integrated in accredited regional NRM plans against the following criteria outlined in McDonald et al. (2004).

- How well Indigenous values are recognised and protected (criteria 3).
- How well non-indigenous cultural heritage and landscape values are recognised and protected (criteria 4).
- Whether processes for inclusive participation and active involvement in community stakeholder groups and networks are established and maintained (criteria 7).

Community ownership of regional NRM planning raises three key questions that address the criteria outlined above and analysed in this review:

- How is the community defined in regional NRM plans
- How well is the knowledge held by different Indigenous and non-Indigenous community stakeholders captured in regional NRM plans.
- How well is different community stakeholder knowledge integrated with other forms of (scientific, government) knowledge in different NRM plans.

A collaborative approach to regional NRM is one response that has been adopted to incorporate community stakeholder knowledge into the content and implementation of regional NRM plans (<http://www.regionalnrm.qld.gov.au/index.html>). Yet the process of **capturing community stakeholder knowledge** is difficult because local stakeholders are often scattered, varied or protective in their views and interest in natural resource management problems and solutions (Barnes et al. 2003). One or more stakeholder groups might perceive the consequences of a particular NRM goal to be adverse which can often lead to non-cooperation or even opposition to delivery or success of management actions (Beierle and Konisky 2000). Opportunities to be involved in NRM planning has not always been equal between stakeholders while those stakeholders who do get involved often face continued frustration and constraints to implementing any meaningful changes to natural resource management planning policies and approaches that have been set by government funding programs and policies.

Even so, considerable effort has been made to include community input into regional NRM plans through various strategies. This includes various strategies to gain community input to set and prioritise management and resource condition targets and ensure community stakeholder interests are represented on Regional Body boards.

Integration of knowledge held by different community stakeholders into regional NRM plans can also be difficult. For example, Indigenous Ecological Knowledge is governed by protocols that can make it difficult for Indigenous people to share their knowledge with other stakeholders (Robinson and Mununggurij 2001). Stakeholder priorities, attitudes towards other stakeholders or environment issues also affect community stakeholder's ability to uptake new knowledge (Aplin and Brown 2002; Lockie and Rockloff 2004). There may also be a range of indicators used by different stakeholders use to appraise, monitor and evaluate the threat and the effectiveness of a solution to the same asset (e.g. Robinson et al. 2005).

4.2. Regional and State Level Planning Contexts

There are a number of different processes that have been established to capture and integrate community stakeholder knowledge into regional NRM plans. Under the Commonwealth – Queensland NHT /NAP Bilateral Agreement, Regional Bodies are required to have a majority community membership on their Board which has a key role in balancing production and conservation other interests in the region. Regional NRM plans reviewed included a strong stated commitment from Regional Bodies to act as a forum where the diversity of community interests and priorities can be expressed and through which a regional consensus can be brokered.

Forging partnerships between stakeholder groups is a critical step in this process. This includes provisions to enable community stakeholders to access and integrate technical and other information with their own perspectives and knowledge to ensure plans are accurate, comprehensive, well coordinated and able to be implemented (NHT 2004, Attachment F). Indigenous engagement is a plan accreditation requirement and a critical component many government policies, including Queensland Government's Ten Year Partnership Program '*Looking After Country Together*'. As the NHT Bilateral Agreement states: 'Plans are required to indicate how community support can be developed and maintained, thereby helping to guarantee effective implementation of the plan as well as achieve fundamental changes in resource use. This could be pursued through effective community involvement, communications programs (e.g. ICM groups), and recognition and consideration of community interests.' (NHT 2004, p. 63).

4.3. Planning Information Base

As noted in the previous review (McDonald et al. 2003), social, land use and cultural heritage planning issues are covered in regional NRM plans but it is difficult to identify how specific knowledge held by particular community stakeholders will be impacted by or contribute to regional NRM. There is also the challenge of trying to determine what constitutes 'the community' in regional NRM planning as definitions and membership is often ambiguous within and between regional plans. In general terms, the community who 'own' and contribute knowledge to the different phases of NRM planning processes shifts from stakeholders involved in the development of the plans to who is responsible for the implementation, monitoring and evaluation phases of the planning process (Figure 1).

Where and why a particular community stakeholder's knowledge is incorporated into NRM planning also varies. For example, the rationale behind capturing Indigenous knowledge (IEK) ranges from the contribution of IEK to a region's natural resources to an acknowledgement that Indigenous Traditional Owner groups have rights and interest in the region. How to integrate the multiple social, cultural and economic values within a given region is also unclear. Some of these issues might include what is a resource for some might be a pest to others (e.g. the value of the *Leuceana* weed for pastoralists, FNQNRM 2004, p. 29). Or how or why different stakeholders use management tools – such as fire - to achieve a desired natural resource outcome.

Figure 1 - Who is 'the community' in community-based Regional NRM planning?

THE COMMUNITY WHO OWNS THE PLAN

- Focus on who lives, works and is socially / connected to the region. Sometimes includes local government but often excludes State / Federal Government and International stakeholders.

THE COMMUNITY INVOLVED IN PLAN DEVELOPMENT

- A wide membership including government, NGOs, scientists, landholders, the Indigenous community and the Australian public. The difficulty to engage some sectors, e.g. Indigenous, tourism, local government, forestry, education and fishery sectors are often noted.

THE COMMUNITY TO IMPLEMENT THE PLAN

- Emphasis on landholders, Landcare / catchment groups, industry stakeholders, local government and Indigenous communities who implement actions to meet targets.

COMMUNITY MONITORING AND EVALUATION

- A wide membership to achieve monitoring, evaluation and reporting targets. How different community stakeholders will be involved to set criteria and indicators to measure progress towards NRM success will be set is ambiguous.

Based on how "community" is defined in accredited regional NRM plans reviewed Feb 05.

The nature and variability of community engagement and awareness about natural resource management issues is a common concern identified in plans reviewed. Some regional bodies can draw on the findings and processes of community engagement that have been occurring in different ways before NRM regional processes (e.g. Landcare groups). Yet the impact of past NRM plans and planning can also pose some challenges to the current regional NRM initiative. For example, Smyth (2004) notes that many Indigenous people still feel hurt for the lack of respect about their values and connection to country in the past, while non-Indigenous stakeholders continue to grapple with how to understand and implement these Indigenous worldviews into the regional NRM agenda.

Threats to some sectors of community knowledge are acknowledged as a critical issue for full community engagement and ownership of regional NRM issues, particularly in regions that are remote from major town centres. This includes **concern about the lack of youth involved in regional NRM** in rural and remote regions because young people are moving into cities to look for work. In South-east Queensland the shift towards a 'more materialistic and self-interested populace' poses a challenge for community involvement in NRM (NRMSEQ 2004, 151). **Changing land use** (e.g. a shift from sheep to cattle), changes in the workforce for some industries (e.g. grazing and mining) and lack of capacity to tackle NRM issues of concern has meant that large tracts of land is not being managed adequately, being managed by an absentee landholder, or with a transient work force. Meanwhile those **rural residents** that do live in remote regions **struggle to be involved** in community decision-making processes **due to distance or a lack of representation**. For example, the Desert Channels plan notes that over the past ten years councils have shifted from having a good representation from rural areas to now being made up of almost entirely townspeople (DCQ 2004, p. 15).

4.4. Targets and Objectives

There are a range of targets and objectives within regional plans that aim to capture community stakeholder knowledge and integrate this with other forms of knowledge. In some cases 'community knowledge' is treated as a single homogenous entity that is to be somehow captured and integrated with other forms of knowledge to assess the condition of a particular landscape issue. **When there is an attempt to discern differences in community stakeholder knowledge and its contribution to NRM there is some interesting biases in the contribution of different stakeholders to particular targets.** For example, it is not clear why Indigenous Ecological Knowledge (IEK) is often focused on helping to achieve biodiversity, cultural heritage or social and cultural outcomes, rather than offering a contribution to wider NRM targets. Conversely, there is no mention of how knowledge held by non-Indigenous community residents can contribute to biodiversity or cultural heritage. There is also no sense of how the ethnic diversity of stakeholders within some industries (e.g. horticulture and tourism) might affect regional NRM decision-making and implementation.

Even so there are some innovative efforts and proposals to capture and integrate particular community stakeholder knowledge into regional NRM planning. In particular, Indigenous groups or forums have been established to capture and represent Indigenous knowledge and input into the wider NRM process. The efforts of these Indigenous representative groups can be seen in a number of regional plans. This includes management action targets in the Wet Tropics to reflect the holistic features contained in Indigenous country based management, as well as support proposed for decisions made by Indigenous Land and Sea Centres in the Southern Gulf.

Plans also reflect an effort to integrate what is usually defined as 'local' or 'community' knowledge with 'scientific' knowledge or legislative requirements. This includes targets to assist land managers in the Northern Gulf to map their properties for their natural values, cultural values, and infrastructures for sustainable management (Nthn Gulf 2004, p. 51), incorporate Aboriginal people's skills to enhance coastal monitoring in the Southern Gulf (SCG 2004, p. 144), and assist landholders to deliver appropriate management and protection of wildlife/vegetation habitats available through the *Vegetation Management Qld Act 1999* (e.g. NGRMG 2005, 118; FNQNRM 2004, B3.1.6).

Despite a widespread effort to engage regional communities, challenges to engage some stakeholders remain. Although local governments have considerable responsibility for managing natural resources under the Local Government planning schemes prepared under the *Queensland Integrated Planning Act (1997)*, Local Government engagement in regional NRM planning is still recognised as an issue in many regional plans reviewed. Tourism and Defence interests are other examples of '**silent stakeholders**' whose interests are not included in NRM target setting or implementation, even when these interests are noted as being a significant pressure or interest group within the region.

4.5. Priorities and options

All plans document a process that aimed to enable community stakeholder groups to be involved in a process to choose what assets need most attention and to prioritise investments. However, the **process of integrating the multiple of values and uses associated with each regional asset** within community stakeholder groups, between community stakeholder groups and between community stakeholders and other forms of knowledge is often unclear. The most common approach has been to capture the "best available" community knowledge to help set draft targets through a public consultation and submission process, and then allow Board members or expert panel groups to negotiate and prioritise targets proposed.

Many of the short-term targets outlined in regional NRM plans relate to changes that need to occur in the way community stakeholder groups and organisations do their business (e.g. landholders' farm planning systems, improved leadership by NRM based community groups

etc). However regional plans reviewed are unclear how community stakeholder support, priorities and knowledge will continue through to the implementation and evaluation phases of this adaptive management process (see also community capacity section, Robinson this volume).

4.6. Implementation and Investment

Although most plans commit to an integrated approach to regional NRM, it is **ambiguous as to how knowledge held by community stakeholders will be captured and integrated** with other forms of knowledge (scientific, government, etc). For example it is unclear how scientific and 'regional community knowledge' will be combined to set management action targets in the Fitzroy (FBA 2004, p. 63), how 'community knowledge' will be used to set grazing and land management standards in the Southern Gulf (SGC L1-2.1), how groundcover targets will be set that are both technically robust and accepted by the Desert Channel community (DC 2004, p. 49) and so on.

Often the **process of knowledge integration suggests a process that is actually about raising community awareness about other forms of knowledge** (government regulations, scientific data and techniques etc) rather than other integrating a variety of knowledge systems to meet NRM targets. This includes targets to develop community extension programs (CCNRM 2004, p. 115), increase community education / awareness packages on biodiversity values and landscapes in the Desert Channels (DCQ 2004, p. 61), and the importance of native vegetation in the Wet Tropics (FNQNR 2004, B1.1.1), or encourage landholders to use satellite image / air photo and property planning kit to map paddocks, infrastructure, land types and land condition in the Northern Gulf (NGRMG MAT2). This is perhaps not surprising given that one of the key activity areas of the NHT Extension Framework Agreement (2001) is to provide 'landholders, community groups and other natural resource managers with understanding and skills to contribute to biodiversity conservation and sustainable natural resource management'. Yet the contribution of community stakeholder knowledge to regional NRM outcomes does raise the question about if and how regional planning can capture and integrate the diversity of community based knowledge to develop innovative NRM solutions.

The issue of fire management is a good example of this challenge. Information in Regional NRM plans reveal that community stakeholder groups use fire for a range of purposes – fire controls woodland density, it is used to help fulfill Indigenous obligations to care for their country, and is used by farmers in their efforts to stimulate seed production or green feed. Many cultural, conservation and commercial values are created, restored or maintained by burning. Yet plans reviewed highlight the fact that fire management is a contentious NRM issue. Some stakeholders contend that particular fire regimes (e.g. hot fires) can damage some land types and habitats while others argue the appropriate use of fire is critical to 'clean up' the country. Management targets and actions to capture and integrate these multiple values to ensure fire management targets achieve desired regional outcomes is a key challenge facing the implementation phase of regional NRM planning. Most Management Action Targets (MATs) contained in plans describe an intent to work in collaboration with land managers and Indigenous Traditional Owners to incorporate 'appropriate' or 'the best' fire regimes possible into property plans, grazing and agricultural land use, for biodiversity and production values. The negotiation of what is 'the best' fire regime to achieve an agreed 'healthy' landscape outcome is both a challenging and unclear regional aspiration.

4.7. Monitoring and evaluation: Incorporating community stakeholder knowledge or promoting community awareness?

The review of regional NRM plans suggests it is not clear how monitoring and evaluation (M&E) frameworks will capture indicators that community stakeholder groups might use to measure NRM trends and assess progress towards management goals and integrate these evaluations with other (scientific and government) indicators that have been developed to monitor program performance. Instead support and commitment for M&E appears to be focused on increasing community awareness and involvement in scientific and government

monitoring programs that measure the health and threats of the region's natural resource assets.

This may pose a challenge for some stakeholder groups. For instance, while it is a Commonwealth and State requirement to incorporate Indigenous values into regional NRM planning process, the FNQNRM plan notes the absence of M&E approaches to ensure Indigenous people's knowledge and priorities are effectively monitored (FNQNRM 2004, p.146). The effort taken to include community stakeholder views must continue through the implementation and M&E phases of the adaptive management cycle. If this is not done the current regional NRM initiative risks the loss of community input and learnings needed to assess progress towards natural resource condition targets and loss of community support to engage in the improvements of future plans and investment strategies.

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5. Native vegetation and biodiversity in rangelands

Clive McAlpine

5.1. Introduction

Biodiversity conservation is key component of regional NRM planning initiatives in the tropical savannas, including Queensland's rangelands. The clearing, thickening and thinning of native vegetation, excessive grazing pressure, biological invasions, and altered fire regimes all impact on terrestrial biodiversity in these extensive rangelands. Under the *Queensland Vegetation Management and Other Legislation Act 2004*, clearing is to be phased out by December 2006, with 500,000 ha of assessed clearing permitted until this date. The impact of past clearing varies regionally, with QMDB, South West and the Fitzroy Basin the most affected regions, followed by the Desert Uplands sub-region of the Desert Channels. Clearing poses a lesser threat in the Northern Gulf, with the eastern Mitchell River catchment the worst affected area. Minimal clearing has occurred in the Southern Gulf. In the most affected regions and sub-regions, the management of regrowth vegetation is now an important issue, while vegetation thickening and thinning are important issues in northern regions. Regional ecosystem diversity and integrity also is an important component of regional biodiversity, and is affected by clearing of native vegetation, excessive grazing pressure, fire and invasive plant and animal species. Three biogeographical regions (the Brigalow Belt, the Desert Uplands and the Einasleigh Uplands), which overlap Queensland's rangelands, are listed as national biodiversity hotspots (DEH 2003). Clearing and fragmentation of native vegetation, grazing disturbance, altered fire regimes and invasive species are recognised threats impacting on the biodiversity values of these biodiversity hotspots.

The aim of this section is to evaluate the native vegetation and biodiversity content of accredited regional NRM plans for Queensland's extensive rangelands. Key questions addressed are:

- How well do the content of the regional NRM plans capture, integrate and prioritise native vegetation and biodiversity issues in Queensland's extensive rangelands?
- How consistent is the treatment of native vegetation and biodiversity across the regional NRM plans?

Plans¹⁰ were reviewed for the following regions:

- The Northern Gulf
- The Southern Gulf
- The Desert Channels
- The Fitzroy Basin
- The Queensland Murray Darling Basin and South West NRM region

The geographic focus was the extensive rangelands of western and northern Queensland. The cropping lands of the eastern Fitzroy Basin and the Queensland Murray Darling Basin regions were considered outside the scope of the review as they represent more intensive land use zone with somewhat different but overlapping threats to biodiversity. The Burdekin Dry Tropics regional NRM plan was not reviewed as it was not accredited at the time the review was undertaken. The focus is on terrestrial biodiversity rather than aquatic biodiversity although wetlands and mound springs are considered in somewhat less detail.

Plans were reviewed against the following criteria outlined in McDonald et al. (2004).

- Landscape structure and diversity are maintained or improved (criteria 20).

¹⁰ Important to note that only the NRM plans were reviewed. The review did not include background technical reports contributing to plans' development or subsequent regional investment strategies following plan development.

- Ecosystem diversity is maintained or improved (criteria 21).
- Species diversity is maintained or improved (criteria 22).
- Ecosystem integrity is maintained or improved (criteria 23).

The results of the evaluation are discussed below in relation to planning context, information base, targets and objectives, priorities, implementation and monitoring and evaluation components of plans.

5.2. Planning context

5.2.1. International Context

Most plans recognised the relevant national policies and programs for biodiversity conservation, while reference to relevant international conventions was confined to the Northern Gulf regional NRM plan (NGRMG 2005) and the Southern Gulf regional NRM plan (SGC 2004). International conventions listed included *Agenda 21* (United Nations 1993), *Ramsar Agreement on Wetlands of International Importance*, and the *Japan Australia Migratory Bird Agreement* (JAMBA 1974) and the *China Australia Migratory Bird Agreement* (CAMBA 1987).

The Desert Channels plan did not list any international conventions, nor did it make reference to the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*. Reference to relevant national legislation is patchy for the Queensland Murray Darling Committee and South West regional NRM plan (QMDC & SWNRMG 2004). This plan referred to the Commonwealth biodiversity legislation and *Weeds of National Significance* (Commonwealth of Australia & NWSEC 1999), while *National Principles and Guidelines for Rangeland Management* (ANZECC & ARMCANZ 1999) and the *National Framework for the Management and Monitoring of Australia's Native Vegetation* (Natural Resource Management Ministerial Council 2000) were examples of notable omissions at the national level for this plan.

5.2.2. State context

State biodiversity and native vegetation management legislation and policies were, in general, well recognised in the plans. The plans strongest in this area were the Desert Channels and the Northern Gulf NRM plans, while State-linkages were less explicit in the Southern Gulf and QMDC & SWNRM plans.

5.2.3. Regional context

Reference to the regional planning context, both within and cross-regional, was variable between regions. The Northern Gulf regional NRM plan and the Desert Channels regional NRM plan provided a comprehensive list of existing regional plans and relevant cross-regional linkages and issues. Reference to regional native vegetation management plans previously developed for regions was sparse, with the Desert Channels regional NRM plan providing reference to eight regional vegetation management plans (RVMPs) while the Southern Gulf regional NRM plan made no mention of previous vegetation management plans. This discrepancy may be a function however of the uncertain status of draft regional vegetation management plans in Queensland at the time of NRM plan development. Subsequently, RVMPs were never endorsed by Queensland State Government in their existing form but were converted to and released as vegetation clearing 'codes' for bioregions.

5.3. Planning information base

All plans adopted an assets-based approach to planning, with native vegetation and biodiversity classed as regional assets in most plans. Regional profiles, or overviews, provided the major documentation on the condition and trend in these assets. The Northern Gulf regional NRM plan also provided a separate analysis of a range of biophysical themes. The analysis of the planning information base outlined below is separated into:

- Native vegetation cover and landscape structure; and
- ecosystem and species diversity.

5.3.1. Native vegetation and landscape structure

Native vegetation and landscape structure were recognised as assets/themes in the five regional NRM plans reviewed. However, the information on native vegetation cover and fragmentation varied considerably among regions.

The Desert Channels regional NRM plan mentioned that 3.2% of the region has been cleared and that increased habitat fragmentation is a major threatening process to the region's ecological values. No mention was made of the impact of clearing on biodiversity, especially in the southern Desert Uplands, where extensive clearing has occurred over the past 15 years (McAlpine et al. 2002).

