

6 Managing diffuse-source water pollution in northern Australia

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Introduction

Water pollution is caused by point sources – wastewater treatment plants and industries, and by diffuse-sources from rural run-off and urban storm water. The main management practices affecting diffuse source pollution in rural areas are clearing, overgrazing and cultivation causing erosion and hydrological changes in catchments, riparian zone clearing and degradation, stream channels changes, and affect wetlands and floodplains. These changes can potentially cause increased nutrient and sediment concentration and suspended solids, toxins and contamination from chemicals, eutrophication (overgrowth of aquatic plants and algae), and increased exotic weeds in receiving waters.

Northern Australia has only small areas of intensive agriculture and small urban populations and so water bodies are in relatively good condition. There are, however, some significant localised diffuse source threats from high intensity mostly irrigated agriculture and from widespread grazing of seasonally variable rangelands. There are important northern assets to be protected, especially the Great Barrier Reef, conservation values in “wild rivers” and the maintenance of water supplies.

Objectives and Approach

This case study reviews the state of play for diffuse source water pollution from rural lands in the current NHT/NAP regional natural resource management plans. With the exception of Cape York, the review covers five distinct regions in northern Australia ranging from the highly urbanized, well resourced South East Queensland (SEQ), the regions draining into the Great Barrier Reef, two regions in the Gulf of Carpentaria, the Northern Territory and the Ord region of WA. Information comes from participatory observation especially in the case of the SEQ, Reef catchments and NT, from interviews with agency and regional body staff in most of the Queensland GBR regions and from plan and RIS reviews in all regions.

The review is structured by the principles of adaptive management tailored for water quality applications by the Coastal CRC (see Lawrence *et al.* 2004). The elements are:

- **Core Components:** Contextual and organisational issues
- **Systems analysis and vision:** System understanding, pressures, goals
- **Planning:** Targets and priorities, proposed activities
- **Implementation:** Delivery arrangements and expenditures
- **Monitoring:** Measuring and reporting on conditions and actions

The Australian National Water Quality Management Strategy sets out a generic approach to water quality management centering on defining water quality values or social goals for water use, and objectives, specific water quality attributes that would achieve those values. The associated Australian Water Quality Guidelines (AWQG) set default trigger values (levels above which action needs to be taken to address threats) for five climatic/geographical regions across Australia and New Zealand including tropical Australia. The AWQG note (ANZECC & ARMCANZ 2004):

“There are few data for tropical water bodies; 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)”.

There is a need for tropical, risk-based guideline packages to be developed for Australian aquatic ecosystems, which are characterised by elevated seasonal temperatures and significant seasonal variability in rainfall and stream-flow patterns (Finlayson & McMahon 1988). For instance, seasonally-variable stream flows can cease for large parts of the year. Seasonal rainfall events often produce ‘first-flush’ loads of stressors that can cause rapid changes in stressor concentrations (Hart *et al.* 1987, Townsend *et al.* 1992) that may not be captured with routine monitoring programs. (ANZECC 2004:3.3-21, 64)

For these reasons and despite the publication of default trigger values in both the national and state guidelines (calibrated largely on undisturbed streams), guidelines for tropical rivers are not widely applied or accepted due to the lack of reference data and the very strong seasonal influences and episodic extreme events that drive tropical systems. Regional bodies in tropical Australia therefore had very little foundation on which to develop condition assessments, priorities, targets and actions. Additionally, there is debate about whether ambient or load based standards and targets are the most appropriate in Northern Australia. An annual load (discharge) is relevant for receiving water quality, for example in Moreton Bay, the Great Barrier Reef lagoon or freshwater lakes and impoundments. However for the water contained in freshwater streams in any given reach (for example in a National Park), ambient water quality is the most important for use values in that reach. The water quality guidelines provide trigger values for ambient water quality only.

Ord

Core Components

The Ord River Basin is one of the 21 priority catchments under the NAPSWQ. It is in the WA Rangelands Region, which covers approximately 90% of the state. Due to the size and complexity of the region, the *Rangelands NRM Coordinating Group (RCG)* created four sub-regional plans to make up the overarching Rangelands Strategy. Kimberley is the most northern sub-region in the Rangelands and includes the Ord River catchment.