The QMDB & SW regional NRM plan listed the percentage remnant vegetation cover for the 10 sub-regions that make up the Mulga Lands bioregion and 13 subregions of the Southern Brigalow Belt subregion. A regional 1:4,500,000 map of the vegetation status of the region also was provided. This was the only region to provide a map of vegetation cover and its status for the whole region. The QMDB & SW regional NRM plan recognised the biodiversity, tourism and indigenous values of the region's native vegetation, with the loss of this vegetation a major threat to the long-term conservation of the region's biodiversity. No mention was made of the level of fragmentation of remnant vegetation, or the increased disturbance pressures posed by weeds, grazing, fire, and feral and macropods associated with fragmentation. Landscape diversity and regional ecosystems were listed as an asset under "Ecosystem Health and Biodiversity" in the regional profile of the Fitzroy region's NRM plan. Regional trends in clearing rates and an analysis of the extent of clearing (percentage of remnant vegetation) for the various sub-regions of the Fitzroy Basin is also presented. The area of state significant remnant vegetation is also mapped for the region (FBA 2004 p155-157). Associated quantitative indicators for remnant vegetation are also presented.

5.3.2. Ecosystem and species diversity

In all plans, regional ecosystems were mentioned, with varying level of detail on the status of regional ecosystems for each region. There were some notable omissions, including in the QMDB & SW NRM plan, where completed regional ecosystem mapping data was available. Queensland Herbarium regional ecosystem mapping was the major source of information on regional ecosystem diversity, providing an almost seamless mapping coverage across the state at a scale of 1:100,000. However, while regional ecosystem classification has been completed for all regions (Sattler and Williams 1999), the state-wide regional ecosystem mapping program was still not complete for the Northern and Southern Gulf NRM regions and the western Desert Channels NRM region. This limitation made comparison of the ecosystem diversity content for all the regional NRM plans difficult. A comparison of the plan information base on ecosystem diversity shows varying levels of recognition and analysis of the status of regional ecosystems, that is: not of concern (>30% pre-clearing extent remains), of concern (10-30% pre-clearing extent remains), endangered (<10% pre-clearing extent remains).

The Southern Gulf regional NRM plan reported the number of 'of concern' ecosystems for the region, while a comprehensive review of all available native vegetation data was undertaken in the preparation of the Northern Gulf NRM plan. This included Queensland Herbarium HERBRECS and CORVEG databases, regional ecosystem mapping (41% of the region is currently mapped) and the Vegetation of the Australian Tropical Savannas mapping at a scale of 1:2,000,000 (Fox et al. 2001). For the Northern Gulf, 581 regional ecosystems were

recognised, with four listed as 'endangered, and 139 'of concern'. A detailed analysis was also provided of inland aquatic ecosystems for the Northern Gulf.

The information base on fauna and flora species diversity was more extensive, with all plans providing information on the status of fauna and flora species. Much of this information was drawn from listings under the *Environmental Protection and Biodiversity Conservation Act 1999*, the *Queensland Nature Conservation Act 1992* and Queensland Environmental Protection Agency databases CORVEG, HERBRECS and WILDNET. However, apart from listings of rare and vulnerable species and description of threatening processes, information on the distribution, habitat requirements and population viability of fauna was sparse and spatially variable. The QMDB & SW NRM plan listed the number of extinct, rare, endangered and vulnerable species for plant, mammal, bird, reptile, frog, fish and butterfly species for the region. No geographic breakdown of this information was provided, or analysis of threatening processes impacting on these species. The Fitzroy region's NRM plan provided a more detailed description of the region's flora and fauna for several important vegetation communities, including the Shoalwater Bay and Corio Bay areas, the Brigalow Belt, Serpentine communities extending north from Marlborough to Rockhampton, and semi-evergreen vine thicket communities. Rare and threatened plant and wildlife species for these broad vegetation communities were identified.

The Desert Channels regional NRM plan identified the region as providing important habitat for rare and threatened fauna, wetland birds, and artesian spring complexes, which contain endemic plant, snail and fish species. It acknowledged that more investment was needed to understand "the spatial aspects of species distribution and their specific ecosystem and habitat needs" as a prerequisite for better protection from threatening processes. The Northern Gulf regional NRM plan also acknowledged that the biodiversity knowledge base of the plan area was very poor. However, despite this knowledge deficiency, it provided a detailed assessment and analysis of species diversity and threatening processes impacting on this diversity. The Southern Gulf regional NRM plan provided a similar level of assessment, although more descriptive.

5.4. Objectives and Targets

5.4.1. Resource assessment and mapping

The Southern Gulf regional NRM plan had the most management action targets addressing the need to conduct further monitoring and mapping. This included completion of systematic surveys and biodiversity audits in targeted areas by 2007, and regional ecosystem mapping also by 2007. These targets reflect the lack of suitable information on biodiversity in the region, including regional ecosystem mapping data. In contrast, the Fitzroy region's NRM plan did not propose any management action targets that are concerned with conducting further research and mapping into regional biodiversity. Several NRM plans had as a management action target to identify highest priority biodiversity areas although no criteria were provided to define these areas.

5.4.2. Landscape structure and native vegetation

The two regions with the greatest loss of native vegetation cover differed in the level of specificity of resource condition and management action targets relating to landscape structure and native vegetation cover. The QMDB & SW regional NRM plan set three resource condition targets for native vegetation: (i) retain a minimum of 30% native remnant native vegetation coverage at a bioregional and priority sub-catchment level by 2020; (ii) no net loss of remnant native vegetation in mapped bioregional corridors of state significance (as identified by the Queensland EPA) by 2010; and (iii) sustainable use of native forests on public and private land. The 30% remnant target was not well defined, and is unclear what geographic entities it actually refers to (i.e. the whole region or subregions or sub-catchments). The 30% target is well below the 38% native vegetation cover for the Brigalow Belt South bioregion. Primary management action targets set to help achieve these resource condition targets included: identifying and delivering opportunities and incentives for increasing or maintaining the extent of vegetation cover to 30% or greater by 2009; and

develop and coordinate delivery of incentive packages to restore and enhance priority landscapes by 2010.

The resource condition targets specified in the Fitzroy region's NRM plan were more specific, and included quantitative targets for improving total area of vegetation cover and also landscape cohesion. The plan set two resource condition targets for native vegetation cover:

- minimum 40% or original extent of native vegetation cover in patches \geq 500 ha or greater within 10 years; and
- an additional 5000 ha of non-remnant native vegetation regenerated on private lands in areas forming wildlife corridors and linkages, particularly in riparian areas, within 10 years.

It also set related resource condition targets which aimed at:

- protecting biodiversity on 150,000 ha of private lands through voluntary conservation agreements; and
- managing an additional 150,000 ha of private land supporting regionally significant native vegetation primarily for conservation.

Management action targets designed to achieve these long-term resource condition targets included:

- full implementation of regional vegetation management plans;
- protection of remnant vegetation on private lands; and
- regeneration of 5,000 ha of non-remnant vegetation on private lands as wildlife corridors and linkages.

Management action targets included implementation of draft regional vegetation plans and the *Native Vegetation and Other Legislation Act 2004*; 150,000 ha of private land managed primarily for conservation within 10 years; and 5,000 ha of non-remnant vegetation restored on private lands and forming corridors/linkages within the 10 years.

The Northern Gulf NRM region has over 90% remnant native vegetation cover. The major native vegetation management action target of the Northern Gulf regional NRM plan relating set no further loss of native vegetation that is 100% of current extent. The stated biodiversity goal of the Southern Gulf regional NRM plan was to protect and restore the natural biodiversity of the region. No specific resource condition or management action targets were set for conserving or restoring native vegetation cover in this region. This is not surprising, given that the majority of native vegetation cover is intact, and clearing is not an immediate threat. However, the potential for future development of irrigation agriculture on the Gulf Rivers' floodplain is an important threat that was not adequately accounted for in this plan.

The Desert Channels regional NRM plan resource condition target relating to native vegetation stated that the extent of remnant native vegetation for 2015 cover does not drop below the measured level for 2007. This target allows for further clearing permits to be issued under the *Queensland Vegetation Management and Other Legislation Act 2004*. There were no targets to increase the area of remnant vegetation in heavily cleared landscapes of the southern Desert Uplands sub-region through the targeted restoration of regrowth. One stated native vegetation management action was the establishment of east-west vegetation (bioregional) corridors in the Desert Uplands through market-based incentives aimed at protecting existing remnant vegetation. Linkages between this management action and the review of native vegetation and biodiversity assets were not specified.

5.4.3. Ecosystem diversity

Key targets relating to ecosystem diversity focused on 'endangered' and 'of concern' ecosystems as defined under the *Queensland Vegetation Management and Other Legislation Act 2004*.

The Northern Gulf regional NRM plan provided the most comprehensive set of objectives and targets for managing and restoring ecosystem and species diversity.

Specific ecosystem diversity targets aimed to maintain and/or improve the long-term viability and stability of 95% of ecosystems and habitats in the region by 2015. No quantitative indicators were attached to measure progress towards achieving this target. Six management action targets were set to achieve this objective. Ecosystem diversity targets included the control and management of ecosystems to ensure 95% of all ecosystems in good condition are maintained in their current state and 50% of all ecosystems in poor condition are restored to good condition by 2010. No definition or indicators were provided of what is "good condition". The Desert Channels regional NRM plan outlined resource condition targets for improving ecosystem and species diversity in the region by 2015. These included protecting 80% of representative samples of regional ecosystems on either private or State land, and improving the condition of at least 1,000 ha of endangered ecosystems.

The Southern Gulf NRM plan set eight resource condition targets relating biodiversity conservation and restoration. The highest priority target focused on identifying and protecting the top 15 biodiverse areas in the region by 2015. However, no definition was provided of the attributes which define a "biodiverse area", including its critical size. Similarly, the term biodiversity function was used extensively in target setting but was not defined.

Management action targets designed to achieve this objective were very broad and reflected the current lack of relevant information and understanding of the region's biodiversity. Management actions focused on: the development of a research program to identify high biodiversity priority areas; the establishment of benchmarks for setting resource condition targets; fauna surveys to identify the composition, distribution, environmental patterns, habitat associations and threatening processes by 2008; and a region-wide biodiversity campaign.

The Central Queensland Strategy set four resource condition targets specifically aimed at protecting ecosystem diversity. The major resource condition target being to protect from further habitat loss 90% of 'endangered' ecosystems not protected under the *Vegetation Management and Other Legislation Act 2004*, and where not possible, full re-establishment of the original native vegetation following regeneration. This target focused on the protection and regeneration of endangered non-remnant native vegetation (e.g., disturbed or regrowth Brigalow *Acacia harpophylla*) that is currently not protected. It also set resource condition targets for 80% of all regional ecosystems protected on state land primarily managed for conservation (National Parks and other reserves) within 10 years.

5.4.4. Species diversity

All five NRM plans reviewed developed management action targets for rare and threatened species. The Southern Gulf NRM plan developed an extensive list of management action targets concerning rare/threatened species. Other plans proposed one or two management action targets concerned with rare/threatened species. Several plans suggested to research and review recovery plans (eg. Desert Channels, Fitzroy region NRM plan and the Southern Gulf regional NRM plan). The Northern Gulf NRM plan aimed to maintain and/or improve the long-term viability and stability of 95% of native plant species, and threatened native plant species by 2015. Management action targets relating to this objective aimed to ensure no further native plant species become threatened by poor land management practices or other means such as pest plant and animal species, and the control and management of invasive species to decrease their impact on biodiversity. No specific management action targets were set for terrestrial fauna species. Biodiversity linkages were also made with resource condition and management action targets for fire management, soil and pasture health, pest and weed management and control. The Desert Channels plan set targets for 100% of known rare and threatened species protected by regionally implemented management plans by 2015. Targets aimed at improving the conservation status of rare and threatened species within the region by 2020, with a more immediate management action target to identify rare and threatened

habitats and species by 2006. The Fitzroy region NRM plan set two resource condition targets specifically designed at protecting terrestrial species diversity. These included: no further loss of biodiversity at a species, subspecies or major geographic population level within the region; all significant habitats of migratory or breeding water birds and drought refuges are protected from incompatible activities; and, population sizes are maintained within acceptable limits. Management action targets aimed at protection, maintenance and enhancement of the habitat and dependent populations of regional species and their distribution, and the review of recovery plans for rare, vulnerable and endangered species and communities to identify common priority actions by March 2005.

The Southern Gulf NRM plan also set resource condition targets for the biodiversity impacts of the greenhouse effect, impacts of tourism, fire management and pest plant and animal species with specific biodiversity and ecosystem management action targets designed. Resource condition targets also were set for:

- maintaining wetland, riparian and in-stream biodiversity at 2006 levels, with management action targets developing a baseline monitoring program;
- development of an effective communication and awareness program;
- fencing off or riparian areas at ten important riverine sites; and
- reviewing and developing regional ecosystem management guidelines.

The QMDB & SW regional NRM plan management action targets were stronger on the management and restoration of native vegetation cover compared to ecosystem or species diversity. Specific species diversity targets set minimum negative impacts on and no-net loss of 'at-risk' fauna and flora species and associated habitat as identified in State and Commonwealth legislation and the Queensland Environmental Protection Agency by 2008. No specific targets were set for the management or restoration of 'endangered' or 'of-concern' regional ecosystems.

5.4.5. Training and education programs, knowledge sharing and awareness raising

Most regional NRM plans identified education and awareness raising programs to be a key priority and have developed management action targets accordingly. The Desert Channels regional plan provided the most explicit set of management action targets and management actions in order to achieve greater education and awareness within the community. One management action target aimed at developing education / awareness packages for the community on biodiversity values and landscapes by 2007. Actions proposed to achieve this target included the review of existing information on biodiversity, making biodiversity information available in a useable form and providing education on the role of biodiversity in the landscape.

Another example was the QMDB & SW NRM regional plan, which proposed to produce 15 case studies on nature conservation, vegetation planning and management at property, sub-catchment, catchment and regional scales over a three-year period. It is foreseen that the case studies will be made public through appropriate media outlets. The Fitzroy region NRM plan was the only regional plan reviewed that did not propose any management action targets addressing the need to develop education and awareness raising programs on biodiversity values.

5.4.6. Voluntary Nature Conservation Agreements (VNCAs)

All plans have recognised the need to enhance biodiversity conservation on private land and have set management action targets to develop voluntary nature conservation agreements. However, the management action targets are formulated in very different ways and with differing approaches and time spans. For example, the QMDB & SW NRM regional plan proposed to achieve 10 new voluntary nature conservation agreements each year until 2010. The Central Queensland Strategy, on the other hand, suggested having 150,000 ha of private land managed primarily for conservation and under voluntary agreements with the state within 10 years.

The Southern Gulf NRM plan gave a low priority rating to the promotion of VNCAs and has proposed to start its actions to create VNCAs much later than the other regions. The relevant management action target aimed to promote voluntary and formal conservation agreements for prioritised habitats from 2009 and ongoing thereafter. The Southern Gulf plan set resource condition and management action targets for development of an effective formal and voluntary reserve system for protecting representative examples of regional ecosystems that are currently not protected.

5.4.7. Incentives for protecting and restoring native vegetation

The QMBD & SW NRM regional plan and the Southern Gulf regional plan were the only two plans that developed management action targets explicitly mentioning incentives other than VNCAs (See also *Aligned and adaptive institutions*, this volume for discussion on incentives). The QMBD & SW NRM regional plan developed two management action targets concerned with providing incentives for the protection and restoration of native vegetation, which were:

- the delivery of incentives for increasing or maintaining the extent of native vegetation to 30% or greater by 2009; and
- the development of incentive packages to restore and enhance priority landscapes by 2010.

Even though the Northern Gulf NRM plan and the Fitzroy region NRM plan have not developed any management action targets specifically addressing incentives, they still have included several actions that suggest the use of incentives. Proposed actions include:

- the provision of incentives to land managers to assist with the appropriate management and protection of habitats identified as being significant wildlife/vegetation habitats; and
- the implementation of an incentive program for the retention of existing remnant vegetation.

5.5. Priorities

Native vegetation and biodiversity received a variable priority rating across the five regional NRM plans reviewed. However, the level of comprehensiveness of the information base was not a guide to how a plan ranked native vegetation and biodiversity against other assets and threats.

Biodiversity, fire management and weeds and pests received a relatively low priority rating (6, 7 and 9 on a scale of 1 (high) – 9 (low)) for the Northern Gulf NRM plan. The Southern Gulf regional NRM plan set as a high priority the identification of the functions of the top 15 biodiverse areas by 2015, and the restoration of the biodiversity function of degraded areas by 2020. Best fire management practices received a medium to high priority, while management action targets relating to the conservation management of non-protected ecosystems received a priority rating ranging from low to high. The Desert Channels ranked native vegetation management as a high priority, although the basis for this prioritisation may have been more for concerns over the impact of vegetation thickening on pasture production than on the loss of native vegetation cover *per se*. Within the stated biodiversity management action targets, review of existing information on biodiversity, the incorporation of benchmarks for biodiversity condition into the Queensland Department of Primary Industries & Fisheries' Grazing Land Management package, the completion of regional ecosystem mapping (an EPA responsibility), and the provision of incentive schemes received a high priority ranking.

The Fitzroy region NRM plan employed a risk analysis approach to determine highest priority targets, and assessing which actions contributed most to achieving these targets. Riparian zones, in-stream habitats and freshwater wetlands targets received a consistently very high priority rating (Score 1). Ecosystem health and biodiversity conservation resource condition targets received a consistent final high priority rating (Score 2), while resource condition and management action targets for conserving species diversity received a low (Score 4) priority

rating. Riparian zones, in-stream habitats and freshwater wetlands targets received a consistently very high priority rating (Score 1).

Native vegetation and biodiversity condition and management action targets were ranked in priority order for the QMDB & SW NRM plan. There was no prioritisation of these assets and threats to these assets against other regional plans. The highest biodiversity priority was given to the management and restoration of native vegetation over in the region.

5.6. Monitoring and evaluation

The issue of who is responsible for monitoring biodiversity is yet to be resolved as part of the regional NRM planning arrangements. The Queensland Department of Natural Resources and Mines SLATS program currently provides an effective monitoring of native vegetation cover. The Regional Ecosystem mapping program provides the basis for monitoring ecosystem diversity. However, the monitoring of the condition of these ecosystems with relation to grazing and fire disturbance, and especially the monitoring of fauna and floristic diversity is unclear and underdeveloped. The Queensland Environmental Protection Agency currently does not have a systematic program for monitoring these biodiversity components in Queensland, and it is unlikely that the regional bodies will have the resources to fill this gap. NRM plans made little or no reference to key resources for monitoring biodiversity in Australia's rangelands (e.g. Woinarski et al. 2000). Only a few plans nominated resource condition indicators attached to targets for native vegetation. The Fitzroy NRM plan for example proposed the rate of clearing, extent and distribution of native vegetation cover, and the extent of native vegetation cover by bioregion as key indicators in this regard.

5.7. Discussion

Key points arising out of the evaluation of the regional NRM plans are:

- Plans varied in level of assessment and review of existing available information, with available information was not always adequately captured in plans. Information on the comprehensiveness, adequacy and representativeness of the protected area estate was very limited, although protected areas and reserves are mentioned in the management action targets for some plans. Information on major threatening processes of habitat loss and fragmentation, biological invasions, altered fire regimes and excessive grazing pressure was variable, with the impact of excessive grazing pressure on biodiversity poorly recognised.
- Stronger input from biodiversity researchers/scientists into the regional NRM planning process would be beneficial – such as occurred in the Northern Gulf. Scientists and research bodies need to work closely with regional NRM bodies to achieve effective biodiversity outcomes from the regional NRM planning process. Evidence from the plans reviewed indicates that the comprehensiveness of the information base and the specificity of target setting benefits substantially from the direct involvement of researchers. However, this is not a guarantee that native vegetation and biodiversity will receive a high regional priority.
- While all plans set long-term resource condition targets and shorter-term management action targets for managing native vegetation, ecosystems and biota, there was considerable variation in the level of specificity and comprehensiveness of management action targets. For example, there was a lack of quantitative indicators and targets for assessing the fragmentation of native vegetation (landscape structure). Some regional plans expressing management action targets as general statements of intent while others were more specific/quantitative in the setting of management action targets. The rationale for selection of management action targets with reference to mitigating specific threats was not always transparent. It was difficult also to determine the level of integration between the planning information base and between management action targets for the various assets, with some plans explicitly stating linkages while for others linkages were less obvious. Further, even when

linkages are explicit, it was unclear how integration between management action targets will be achieved. Several plans hint that this integration will be progressed through the development of regional investment strategies.

- The biodiversity values of regrowth of native vegetation received little mention. Similarly, the biodiversity consequences of native vegetation thickening, thinning, excessive grazing pressure and altered fire regimes were not well recognised.
- NRM plans recognised the need to address causes to problems rather than symptoms for plans to be effective. However, the specific cause-effect linkages were rarely specified. Threats are used as broad-brush surrogates for causes, with mitigation of threats key to addressing NRM problems in the region. Sometimes cause-effect relationships are easily identifiable. For biodiversity conservation, species decline may be multi-causal (e.g. fire, grazing, predation) and involve long relaxation periods (McAlpine et al. 2002). Given the limited resource information base identified above, it is surprising there was limited reference to published research knowledge in the regional NRM plans. A comprehensive review of such knowledge would allow more quantitative ecological indicators, surrogates and thresholds in these indicators to be built into the definition of resource condition and management action targets.
- Most plans reviewed identified voluntary nature conservation agreements on private land as a key action for protecting and restoring ecosystem and species diversity. However, there was an absence of thorough evaluation of the effectiveness of these agreements to deliver long-term biodiversity outcomes. Similarly, community education programs were promoted widely to raise awareness of biodiversity issues in the regional communities. Incentive schemes were promoted less often (only two plans of the five reviewed) as a native vegetation and biodiversity restoration tool.
- Native vegetation and biodiversity received mixed priority ratings, although in general they were given a relatively high priority.
- There are major gaps in the biodiversity monitoring, evaluation and adaptive management programs across all plans reviewed. The solution to this issue will require close collaboration between regional bodies and the Queensland Environmental Protection Agency.
- The plans reviewed lacked effective integration of natural resource and biodiversity conservation planning. This has also however largely eluded State and Commonwealth Government agencies to date in Australia. There is a real danger than regional NRM planning initiatives (both in the rangelands and other regions) will follow a similar path. It is critical therefore, that regional bodies, State government agencies and research bodies work together to develop the necessary information/knowledge base and management frameworks for integrating biodiversity conservation and soil/pasture management actions in rangeland landscapes.

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6. Industries and economies for sustainable regions

Bruce Taylor

6.1. Introduction

Most goals and aspirational targets in regional NRM plans recognise and seek to achieve, economic and socially beneficial outcomes from resource management and investment. Do these aspirations however translate into a working knowledge of resource industries and regional economies within plans? Are different types of regional 'economies' and the role of traditional and emerging industries in sustainable development adequately understood and reflected? Are the links with resource management activities and use pressures clear?

This section reviews the content of non-statutory regional natural resource management plans from several Queensland regions¹¹ against the following criteria (see Table 1, Introduction):

- Consider and address economic viability of natural resource dependant enterprises and industries (criteria 6).
- The ability of regions to respond positively to external change pressures and internal variability (criteria 10).
- Consider the relevant population, employment and service provision characteristics of the region (criteria 1).

6.2. Regional and State level planning contexts

In the NRM plans of northern and western regions of Queensland, statutory mechanisms geared at regulating rural industry use of the resource base are well recognised including, for example the *Vegetation Management Act 1999*, *Water Act 2000*, *Land Protection (Pest and Stock Route Management 2002)*, and *Draft Rural Leasehold Land Review Strategy (NR&M 2003)* (e.g. SGC 2004, Book 4. p.87). Planning policies that mitigate impacts of inappropriate development on good quality agricultural land and acid sulphate soils are similarly well recognised in the plans of southern and coastal regions (FBA 2004 p.82). Also widely noted in plans are legislative and policy drivers for limiting agricultural development on certain land systems, and the importance of security of water supply for economic activity and diversification.

Where they exist, regional frameworks for growth management or regional economic development planning is referred to in detail in regional plans. In some instances deferring to these planning processes in terms of social service and infrastructure provision and industry development or for complementary action in issues such as climate change (FBA 2004 p.78). Other plans refer to explicit regional land use policies as part of their planning information base, for example the *EDROC Land Use Study* (EDROC 1996) in the Condamine NRM plan (Condamine Alliance, 2004).

Importantly the incompatibility between major NRM funding program objectives and the 'business end' of resource management problems is widely evident in the treatment of social and economic aspirations within regional plans. Only one of the eight national outcomes under the Natural Heritage Trust (NHT 2001) recognise non-ecological values and refers to maintaining the productive capacity of the resource base. There is similar awkwardness in reconciling interdependence between employment, economic development, and resource access in Indigenous communities and the more narrow scope of funding parameters under the *Natural Heritage Trust* and *National Action Plan for Salinity and Water Quality*. Some examples of this are provided in the following discussion.

¹¹ Regional NRM Plans reviewed for this chapter included plans prepared for the Southern Gulf, Northern Gulf; Far North Queensland; Fitzroy; Desert Channels; Condamine; Qld Murray Darling Basin / Bulloo /Border Rivers; SEQ Western Catchments; and South East Qld regions.

The Queensland Government's current suite of state-level investments, seeking to improve the inclusion of social and economic information into NRM planning (Queensland Government, 2004) are also recognised in several plans. The 'foundation' nature of this portfolio of investments is indicative of the early status of the broader debate on the role of industry and business enterprises in NRM and the accessibility of relevant data for planning.

6.3. Planning information base

An appreciation of building a reliable picture of regional economies, industries and communities was evident in plans. This involved attempts to communicate the contribution of regional industries, scope constraints to sustainable resource use and improve "understanding...[of] social and economic consequences that may arise in the delivery of actions [to achieve] targets" (FNQNRM 2004 p. 6). Regional **economic assets** are universally defined in plans to include production land uses for extractive and primary industry (mining, grazing and agricultural land). Other less commonly recognised values included cultural tourism, recreation and scenic amenity.

Several plans recognise **ecosystem services and values** of regional assets including the *dependence* of regional industries on land and sea condition (e.g. ...90% of grazing based on native and naturalized pastures (QMDC & SWNRMG 2004 p.42) or economic value of fire as management tool for pasture rejuvenation [Northern Gulf 2004, p.63]). Other plans recognise multiple values of a given asset such as wetlands or values associated with harvesting marine species (SGC 2004). Such examples include recreational values and impacts, commercial and subsistence values, and recognising changing values external consumers see in landscapes. Although clearly articulated little data was actually presented in plans quantifying direct and indirect ecosystem services [with the exception of SEQWC (2004)].

Regional **industry and economic profiles** are included in most plans reviewed. These profiles report industry contribution to gross regional output and sectoral contribution to employment, underpinning discussions of community structure, economic functions of towns and description of major land uses. In only a small number of plans land use or economic activity was presented by catchment or by designated management sub-units within the catchment (e.g. CCNRMC 2004). Interestingly in many regions mining, metals manufacturing and minerals processing, service sector and public sector contributions often exceeded 'traditional' agricultural sector contribution in either employment or gross output. Even so, rural industries are continually positioned as the 'lifeblood' of the region's communities within the plans. In only a small number of plans a comprehensive social, demographic and economic profile is present and outlines implications for plan implementation (e.g. QMDC & SWNRMG 2004).

In several northern plans (e.g. Northern Gulf), relationships between specific industry activity, community structure and condition of the resource base are best analysed for **tourism and commercial fishing sectors**. These relationships are also recognized in grazing and mining (but focus mostly on 'external' pressures on these sectors). The coastal and marine section of the Northern Gulf plan (NGRMG 2004, p.110) displays an explicit link between resource use and impacts on commercial and economic values of the region. It also considers the economic consequences and contexts of resource exploitation (e.g. commercial and recreational stocks, dugong numbers etc). Even more rare is the recognition of subsistence food values of marine species for Indigenous people as "contribut[ing] significantly to the domestic economy of families in isolated communities" (NGRMG 2005 p.135).

Data on the contribution of the public sector economy in maintaining local initiatives, infrastructure, services and even local government activity is presented in the Southern Gulf plan (SGC 2004). The plan also presents a sector by sector profile of their regional industries' economic environment, external drivers, structure, alignment of NRM initiatives with commercial or production imperatives and the influence of regulation and implications for regional NRM (for mining, fishing, grazing and tourism). Some particularly good examples of this interpreted data include (*Pastoral sector: managing Risk* Box 7.2, p55; and, *Mining Wealth under pressure* p.57, Book 1). Plans such as Desert Channels Qld also clearly state in qualitative terms, the relationship between pests, cost of control, enterprise viability, reduced employment and therefore management capability (DCQ 2004). Although the broad relationships appear well understood there is no quantification of these trends or relationships presented in the plan.

Common data sources used in plans appear to range from anecdotal evidence, stakeholder perceptions, basic ABS statistical community profiles for Local Government Areas, industry derived data, information from existing plans and strategies. Rarely resource economics assessments or research at the regional scale is utilised. Surprisingly more rare is the application of socio-economic data to profiling rural producer or enterprise characteristics in the regions.

Despite regular reporting of scores for *Socio-Economic Indexes for Areas*, for example, no cases where identified where implications of scores are explained in the context of resource management needs (NGRMG 2005 p152). Poor availability of data for property size, viability characteristics or capital required for sustainable practice adoption is reported in several plans. No data on regional incomes generated from customary activities was evident. In several regions, particularly 'outback' regions, tourism data from providers such as the Australian Bureau of Statistics was stated in plans to be inadequate or inaccurate. And poor availability of catch / income data from recreational fishing or customary fishing at regional level was also reported in the Northern Gulf plan. In this instance there was considerable reliance on a small number of research sources for this data (such as Greiner, 2004).

Most plans described significant **drivers, pressures and threats** to the viability of resource industries and related market or economic threats to the resource base (see Box 1, this page). This varied from fairly basic recognition of broader market trends through to detailed analyses of time series data, emerging markets and implications on resource use.

Box 1: Some examples of descriptions of economic pressures on natural resource based industries within NRM plans

"Pressures currently affecting the viability of the region's food and fibre industries include water availability, high reliance on world commodity prices, cost-price squeeze, transport costs and concerns over tenure and resource allocation security. Building the resilience of these industries to seasonal, market, workforce, and institutional change is key to their viability and capacity to sustainably manage the natural resource base (FBA, 2004, p.107)

"The decline or rise in rural communities is often directly related to the fortunes of particular enterprises or the associated technologies, international trading climate and changes in management practices for the enterprise" (QMDC, 2004 p.72)

"...for example, where farm debt structure indicates greater capital expenditure and optimism about future returns in a catchment (associated with diversification such as irrigation), different approaches are required than say in a catchment where patterns of high equity, low rates of return and increasing debt may limit producers' capacity for NRM expenditure on improved management practices." (FBA, 2004 p107)

Types of drivers and threats identified in plans included:

- **export markets, market variability** (including emerging markets, historical trends) and low commodity prices relative to input costs;
- recognition of **external 'user' groups** and consumers (tourists, consumers, absentee landholders) which is strongly differentiated from regional land managers and residents;
- implications of **exotic diseases**;
- risk associated with seasonal and **climate variability**;

- **structural and industry trends** and related impacts (e.g. downsizing and closure of mines, changes to workforce, impacts of deregulation, market failure and costs of restructuring and related demographic and service changes¹²;
- land use competition and **land use change** is often noted but no analysis presented;
- tenure and **allocation security, regulatory trends**, increasing compliance, costs of compliance and implementing codes of practice and improved systems;
- workforce and farm debt structure related to **capacity to pay**;
- impact of 'short term' decision-making or **discounting** of future economic or environmental costs.

In NRM plans in southern regions (e.g. CCNRM 2004), many of the threats were characterised in relation to manufacturing industries, surety and quality of supply of raw materials (and impacts of resource degradation on this), community expectations; competition for resources, damage to and impacts of infrastructure.

Emerging industries are simply noted in some plans and profiled and discussed in more detail in others. Plans in southern regions explore the economic possibilities of using agricultural and waste stream residues for products and alternative energy generation potential (e.g. QMDC & SWNRMG 2004). Other industries identified in southern regions included organic agriculture; fibre composites; eco-tourism and wine tourism. Bio-prospecting is outlined as a key emerging industry in northern Queensland and issues with regulations and sectoral perspectives are outlined (FNQNRM 2004). Farm forestry is also highlighted the FNQNRM NRM plan as having:

"the potential to become a true primary industry but is not viewed by many landholders as a viable enterprise due to past taxation impediments, failure of similar previous government schemes due to inadequate long-term resourcing, concerns over timber resource security due to conservation and habitat values of plantings, and the medium to long-term time frame required before harvesting generates a return on the initial investment" (FNQNRM, 2004 p. 80).

Emerging primary industries noted in the Desert Channels plan (DCQ, 2004) include goat meat, organic beef and native foliage enterprises. This plan also recognises commercial and economic values of commercial kangaroo harvesting and feral animal harvesting however this is surprisingly rare or absent in other plans. Cultural heritage is also discussed as an economic or commercial resource in some plans.

The socio-economic or industry profiles presented in plans largely focus on the 'private sector' economy associated with traditional agricultural or pastoral land uses. Absent in most instances is a discussion on the **contribution of the public sector economy** such as defence, other national and state government agency employment, and contribution of programs such as Community Development Employment Projects (CDEP) to the well-being of remote communities. The DCQ plan however describes in qualitative terms the impact on regional NRM activity when public sector investment such as landcare funding, government services or extension support is withdrawn from the region. This review was unable to locate any data - apart from listing current management responses - relating to the public sector's contribution or investment in natural resource management or protection in regions.

The recognition of and subsequent role of the **customary economy** in contributing to social well-being and resource management outcomes in remote indigenous communities (Altman, 2004) is largely absent from plans. Adding to this there is only very limited reference to recent and anticipated land ownership change associated with increasing Indigenous interests in grazing tenure, the outstation movement and expression of native title rights and interests. The FNQNRM plan recognises the potential contribution of programs such as CDEP for "Aboriginal people to become involved with NRM activities" but also notes the need to long-term solutions (FNQNRM 2004, p.161). The plan also recognises economic (commercial and subsistence), employment, health and well-being values as part of 'caring

¹² e.g. Increasing numbers of absentee managers of enterprises, diversification, labour implications and flow on effects of moving from sheep to cattle, growth in tourism are noted in the DCQ Plan (DCQ, 2004) There is however generally limited description of adjustment pressures in plans.

for country'. This includes customary practices; harvesting and hunting knowledge (nutritional and medicinal); cultural practices and materials; and intellectual and cultural property (FNQNRM p122). A small number of plans discuss options to employ Traditional Owners to conduct 'burning' for property management and cultural purposes which may be undertaken by way of an Indigenous Land Use Agreements. Others promote involvement in agroforestry land uses and, the importance of maintaining and revitalising Indigenous knowledge and customary practices to provide substantial benefit for regional NRM outcomes (see also Robinson, this volume). Fenton presents a view linking NRM investment with opportunities to improve the well-being of Indigenous communities:

"It is perhaps not so much how the capacity of Indigenous people can be developed to address NRM issues, but how innovative approaches to NRM and planning may be used to address serious issues of social and economic disadvantage for Indigenous people in the region" (Fenton in FNQNRM 2004 p123)

In most cases economic impacts of weeds, ferals and changed fire regimes on woody thickening on **production and costs of management** are noted. These costs however are generally not quantified. Some exceptions include using research on estimates of costs of rehabilitation of degraded areas through revegetation (CCNRMC 2004) and discussion on economic impacts of acid sulfate soils, urbanisation and tourism development pressures on agricultural land. Some key gaps in this area identified in plans' *regional profiles* include social and economic data to determine the impacts of population growth on assets; and, quantifying commercial profit and loss relationships and trade-offs for adoption of best management practices.

6.4. Targets and Objectives

Many of the higher order 'aspirational targets' or goals in plans seek to achieve or integrate economic and social well-being with resource management objectives, for example: "Improve the productive capacity of the region's land together with its ecological condition and cultural values" (SGC 2004 p.88). Most of the specific targets associated with regional economies and industries are designed as 'management action targets' or 'management actions' (intermediate outcomes and tasks) rather than seeking to achieve specific sectoral, industry or enterprise 'condition' outcomes. A summary of the different types of targets evident in plans, and examples, is presented in Table 1. Several targets emerged addressing business resilience, security of tenure and capacity to pay outcomes at both enterprise and industry scales. Targets or actions to improve access to, and management of, country for Indigenous stakeholders were also identified (e.g. Indigenous rangers managing weeds and pests). Fewer plans however identify targets for commercial or economic values associated with customary or custodial roles (e.g. develop business strategies for traditional owners as advisors in planning or cross cultural training providers) (FNQNRM, 2004). Over half the targets and actions identified are concerned broadly with undertaking further investigation or feasibility studies into sustainable carrying capacities, developing incentives or approaches for quantifying social and economic impacts or ecosystem services. The author believes this reflects the paucity of regionally relevant knowledge, tools and processes currently available to resource planners to address these management needs.

Table 1 Examples of targets and actions identified in NRM plans

Focus of targets	Examples from NRM plans
Improve industry condition or increase business resilience	<ul style="list-style-type: none"> ▪ Populations of commercial and recreationally important fish and crustaceans maintained (FBA 2004) ▪ Development of options and opportunities to increase business resilience through marketing, diversification and responsiveness to ambient changes (FBA 2004)
Improve security of tenure	<ul style="list-style-type: none"> ▪ Security of tenure and water allocation improved through demonstrated environmental stewardship (e.g. PMP, LWMP, EMS, BMP) within 5 years (FBA 2004)
Increase capacity to pay	<ul style="list-style-type: none"> ▪ Within 1 year develop protocols to ensure the major resource-based employment sectors contribute to the sustainable wealth of the region MAT, (SGC, 2004) ▪ Identify areas of the basin and industries with potentially greatest / least economic capacity for improved NRM practice within 1 year (action from FBA, 2004)
Develop traditional owner business strategies	<ul style="list-style-type: none"> ▪ Within 1 year commence the development of a regional economic development strategy including training opportunities for Aboriginal communities (SGC 2004)
Regional economic development objectives	<ul style="list-style-type: none"> ▪ Within 3 years develop programs to provide improved facilities and infrastructure for tourist appreciation of natural resources to minimize impacts on current sites and promote the regions economies (SGC 2004)
Setting carrying capacities and sustainable yields	<ul style="list-style-type: none"> ▪ Developing property planning tools to manage climate risk, variability and safe carrying capacities for grazing enterprises e.g. Grazing Land Management (DCQ, 2004) ▪ Set sustainable yields of surface water harvesting (numerous plans) – see also <i>McDonald and Walker</i> this volume)
Conduct feasibility studies into establishing economies of scale, new products or commercial resources	<ul style="list-style-type: none"> ▪ Explore opportunities to exploit pests as a commercial resource to manage biodiversity (SGC 2004) ▪ Regional groups/clusters established to aggregate environmental services into marketable amounts to attract investment (FBA,2004) ▪ 15% increase in private sector (non government) investment and involvement in sustainable natural resource management by 2015 (QMDC & SWNRMG 2004).
Identify ‘costs’ of threats and costs of mitigating the impacts	<ul style="list-style-type: none"> ▪ Several actions propose “Develop a better understanding of the impacts of excessive numbers of kangaroos, weeds and ferals on biodiversity, ecosystem processes etc” but does not appear to extend to economic costs or opportunities; Numerous
Investigate the implications or future scenarios of industry structural change or future land use change	<ul style="list-style-type: none"> ▪ Investigate NRM implications of industry change in the region (sheep to cattle) linked to ‘Changes in Social Fabric’ study; (DCQ 2004) ▪ Conduct land use investigations that consider future use of cane land...[linked to sugar industry restructuring programs and State Planning Policy 1/92.]; (FNQNRM 2004) ▪ Future scenarios of regional structural adjustment understood within 5 years to inform NRM investment planning and industry viability planning. (FBA 2004)

<p>Investigate feasibility of carbon trading (See <i>Carbon management and Energy Consumption</i> review, this volume)</p>	<ul style="list-style-type: none"> ▪ Feasibility for commercial carbon trading determined by 2009 - Investigate forestry activities to provide a role in carbon sinks or carbon sequestration project (SEQWC 2004)
<p>Quantify market and non-market service values and consumer demand</p>	<ul style="list-style-type: none"> ▪ Quantify the intrinsic market / non-market services provided through biodiversity by 2008 and Evaluate consumer acceptance and demand for products (QMDC & SWNRMG 2004)
<p>Impact assessment for priority investments</p>	<ul style="list-style-type: none"> ▪ Several MATs focus on conducting social and economic impact assessments of an identified sub-set or priority management targets (see also <i>Priorities & Options</i>, this chapter)
<p>Development, trial and implementation of incentive-based schemes (See <i>Aligned Institutions</i> review, this volume)</p>	<ul style="list-style-type: none"> ▪ Apply a range of incentives schemes to increase ground cover e.g. off-stream watering points, equipment, tender system ▪ Develop most effective financial and legal instruments necessary to finance farm forestry within 5 years (FBA 2004)

6.5. Priorities and Options

In a ranking of critical regional issues, risks to assets or priority actions, some key economic or viability considerations are reflected in most plans. A small number of plans explicitly outlined **criteria** for priority setting, including “best value for money” or cost effectiveness and “contribution to ecological, economic and social services to the region”. Other criteria used for prioritising investment included: ‘retaining or increasing employment’, ‘increasing Gross Regional Product’ and ‘sustainability of business income’ (QMDC & SWNRMG 2004).