The *Strategy for Managing the Natural Resources of Western Australia’s Rangelands* is the regional NRM plan that includes the Ord catchment. The Draft Kimberley NRM plan was developed with active participation from the Kimberley community, the Ord River Reference Group, Ord Land and Water Board, pastoralists, irrigators, local government and state government agencies. There is also the *Kimberley Development Commission (KDC)*, a statutory authority to promote economic and social development notably ‘Ord Stage Two’.

The pre-existing *Ord Land and Water Management Plan 2000* addresses a wide range of issues, including the health of river systems (Rangelands NRM Co-ordinating Group 2005). It plays a strong role in developing and implementing ‘best practice’. The community-based Ord Land and Water Board was established to oversee the implementation of the plan. Important goals of the plan are to reduce the load of nutrients, chemicals and sediments in tail water by 40% within 5 years and to prevent further damage and modification of the natural riparian vegetation (Holmes 2004).

The *Ord Water Quality Program* is a partnership program with the Department of Environment and the *Ord Irrigation Cooperative (OIC)* that collects water quality data on a monthly basis from 11 sites.

Systems analysis and vision

The construction of the Ord River Dam (1973) to irrigate 13,000 hectares for agriculture changed the Lower Ord River from a seasonally dry tropical river to a permanent flowing river (Lund 2001). This has had major impacts on the hydrology and ecology of the river, causing changes in river dynamics, sediment transport, channel morphology, biodiversity and riparian vegetation. Problems include impacts on barramundi (*Lates calcarifer*), exotic weed rising groundwater, salinity and decreased water quality, particularly through nutrients, chemicals and sediments returned to the Ord River via drains (Doupé 2002, WRC 2003, Rangelands NRM Coordinating Group 2005).

Overall, waterway condition in the Kimberley region is not well understood (Holmes 2004). One of the key challenges for planning is the limited availability of flow and water quality data for the irrigation area or the Ord River (Lund 2001).

At present, there is no overarching management goal for the Ord River catchment. This absence of an overall goal was criticised again in May 2006, when scientists called for a desired future stated to be defined for the Ord River ecosystems which should become the operational goal for ecosystem management. This requires a detailed management objective to be formulated as a measurable future state (Doupé 2006).

Planning

Declining water quality was identified as a key priority for the Ord catchment. The NRM plan for the Rangelands region has resource condition targets relating to water, including the Ord River. They include the target that water quality meets guidelines set for Ord Catchment by 2010; that natural river flows are maintained or in close to natural state and that water allocation does not diminish environmental flows by 2020. (Holmes 2004 and Rangelands NRM Co-ordinating Group 2005). Management action targets for the Ord are all in the future targets to set targets for river water quality, BMPs for chemical use adopted by industry and implemented by 100% of users by 2008, groundwater levels maintained as recognised industry parameters in 100% of the groundwater use area by implementing options for groundwater level management by 2008, Water Allocation Plans developed and finalised for all surface and groundwater – as required

Implementation

In 2004-05, the Ord River catchment received \$0.285m of NAP funding to improve water management. Outputs included baseline, trend and condition studies for the development of targets, research and development studies, the distribution of newsletters and the undertaking of forums and media opportunities (Commonwealth of Australia 2005). Furthermore, the Australian and WA Governments announced in May 2006 that the Rangelands region would receive \$13.7 million of NHT and NAP funding over three years (Joint Media Release 2006). For the first year (2005-06) this includes approved investment of \$2m in projects in the Ord Catchment funded under the NAP. These projects include delivery of BMPs focusing on reducing erosion and improving Ord River water quality; a project to identify the major causes of plant biomass build-up such as nutrient and sewerage; and work to reduce these causes. (Rangelands NRM Co-ordinating Group 2006)

Implementation of the Water Use Improvement Program and the Ord Land and Water Management Plan are on-going

Monitoring

The Rangelands NRM Strategy realises that a robust framework for monitoring and evaluation is essential to be consistent with the adaptive management principles. There are a number of critical monitoring activities underway:

- Collecting baseline data to determine sediment loads and water volumes by 2010,
- A project to monitor and assess pesticide and nutrient impacts on ecosystem function/process to set benchmarks by 2010
- Development and implementation of trial methods designed to reduce nutrients and toxins from run-off by 2009
- Water Quality Monitoring in the Irrigation Area (a trial of on-farm water quality monitoring systems in the Ord Irrigation Area to reduce pollutants in drainage water);
- Assessment of responses of the Lower Ord and Estuary from catchment loads and flows.