Some plans refer to having undertaken some form of “social and economic analysis, with participants from local government, industry, community groups, and land managers” and that “tradeoffs between social, economic and environmental benefits were considered” as part of the prioritisation process (CCNRMG 2004 p.122) The content of plans reviewed provided no or little documentation of the approaches proposed or used to do this. The Fitzroy plan did propose however to invest in dedicated social assessment for a subset of priority management actions using research providers (FBA 2004) see also *Implementation and Investment* this section, below).

6.6. Implementation and Investment

As most of the detail on implementation activities and investment will be contained in regional investment strategies¹³ this section reports on aspects of broader implementation frameworks outlined in plans. Implementation directions are also evident in the actions and management action targets presented in Table 1 above. Some other notable trends identified include:

- a high reliance on property management planning, codes of practice and research based investment for industry sectors - for example, in pastoral regions Grazing Land Management is seen as key tool to “improve pastoral communities economic viability as well as their ability to sustainably manage their natural resources” (DCQ 2004 p13);
- common themes of supporting Aboriginal employment and economic development aspirations are generally linked to cultural heritage management outcomes. These

¹³ Regional NRM bodies at the time of writing are also preparing *Regional Investment Strategies* as a supporting document to the Regional Plan, for approval by state and Australian Governments Joint Steering Committee.

- are largely undefined however and less directly linked to broader caring for country actions or employing Indigenous people in land and sea country management; and
- increasing scrutiny and growing recognition of the roles of commercial service providers and water infrastructure managers (such as *Sunwater*) in current and potential delivery of NRM outcomes associated with water use efficiency.

The Wet Tropics plan presented a detailed case study on potential to invest in emerging industries in the region, namely commercial agro-forestry to ‘ascertain whether there are commercial drivers for sustainability that could help to achieve NRM targets in Far North Queensland’, (FNQNRM 2004 p.81). Reference is made in the Southern Gulf plan to an existing \$101K investment in the region to conduct a ‘resource inventory of native vegetation by indigenous managers’, with proposed commercial and intellectual property benefits.

As a deliberate component of the implementation framework for the Fitzroy plan, a set of management action targets have been identified and will be assessed for **social and economic impacts** arising from implementation. This assessment is proposed to include mitigation opportunities, identify groups affected and costs and benefits associated with action and non-action. An investment in commissioned research is proposed to undertake this assessment including three ‘impact assessment’ case studies of: 1) adoption of sustainable property management systems; 2) cumulative impacts of voluntary agreements on private land, and 3) implementation of a regional cultural heritage protection program (FBA 2004).

6.7. Monitoring, evaluation and reporting

In general, the different types and functions of indicators available for regional NRM were discussed in plans, however specific measures or indicators relevant to economic attributes of NRM were rarely articulated. The development of a separate *monitoring and evaluation strategy*, or targeted investment through the *Regional Investment Strategies* was often reported as the vehicle for progressing this aspect of planning. Indicators identified (generally ascribing how and by whom they would be measured) included, from Fitzroy plan (FBA 2004):

- Uptake of options to increase business resilience
- Youth and indigenous employment levels, net outflow of youth
- Number of access to country or co-management agreements
- Percentage of regional income dependent on exports
- Prices for commodities of importance to region
- Index of economic diversity
- Profit margins

The SEQ Western catchments plan also identified several measures which appear to seek to integrate productivity or institutional measures with resource condition or pressure measures, including (SEQWC, 2004):

- ratio of water available to perceived need for water by catchment;
- number water applications granted;
- current price of water / cost of provision;
- crop based measures of water use efficiency / yield;
- percentage of given sector using Best Management technology or practices;
- change in land use by sub-catchment, on Good Quality Agricultural Land or entry / exit rates from agriculture; and
- total grazing pressure relative to net primary productivity by land cover.

The monitoring and evaluation strategy of the Southern Gulf regional plan (SGC 2004) outlines the need to play a role in managing risk associated with climatic variability, reporting against socio-cultural viability; and family and business dynamics in the region.

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7. Soil, pasture and ecosystem integrity in rangelands

Clive McAlpine

7.1. Introduction

Soil and pasture degradation and deterioration are key issues in Australia's northern rangelands (Tothill and Gillies 1992). It follows that sustainable soil and pasture resource management are key features of regional NRM planning initiatives in these regions. Invasive weed species also threaten the integrity and productivity of rangeland ecosystems across the tropical savannas. It is essential, therefore, that regional NRM plans develop integrated planning strategies for the sustainable management of soil and pasture resources. The aim of this section is to evaluate the soil and pasture resource content of regional NRM plans in Queensland's extensive rangelands, that is, where grazing is the dominant land use. Key questions addressed were:

1. How well do the content of the regional NRM plans capture, integrate and prioritise soil, pasture and ecosystem integrity (weed species, fire and woody vegetation thickening) issues currently confronting Queensland's rangelands?
2. How consistent is the treatment of soil, pasture and ecosystem integrity across the regional NRM plans?

Plans were reviewed for the following regions:

- The Northern Gulf
- The Southern Gulf
- The Desert Channels
- The Fitzroy Basin
- The Queensland Murray Darling Basin and South West NRM region

The geographic focus was the extensive rangelands of western and northern Queensland. The cropping lands of the eastern Fitzroy Basin and the Queensland Murray Darling Basin regions were considered outside the scope of the review as they represent a different set of land use and planning issues (e.g., salinity, quality of irrigation water runoff). The Burdekin Dry Tropics regional NRM plan was not reviewed as it was not accredited at the time the review was undertaken in February 2005.

The five plans were assessed against the following criteria as outlined in McDonald et al. (2004).

- Ecosystem integrity is maintained or improved (criteria 21).
- Pasture condition and health are maintained or improved (criteria 25).
- Soil condition and health are maintained or improved (criteria 24).

The results of the evaluation are discussed below in relation to planning context, information base, targets and objectives, priorities, implementation and monitoring and evaluation components of plans.

7.2. National, State and Regional Context

To ensure plans are aligned to the larger policy and planning context, regional NRM planning initiatives in the rangelands need to recognise relevant National and State legislation, policies and strategies, plus have cross-regional or cross-border linkages with neighbouring regions. However, while most plans explicitly identified these linkages at each administrative / institutional level, there were some noticeable exceptions and gaps at the three levels of government and across regions.

7.2.1. National context

The plans reviewed recognised the relevant national policies and programs for rangeland management. However, National Principles and Guidelines for Rangeland Management (ANZECC and ARMCANZ 1999) and the National Land and Water Resource Audit (2001) report on tracking changes in Australia's rangelands were notable omissions from several plans.

7.2.2. State context

State legislation and policies were, in general, well recognised in the plans reviewed. The plans strongest in this area were the Desert Channels Queensland regional NRM plan (DCQ 2004) and the Northern Gulf regional NRM (NGRMG 2005) plans, while State-linkages are less explicit in the Southern Gulf regional NRM plan (SGC 2004) and the Queensland Murray Darling Committee and the South West regional NRM plans (QMDC & SWNRMG 2004). The Draft State Rural Leasehold Land Strategy (Queensland NRM 2003) was not referred to for the Queensland Murray Darling Committee and the South West regional NRM plan (QMDC & SWNRMG 2004).

7.2.3. Regional context

Reference to the within and cross-regional planning context was variable. The Northern Gulf regional NRM plan (NGRMG 2005) and the Desert Channels Queensland NRM plan (DCQ 2004) both provided a comprehensive list of previous and/or existing regional plans and also relevant cross-regional linkages and issues. For example, the Lake Eyre Basin Strategic Plan (Lake Eyre Basin Coordinating Group 2000) provided an important planning context for the Desert Channels. Existing catchment management plans were recognised several regions, including the Desert Channels and the Southern Gulf. However, cross-regional or cross-border linkages were not mentioned for the Southern Gulf regional NRM plan (SGC 2004).

7.3. Planning information base

All plans adopted an assets-based approach to planning with land resources (comprising soil and pasture resources) classed as regional assets. Regional profiles or overviews provided the major documentation on resource condition and trend, with further information contained under threats. The Northern Gulf regional NRM plan (NGRMG 2005) also had a separate analysis of a range of biophysical themes split into three resource categories:

- soil resources;
- pasture resources; and
- ecosystem integrity (fire, thickening and thinning, pest and weeds).

7.3.1. Soils and Pasture Resources

All regional NRM plans reviewed were constrained by a lack of detailed baseline information on soil and pasture resource condition, although this varied among regional plans. The Northern Gulf regional NRM plan (NGRMG 2005) provided the most comprehensive assessment of the soil resources, drawing heavily on previous work by Shaw et al. (2004) and earlier work by Tohill and Gillies (1992) on land degradation in northern Australia. The susceptibility of broad soil types to degradation was identified and discussed, with river frontage and riparian areas listed as the most sensitive and affected areas. Overgrazing was explicitly identified as a key issue in regard to soil health, with that less information available on the condition of soils occurring away from the major gulf rivers. A similar level of detail was provided for pasture health, although this information is now 13 years old and was mapped at a coarse spatial scale (1:2,500,000). The Southern Gulf regional NRM plan (SGC 2004) made reference to land system mapping conducted for Southern Gulf catchments by Christian et al. (1954) and Perry et al. (1964), and also the Atlas of Australian Soils 1:2,000,000 soil mapping. However, there was almost no recent information on the condition and trend of soil and pasture resources, which areas are likely to be most degraded, and what are the critical grazing management practices affecting resource condition and trend.

For the other plans reviewed, the soil resource information content was less comprehensive. For example, the Queensland Murray Darling Committee and the South West regional NRM plan (QMDC & SWNRMG 2004) did not report, assess or analyse the condition and trend of soil resources in the extensive rangelands of the Maranoa, Warrego, Paroo and Bulloo catchments. However, grazing pressure and clearing were mentioned as a major contributing factor to scalding of surface soils in the mulga/gidgee lands of the south-west. Grazing also was recognised as an important threat to riverine areas, floodplains and wetlands, but there was no review or assessment of potential impacts. Little information was provided on the important issue of soil and pasture degradation in the South West NRM regional NRM plan. A similar level of detail was provided for the Southern Gulf regional NRM plan and the Desert Channels regional NRM plan, where information on the condition and trend of the region's natural resources was variable (see also *Community Stakeholder Knowledge and Industries and economies for sustainable regions*, this volume for a discussion on the use of stakeholder knowledge to define key threats and pressures).

The location of artificial watering points is a key factor affecting grazing pressure in rangeland landscapes (e.g., Ludwig et al. 1999). However, little information was provided on the number and distribution of watering points for each region and relationships with the distribution of grazing pressure. The Northern Gulf regional NRM plan was the only plan which explicitly mentioned this problem. It referred to recent work on land condition assessment and sustainable grazing land management by Shaw et al. (2004), and the trade-off between a broader spread of grazing pressure through the addition of new artificial watering points as opposed to reliance on natural watercourses and waterholes, which, without protection, are subject to intense, localised grazing pressure.

End of dry season ground cover was emphasised in the Fitzroy region NRM plan (FBA 2004) as the critical factor affecting soil health and erosion. It acknowledged that although excessive grazing pressure caused soil erosion and other deteriorations in land resource condition, and that this problem may be diminishing either through regulation or adoption of best practice. However, little information is currently available to provide a precise picture of what grazing land management practices are used and where, and what is the current condition of land under grazing. Information on pasture composition was also variable. The Fitzroy region NRM plan (FBA 2004) noted that pastures varied in composition with land use and that introduced pastures (e.g., Rhodes grass *Chloris gayana*, buffel grass *Cenchrus cillaris*) are an important contributor to the grazing economy of the region. However, no details of the impact of overgrazing on the composition of native pastures was provided. The Desert Channels regional NRM plan highlighted the impact of the 2001-2003 drought on the region's pasture resources with the recovery of Mitchell Grass (*Astrebla* spp.) slow and patchy. Interestingly, buffel grass was identified as a pasture resource in the Desert Channels and the Central Queensland Strategy, but was listed as a weed in the Northern Gulf. Large macropods were also mentioned as an important contributor to excessive grazing pressure in the Desert Channels, but were not mentioned for other regions where substantial large macropod populations also occur (e.g. Queensland Murray Darling and South West NRM regions).

The Desert Channels plan identified that many riparian areas in the region are adversely impacted by weeds, feral animals, excessive grazing pressure and unsustainable grazing practices. However, no recent systematic survey of the condition of riparian areas was available to inform development of that plan.

7.3.2. Fire and woody vegetation thickening

The assessment of the threats posed by altered fire regimes on the integrity of savanna ecosystems showed a similar overall lack of detailed information in the plan's reviewed. The relationship between fire management, vegetation thickening and pasture productivity also received limited mention. The Northern Gulf regional NRM plan (NGRMG 2005) recognised that sound long-term fire management is essential for safeguarding sustainable pasture productivity, and provided a detailed review of the ecological and socio-economic issues pertaining to what is sound fire management. It also recognised that fire is currently used little in the management of the grasslands in the region, and that little or no information was available on the sensitivity of grass and other plant communities to fire for the region. Reduced fire intensity and frequency also were recognised by the Northern Gulf plan as

important factors affecting woody vegetation thickening currently being experienced in savanna ecosystems, and that frequent burning can play an important role in the management and control of weeds such as rubber vine, although this may have negative consequences for some fauna species.

The Southern Gulf regional NRM plan (SGC 2004) recognised fire management as a key factor in sustainable land resource management, and that best practice fire management for the region is not well understood, partially because of the problem of spatial and seasonal variability. However, relatively little information was provided on how fire frequency and intensity affect the tree-grass ratio and hence pasture productivity in the region. The Desert Channels regional NRM plan (DCQ 2004) provided limited information on fire regimes for that region. Fires historically occurred in the Mitchell Grass Downs, while in recent decades pastoralists have sought to suppress fire because of its impact on often scarce pasture resources and consequently on livestock numbers and production. The Desert Channels plan recognised that vegetation thickening and encroachment are having an adverse impact on pasture productivity and vegetation structure for a number of gidgee (*Acacia cambagei*), mulga (*A. aneura*) and eucalypt (*Eucalyptus* spp.) communities in the region. However, no detailed analysis of the drivers and impacts of these changes are provided. Mention of fire, grazing and woody vegetation thickening are made in the QMDB & SW NRM regional NRM plan and the Fitzroy region NRM plan under threats to assets and priorities for action. However, no detailed assessment or analysis of fire regimes was provided for each region.

7.3.3. Weed and pest animal species

A major strength of the five regional NRM plans reviewed was the level of recognition and assessment of the threats posed by invasive weed and pest animal species. However, as with other assets and threats, the comprehensiveness of the information base and analysis of available information was quite variable across the plans reviewed. A detailed overview of the impact of weeds on the region's assets was provided for the QMDB & SWNRM regional plan (QMDC & SWNRMG 2004). A series of coarse-resolution maps of the distribution of several major weed species (African boxthorn *Lycium ferocissimum*, Harrisia cactus *Eriocereus martinii* and *E. tortuosus*, mesquite *Prosopis* spp., mother of millions *Bryophyllum* spp.) and feral goats (*Capra hircus*), feral pigs (*Sus scrofa*), rabbit (*Oryctolagus cuniculus*) and wild dog was contained in the plan appendix. This information also was derived from Pest Info, the Queensland Department of Natural Resources and Mines (QNRM 2005) database on pest and weed species, and the annual pest assessment maps developed by the Department of Natural Resources and Mines. Mention was made of research organisations conducting weed research in the region. Weeds and pest animal species were recognised as a priority for action in the regional aspirations, targets and actions of the Fitzroy region NRM plan. This plan recognised acquiring accurate information on the distribution and abundance of weeds and pest animals and their environmental and production impact within each catchment was a major challenge.

For the other regional NRM plans, little or no spatial information was provided on the distribution of weed and pest species. This reflects an information deficiency on weed and pest species distribution at a sub-regional level in Queensland. For example, rubber vine *Cryptostegia grandiflora* was recognised as a priority weed species for the Northern Gulf region, however no maps were provided on its current distribution and rate of spread. Riparian areas, floodout areas and wetlands were recognised as particularly vulnerable to weed invasions, including species well established in adjacent regions but not yet identified as being present in the Northern Gulf. For the Southern Gulf and Desert Channels regional NRM plans, moderately detailed information on the threats posed by introduced plants and animal species was provided. Less detailed information and analysis was provided on weed and pest species, their distribution and abundance, and the threats they pose to production and biodiversity. (Note: more detailed information was provided in the Desert Channels Community Information Paper).

7.4. Objectives and Targets

7.4.1. Soil and pasture health

Resource condition and management action targets for soil and pasture health varied among regions in terms of their specificity and measurability (Table 1). These differences are partly due to regional differences in suitable information on resource condition and trend, with NHT2 regions often setting targets to conduct further resource assessment and mapping upon which to base more specific management action targets. In contrast, resource assessment and mapping targets were not common for NAP regions such as the Fitzroy Basin and the Queensland Murray Darling Basin and South West NRM. For the Southern Gulf NRM region, the lack of specific and measurable targets was indicative of deficiencies in the resource information base for the region, and also a planning preference/decision to defer defining specific thresholds until improved information becomes available, even if this may take 10 years to develop. To overcome this deficiency, the Southern Gulf regional NRM plan set targets for conducting resource condition mapping and identifying high risk management areas requiring special management.

Sub-catchment and property management planning were a common feature of most plans reviewed (Table 1), although there was considerable variability in the specificity of targets relating to property management planning implementation. The Fitzroy region NRM plan and the QMDC & SWNRM regional NRM plans adopted a sub-catchment approach to management plans and sought to develop integrated multi-property management plans as a basis for implementing on-ground planning actions. The Fitzroy region NRM plan set a management action target to implement property management plans via neighbourhood catchment approaches, with specific actions to develop criteria for voluntary property management plans. The Desert Channels regional NRM plan sought to develop regional guidelines for property management plans that match land use management practices to land capability/suitability. The Northern Gulf Region NRM plan developed several specific management targets for land managers to manage land resources sustainably. In this case, the uptake of the Queensland Department of Primary Industries & Fisheries GLM package (QDPI & NTDBIRD 2002), the application of satellite/aerial photo technology and property planning toolkits to map paddocks, infrastructure, land types and land condition were key actions for achieving these targets.

Another common target was the development and implementation sustainable grazing land management practices for improving soil and pasture condition, although the specificity and measurability of these targets varied between regions. The Fitzroy region NRM plan soil and pasture resource condition targets were quantitative, with 30% ground cover set as key groundcover threshold for the region. This threshold was to be achieved on 50% of all land within 5 years, 75% of all land within 10 years, and 95% of all land within 15 years. Specific management action targets designed to help achieve these resource condition targets involved the:

- adoption of land and grazing management systems that increase ground cover by an additional 500 landholders within 5 years; and
- target development and refinement for ground cover on different soil types, slopes, average rainfall and land uses within 5 years.

Table 1 Summary of management action targets and actions for soil and pasture resources and ecosystem integrity

Focus of Targets	Examples from regional plans	Actions	References
Conduct resource assessment and mapping.	<ul style="list-style-type: none"> Resource assessment and habitat conditions will be mapped for 50% of the region by 2010. Assess riparian zone condition and determine priorities for action by 2008. By 2007, integrate strategic mapping of pest species through pest management plans, in conjunction with collaborative efforts relating to control and mitigation techniques. 	<ul style="list-style-type: none"> Vegetation and soils mapping, GIS survey work, priority risk assessment. Provision of assistance to land managers to map properties for their natural values, cultural values, and infrastructures for sustainable management. 	Southern Gulf regional NRM plan (p91). NGRMG and TS CRC (2004, p55, p61)
Develop property management plans.	<ul style="list-style-type: none"> Annually 15 additional landholders engaging in GLM+ and using satellite images/air photos and property planning kit to map paddocks, infrastructure, land types and land condition. 80% of land managers engaged in developing property management plans within 5 years. Develop and promote the adoption of regional guidelines for property management plans that match land use/management practices to land capability/suitability. Property management plans implemented (via neighbourhood catchment and/or other appropriate approaches) incorporating sustainable production systems and achieving a range of catchment targets – 25% of catchment within 3 years, 45% in 5 years and 70% in 10 years. 	<ul style="list-style-type: none"> Provision for land managers to map properties for their natural values, and infrastructure for sustainable management. Provide support and training grazing and other local and state managers regarding sustainable land management techniques. Encourage adoption of property management planning through making planning a component of on-ground works. Identify high priority neighbourhood catchments for on ground action that will achieve multiple management outcomes Develop criteria for voluntary property management planning in consultation with stakeholders within 2 years. 	Southern Gulf regional NRM plan (p91). Desert Channels Queensland (2004, p60) NGRMG & TSCRC (2004, p46) FBA (2004, p70)
Develop sub-catchment management plans.	<ul style="list-style-type: none"> 100% of Maranoa-Ballonne and Border Rivers, covered by sub-catchment management action plans and 30% of Nebine-Mungallala, 	<ul style="list-style-type: none"> Develop and use sub-catchment and integrated multi-property management plans as a basis for implementation of natural resource 	QMDBC and SWNRM (2004, p95)

	Warrego-Paroo and Bulloo catchments integrated multi-property planning schemes by 2010.	management works. <ul style="list-style-type: none"> • Ensure consistency between planning processes and under the Integrated Planning Act 1997(Queensland Government 1997) 	
Develop and implement sustainable grazing land management practices.	<ul style="list-style-type: none"> • Grazing and land management standards will be agreed by 2008. • Promote a better understanding of climate and pasture cycles in the major pasture types. • Annually 15 additional landholders managing stocking rates according to soil and climatic constraints, setting sustainable stocking rates and maintaining an average ground cover greater than 50% at break of season. 	<ul style="list-style-type: none"> • Develop a reliable and credible method for assessing biodiversity condition of grazing lands. • Develop links to current Department of Primary Industries and Forestry Mitchell Grass project. • Safe carrying capacity assessment made available to grazing enterprises. • Provision of incentives to land managers to maintain good ground and/or vegetation cover. 	Southern Gulf regional NRM plan (p92). Desert Channels Queensland (2004, p59)
Training and education programs/sharing knowledge.	<ul style="list-style-type: none"> • By 2006, 50% of land managers in the region are computer literate and trained in the use of satellite imagery in association with GIS to monitor and respond to fire management issues. 	<ul style="list-style-type: none"> • Increase community and managers awareness of and ability to identify, prevent, treat and manage new weeds and pest animals in land and aquatic environments by 50% within 3 years and ongoing. 	(FBA 2004, p74) NGRMG & TSCRC (2004, p67)
Manage vegetation thickening and thinning.	<ul style="list-style-type: none"> • Research woodland thickening/pasture processes. 	<ul style="list-style-type: none"> • Develop best management practice for ongoing maintenance of gidgee and eucalypt woodlands. 	Desert Channels Queensland (2004, p59)
Minimise impact of fire on ecosystems and production.	<ul style="list-style-type: none"> • Collaboratively work with land managers to develop a policy on best fire regime as part of a catchment-wide plan by 2005. • Incorporate appropriate fire regimes into property plans for grazing and agricultural land uses and into protected area management plans by 2006. 	<ul style="list-style-type: none"> • Make available tools and information for graziers to assess carrying capacity depending on land type, paddock size and climate to maintain good ground cover. 	NGRMG & TSCRC (2004, p55)
Reduce human impacts on riparian zones	<ul style="list-style-type: none"> • By 2008, 25% of riparian areas along major watercourses being involved in rotational wet season spelling on average each wet season on each property. 	<ul style="list-style-type: none"> • Provision of incentives to land managers to maintain good ground and/or vegetation cover. • Develop and implement riparian management plans for each 	NGRMG & TSCRC (2004, p55) QMDC & SWNRM (2004, p104). FBA (2004, p97).

	<ul style="list-style-type: none"> Identify strategic areas and develop coordinated riparian management plans by 2008. Implement healthy waterways program to protect and improve 1500 km of riparian area and 2000 ha of wetlands. 	<ul style="list-style-type: none"> catchment by 2008. Identify and map important functional riparian habitat within 3 years. Determine most effective dimensions (e.g. riparian zone width) and appropriate actions to improve riparian function within 3 years. 	
Control invasive species	<ul style="list-style-type: none"> Develop and monitor effective control mechanisms for the treatment of new introductions of pest species. 10% increase in effort to assist identification, treatment and management of existing weeds and pest animals within 3 years. 50% increase in effort to assist identification, treatment and management of new weeds and pest animals. 	<ul style="list-style-type: none"> Provide information about new weeds and infrastructure to reduce the spread of new weeds. Support local government to prevent the introduction of new weed species. Identify priority species and locations for on-ground action within 2 years. Pest management plans developed and utilized by all local governments within timeframes required by the Land Protection Act 2002 	<p>NGRMG & TSCRC (2004, p61)</p> <p>(FBA 2004, p74)</p>

The Northern Gulf NRM plan presented four resource condition targets and seven specific management action targets for soil health. Resource condition targets aimed at increasing the proportion of regional soil groups (e.g., alluvial country, Georgetown granites, red duplex soils) in the better condition (A and B) categories. These categories and targets directly relate to previous soil resource assessment by Shaw et al. (2004). Management action targets for the Northern Gulf aimed at improved management of stock numbers for achieving pasture condition outcomes, and specific targets aimed at improving the capacity of landholders to manage pasture resources sustainably. Specific targets included:

- on-ground actions such as setting sustainable stocking rates and maintaining an average ground cover greater than 50% at the break of the season;
- wet season spelling programs; and
- adjusting stock numbers according to available feed.

Management action targets relating to sustainable grazing management practices were less specific, especially the setting of quantitative minimum ground cover targets. For the Desert Channels regional NRM plan, soil and pasture targets set for land (soil and pasture) resources within the Desert Channels plan focused more on developing information, understanding and education than specific quantitative ground cover targets. These targets included developing scientifically sound, community accepted and measurable soil and ground cover targets by 2008, with the remaining targets emphasising capacity building, development of best management practices for major pasture types/vegetation communities and improvement in information delivery to landholders. For the Southern Gulf regional NRM plan, specific resource condition targets aimed to manage 95% of the land area sustainably by 2020 and an increase in average pasture cover rating by an amount agreed by 2015. This was dependent on:

- baseline survey information of current land condition and groundcover,

- 80% of land managers engaging in developing property management plans, all landholders becoming aware of the land management services being available to them, and
- agreement on grazing and land management standards by 2008.

The QMDB & SW plan set a progressive reduction in the rate of decline of soil condition as a resource condition target, with specific soil resource condition targets for grazing lands to be developed by 2007. Management action targets for soil condition targets were grouped within a broader set of land and soil (salinity, saline groundwater and soil) condition targets. No specific pasture condition or groundcover threshold resource condition and management action targets were set for this region. The highest priority action for 100% of the Maranoa-Balonne and Border Rivers catchment plans covered by sub-catchment plans by 2010, and 30% of the Nebine-Mungallala, Warrego-Paroo and Bulloo catchments covered by integrated multi-property planning schemes by the same date. A second priority target set 60% of the action plans developed for the broader catchment and sub-catchment targets to be implemented at the property-level by 2008.

7.4.2. Riparian areas

Most plans set specific and measurable management action targets for riparian areas. The Fitzroy region NRM plan (FBA 2004) aimed to implement healthy waterways program to protect and improve 1500 km of riparian areas and 2000 ha of wetlands. The QMDB and SW NRM regional plan (QMDC & SWNRMG 2004) aimed to implement at least 300km of riparian management works in priority areas each year until 2009, and identify strategic areas and develop coordinated riparian management plans by 2008. Actions to achieve these targets included provision of financial incentives and technical support to landholders in priority areas (eg. for fencing, riparian restoration, etc.), and the review of available riparian management guidelines, and if lacking, produce and distribute widely updated guidelines. The Northern Gulf regional NRM plan (NGRMG 2005) set specific management action targets to assess the condition of riparian zones and determine priorities for action by 2008, with 25% of riparian areas along major watercourses being involved in rotational wet season spelling with at least 20% of those being spelled on average each wet season on each property. The Southern Gulf regional NRM plan (SGC 2004) developed one management action target that aimed to fence off riparian zones at 10 important riverine sites by 2010. The following actions were regarded as necessary in order to achieve this target:

- Fence high priority waterways (flow or no flow).
- Determine where best results will be gained.
- Tie fencing into property management plans and weed management.
- Rejuvenate riparian zones.

As with most of the regional NRM plans reviewed, the Southern Gulf NRM plan did not mention the possibility of implementing riparian management plans. For the Desert Channels regional NRM plan, not a single management action target in any asset category (land, weeds and feral animals, water, biodiversity) explicitly mentions riparian areas. However, several soil and pasture resource and weed management action targets will reduce human impacts on riparian zones, even though riparian areas were not explicitly mentioned

7.4.3. Fire and vegetation thickening and thinning

Specific targets for the management of vegetation thickening and thinning were limited. The Northern Gulf regional NRM plan (NGRMG 2005) recognised the connection between fire management and exotic weed invasions, but no specific targets were set for the management of the density of native woody vegetation. The Desert Channels regional NRM plan (DCQ 2004) set a target for research into best management of gidgee and eucalypt woodland thickening. Target setting for fire management also was variable across the plans reviewed. The Northern Gulf regional NRM plan (NGRMG 2005) set two specific resource condition targets for fire management, which aimed at managing fire regimes to minimise damaging impacts on the region's ecosystems. Fire management action targets involved a mixture of landholder capacity building, development of best fire management practices to be incorporated into property management plans, and by 2007 develop appropriate targets and

actions as improved information becomes available. Fire was acknowledged as an integral part of the Central Queensland landscape (FBA 2004), especially in the northern part of the region, impacting on vegetation structure and pasture productivity. However, no immediate resource condition targets were set, with a 10 year timeline set for the defining and implementing appropriate fire management regimes. No targets were set for improving fire management in the Southern Gulf regional plan, although fire was mentioned within biodiversity condition and management action targets. Similarly, no specific fire resource condition targets and management action targets were set for the Desert Channels (FBA 2004) and QMDB & SW regional NRM plans (QMDC & SWNRMG 2004).

7.4.4. Weed and pest animal species

Plans showed a higher level of consistency in the development of targets for controlling the spread and infestation of pest plant and animal species, a key threatening process to ecosystem integrity in rangelands. A key common feature of these targets was:

- the control and containment of existing infestations;
- the prevention and control of new infestations;
- improved information base, especially mapping, for the management and monitoring of new invasions; and
- increasing the capacity of land holders to manage weed and animal species.

The Northern Gulf regional NRM plan set targets for pest animal and weed species impacting on ecosystem integrity in the region. Targets for pest and weeds aimed at: detecting within 2 years new introductions of ecologically significant invasive weed and pest species; and controlling the density distribution of invasive weed and pest species by 2007. The four management action targets aimed mainly at improving the quality of information on pest and weed species, and to develop targets and actions by 2007 as more reliable information becomes available. The Desert Channels regional NRM plan also set two broad resource condition targets controlling the spread of invasive weed and feral animal species. Management action targets designed to help achieve these resource condition targets involved a mixture of strategies aimed at on-ground control and containment of weed and feral animal outbreaks to mapping and regional database development and incentive schemes for the strategic and innovative management of weeds. No resource condition or management action targets were set for fire management in the Desert Channels.

The Southern Gulf regional NRM plan set a resource condition target to:

- prevent the spread of weeds of national significance beyond the 2004 infestation distribution, and
- a reduction by at least 20% of all pest species within containment lines.

No date was set for achieving the last target. Management action targets involved a combination of education programs, landholder capacity building and development of improved information on species distribution and spread. The Fitzroy region NRM plan also set resource condition targets for the containment of pest plant and animal species within 10 years, and for the 100% control of new pest outbreaks. Management action targets aimed at increasing the effort and capacity to identify treat and manage existing and new invasive species, and pest management plans developed and utilised by local governments. The QMDB & SW NRM plan set similar resource condition and management action targets for the control of exotic weed and pest animal species.

7.5. Priorities

The process of priority setting and ranking of resource condition and management action targets varied across the regional NRM plans reviewed. Similarly, priorities for soil and pasture health, and ecosystem integrity targets varied regionally. Grazing land management (pasture health, property planning and resource condition mapping were set as Priority 2 for the Northern Gulf NRM plan, while fire management and weeds and pests were ranked as Priority 7 and 8 respectively. Aspirational and management action targets for the Southern

Gulf NRM plan were given a priority rating of high, medium or low. Sustainable land use management practices and the control of weeds of national significance were given a high priority rating. However, within these broad targets, key management action targets received a range of priority ratings. For example, an increase in the average pasture condition rating through the setting of grazing and land management standards (by 2008) received a medium priority rating, as did the confirmation or establishment of containment lines for all significant weed species by 2006.

The Fitzroy region NRM plan employed a risk analysis approach to determine highest priority targets, and assessing which actions contributed most to achieving these targets. Three criteria were used to score risk assessment: impact of pressure on asset; trend of impact; and extent of pressure. Low ground cover (grazing pressure) scored a high median risk score (0.8), while altered fire regimes received a median risk score of 0.6, and invasive weed species a relatively low score (0.4). The risk assessment scores were then used to set priorities for implementation. Resource condition and management action targets aimed at improving soil condition through adoption of management systems that improve ground cover were classified as Priority 1 or very high priority. Resource condition and management action targets relating to pest animals and weed invasions received a high priority rating (Priority 2), while fire resource condition and management action targets received a medium (Priority 3) rating.

Resource condition and management action targets were ranked in priority order for the QMDB & SW NRM plan. The resource condition target for soil health was ranked third after reduction in soil and groundwater salinity. The priority management action target was the development of integrated multi-property planning schemes for sub-catchments by 2010. The Desert Channels regional plan briefly mentioned the prioritisation process involving community workshops. Management actions designed to address unsustainable land management practices, lack of property planning, and also changes in the structure of vegetation communities, were given the highest priority rating. Management actions designed to improve strategic weed and pest control were also given a high priority rating.

7.6. Monitoring and evaluation

The regional NRM plans reviewed recognised that appropriate monitoring, evaluation and reporting are necessary to ensure improvements in resource condition. However, at present, no specific strategies are in place for developing and implementing integrated soil and pasture condition monitoring and evaluation strategies. With the exception of the Fitzroy region NRM plan no specific indicators were identified for monitoring soil and pasture condition. No plans identified how soil and pasture monitoring was to be conducted in practical terms. Several plans however recognised that regional bodies have a role in measuring progress towards resource condition targets focusing on the effectiveness of management and capacity building actions rather than on on-ground monitoring. It appears that the regional bodies will rely heavily on State Government agencies with support from local government and industry to be responsible for developing and implementing on-ground monitoring programs

7.7. Discussion

Key findings from the review of soil and pasture management in NRM plans are summarised below.

7.7.1. Soil and pasture resources

1. Poor availability of spatial information on total grazing pressure and the condition and trend of pasture/ground cover and soil health is a major limiting factor. Available information was captured at a coarse spatial scale and often outdated. All plans recognise a lack of current region-wide spatial information of resource condition at an adequate spatial scale (e.g. 1:100,000 or even 1:250,000) for use in property planning.

2. Extensive grazing of cattle and, to a lesser extent sheep, are the most extensive land use in Queensland's rangelands. However, plans varied in the level of recognition of excessive grazing pressure, coupled with seasonally variable rainfall, as a major threat to pasture and soil health.
3. The level of assessment and analysis of existing soil and pasture resource information ranged from poor to good, with most plans making limited use of available scientific information. The Northern Gulf NRM plan provided the most detailed assessment of soil and pasture health, including the integration of scientific information. Apart from the Northern Gulf, plans provided limited detailed information on changes in native pasture composition. Given the limited resource information base available, planners may have benefited from referring to key published research to support more quantitative pasture and soil indicators, surrogates and thresholds and target definition.
4. Targets varied in the level of specificity and measurability. Only two plans set quantitative indicators for assessing pasture cover. While NRM plans recognised the need to address causes of problems rather than symptoms, specific cause-effect linkages were rarely specified. Threats are used as broad-brush surrogates for causes, with mitigation of threats proposed as key to addressing NRM problems in the region. Sometimes cause-effect relationships are easily identifiable. For example, excessive grazing pressure, especially during drought, is a recognised major cause of decline in the condition of soil and pasture resources (McKeon et al. 2004).
5. There seems to be no consistent approach to setting targets, and very often there is no demonstrated rationale for why a particular management action target was selected. Only two plans set quantitative ground cover, pasture condition targets. Several plans indicated that specific ground cover/pasture condition targets would be set once better information became available.
6. Property management plans are presented in plans as an important link in regional NRM bodies achieving improvements in soil and pasture condition. No consistent cross-regional standards/guidelines are currently available in Queensland for the development of property management plans, or for the integration of property management plans at a sub-catchment level. Several regional NRM plans reviewed aimed to develop guidelines for property management planning, while the Queensland Murray Darling Basin and South West regional NRM plan and the Fitzroy region NRM plan opted for an integrated multi-property planning option.
7. Considerable resources are being invested in improving the capacity of land holders to develop and implement effective property management plans. The effectiveness of these investments will depend on close cooperation between regional NRM bodies, State Government agencies (e.g. Queensland Department of Primary Industries) and landholders. The exact nature of these arrangements will also be influenced particularly in rangelands by the outcomes Draft State Rural Leasehold Land Strategy review process (Queensland NRM 2003).
8. Scientists/ researchers need to be more actively involved in all aspects of the regional NRM planning process. There is a major gap in how progress towards achieving soil and pasture resource condition targets will actually be physically monitored in space and time. Much work needs to be done in this area. Research agencies can play an active role in working with regional NRM bodies to develop effective monitoring programs including better use of existing monitoring frameworks for the rangelands and savannas (e.g. Whitehead et al. 2001).

7.7.2. Fire, weeds and pest animal species

1. Plans were relatively comprehensive in their assessment of the threat posed by weeds and pest animal species. These threats received a relatively high priority rating in most plans. Fire management was more varied, being set a high priority for the Northern Gulf plan, a medium priority score for the Fitzroy plan and not listed for the other plans. This partly reflects regional differences in the importance of fire, with the Southern Gulf being a notable exception.
2. The impact of altered fire regimes on the tree-grass ratio and pasture productivity is a major gap in almost all plans reviewed.
3. Suitable spatial information on the distribution, spread and abundance of invading plant and animal species is currently inadequate for developing regional control strategies. This problem is common across all regions, but appears to be particularly limiting for the Southern and Northern Gulf NRM regions of Queensland.
4. The limited spatial information base on the distribution and spread of invasive weed and pest animal species makes spatial prioritisation of measures to control the spread of weed species difficult and somewhat arbitrary. Further, it is important that the implementation of management actions be closely coordinated between regional NRM bodies and existing state and local government weed and pest management strategies.

7.8. References

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8. Supporting individual and community capacity outcomes in regional NRM plans

Cathy Robinson

8.1. Introduction

The intimate connections between healthy landscapes and healthy regional communities raises some important questions regarding the objectives of and support for individual and community capacity outcomes in regional NRM. These questions include:

- What is the rationale behind building individual and community capacity reflected in regional NRM plans?
- How good is the information to set and prioritise regional NRM targets to deal with the suite of capacity outcomes areas?
- How well do management targets and priorities seek to improve participation of individual and community stakeholders to set, implement and evaluate capacity building activities and programs?

This section evaluates accredited regional NRM plans to examine these questions using the following criteria outlined in McDonald et al. (2004).

- Are the costs and benefits of resource management shared equitably (criteria 5)
- Whether processes for inclusive participation and active involvement in community stakeholder groups and networks are established and maintained (criteria 7).
- How effective on-going learning, skills development and training is supported (criteria 8).