Northern Territory

Core Components

The *Northern Territory Water Act (1992)* provides for the management of all water resources in the NT, including the declaration of beneficial uses (environmental values) for inland waters and is the primary framework for water quality and water allocation management in the NT consistent with the National Water Quality Management Strategy (NT Government, 2004).

According to the Daly Region Community Reference Group current NT legislation does not deliver an ecological sustainability framework, integrate the management of natural resources or adequately provide for the community engagement necessary to achieve these. (Daly Region Community Reference Group, 2004, 2)

Initially part of the NT was a priority region under NAP, the Darwin-Katherine region including the Daly and Mary River catchments, and the NT section of the Ord River region. In the Darwin-Katherine region, the Mary River Catchment Committee was appointed and advisory committees established for the Daly River Catchment and the Ord River region. The *Daly Region Community Reference Group* was established in 2003 as a non-statutory advisory committee to assist the government on the formulation of an *Integrated Regional Land Use Plan for the Daly Region* (DRCRG, 2004).

The regional body responsible for implementing the integrated NRM Plan and RIS in the NT is the Natural Resources Management Board (NRMB) which took over from the Landcare Council of the Northern Territory (LCNT) in late 2005. The NT is treated as a single region despite its large size but there are emerging sub-regions to cater for the huge variations in issues, climate and landscape.

Systems analysis and vision

The rivers of the NT are largely unmodified compared with those elsewhere in Australia (SKM 2005). There are no major dams or diversions, and salinity is not a serious issue in any of the major catchments. NT has made little industrial and agricultural use of its water resources but there are economic pressures to access water for irrigation development especially in the Daly.

Agricultural development in the Daly Basin is likely to increase since the Northern Territory government has plans to subdivide current pastoral land, undertake large scale clearance of native vegetation and carry out other forms of land modification (Erskine *et al.* 2003; Price *et al.* 2002). In the Daly catchment, several threats from future agricultural development and land clearing include altered soil and catchment hydrology (Dilshad *et al.* 1996); accelerated soil erosion and sediment delivery to rivers (Elliott *et al.* 2002); reduced groundwater recharge and base flow discharge; increased incidence of fish kills.

Integrated NRM in the NT is limited by the lack of coordinated and sustained research and monitoring programs assessing the condition and extent of inland water systems, nutrient loads, influx of sediments and contaminants and environmental water requirements for rivers, groundwater systems and wetlands (LCNT 2005).

Planning

Water quality management in the sense of controlling the discharges of pollutants is not particularly relevant in the NT. Water quality is so closely interdependent with stream flows, water usage and groundwater discharge that groundwater and surface water quality need to be managed holistically and supported by an integrated natural resource management approach. Extractions from flood flows and levels of dry season stream flows are critical for water quality in streams and their impact on natural and cultural values.

Water Control Districts have been declared in areas where there is a need for closer management to avoid stressing of groundwater reserves, river flows or wetlands. Districts have been declared in the Darwin Rural Area, Grove Peninsula, and the Katherine, Tennant Creek, Ti Tree and Alice Springs regions. Water Allocation Plans will be declared for Water Control Districts to manage water extraction to sustainable levels. The plans will allocate water resources to the types of beneficial uses occurring in the district. Beneficial Uses are community derived water quality objectives declared under the Act. These are the basis for waste discharge licences, water allocation planning and water quality planning.

In this context the role of the regional planning process is closely connected to the water allocation and water resource development process. The INRM does have general Resource Condition targets that by 2010 water resources in the region will maintain aquatic biodiversity, sustain water dependent ecosystems, and support enterprise and domestic use requirements; surface and groundwater quality is maintained in all undeveloped catchments; surface and groundwater quality is improved in degraded and developed catchments (SKM 2005).

The management action targets for water quality include that by 2008 -10:

- Targeted research and monitoring programs are in place to provide priority information for social, economic, environmental and cultural planning for inland water environments and resources.
- Water allocation plans are implemented for all Water Control Districts and appropriate licensing is in place elsewhere.
- water quality standards for sediment and nutrients in waste water discharges into developed catchments and ground water systems will be set, incorporated into integrated
- Catchment management plans and considered in wastewater discharge licensing.
- By 2010 best management practices will be adopted for 50% of all inland aquatic ecosystems subject to land use and development pressures. (LCNT 2005):

Implementation

The NT RIS proposed a total investment of \$20.9m for the years 2004-05 to 2006-07 sourced from both the NAP (42%) and NHT (58%) programs (SKM 2005). Of this, \$3.2m is allocated to the 'Inland Waters' program. The funding will be used to protect aquatic ecosystems by identifying and monitoring groundwater aquifers at risk of pollution, requirements for wetlands of national significance and changes in water dependent ecosystems. There is also investment in the development of best practice management plans for fire, weeds and feral animals and assessment of aquatic imports against risk assessment criteria.

Monitoring

The RIS of the Northern Territory affirms that monitoring and evaluation (M&E) are critical activities within a modern approach to NRM as they provide feedback on progress with implementation programs and help determine if objectives are being met. Furthermore, it is recognised that monitoring and evaluation are the 'basis for continuous improvement and adaptive management processes because they reveal changes, trends and underlying social and biophysical processes' (SKM 2005: 16). At present, the RIS has put aside \$0.7m for monitoring and evaluation activities for the three year RIS period, which represents approximately 3% of total proposed investment in the region (SKM 2005).

Gulf regions

Core Components

The regions of the Northern Gulf and the Southern Gulf have experienced low levels of development in comparison with most other regions in Queensland. As a result, the condition of many of the aquatic assets remains high, but still requires active management to maintain their condition status and to manage existing and emerging threats (NGRMG 2004).

The Northern Gulf NRM region encompasses the catchments of the Mitchell, Norman, Gilbert and Staaten River systems. The rivers are largely unmodified and only a few large dams, associated with past and present mining activities, exist in the region. Importantly, the region is currently being examined for irrigated cropping potential, with the possibility of larger water storages and infrastructure being built in the Mitchell and Gilbert systems (NGRMG 2004).

The Southern Gulf NRM region includes the catchments of the Flinders, Leichhardt and Nicholson River systems, in which water quality is still largely very good (SGC 2004).

The Queensland Government is currently preparing a *Gulf Water Resource Plan (GWRP)*, which will cover the geographical area of the Northern Gulf, Southern Gulf and Mitchell River. The GWRP will provide for sustainably allocating and managing water for human uses while ensuring that proper provision is made for water dependent ecosystems (DNRMW 2005).

Systems analysis and vision

In the Gulf regions, there has been very limited research to determine water quality of surface waters. For example, there is insufficient data available to identify condition and trend for salt loads, turbidity and sediment loads, phosphorous and nitrogen in river systems of the Gulf (SGC 2004).

The primary water objective in the Northern Gulf is 'to maintain, and where necessary, improve water quality and environmental conditions in the Northern Gulf River systems' (McDonald *et al.* 2004: 65). Resource condition targets include:

- Develop an understanding of Water Quality and Quantity needs for domestic and primary productions purposes and requirements for environmental flows by 2010;
- The health, condition status and biodiversity of all priority, natural waterbodies or stream reaches, does not decline from their current status; and by 2020, is improved in 40% of cases where improvement is desirable and achievable;
- By 2015, 15% of high value, and 5% of all, permanent natural waterbodies or stream reaches within the catchment are being specially managed in a manner that would aid in the maintenance of their ecological values (e.g. wet season spelling, riparian fencing, offstream watering, high ground cover).
- A 10% decrease in bank and gully erosion on all major streams within the catchment and remediation for priority actively eroding spots in critical locations across all land condition classes (A to D) by 2025;

In the Southern Gulf, the goal for inland water is that ‘water ecosystem values are protected, while the sustainable use of water is promoted for productive, social and cultural benefits’ (SGC 2004). Resource condition targets include:

- Water Quality in 75% of target sites will have an improving trend and will meet or exceed guideline values by 2020;
- Wetland, riparian and instream biodiversity to be maintained at 2006 levels at target sites for at least 10 years; and
- Characteristics of natural flow are maintained to meet environmental requirements.

Planning

The NRM plans for both Gulf regions 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.

Actions and targets for the Gulf regions are necessarily vague given the lack of prior planning and research. Adequate baseline data and quantitative benchmarks for resource condition targets do not exist at this stage and therefore 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 to 5 years time.