In this context, capacity refers to a dynamic process that improves the assets and attributes of individuals and community stakeholder groups to define, assess, analyse and act on common NRM concerns. What constitutes 'effective' capacity building efforts and 'improved' capacity building outcomes are important yet challenging questions (Macadam et al. 2004). Adding further complexity to this challenge is that 'the community' is neither a homogenous nor stable entity – membership and definitions are affected by issues such as class, length of residency, economic activity, interests, ethnicity and lifestyle (Liepins 2000, p.336; see also section on community knowledge, Robinson this volume). **Efforts to build capacity need to be specific to the needs, views and aspirations of a particular individual or community stakeholder group and reflect the unique NRM issues and requirements of the region.**

It is therefore not surprising that planning for and investing in individual and community capacity outcomes as part of the regional NRM planning process has been a difficult task for regional planners. Efforts to build capacity at the regional scale have occurred in the context of:

- A strong recognition, albeit narrow definition of capacity-related issues in Intergovernmental and Bilateral Agreements underpinning the 'roll-out' of NHT extension and National Action Plan for Salinity and Water Quality programs.
- The National Natural Resource Management Capacity Building Framework endorsed by Queensland (Australian Government 2002a). This identifies four key areas of specific importance to capacity building that include reference to the community.
 - *Awareness*: Individuals within the community are aware of regional NRM issues and understand the link between these issues and the long-term viability of the community.
 - *Information and knowledge*: Natural resource managers and users are able and willing to access the necessary information, data and science – biological, social and economic – to make sound NRM decisions.
 - *Skills and Training*: Natural resource managers and users equipped with, or having access to, the necessary technical, people management, project

- management and planning skills to participate in the development and implementation of sustainable NRM at the property, local and regional scales.
- *Facilitation and Support*: Support systems in place to ensure the engagement and motivation of the community to build social capital and enable skilled NRM managers and users to exercise ownership over regional NRM decision making processes, and effectively implement actions arising from these processes.
- A sizeable long term investment in State-wide investment projects (SIPs) to deliver improved capacity outcomes within Queensland.
- The importance of building capacity in key sectors to participate effectively and fairly in NRM business – for example NRM plans reviewed in this and the 2002-3 TSCRC review revealed that capacity related issues were consistently ranked as high investment priorities within regional strategies.

8.2. Regional and State Level Planning Contexts

Community involvement and capacity building is a distinct feature of regional planning under the NHT /NAP initiative based on the acknowledgement that many NRM issues are more effectively managed at a regional level and that communities must have ownership of NRM outcomes, priorities and choice of on ground actions. Yet regional NRM plans are supported by funding agencies (including the Australian government) which do not consider capacity building as a resource for which targets must be established, but as a mechanism through which the natural resource condition targets will be achieved (Australian Government 2002b). This can pose a risk to the community-based nature of the current regional NRM initiative whereby individual and community stakeholders are only be supported to pursue a narrow range of options and programs to achieve biophysical targets or pursue capacity building projects that reflect many untested assumptions about the ways in which these stakeholders see their futures and their involvement in regional NRM. **A key challenge facing regional NRM is to address social, cultural and economic limitations and drivers rather than providing support for individuals and communities to solve NRM issues using conventional approaches.**

Under these conventional approaches, scientists, government and industry define the problem, identify what community or individual capital is needed to reach that goal, and then outline strategies needed to enhance capacity where it is perceived to be lacking. There are three key problems with such an approach:

- It assumes what knowledge and skills exist within a community and that community stakeholders are 'empty vessels' that need to be trained and educated rather than as stakeholders who can offer skills and knowledge that contribute to innovative NRM solutions (see also section on community knowledge, Robinson this volume).
- It can present a one-dimensional perspective of change when in reality the environmental, social and economic and dimensions of a region will change. Capacity program milestones may need to be adaptive to maintain individual and community interest and motivation and relevance to current regional opportunities and challenges.
- It conveys a 'top down' approach to tackling environmental issues and assessing social capital that exists in regional communities.

While there is evidence of conventional approaches to capacity building within plans reviewed, there is also evidence of a long-term perspective that recognises that the future health of the environment is dependent on social, cultural and economic health of the region (see also Whitehead et al. 2001). This includes commitments or goals outlined in plans that offer support for individual and community capacity-building programs that aim to:

- Increase the level of knowledge and control people have over their social, economic and environmental futures.
- Support the desire for communities to assume a leadership role, including the cultivation of new leaders.

- Enable groups and individuals to effectively implement specific 'on ground' NRM actions and understand specific policy and institutional arrangements.
- Enable individual and community stakeholders to access and understand relevant science and technical information to assist in NRM decision-making and activities.
- Encourage increased uptake of sustainable technologies leading to more profitable and sustainable industries.
- Value add to projects through community investment of funds, knowledge, voluntary activities, time or other in-kind contribution.

8.3. Planning Information Base

Plans reviewed reveal a concerted effort to understand the social capital and capabilities of the community within the region. In this process 'the community' is usually undefined or categorised by stakeholder groups who live in the region (see also section on community stakeholder knowledge, Robinson this volume). This included **the collection of information about the region's social, demographic and cultural profile**. Demographic and socio-economic information was obtained from government census data. While this information provided a general overview, this data was often limited or unsuitable to help with indepth analysis of many capacity and socio-economic questions relevant to NRM planning (e.g. to assess social and economic impacts of a NRM policy or action). Specialist skills and consultancies were undertaken in some regions to undertake 'capacity audits' (e.g. Fenton 2004); offer tools for regions to consider social and economic impacts associated with NRM decisions, and explore the use of economic and social incentives to achieve improved NRM outcomes (e.g. Comeford 2004; Stanley et al. 2004).

A significant amount of support and effort was also dedicated to consultation programs in order to gain a widespread and integrated view of the state of region's assets, including the community (Box 1). This included the establishment of various types of working groups for particular stakeholder groups, or a mix of scientific, technical and community representatives to review feedback and recommendations from wider consultation processes.

Box 1 Examples of attributes of community assets identified in regional NRM plans

Capacity for **long-term adaptive management** of natural resources and the cultural values inherent in natural systems (especially for Aboriginal people) (FNQNRM 2004).

Extensive **community values and knowledge** contained in the long-term standing planning partnerships already developed across the region (QMDC & SWNRMG 2004; FBA 2004).

Social capital (which is built through) social networks, relationships and processes of a community to support individuals and communities to exercise their capabilities (SEQ 2004)

A well-informed, resourced, motivated and inclusive community will wisely manage its natural resources, heritage and institutions (DCQ 2004).

There is a general acknowledgement in most plans that stakeholders will have varying capacity and will need separate processes to engage in NRM. The challenges to engage Indigenous communities, for example, are generally recognised. Plan accreditation requires Regional Bodies to undertake 'effective engagement' with Traditional Owners and it is recommended that relevant Traditional Owner groups are consulted at the early stages of the plan rather than after all other stakeholders have contributed to the plan (Planning Arrangements Working Group 2004). Culturally appropriate engagement strategies have been developed in some regions, including the appointment of Indigenous project officer(s) to act as a facilitator between Traditional Owners and the wider NRM planning process,

workshops to discuss Indigenous concerns and aspirations, and a dedicated planning process to capture and integrate Indigenous values and priorities in the Wet Tropics.

Plans also acknowledge the knowledge and expertise available through existing community-based NRM activities, which include non-government organisations, local environment groups, as well as Landcare, Waterwatch, Coastcare and ICM groups. A common concern is community capacity built through the activities of these groups has been lost or threatened when government support has been cut (e.g. support for a facilitator or coordinator under the first phase of NHT) or access to funds have been sporadic. Some plans also acknowledge that **volunteer burnout, decreased enthusiasm for NRM issues, and lack of support needed to ensure community-based NRM programs can be strategic and sustained pose a challenge to the success of the current regional NRM initiative.**

Information obtained through consultation processes was integrated with other data obtained from scientific studies, government reports and ABS statistical community profiles and used to base a discussion about the unique features of the region and how this affects the current capacity of individual and community stakeholders to achieve sustainable NRM targets. In broad terms, plans for the **tropical savanna and inland regions** of Queensland reveal that these regions are characterised by economic industries that rely on a transient workforce and **not enough people** living in physical environments that require active management intervention. In comparison, plans for the **coastal and southern areas** of Queensland identify impacts associated with **population growth** in urban centres and the intensification of land use (e.g. issues associated with the growth of peri-urban communities) as the key issues of concern.

Plans reviewed also highlight the difficulty of obtaining detailed information about the nature and level of relevant expertise amongst stakeholders and organisations in the region. Broad information on conventional indicators of community capacity is presented – such as qualifications held by residents, percentage of the region's population that are Indigenous, age structure of the population and economic assets of the region. Significant **drivers and pressures** on the condition of social capital in the region are identified and include:

- **Fluctuations in rural community populations** affected by a range of internal and external economic drivers (ranging from employment opportunities to market trends) as well as climate variability.
- A lack of interest in and awareness of NRM issues **from urban stakeholders and in urban areas** - includes challenges to engage Local Government.
- Challenges to train and maintain **NRM 'leaders'** in the community, including issues associated with volunteer burnout.
- **Conflicts within the community** about NRM issues – especially when tenure or jurisdictions are ambiguous or overlap, when stakeholder groups are forced to fight for limited resources, or there is a lack of trust between stakeholder groups based on prior experience.
- **Poor NRM information sharing and capture** – includes a lack of capacity or willingness by some stakeholders to take on new knowledge; information from government agencies that is inconsistent, difficult to access or reluctantly provided.

In most plans reviewed, planners acknowledge that it is difficult to consider what are the specific social, cultural and economic implications of proposed NRM targets and activities. Issues surrounding the contributions of Aboriginal people to engage in NRM provides a good example of this challenge. Most of the plans reviewed recognised a range of environmental, economic, cultural and social contributions of Indigenous Ecological Knowledge and customary practices in land, sea and wildlife management. Yet there is less detailed information about how Indigenous people and their customary economies and practices can be integrated in appropriate ways at appropriate scales with other NRM systems; contribute to Indigenous communities' social well-being or help to meet conservation objectives for the region (see also section on regional economies, Taylor this volume).

Only a small number of plans canvas detailed activities and options to improve Indigenous people's capacity to pursue these issues. Even less information is provided about what

specific knowledge and skills are needed for Indigenous people to contribute to the regional NRM outcomes proposed in regional NRM plans. This will become increasingly important given the growing recognition of Indigenous interests to pursue cattle enterprises, live in outstations, run caring for country programs through Aboriginal Land and Sea Centres, and have native title rights recognised. In many of Queensland's northern regions, Aboriginal people make up a large proportion of small regional populations, are a major landholder yet struggle to have the capacity to effectively engage in NRM. Whitehead (2002) cautions against pursuing a narrow range of capacity-building options for Indigenous communities who have a role to play in delivering regional NRM:

The current emphasis on capacity building] in Indigenous communities emphasise their status as mendicants, as recipients of services from others. This seems an underdesirably constrained view of options to improve community well being. A more inclusive and positive view of the options might present Aboriginal people as full and vital members of the Australian community, if serious efforts are made to properly support expanded contributions. Issues of governance, capacity building and leadership might be more explicitly linked to enhancement of these contributions, rather than directed mostly to mitigate disadvantage through better delivery of basic services (Whitehead 2002, p.2).

8.4. Targets and Objectives

Individual and community **capacity building is a central feature of many management action targets (MATs) and short-term priorities stated in current regional NRM plans.** This is justified as being part of a wider goal to integrate the unique social, economic and cultural values and issues of the region with meeting NRM outcomes (e.g. see Box 2). Under the National Natural Resource Management Capacity Building Framework, capacity building management actions and targets are meant to reflect how the **range of social, economic and cultural characteristics of community stakeholder groups** affect stakeholder's ability and willingness to build social capital. Yet without a detailed understanding of the current social capital available to a given region, it is difficult to set S.M.A.R.T. (Smart Measurable Achievable Realistic Time-bound) targets to direct areas of changes needed in stakeholder knowledge and activities, or identify key stakeholder members to target capacity building efforts. Not surprisingly, many capacity-building MATs are not specific or are focused on gaining information so that the performance of future capacity-building MATs can be monitored and evaluated.

Box 2 Examples of capacity building Management Action Targets in regional NRM plans

Building awareness:

Focus on building landholders awareness of natural resource assets and threats

Examples:

- 30% of relevant enterprises engaged and having an increased awareness of impact of pests by 2005 (**MAT6, QMDC & SWNRMG 2004**).
- Improve community's knowledge of the value of natural and artificial wetlands and riparian areas within three years (**A215, FBA 2004**).
- Active Involvement and participation of 10 schools across the region with NRM issues by 2006 (**EP MAT6, SEQ 2004**).

Information and knowledge:

Focus on the development of systems to fill in knowledge gaps, translate information to a useable form, and contribute to monitoring programs

Examples:

- Undertake a needs analysis with Traditional Owners to identify Traditional Owner groups who want to undertake country based planning (**A2.2.1, FNQNRM 2004**).
- Information is readily available to the regional community in a useable form to assist with decision-making and other decision support tools that accommodate enterprise level monitoring by 2007 (**MAT58, NG 2004**).

Skills and training:

Focus on improving stakeholder disadvantage and developing stakeholder skills necessary to improve NRM outcomes

Examples:

- Work with the indigenous community and human services sector to increase indigenous and youth employment opportunities (in the non coastal areas of the region) within 5 years (**A269, FBA 2004**).
- Implement a knowledge and skill development program to achieve a 10% on ground NRM change by 2010 (**C5b, CA 2004**).

Facilitation and support:

Focus on support for volunteer and other stakeholder groups who are not engaged in NRM (for a range of social, economic and political reasons) and facilitation to define and support existing and proposed partnerships or agreements

Examples:

- Provide proactive support and employment opportunities to young (17-26 years old) people in the regions to maintain viable and vibrant rural communities (**CC MAT1 A1, QMDC & SWNRMG 2004**).
- Ensure active community involvement in NRM planning and action by 2007 through support for the DCQ Board, Cooper's Creek Catchment, Georgina Diamantina Catchment and Desert Uplands committees and other NRM groups in the region in a healthy partnership with governments (federal, state and local) (**MAT 5.2, DCQ 2004**).
- Consult with adjoining coastal NRM regions to develop community based assessment and monitoring programs of marine debris in the Southern Gulf. Identify current levels of marine debris and ghost nets by 2007 (**M6-1.1, SG 2004**).
- Develop and implement Country Based Management Plans, Community Based Management Plans and TUMRAs for land and sea country for Traditional Owner groups to commence in 2005 (**FNQNRM 2004**).

Source: Accredited regional NRM plans (Feb 05)

8.5. Priorities

Most plans outlined a process to incorporate input from stakeholder groups in the prioritisation of management action targets and actions. A few plans outlined explicit social, economic and cultural criteria and processes for priority setting. For example, QMDC and SWNRMG established a prioritisation process that was informed by a social and economic impact assessment. However it is difficult to assess how or the extent to which this information was used to weigh up the benefits and costs of proposed NRM decisions on different stakeholders. To determine what would be the best value for money in sustaining the assets in the Wet Tropics, 'best' investments included assets that provided important ecological, economic, social and cultural services for the community (FNQNRM 2004, p.154). How these services were weighted to make this assessment is unstated.

Some plans note the difficulty in ensuring that the prioritisation process was equitable between stakeholders and effectively captured critical NRM issues within the region. Stakeholders in the Southern Gulf, for example, found it difficult to reach consensus on water extraction and flow issues given the complexity of interests and views about water management (SG 2004, p.18). In the QMDC & SWNRMG plan, community priorities for weeds and pest animal management are focused on animals and plants that have an impact on productivity on a property scale or affect the integrity of a riparian zone or bushland reserve. Yet it is acknowledged that these are not necessarily declared pests, which will have higher priority for government (QMDC & SWNRMG 2004, p. 57).

8.6. Implementation and Investment

Most of the management action targets (MATs) set for the next twelve months include activities to build individual and community capacity to effectively manage the natural resources in the region. This includes building knowledge about the condition of regional assets and other stakeholder's values and aspirations (particularly those of Indigenous people and local government). Northern plans (e.g. Northern Gulf, Southern Gulf, Wet Tropics) also include efforts to facilitate and support stakeholder partnerships that define and build on existing and potential NRM roles and responsibilities. Many of these partnerships focus on NRM issues that require coordinated efforts across tenures and regions (e.g. for NRM issues such as marine debris, weeds and fire) or issues of mutual concern (e.g. pest animal management).

Most plans reviewed emphasise the need to increase the capacity of individuals (especially landholders) and community stakeholder groups for effective regional NRM implementation. Yet in some plans and for many MATs it is often unclear

- What specific skills and information need to be obtained.
- Which members in a community or stakeholder group should be targeted to ensure that efforts to increase awareness and knowledge about a particular NRM issue are both strategic and effective.
- How proposed capacity building activities and programs will be tailored to meet the requirements and aspirations of the targeted individual and/or community stakeholder group and be delivered to accommodate and contribute to the unique needs and services in the region.

Plans also commit local, state and federal government to be involved in building individual and community capacity. Hopefully more details about the nature and level of this support will be provided in regional investment strategies but proposed activities suggest that **this role will focus on providing information and training or funding NRM activities** (e.g. incentives to help landholders to contribute to off-reserve conservation, tools for stakeholder groups monitor and evaluate protection and management activities, etc).

8.7. Monitoring, Evaluation and Reporting

Most plans recognise that capacity building performance indicators need to be developed to ensure that they are appropriate to the social and cultural geography of the region and provide meaningful information about stakeholder reactions to proposed NRM initiatives. Indicators that are currently listed reflect the kind of information for Commonwealth and State program reporting requirements (e.g. participation in management relevant training and education activities). A few plans have committed to the development of regionally and/or stakeholder specific evaluation programs to help stakeholder groups learn, adapt and improve on their role in the regional NRM program. This includes the CBO3 Capacity Building State Investment Project (SIP) that is directed at regions funded by NAP in South West Queensland and is specifically targeted at building appropriate monitoring and evaluation systems.

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9. Adaptive and aligned institutions

Bruce Taylor

9.1. Introduction

Legislation, policy and regulatory mechanisms are examples of institutions that significantly influence the way resources are used, managed or protected. More broadly, institutions have been defined as “underlying, durable patterns of rules and behaviours” which can be formal or informal, legal, customary, political, scientific or economic (Dovers, 2001). The land tenure system, for example has historically dictated resource user rights and responsibilities through lease agreements as extensions of public policy, however the same system may also limit the potential for multiple use options or coordination across tenures (Holmes, 2000). Not only is the design of institutions important, but how well they align with or lessen hurdles for achieving sustainability priorities defined by regional communities¹⁴.

This section reviews how institutional design and operation is considered within regional NRM plans, in particular:

- The alignment of institutions at the regional level to support sustainability outcomes (criteria 10)¹⁵ and,
- The responsiveness and adaptability of resource management institutions in dealing with pressures from within (e.g. poor coordination) and outside the region (e.g. market and climatic variability) (criteria 11).

Given the importance of perceptions of fairness in NRM transactions and decisions (e.g. Syme et al. 1999) what evidence is there in NRM plans of institutions firstly identifying and then secondly sharing the costs and benefits of resource use in an equitable way (criterion 5)? In exploring these considerations, this review provides some insight into the treatment of *institutional* capacity (see also Robinson, this volume) and institutional barriers to sustainable resource management outcomes addressed in other chapters. The above criteria can be considered at two levels. Firstly, the somewhat pragmatic requirements of plan implementation e.g. “How do we utilise current institutional frameworks and create new arrangements that support the development and implementation of this Plan?” (NRMSEQ 2004). The second, the broader understanding of the role of institutions in supporting NRM outcomes:

Institutional frameworks for sustainable resource management are the mix of formal and informal procedures and structures found in the public and private sector that enable the effective delivery of public policy and the operation of the market. Procedures include the range of policies and strategies, laws, codes of conduct and administrative rules that inform and guide institutional and personal activities. Structures comprise the assortment of public and private sector Committees groups, forums, bodies, workshops and other ways in which people organise themselves. (QMDC & SWNRMG 2004 p.67)

Even so, the observation that there is “little agreement on the meaning, conceptual definition and measurement” of institutional health within regions for NRM (FNQNRM 2004, p.147) reflects the current difficulty for NRM planners in applying this concept in operational terms.

¹⁴ A discussion on institutional factors influencing NRM in savanna regions is summarised in McDonald et al. (2004).

¹⁵ See table 1, in *Introduction* to this volume for the full list of criteria.

9.2. Understanding of institutional contexts in regions

Most regional NRM plans are very conscious of the main **program drivers** such as the NAPSWQ, the Trust and related governmental agreements. The regional planning bodies signal their intent to meet funding and accreditation requirements of these programs, and in doing so attempt to demonstrate program principles, objectives and prescriptions explicitly in plans. One plan notes that although institutional change is not identified as a component within the *National Capacity Building Framework* (NCBT, 2002), it is nevertheless an important objective of the Trust process. The same plan notes one of the Trust 'activity areas', as 'establishing institutional and organisational frameworks that promote conservation and ecologically sustainable use and management of natural resources'.