Implementation

The Gulf regions have allocated a combined \$1.4m of indicative funding for the management of freshwater over the 3 year funding period (Northern Gulf: \$0.5m and Southern Gulf: \$0.9m). This is 12% and 23% respectively of total indicative funding.

In the Northern Gulf, the Freshwater Management Program intends to further quantify the assets and threats of the region's freshwater habitats and quality, and to monitor key sites to ensure that incentive investment and other projects are appropriate. For example, one important management action includes the implementation of an incentive program for landholders to reduce impacts on and threats to riparian areas, significant wetlands and aquatic habitats by 2006 (NGRMG 2004).

Monitoring

The Southern Gulf region was particularly poorly supplied with condition and trend information on the 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 (SGC 2004). Research projects are currently underway but have not yet delivered any findings⁸. 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.

The regional NRM plan for the Northern Gulf includes a strategy for ongoing monitoring and review of the Plan to reflect new information and experiences, and to ensure continuous development and improvement over time.

Reef catchment regions⁹

Core Components

The *Reef Water Quality Protection Plan (RWQPP)* is the principal driver for water quality management in Reef catchments (Commonwealth and Queensland Governments, 2003). It has the goal of "Halting and reversing the decline in water quality entering the Reef within 10 years" and a key objective to reduce the load of pollutants from diffuse sources entering the Reef. Many Reef catchments also have funding from the *Coastal Catchments Initiative (CCI)* to prepare Water Quality Improvement Plans although none have been completed to date.

Systems analysis and vision

The vision is clear and agreed for the Reef – to protect Australia's important ecological and economic asset. Major projects have assessed the condition of the GBR catchments, rivers and water quality. Catchment modelling is a key methodology to identify potential sources of nutrient and sediment through the Short term Modelling Project and in addition load data has been collated for 27 catchments.

Planning

The RWQPP is specific about what the targets should address although how to set them was to be determined by Regional Bodies. All of the Reef regions' NRM plans included targets to set water quality targets by June 2005 but as yet no region has quantitative water quality targets or investment programs that show how these targets may be attained. The science to inform target setting is rapidly maturing although it is fair to say it is not quite there.

The inherent natural variability and the scale and remoteness of some parts of the GBR Region make routine long-term monitoring unfeasible. A combination of catchment models and monitoring will be necessary for water quality management including target setting in the

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⁸ i.e. DNRM – Technical Advisory Panel to the Gulf Water Resources Plan and Land and Water Resources Research – Northern Rivers Project.

⁹ The bi-lateral agreement commits governments to report annually on the implementation of the Plan across government agencies and regional bodies. There has also been a mid-term review by Howard and Partners although at the time of writing this has not been made public. DNRMW commissioned a review of regional planning in reef catchments due to be released in June.

regions. There are modelling projects in various catchments to show the effect of management actions, CCI programs are collecting information on sector specific management practices and plot scale monitoring programs evaluating pollutant generation rates from various management practices. There are misperceptions as to the assumptions underpinning the modelling approach and the certainty with which they can predict the consequences of management interventions on sediment and nutrient loss. Models are most useful in guiding Regional Bodies as to which management actions would deliver the best outcome in terms of nutrient and/ or sediment loss. However not all management actions can necessarily be modelled.

Implementation

The RISs of the Reef regions (FNQNRM, MWNRM, BDT, FBA, Burnett Mary) allocate an indicative total of \$16.6m for the management of freshwater over the 3 year funding period. This is 24% of the total indicative funding of the Reef regions (excluding Cape York)¹⁰.

NRM planning and implementation activities occur on a number of different levels throughout the regions. 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. 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 themes are research and monitoring, capacity building, improving regional arrangements and partnerships and financing incentives for on-ground change and the adoption of sustainable practices. The plan suggests incorporating local water quality targets in priority neighbourhood catchment planning as a key action for implementation.

Monitoring

Currently there is no effective and coordinated monitoring of on-ground management actions to improve water quality across the Reef catchments. Water quality and water flow monitoring activities have been identified as priority short-term management actions in most regional plans. 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.

Monitoring needs to be hierarchical and carried out at the paddock, subcatchment, and catchment scales. Existing paddock-scale monitoring includes investigation of the effects of beef grazing management practices in the Burdekin on erosion rates and the effect of retention of ground cover on runoff water quality. The effects of reductions in fertiliser usage in sugarcane and banana cropping areas on the loss of nutrients to surface and ground waters and the effectiveness of riparian vegetation and wetlands in trapping sediments, nutrients and pesticides in discharge water from sugarcane and banana cropping areas is currently being monitored in the wet tropics. Sub-catchment event monitoring differentiated by subcatchment land use type is being carried out in the Burdekin, Mackay-Whitsunday, Tully/Murray and Fitzroy Basin Regions.

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¹⁰ This includes Wet Tropics - \$0.6m (13% of indicative total); MW - \$1.0m; BDT - \$5.9m (31% indicative total); Burnett Mary - \$4.7m (27% of indicative total); Fitzroy - 4,386,032 (21% of indicative total).

Ambient river mouth water quality monitoring is carried out to assess long-term change in the concentrations and loads of the major land sourced pollutants (sediments, nutrients and pesticides) discharged to the marine environment at the mouths of 10 priority rivers. River water samples are also collected intensively during high discharge events from the same sites selected for the ambient monitoring program, with samples collected across the hydrograph. Sampling during events is designed to catch the 'first flush' (in October to December) and any significant mid-season events

Water quality monitoring is also carried out in adjacent inshore waters (i.e. within ten to fifteen kilometres of the coast) of the Great Barrier Reef to assess trends in concentrations of water quality indicators including nutrients, sediments and pesticides. Additional water samples are collected from within freshwater flood plumes as they extend out into the marine environment beyond the mouth of flooding rivers during the wet season. This monitoring seeks to establish the extent of improvements in lagoon water quality as a consequence of any reductions in pollutant delivery from the catchments. Whilst the best method for protection of all aquatic ecosystems in the GBR is to base these trigger values on ecosystem tolerances, however our ability to determine these levels is extremely limited at this time. Currently there is a significant lack of physical and toxicological data available to facilitate the determination of GBR and estuarine ecosystem tolerances to catchment derived pollutants.

The current reporting systems associated with regional natural resource management and GBR are primarily addressing program accountability and performance reporting. To a large extent, resource condition reporting, inclusive of water quality is fragmented across institutions and lacks sufficient coordination to offer meaningful information on the impact of the collective actions on water quality and GBR health.

The current reporting for the RWQPP captures institutional effort to support management actions for improved water quality, but there is currently no evaluation of impact and effectiveness or agreement on acceptable water quality targets. The recently completed Short Term Reef Modelling project has provided some evaluation of possible impacts on sediment and nutrient discharges from a range of possible interventions.

Southeast Queensland

Core Components

The existence until recently of two regional bodies: *Natural Resource Management South East Queensland* (NHT funded) and the *SEQ Western Catchments Group* (NAP funded) created a complex regional process. These bodies recently merged into *SEQ Catchments (SEQC)* but transitional issues remain. Furthermore the prior existence of the *Moreton Bay Waterways and Catchments Partnership (MBWCP)* largely a local/state government/ science driven organisation with a strong record of achievement in water quality science and point source pollution management complicates life for the SEQC. MBWCP and SEQC are currently preparing an MOU to align planning and implementation activities and share scientific research, but the two bodies will remain¹¹.

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¹¹ It is relevant to note that the MBWCP Policy Council resolved to continue the mandate of the MBWCP until June 2009; whereas the Board of SEQC resolved to work towards a merger of the two organisations

Systems analysis and vision

The work of the MBWCP provides a thorough analysis of the current condition and threats to the region's catchments, waterways and water quality including the receiving waters of Moreton Bay. The *SEQ Regional Water Quality Management Strategy (SEQWQMS)* sets out a vision of "healthy ecosystems supporting the livelihoods, lifestyles and health of people in SEQ" (SEQ Regional Water Quality Management Team 2001:1). This broad vision is strongly related to reducing pollutant loads to Moreton bay and other receiving waters. Rural diffuse loads comprise 20% of nitrogen, 10% of phosphorous and 80% of total sediment loads based on modelling results.