A good working knowledge of other major plans, policies, legislation and treaties at several scales (e.g. International RAMSAR convention, National Principles and Guidelines for Rangelands Management (ANZECC & ARMCANZ 1999); statutory water resource plans or Local Government planning schemes), and their respective influence is evident in all regional NRM plans reviewed.

Similarly regional organisations (e.g. government agencies or peak industry bodies), managers, networks, alliances, service providers, programs or forums are recognised and described in NRM plans in some detail. This extends in some cases to an effective 'mapping' of roles, analysis of overlaps or gaps in management responsibility and identifying opportunities for cooperation between activities. Structures such as Indigenous regional advisory groups and Traditional Owner organisations and networks or agreements for cultural and natural resource management are often recognised, described and supported in plans (e.g. FNQNRM 2004 pp127,148, 172).

Most plans however only contain limited analysis of policy or regulatory trends and impacts, particularly in terms of 'what's over the horizon'. The intersection of different planning boundaries and implications for this are generally well recognised in plans but again there is little supporting spatial representation or analysis.

Existing statutory plans and related instruments are generally recognised as essential for successful implementation of the NRM plan. This is most apparent in the articulation of pest management responsibilities in northern Queensland plans and development assessment controls in coastal and southern plans.

A clear **role for regional bodies and plans** is stated in most plans, as are the limitations associated with those roles within the planning system. These perceived roles include:

- The Plan has no statutory base, it has no direction over local government statutory planning processes. However, [it] can inform and influence these processes as a reference for actions local governments to include in their own plans (QMDC & SWNRMG 2004 p.161).
- To a large extent the Regional Body can at best only identify issues of institutional change that may need to be addressed, as it has limited capacity to address these issues directly. Many of the issues associated with institutional change will involve direct actions by Commonwealth and State organisations or will involve changes in normative beliefs systems over the long term (FNQNRM 2004 p.145).
- [the regional body as]...the key agent to coordinate delivery of NRM services and management in the region [providing] a "practical way to...coordinate and deliver NRM activities and "guide on-ground action and assist steer government programs in an integrated way" (NG 2004 p.86).

9.2.1. Identifying institutional pressures on NRM

Influential institutional factors - either as positive drivers or as constraints to sustainable NRM - identified in NRM plans, included:

- Legislation and related non-regulatory approaches for **off-reserve conservation** including financial incentives such as grants, rate deferrals and rebates, management agreements, covenants, revolving funds and development benefits (e.g. FNQNRM 2004 p.31);
- implications of the **leasehold land review** process on land manager responsibilities (SGC 2004);
- operational limitations of government agencies and local government services operating in remote regions (e.g. DCQ 2004);
- perceived threats to Indigenous **intellectual property** arising from involvement of Indigenous people and use of Indigenous Ecological Knowledge (see also Robinson this volume);
- in some regions, existing program **funding cycles** limit managers capacity to respond to suitable seasonal conditions (windows of opportunity) for management;
- **splintering of responsibility** for the environment at all government levels;
- poorly defined environmental **priorities** by governments;
- **insufficient regional coordination** of information sharing, research and development, planning and management activities, between and within government departments; and,
- **perceptions of withdrawal of funding support** for local action groups (e.g. Landcare or Waterwatch) and government extension services.

The QMDC & SWNRMG (2004) plan is one of few plans that uses reference material from earlier audits of government operation and program delivery (QMDC & SWNRMG 2004, Table 1, p69).

9.3. Targets and Objectives

Several plans contained a number of broad goal-oriented statements such as “improving institutional and organisational arrangements that support on-ground project implementation” as management action targets. These proposed targets are without clear definition of what those arrangements should entail in practical terms or where effort should be expressly focussed.

Several plans however contained more specific management action targets (MATs) to address identified institutional threats or pressures. These included the design and appropriate use of incentives and payments to land managers; the delivery of existing compliance and regulatory mechanisms and supporting industry or sector groups to develop and articulate NRM policies. These and other examples are presented in the following table (Table 1). Using the incentives example to illustrate, while a large number of management action targets presented in plans refer to ‘providing incentives to landholders to achieve X’, the timing, design, target audience, spatial priority for applying these proposed incentives is not clear. There is generally no analysis, for example, of which parts of industry certain types of incentives might be most effective and where.

Table 1 Summary of the types of institutional targets and related actions in NRM plans

Focus of target	Examples from NRM plans
Incentives & payments	<ul style="list-style-type: none"> ▪ Develop and apply incentives for Water Use Efficiency, adoption of Current Recommend Practices or Voluntary Conservation Agreements (Numerous) ▪ [Apply] incentives for biodiversity conservation (financial and other) on private and other lands...monitor effectiveness of incentives and support R&D investment to design incentives e.g. for carbon trading, agro-forestry (FNQNRM 2004)
Compliance, accreditation or Codes of practice	<ul style="list-style-type: none"> ▪ All local governments will develop and implement plans for appropriate rural residential and lifestyle development while protecting GQAL by 2010 (FNQNRM 2004 p.93) ▪ Mine EMOS and Environmental Authority consistent with catchment and regional plan targets within 5 years (new mines and through review process) (FBA 2004, A162)
Market responses	<ul style="list-style-type: none"> ▪ Define policy arrangements that underpin private/market involvement in natural resource management and government's role in the market by 2006 (MAT) ▪ Encourage finance sector to include long-term land capability, climate variability and land management skills into loan assessment criteria (action)
Impact assessment	<ul style="list-style-type: none"> ▪ Catchment, cumulative and basin wide effects identified and considered in impact and development assessment (including irrigation, mining, industry and infrastructure) within 5 years (FBA 2004, A108)
Adjustment and tenure responses	<ul style="list-style-type: none"> ▪ Develop and trial a range of structural adjustment mechanisms to assist in achieving sustainable natural resource management by 2008 ...Review and revise enterprise reconstruction programs for applicability and implementation across [region] (QMDC & SWNRMG 2004, MAT)
Rights, obligations, duty of care	<ul style="list-style-type: none"> ▪ Work toward establishing agreed property rights and responsibilities for sustainable land... Facilitate mechanisms with State government to enable security via longer-term permits and licenses (QMDC & SWNRMG 2004, MAT). ▪ Recognise duty of care and role of incentives for managing public good outcomes for woody vegetation (QMDC & SWNRMG 2004, MAT)
Joint management	<ul style="list-style-type: none"> ▪ Define joint management outcomes as part of land and sea use management agreements (SGC 2004, MAT) ▪ Effective partnerships with regional and sub-regional indigenous NRM networks and planning organisations (e.g. Fitzroy Basin Elders Committee) within 2 years (FBA 2004, Action)
Sectoral policy	<ul style="list-style-type: none"> ▪ All industries in the region to have a clear natural resource management policy incorporating commitment to continuous improvement and / or best management practices for local conditions within 5 years (FBA 2004, A261)
Institutional design	<ul style="list-style-type: none"> ▪ [Develop]...mechanisms for community stakeholder input into institutional changes at legislative, legal and market levels by 2005 (QMDC & SWNRMG 2004) ▪ Participate in NRM policy development and negotiate alignment of policy to deliver effective land use change by 2005 (QMDC & SWNRMG 2004)

Coordination / cooperation	<ul style="list-style-type: none"> ▪ A shared state of the region reporting system is operational that incorporates baseline data collection, establishment of condition and trend monitoring and public reporting within 2 years (DCQ 2004, MAT) ▪ By 2007 there is effective cooperation between [regional body] and the State water management planning processes... relating to information documentation and consultation processes for Water Resource Plans in the region (DCQ 2004, MAT) ▪ Research and development activities meeting priority NRM information needs and management applications within 5 years (FBA 2004)
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9.4. Implementation and Investment

A wide range of existing and proposed agreements, formal and informal, are described in NRM plans. These include agreements to establish cross sectoral/jurisdictional management of marine debris and 'ghost nets' in the Gulf regions. Approaches such as developing *Indigenous Land Use Agreements* and *Memoranda of Understanding* to address access and some management issues for traditional owners are proposed. There is a major emphasis in northern regions in particular on the use of bilateral "cross-regional" arrangements. These are often formalised through memoranda of agreement to achieve:

- 1) Clarification of management roles, spatially or organisationally, or to manage "an area of overlap" between the regions or define 'areas of dual interest' in the landscape for priority investments;
- 2) Consistency across regional boundaries in delivery approach e.g. Grazing Land Management;
- 3) Protocols and methods for engagement, communication and governance arrangements; and,
- 4) Spatial connectivity between regions to manage around tenure, cultural groupings and connection to country, regional ecosystem distribution, weed, feral and fire management responsibilities.

For example, in the Desert Channels plan, this involves detailed tabulation of cross border initiatives, policies, agreements and co-investment to achieve the above institutional outcomes (DCQ 2004 p48, p79). There is also a very strong pragmatic driver based on sharing of lessons, and making most efficient use of limited available funding resources.

There is also a significant effort being made in formalising **sub regional and catchment based implementation networks**. In fact it appears that delivery on the investment plan is highly dependant on the use of regional 'sub-units' providing a basis for integrated property resource management planning processes. In regions such as Fitzroy this is seen in existing (and proposed) *Memoranda of Agreement* with sub-regional NRM groups, to provide sub-regional coordination and support local implementation groups (FBA 2004).

Within the MATs and actions there is significant reliance on the **role of incentives** to promote better practice. Incentives are promoted for a several purposes including, for example, 'stewardship payments' for landholders to address biodiversity or threatened species conservation beyond existing 'duty of care' requirements, or, directly funding landowners, perhaps on a tender basis to implement works of high public benefit. Discussion of incentives within plans however is generally characterised around the following **objectives**:

- supporting adoption of specific practices (generally not nominated);
- promoting on-ground works (not defined);
- to enter agreements or covenants for conservation; or,
- addressing disincentives for involvement.

The best examples of institutional alignment evident in plans, occurs around **critical issues of mutual concern**, shared interest or capability (such as pest management) or areas of greatest perceived risk or regulation (such as harvesting of the commercial fisheries resource). For example, the alignment of **local government** begins to be more prevalent and

explicit in northern and western regional plans when responsibilities for stock route and weed management are discussed.

A small number of plans reviewed (e.g. QMDB 2004; FBA 2004) detail **cost sharing** as an investment principle or operational approach under the plans implementation framework. In these cases regions propose that funding contributions:

“reflect the public and private benefits anticipated” and that “future funding available to the region will be used to achieve the maximum leverage possible (at a minimum of 1:1 ratio of public to private investment), while ensuring costs for improved NRM are shared equitably across all that benefit” (FBA 2004 p.118)

Further to this, the QMDC & SWNRMG plan (QMDC & SWNRMG 2004) draws on recent research and policy developments on cost-sharing for NRM (including work conducted under the Murray Darling Basin Commission) on development of cost-sharing arrangements, application principles and role of regional bodies in cost-sharing applications.

9.5. Monitoring, Review and Evaluation

Given the still emerging science area of evaluating NRM institutions, it is not surprising that there is generally poor articulation of specific measures for institutional health in regional NRM plans. There is however a fairly good recognition of the role of adaptive management and learning cycles in “managing or minimising risk associated with institutional and governance capacity” (Earth Tech 2004). Types of indicators presented within the Southern Gulf, QMDB and Fitzroy regional plans included:

- Number of access to country agreements; or indigenous co-management agreements
- Level of compliance with regulation; number of water allocation applications, breeches and applications granted
- Level of conflict between planning schemes, legislation, regulation, resource allocation, and community needs

In several plans, discussions on regional monitoring proposals indicate a firm intent to improve the coordination and alignment of existing regional monitoring and reporting frameworks. In most cases this is proposed through various models for *State of the Region* reporting approaches (e.g. FBA 2004 p.132). Maintaining and improving compatibility, interaction and therefore comparability with the state-wide *State of Environment* reporting process is also high on the agenda in several plans.

9.6. Conclusion

Two factors are likely to affect the degree of success that regional planners might have in improving their institutional environment for NRM. Firstly the relatively low emphasis that the major funding programs place on institutions - compared to say water quality outcomes, and secondly the often intangible and complex nature of measuring or managing institutional health. Despite these constraints the recognised need and attempts within NRM plans to effective institutional arrangements to support NRM outcomes is encouraging. Several emerging trends evident from this review of plans are:

- Generally wide recognition and understanding of statutory and legislative constraints and drivers for NRM in regions. However only some plans explicitly explore practical, complementary activities to delivery of water quality or biodiversity outcomes for example. There is also recognition of national and international obligations but in most cases there is poor traction with regionally defined priorities or management application.
- A clear subset of management targets and actions are presented in plans to mitigate or address constraints to management from poorly operating existing institutions, resolve disincentives and improve institutional alignment and coordination in regions.

- A significant amount of investment required in designing and testing various 'incentives' for application in regions with particular sectors or land users.
- Considerable negotiation and effort on establishing new agreements or cooperative arrangements for managing assets. These agreements appear most clearly articulated in resource poor regions, for cross regional or for cross-tenure related management issues such as fire, weeds and feral animal management; or within larger regions between the regional NRM body and catchment or subregional level groups to support implementation.

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10. Carbon management and energy use

Steve Dawson

10.1. Introduction

With growing emphasis within state and national policy on carbon management and greenhouse gas emissions, there is a corresponding expectation that the non-government sector – including regional NRM planning processes and agricultural industries - will contribute to their management and minimisation. The AGO has identified climate change as “potentially severe at the regional level” with water resource, aquatic and terrestrial ecosystems, forests and agriculture especially vulnerable. The Natural Heritage Trust and the National Action Plan for Salinity and Water Quality were recognised by the Australian Greenhouse Office (AGO) as a major investment in sustainable natural resource management that could provide positive complementary greenhouse gas emission and NRM outcomes through a range of management actions. Adoption of emissions trading for example is one such opportunity flagged by the AGO by which private investment could be attracted to terrestrial-based industry through measureable reductions in greenhouse gas emissions and implementation of carbon sequestration projects such as greenhouse sinks. The AGO states:

“The NAP recognises that some market-based measures will be important stimuli for achieving water quality and salinity outcomes. Through NAP and NHT II, pilot areas will test a scheme in which private intermediaries such as forestry companies will be encouraged to bid jointly with landowners and community groups for salinity and biodiversity funds to supplement their return from forestry and carbon credits. This approach provides an important opportunity to test the delivery of multiple environmental services in hedging and/or transitional markets.”(Australian Greenhouse Office 2002, p.43)

Minimisation of regional net carbon emissions and the long term viability of enterprises and industries are strongly related. The ALMWG states that understanding climate change impacts on land management sectors is critical for the development of adaptation strategies at national and regional scales (2003, p.29). Industry responses at the regional scale could include modified land use practices that incorporate fire management, wet season spelling in pastoral regions, carbon sequestration through soil management or revegetation for forest sinks.

The purpose of this section is to review the effectiveness of accredited regional NRM plans in addressing the ‘Carbon Management and Energy Consumption’ outcomes, which are reflected in the following criteria (McDonald et al. 2004, see Table 1 Introduction):

- Regional net carbon emissions are minimised (criteria 19); and
- Economic viability of enterprises and industries is improved (criteria 6).

10.2. Regional and State level planning contexts

Important to note there is an absence of a national framework specifically relating to carbon management within natural resource management arena. Regional NRM planning lacks contextual guidelines similar to those offered for water quality (National Water Quality Management Strategy) or vegetation management (National Framework for the Management and Monitoring of Australia’s Native Vegetation). The National Greenhouse Gas Strategy however proposes a range of actions to encourage sustainable forestry and vegetation management. South-east Queensland Western Catchments identifies this strategy along with a raft of actions as contributing towards minimising atmospheric pollution. In the case of this region, local emission sources are predominantly fires and emissions from activities from metropolitan areas. There was a recognition in the QMDC & SWNRMG regional NRM plan (QMDC & SWNRMG, 2004) that apart from agricultural practices and energy production, energy consumption issues had ramifications for greenhouse gas emissions. The use of farm forestry, plantation forestry, and vegetation rehabilitation projects are among the activities proposed. The NRM plan for the Wet Tropics (FNQNRM 2004, p.71) identified the State

Strategy for Greenhouse Policy Framework as well as other related planning documents specific, or referring to climate change.

Although policies such as the National Framework for Energy Efficiency were not directly recognised, plans such as the South-east Queensland Western Catchments prepared a number of management action targets with the objective of promoting energy efficiency, which were consistent with the frameworks objectives.

"Actions should aim at improving energy efficiency and utilising renewable energy sources in the region."
South-east Queensland Western Catchments 2004, p.126

The Northern Gulf NRM plan demonstrated a recognition that there were international framework conventions on climate change, and identified the a possible source of potential climate change in the region i.e. poor grazing land management, recognised the threat to migratory species, and flagged the need for further research in this area (NGRMG 2005, p.35)

There is however an absence of National and State government policy and guidelines to deliver credible on-ground outcomes for carbon management. Many plans did not identify legislation or strategies specific to these issues. State government agencies have prepared discussion papers and advisory information to assist landholders with carbon credits from forestry. Tools to assist landholders generate carbon credits are not being provided.

10.3. Planning information base

The potential impact of climate change was recognised in many of the NRM plans in the form of changing rainfall patterns and general climatic variability. Vegetation management practices including clearing, fire management regimes, energy use associated with coal-fired power generation, pastoral and agricultural land use management were several of the greenhouse gas contributors named within the regional NRM plans. NRM plans recognise the relationship of these human activities with carbon minimisation and reductions in energy consumption for long-term regional ecosystem health. For example, the Condamine region's NRM plan recognised the role of land cover change on above-ground and below ground carbon storage. This plan referred to work done by Robertson (2003) providing an estimate of greenhouse gas emissions from Australian rangelands with land clearing, savanna burning and livestock being significant contributors (CCNRMG 2004, p.134). Regionally relevant data availability appears to be a major issue however with the Agriculture and Land Management Working Group and the Australian Greenhouse Office (2002, p.7) both recognising there is currently limited research into gas emissions and their relationship to different types of agriculture and different geographical regions.

The Desert Channels region for example highlighted areas of concern in setting resource condition targets due in part to *"hugely variable climate"* and *"limited information base"*.

"Climate change may reduce rainfall in the region and increase stress on ecosystems. Resilience of ecosystems to these threats is not well understood."
"How climate change will affect us needs to be better understood if the pastoral community is to manage the challenges ahead" **DCQ 2004, p.71, p.13**

The Fitzroy Basin Association (FBA 2004, p.124) recognised carbon management as a key input from previous planning activities however in most plans information with regard to carbon management at a regional level was difficult to identify.

Available information varied between regions including for detailed geological information, regional ecosystem mapping, with information for carbon management and energy consumption seemingly more available for regional centres and 'industrial' areas of interest such as Mt Isa in Southern Gulf region.

Regional centres participating in the Cities for Climate Protection Program including Rockhampton, Gladstone and Calliope, produced some information that assisted with target

setting for the Fitzroy Basin Association plan (FBA 2004, p. 78). Larger, remote NRM regions relied on information and data at scales not suitable for regional planning. This detracted from meaningful target setting. In most cases resource condition overviews in plans provided limited base-line information available and identified research to underpin future target setting.

10.4. Targets and Objectives

Several targets were geared at improving the information base for target setting. The NRM plan for Wet Tropics aimed for improved understanding of air quality data and revised sector practices for reducing greenhouse gas emissions (FNQNRM 2004, p.73).

The Desert Channels NRM group acknowledged a number of threatening processes including grazing pressure, altered fire regimes and climate change (DCQ 2004, p.27). This formed the basis of developing management action targets in lieu of measurable and defined energy and carbon management objectives. The Fitzroy Basin Association acknowledged that there was insufficient information to set targets and like several other NRM plans, proposed to develop future targets (FBA 2004, p.62). The Queensland Murray Darling Committee, in the development of their resource condition targets for stabilising and improving air quality also highlighted this intent:

Specific RCT/s will be developed for reduction in energy use and the establishment of community-agreed Greenhouse gas emissions 2007. **Queensland Murray Darling Committee 2004, p.126.**

In general, the lack of region specific carbon management, and in some cases access to energy consumption information has resulted in 'broad' carbon management and energy consumption targets being developed by regional NRM groups. Many of the plans did not 'link' the management action targets of land management, biodiversity, water resources etc to implications for carbon sequestration and associated climatic variation.