Planning

The MBCWP has drafted the 2006 *SEQ Healthy Waterways Strategy (HWS)*, the sequel to SEQWMS. The plan and supporting data of the SEQWQMS and the work of the MBWCP provide the major source of science underpinning targets and priority actions for SEQ. Furthermore the SEQWQMS plan takes account of recently released draft water quality objectives established in the *Environmental Protection Policy (Water)*. These have been applied to create water quality targets for freshwater reaches of major rivers, riparian zones, tidal estuaries and Moreton Bay. Most current levels of pollutants exceed levels required to achieve WQOs. The draft HWS considers a number of scenarios for levels of action for point source and for rural and urban diffuse sources. Targets are for 20% reduction of rural diffuse sourced sediments in the medium term and 50% in the long term. The SEQC regional NRM plan incorporates these WQ targets and associated investment priorities in the HWS.

Key goals are (i) to adopt area based management for priority (hot spot) areas and (ii) to implement sector based or region wide activities across the major land use sectors. There is also a Commonwealth funded Water Quality Improvement Plan project in the region helping to drive this process in focus catchments.

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.

Implementation

The SEQC RIS only covers proposed investment from January 2006 - June 2007 allocating \$2.5m to 'Protecting Water Assets' program. Of this total amount, 83% is NAP funding and 17% is NHT funding. The 'Protecting Water Assets' program has been given 30% of total indicative funding for the 18 month funding period and is thereby the program with the largest proportion of funding in the SEQ Catchment.

There is yet to be a clear and integrated strategy for implementing rural diffuse pollution management in SEQ but it is emerging. SEQC are funding over 700 no-regret projects across the region in all asset themes, mostly delivered by local agents of which 40% are local government. The MBCWP strategy has priority action plans for the Lockyer, Bremer, Logan and Albert Rivers. The institutional arrangements for delivery are still uncertain but the MOU acknowledges SEQC as the preferred coordinator of community-based on-ground natural resource management activities. In practice this will need to be achieved by a variety of local "agents" including Landcare groups, (sub) catchments groups, local governments otherwise the transaction costs will be excessive. Capability varies widely across the region in this regard. MBCWP also has four "(sub) regional implementation groups" which have a geographical focus whereas at present SEQC's extension work is more sectoral or thematic.

The SEQC is currently undertaking community round table meetings in major catchments to comment on and refine priority areas, build on previous project experience, assess the capacity of local land owners and groups and to develop new projects.

The MBCWP recognises SEQ Catchments as the preferred coordinator of community-based on-ground natural resource management activities. They agree that the Northern, Moreton Coast, Moreton Bay and Southern MBWCP Implementation Groups, SEQ WCG Board (also Western MBWCP IG) and NRMSEQ Board are important multi-stakeholder sub-regional fora for regular communication and engagement.

Monitoring

There is no integrated water quality monitoring network in South East Queensland across various groups and agencies although there is lots of data. The MBWCP Ecosystem Health Monitoring Program and annual Report Card have been very effective in raising awareness of water quality issues and generating action. Community based water quality monitoring such as Seagrass Watch are important inputs into the EHMP Report Card process in which scientific oversight assists create valuable data from community efforts.

Recognised needed improvements to water quality monitoring framework in SEQ include an event-based monitoring component as part of EHMP, better data sharing arrangements where required.

Conclusions

The review covered northern regions with wide variations in circumstance from the highly urbanised SEQ region, to the Reef regions where intensive agriculture and horticulture existed in catchments draining to a vital natural asset, to the Ord region where a major irrigation scheme existed to the NT where most rivers drain from natural landscapes but in the case of the Daly intensification is being debated. In the bulk of the northern savanna regions, the Gulf, and NT rivers run free and grazing from natural landscapes is the norm. In these regions the water quality management issue is to protect existing values rather than rehabilitate degraded land affecting water quality.

All northern regions identify managing water quality as an important objective and to maintain rather than remediate water quality problems. At the outset they suffered from a lack of baseline data about resource conditions and trends in most districts and about cost-effective programs of actions. Overcoming these deficiencies was a major challenge for all regions and a major point of difference between northern and southern Australia. (See Benchmark 1, tropical Rivers.)

Core Components

The institutional setting for water quality management varied widely but the most significant similarity is that the regional NRM process under NHT/NAP needs to be integrated with the water allocation process, especially in the NT, Ord and Gulf regions. This is not always the case. In the Gulf regions, a new Water Resource Plan and the advent of Wild Rivers program has given new focus to water quality issues but the overall impact is not yet clear. In Reef catchments, the regional bodies, with assistance from CCI funding and a considerable research effort seem to be rising to the expectations in the RWQPP. The establishment of the Reef Partnership between Australian, Queensland agencies and reef regional bodies seems set to provide a framework for effort alignment in catchment management, target setting and monitoring and reporting that heretofore has not existed.