The Queensland Murray Darling Committee developed a range of management action targets in their plan with an emphasis on alternate energy sources, specific research to reduce energy consumption, community awareness raising, and encouraging mineral and energy industries to adopt sound environmental practices. These management actions had a strong emphasis on addressing the possible causes of climatic change and carbon management from the community level and to make their region more accountable for energy consumption and activities that may alleviate greenhouse gas emissions.

The plans also placed a reliance on industry groups to self-regulate for energy efficiency and regional NRM groups have placed the responsibility for target setting for carbon management associated with climate change back into the Federal and State Government arena. For example, the FBA made reference to the Central Queensland Regional Growth Management Framework which discussed renewable energy options (FBA 2004, p.78).

NRM plans that attempted to set greenhouse gas emission targets approached the concept on the basis of air pollution or air quality and highlighted the need for baseline air quality data to be available to the regions to enable the measurement of revised industry practices and increased carbon sinks.

Energy use and potential renewable energy alternatives were discussed in several of the regional NRM plans. These plans looked at reducing yet to be defined greenhouse gas levels at the regional scale. Industry energy audits, house design, subsidies for reduced energy use, community awareness raising, carbon sequestration through farm forestry and stock management practices were among a number of suggestions for alleviating the impacts of greenhouse gas emissions and associated climate change (Mackay Whitsunday Regional NRM Plan 2005, p.38). Another example from the FNQNRM plan involved:

*"Source twice the current amount of green energy in the region by 2012.
C1.4.1 Calculate the current amount of energy sourced from renewables in the region.*

*C1.4.2 Reduce household greenhouse gas emissions through community education programs on energy efficiency, increased uptake of solar and gas hot water systems and encouraged use of energy efficient appliances, purchase of green power and independent green electricity generation.” **Far North Queensland NRM Ltd. 2004, p.74.***

Many of the plans contained some or all of these options for minimising greenhouse gas emissions however; only two NRM plans defined specific management action targets to implement these potential solutions. The impacts on the economic viability for industry to implement actions towards these targets i.e. cost saving and production efficiencies were not discussed. The Queensland Murray Darling Committee acknowledged and described a range of alternate energy sources and concluded, *“It is not considered appropriate to investigate new technologies further in the NRM Plan area. However, it is recommended that the use of existing technologies such as windmills be actively encouraged”* (QMDC & SWNRMG 2004, p.63) Another example of broad strategies for minimising greenhouse gas emissions reported in the Fitzroy region NRM plan was:

“Development takes place with a focus on efficiency to achieve progress with minimisation of greenhouse gas emissions and with an understanding of the potential impacts of climatic conditions. A number of strategies and actions have been identified to achieve that outcome. These relate to;
Development and implementation of practices to minimise greenhouse gas emissions
Education and awareness with respect to energy efficient practices to minimise gas emissions through energy generation
Research into social and economic impacts of climate change and changed consumption of fossil fuels”
Fitzroy Basin Association 2004, p. 153.

10.5. Priorities and options

It was difficult for regional NRM groups to see what impacts their decision-making would have on climate change. While climate change was seen as important this is not reflected by some regional NRM plans or assigned it a low priority along with industry energy use and carbon management. Priorities were directed instead towards those targets that could be readily implemented, monitored and reported against for the purposes of NHT reporting. The priority assigned to climate and carbon management related issues or threats appears highly dependant on the development pressures in regions and the perceived ability of regional stakeholders (in particular the regional body and landholders) to respond meaningfully to those pressures. This is reflected in the below examples from the Southern Gulf NRM plan and the Desert Channels region NRM plan:

*“We need to be realistic about how much NHT2 and our community can achieve. Some issues may be beyond our current resources or available technology. Of the region’s modest population, only a small percentage is involved in NRM activities. This, coupled with the vast size of the region, is a significant constraint. A small regional group like Desert Channels Queensland has limited scope for undertaking projects (especially of a technical nature) on its own. This is where partnerships, particularly with state agencies, are critical to ensure the best available expertise, particularly in the area of science and extension.”***Desert Channels Queensland Inc. 2004, p. 83.**

*“Due to the Southern Gulf’s relative lack of development such as heavy industry and vegetation clearance the region does not have the same range or scale of atmosphere related problems as other regions of Queensland with the major exception of possible greenhouse gas related climate change.”***Southern Gulf Catchments Inc. 2004, p.158.**

10.6. Implementation and Investment

Consistent with the observations in priority setting, the large scale investments believed required to address climate change were seen as beyond the scope of regional NRM groups to ‘solve’ both in terms of financial and human resources. Despite these general trends, several notable implementation approaches were suggested in NRM plans to achieve climate and carbon management outcomes in regions:

- A number of regional NRM plans recognised the significance of carbon sinks by encouraging enhanced vegetation management techniques and land management practices particularly in agriculture to retain soil carbon. The regional NRM plan for the Southern Gulf (SGC Book 4 2004, p.166) identified the Queensland Carbon Credits Initiative as having a potential for providing financial incentives for carbon sequestration projects through forestry.
- The Condamine NRM plan recognised for example several amelioration opportunities for increasing soil carbon by “using conservation cropping practices, by growing pastures and by re-establishing perennial vegetation. However, the rates of increase normally will be relatively slow” (CCNRM 2004, p.44).
- Inland regional NRM plans have a strong focus on vegetation and fire management primarily in the form of pastoral land management and agricultural land use practices with the aim of maximising ground cover and therefore limiting loss of carbon to the atmosphere. For example, Desert Channels looked to best management practices with a better understanding of climate and pasture cycles in major pasture types as processes understood by the catchment as having impacts on climate risk (DCQ 2004, p.59).
- Regional NRM plans such as Mackay Whitsundays (MWNRM 2005) and Wet Tropics (FNQNRM, 2004) directed their attention to infrastructure-related projects such as energy efficient commercial and domestic building construction, energy efficient household products, alternate forms of energy generation to satisfy community concerns about carbon management and energy efficiency.

10.7. Monitoring, evaluation and reporting

Structures for monitoring and reporting against carbon and climate related investments or associated targets are unclear in plans reviewed. This in part is due to a lack of nationally agreed indicators and protocols that can be practically implemented at the regional level. The use of other associated indicators and contextual information will be necessary to augment national data and performance indicators in the assessment of whether the condition and extent of the carbon management and energy use has been modified by program investments.

An adequate skill-base to undertake quantifiable measures of carbon emissions and sequestration at the regional level is currently lacking. This could have been a factor in many plans failing to attempt to target the carbon management and energy consumption at the monitoring and evaluation phase of the plan (DCQ 2004, p.83). This type of expertise rests with Federal and Queensland Government agencies and this is recognised. Desert Channels noted that they had limited access to potential monitoring expertise and tools, and a modest information base from which to operate. (DCQ 2004, p.85) This was a repeated comment in several of the regional NRM plans.

The program based reporting time frames could be construed as too short given the long-term proposition of impacts from carbon sequestration, changes in energy use patterns or modifications to pastoral land management. Measuring whether a specific strategy is effective is dependent on the flow through effects of a number of these strategies. The influence of climate variability on monitoring design is noted in the DCQ plan:

“The highly variable climate and ecological response cycles of the region (typical of much of Australia’ arid rangelands) means such monitoring will need to be in place over an appropriate period of time to determine any significant changes.” **Desert Channels Queensland Inc. 2004, p.85**

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11. Lessons and future directions for plan-making

Bruce Taylor, Clive McAlpine, Cathy Robinson and Geoff McDonald

11.1. Introduction

The preceding chapters of this report present findings relating to how regional assets such as biodiversity or water quality are managed in NRM plans. When considered collectively however, there are some common and important lessons that emerge from this latest round of regional NRM plan making in Queensland. These lessons have implications for improving the 'practice' of regional NRM planning. The review also identifies longer-term strategic requirements for investment in the broader system of regional, state and national level NRM.

The lessons presented below are drawn from the desktop review of plans only. These compliment the experiences and lessons of regional planners' from savanna and other regions captured at the project's Brisbane workshop held in March 2005.¹⁶ These findings also contributed to the main project report that benchmarks regional NRM planning progress in the savannas during 2004-5.¹⁷

Lesson 1: Critical gaps in the planning information base limited resource condition target development

Common and critical gaps in the resource condition information base prevented regional planners developing meaningful and measurable resource condition targets for several key resource management issues. The fact that 'interim' resource condition targets were commonplace and that a large number of MATs proposed investment in data gathering in regions highlighted this. This was also indicative of the current pragmatic and adaptive approach to setting targets as better information becomes available.

Some of these common critical gaps in plans' information base included:

- Spatial and quantitative information that provides specific assessment on coastal and surface water resources;
- The diversity of values and knowledge systems within a region and the impact this has on resource assessment and management solutions;
- Remotely sensed imaging for pasture and soil health assessment (cover and condition) in rangelands regions;
- Quantification of the efficacy of farm management practice adoption on off-site water quality, and, more broadly poor understanding of connectivity between terrestrial, freshwater and estuarine or marine systems
- Adequate socio-economic profiling of resource user communities and industries, and
- Regional carbon sequestration and emission rates associated with landscape change

Directions for NRM planning practice in regions

Regional NRM bodies and scientific communities in regions would benefit from maintaining and building on relationships developed through the plan development process. Plans would also benefit significantly from the development and use of techniques that improve the transparent capture and integration of stakeholder and local knowledge into the target development and review process.

Directions for the NRM planning system

Improved coordination of the resource monitoring system at state-wide and regional scales is required. Joint investment initiatives outlined in plans suggest that data collection priorities of

¹⁶ Experiences and lessons: regional NRM planners workshop report, Healthy Savanna Planning Systems project, TSCRC, 9th March 2005, CSIRO Brisbane. (insert web link)

¹⁷ insert pdf / web link to benchmark report

research providers are becoming increasingly aligned with regional planning and management requirements. Even so, data and information sharing arrangements, particularly between regional planners and government custodians, still need clarification and commitment. Given the current scientific data limitations a genuine in-practice commitment by funding agencies to adaptive management in target setting and testing is also required.

Lesson 2: Asset-based planning approaches limit integration of management responses

The link between threatening processes and resource condition targets are not always clear in plans. Asset-based planning frameworks adopted in regional NRM plans contribute to this issue. Targets set for particular assets (water, biodiversity, etc) makes it difficult to tackle the cumulative and multiple pressures on the condition of a given resource. Regional planners have tried to tackle this problem by proposing cross-tenure, sub-regional or property-scale investment frameworks that integrate a range of NRM issues and solutions. This however can create somewhat of a disconnect between target design and delivery arrangements.

Directions for NRM planning practice in regions

Improved use of integrated, multi-scale frameworks for planning and implementation is an approach that could be used more widely to ensure regional targets are clearly linked to regional outcomes. A review of regional investment strategies would also provide more detail on implementation of the current asset-based targets and to what degree they promote fragmentation or integration of on-ground NRM solutions.

Lesson 3: Priority setting techniques need improvement

The complexity and significance of the priority setting process was recognised in NRM plans reviewed. It was clear however that there is still a need to develop better approaches to capture and integrate the diversity of aspirations, (social, economic, environmental) issues and values that exist at the *regional scale* (versus catchment scale issues or sector-based interests). Key issues of concern include

- Poor definition of spatial priority setting in plans, flowing on from avoidance of spatially defined targets
- How to balance social, cultural, economic and environmental criteria into priority setting
- Addressing issues of equity and fairness in the priority setting process by balancing the aspirations of regional communities and stakeholders.

Directions for NRM planning practice in regions

Improved documentation of the rationale, assumptions and outcomes of the priority setting process would improve transparency and validity of investment decisions. There is considerable scope for regions to reflect on the effectiveness of formal and informal decision-support tools that were used. This evaluation might include efforts to improve the contribution of social impact assessment and formal cost-benefit analysis into the priority setting process rather than post-hoc application to prioritised investments that currently occurs. It might also include how sectoral and geographical priorities might be distinguished and funded in a strategic and politically sensitive way.

Lesson 4: Plans need to recognise and value the diversity of local, stakeholder and Indigenous knowledge.

The plan review highlighted the question surrounding who is 'the community' in community-based regional NRM planning. This evoked a vague and variable answer. Plans reported on the considerable effort that was made to ensure community views were captured and that different stakeholder interests and aspirations were not assimilated during the planning

Lessons and future directions for plan-making. Bruce Taylor, Clive McAlpine, Cathy Robinson & Geoff McDonald

process. Even so, it was difficult to gauge how the values and contributions offered by Indigenous, local, industry and other stakeholders were judged as providing important contributions to NRM targets and the design of implementation frameworks – particularly when these values reflect conflicting aspirations and viewpoints.

Directions for NRM planning practice in regions

It is important that the planning process is clear on the value and contribution of diverse local, stakeholder or Indigenous knowledge to regional NRM targets and solutions. This might require considered, pragmatic and frank dialogue on the contribution of different knowledge for different components of the regional NRM planning process (resource assessment, investment priorities, management solutions etc) and how diverse (including conflicting) information and aspirations can be integrated or weighted to inform planning decisions.

Directions for the planning system

How the diversity of community interests in regional NRM planning can be effectively captured and integrated is a complex and multi-scaled challenge. It requires clear and consistent articulation of state and national NRM priorities by governments. It also requires local-grown solutions to tackle NRM priorities that are informed by these larger-scale aspirations but also reflect the political, geographical and socio-economic realities of the region.

Lesson 5: Better knowledge of natural resource dependent communities is needed to improve implementation mechanisms promoted in plans

Directions for NRM planning practice in regions

The high volume of management targets associated with developing or providing financial incentives to landholders does not correlate with an adequate profile of those resource industries and communities. It is not clear exactly who the incentives are proposed for or what they are intending specifically to achieve. When developing regional profiles, planners need to consider analysing the status of key resource industries in the region including: structural adjustment trends, impacts of external forces such markets, and heterogeneity with the industries themselves (e.g. different types of enterprises, management objectives). Similar assumptions exist regarding the application of voluntary nature conservation agreements for broad scale biodiversity conservation outcomes. This raises the concern that financial incentives and voluntary agreements, unless tightly targeted and monitored, will not deliver social and environmental outcomes outlined in management action and resource condition targets committed to in regional NRM plans.

Directions for the planning system

Links between regional social and economic development agendas, planning and investment activities need to be improved. The current scope of NRM funding program rules largely exclude social and economic motivations and benefits related to investment in resource condition. There is an identified need to:

- Improve the availability and suitability of resource dependent industry and community data at the regional and sub- regional scale, including alternative and emerging industries.
- In designing incentives, build on partnership agreements with industry stakeholders in order to access industry developed data, strategic and operational plans, or industry-funded socio-economic research.

Lesson 6: Some NRM issues and solutions are outside the scope of regional NRM plans

Directions for NRM planning practice in regions and the planning system

Regional NRM plans reflect the ongoing NRM planning struggle to tackle issues such as marine and coastal management, climate change, greenhouse gas emissions and carbon management at the regional scale. Many of these broad scale or exogenous pressures appear outside the scope or influence of regional groups and NRM plans to manage effectively. Even so, it is important that regional bodies are critical players in providing a coordinated response from all levels of government. This coordination will also need to be pursued through existing regional development planning or growth management activities. There is a need for a strong regional response on large-scale NRM issues, particularly as a vital 'bridge' to clarify and align local, state and national management and policy frameworks and agendas.

Lesson 7: The need for regionally-based monitoring and evaluation systems

It is critical that regional NRM planning continues to be community-based as it shifts into the implementation and evaluation components of the adaptive management cycle. Most plans reviewed did not dedicate much consideration as to how the progress towards agreed resource condition targets (RCTs) management action targets (MATS) will be judged or the criteria used to change RCT and MAT focus or priorities. This will require considered and strategic approaches to ensure that all stakeholders (including those within the communities) can contribute to the evaluation of current NRM planning success and use this to inform future NRM planning goals and solutions.

Directions for NRM planning practice in regions

A large proportion of management actions in plans seek to identify and test regionally relevant and property-scale indicators. This is indicative of the immature nature of monitoring systems that currently exist for regional-scale NRM management. Resolution of this problem will require ongoing partnerships with land managers to select and refine useful measures and for tracking and evaluating local and regional responses to identified resource pressures. This includes working cooperatively with all land-owners, including Traditional Owners, to contribute to the assessment and evaluation of resource investments. Several plans nominate indicators associated with considerations such as 'capacity to pay', but are yet to identify quantifiable measures for tracking these indicators.

Directions for the planning system

There is a need for improved coordination and co-investment in resource condition monitoring which are suitable for regional-level reporting and management. Given the strong interest in most regions for progressing *state of the region* reporting frameworks, this model provides a useful platform for linking with state-wide *state of environment* reporting. There is also a wide disparity of accessibility to and suitability of regional-level data for key resources such as soil, pasture and biodiversity condition in rangelands regions.

Lesson 8: How to determine the impact of management actions on resource condition

Given the environmental and management complexity surrounding regional NRM issues, it is not surprising that it is difficult for anyone (including regional NRM bodies) to gauge the full impact of management actions on changing resource condition. Even so, there is some basic information about the natural resources and the management system available that is

required to undertake this challenge. It is worrying that this information was often not available or not fully utilised to guide management action targets and investment strategies.

Directions for the planning system

The importance of understanding the state of and threats to a given resource, the cost effectiveness of management priorities and implementation programs is a critical information base for regional NRM planning. Most plans reviewed revealed that this information is unavailable for many action/asset issues, or it may exist but has not been clearly codified for many land-use (e.g. agricultural, grazing) practices. Instead regional plans and their investment strategies were often based on flimsy evidence and inadequate benefit-cost data. (eg on the design and benefits of riparian fencing which is a major activity in many regions). Improved decision support tools or manuals that document the current available knowledge on *costs and benefits of different management practices* for land managers at the property and sub-catchment scale are required.

Lesson 9: Improvements and recurring limitations in plan-making under NAPSWQ and NHT2

To help assess progress in plan making, the findings of this review are discussed here in light of the findings from an earlier review in late 2002¹⁸. The earlier review occurred on the cusp of agreements being finalised for NAPSWQ and the extension of the Natural Heritage Trust. These new agreements had more stringent requirements in the application of science and other technical information to the regional planning process, particularly in the identification of pressures on resource condition and the setting of quantitative targets.

The new plans represent a significant improvement in the **use of available scientific data** in areas found lacking in the pre-NAPSWQ plans. In particular soil and water salinity and pasture and soil condition were two key areas in this sense. This is not to imply that the current data set for regions is adequate, however current regional plans reflect concerted effort to incorporate and interpret newly generated data sources where available (e.g. salinity hazard mapping, regional ecosystem mapping). However, several NRM issues can still be described as universally data poor with little improvement in between rounds of regional planning. These data poor issues include groundwater quality and quantity, and, regional carbon emissions and sequestration.

The earlier 2002 review noted that plans proposed broad and largely qualitative objectives to address key regional 'issues'. While recognising the limitations in target setting under the current arrangements, significant progress has been made in **articulating and negotiating quantifiable resource condition targets** and measurable management action targets by regional planners, stakeholders and the science community. An important factors that has not improved with target setting include generally poor spatial specificity of many resource condition targets. On the positive side the important contribution of stakeholder knowledge to supplement target setting in data poor conditions has been maintained.

There has also been a greater value placed on **economic and social assessment** in the current set of plans, including the use of tools such as cost-benefit analysis to help design or refine targets and implementation strategies. In practical terms however this assessment is largely occurring post plan development and there appears still little connection between regional social profiles and development of targets.

Only a small number of NRM plans in the earlier review proposed or applied a **sub-regional implementation framework**. However, this was a common and particularly strong feature of the current suite of plans. This greatly improved the clarity of implementation roles and

¹⁸ McDonald, G. Taylor B, McAlpine, C and Vagg, A. 2005 Evaluating regional resource management plans in Bellamy, J. (ed) *Regional Natural Resource Management Planning: the challenges of evaluation as seen through different lenses*. CIRM Social Dimensions of Natural Resource Management Working Group Monograph Series, The State of Queensland. http://www.cirm.org.au/workinggroups/socialdims/split/social_a.pdf

responsibilities and articulation of sub-regional priorities. When reviewed in 2002 most NRM plans recognised *the need* for effective monitoring approaches. However, none of the plans reviewed at that time presented a consolidated monitoring and reporting proposal or set of agreed indicators. The current set of NRM plans still to recognise this need. The identification of meaningful regional indicators however has not improved greatly. A critical difference however is there is a much clearer picture on what monitoring investment is required and how this fits in with state and local scale **monitoring and reporting activity**.