SEQ is institutionally the most complex and as yet the delivery of programs for rural diffuse pollution management is not clear – although the SEQC has an agreed role to coordinate community based action through localized delivery agents such as Landcare groups, catchment groups and local governments.

Systems analysis and vision

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 NAP/NHT frameworks.

All regions have general RCTs that aim to maintain aquatic biodiversity, sustain water dependent ecosystems, and support enterprise and domestic use requirements; maintain surface and groundwater quality in all undeveloped catchments.

Planning

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.

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.

In this context, regional activities which must be termed minimum regret actions:

- Campaigning for integrated NRM
- Providing a focus for community based actions in catchments
- Projects to improve grazing land management which is the pervasive use of northern Australia by programs such as the GLM with obvious but unquantified benefits for WQ.
- On ground works to protect riparian zones from stock access and provide alternative watering points
- Actions to increase land owners awareness and capacity for improved land management are very common. .

Implementation

Regional bodies 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 also Core components above).

Monitoring

Actions to improve the information base are prevalent in plans. Coordinating and integrating the necessary scientific economic and social knowledge to inform the choice of effective and efficient actions is also a challenge.

At present there are many providers of this information in government agencies, universities and industry organizations. Coordination occurs through MTSRF, CCI, CSIRO Healthy Country and other programs, but there is still a challenge to consolidate and build on existing information required for catchment management. The MBCWP is a promising example of a coordinated science approach to monitoring and adaptive management.).

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. The best examples of this are the Fitzroy regions neighbourhood catchment approach which combines on-ground actions with localised monitoring and the SEQ annual water quality scorecard.

Future directions

Despite these difficulties, a great deal of innovative and catalytic work resulted from 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.

Perhaps the greatest on-going weakness is the absence of any rigorous monitoring program covering both water quality and management actions in all the regions except SEQ. 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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7 Country-based management proposal for Kakadu National Park

Cathy Robinson, Dermot Smyth and Peter Whitehead

Introduction

Regional delivery of natural resource management (NRM) offers innovative opportunities for active participation and involvement of community stakeholder groups. The purpose of this planning approach is to offer strategic and innovative solutions through provisions that enable community stakeholders to access and integrate technical and other information with their own perspectives and knowledge to ensure NRM planning is comprehensive, well coordinated and able to be implemented. The adaptive and responsive features of regional NRM accepts that agreed management actions and decisions are based on a degree of uncertainty about what constitutes the most effective actions and partnerships. Participatory approaches to ensure collaborative learning from best available information and management actions is essential.

An evaluation of the establishment and planning phases of regional NRM highlights the opportunities and challenges in reaching agreement or at least acceptance of NRM objectives and measures of success with key community stakeholder groups (McDonald *et al.* 2005a)¹². Success at forging shared NRM goals and approaches with Indigenous people was identified as a particular challenge and continuing goal for regional body efforts in many regions (e.g. CRC Savannas Planners Workshop 2005). Now that many regional plans are reaching implementation and review phases of the adaptive management cycle, regional bodies are exploring strategies that encourage strategic and collaborative learnings from management actions. This will include the need for targeted approaches to ensure Indigenous people are involved and their perspectives incorporated into regional monitoring and evaluation programs.

Plan reviews and interviews undertaken as part of the McDonald *et al.* (2005a) evaluation of regional NRM highlighted that the monitoring and evaluation (M&E) component of regional arrangements still needs improvement to ensure there is effective use and integration of stakeholder, scientific and other information. This includes:

- the need to ensure that government requirements on regional bodies are not unreasonable,
- regional bodies have enough information and tools to monitor progress towards management action targets and resource condition targets, and
- the evaluation feature of adaptive management improves future delivery of regional NRM.

Most of the attention to date has been focused on how to ensure that reporting requirements for various National and State program investments are integrated, effective and useful to all stakeholders responsible for regional NRM delivery. Less attention has been paid to the

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¹² Engagement with Indigenous groups for NRM is a goal of State and Commonwealth policies and legislation (e.g. *Environmental Protection and Biodiversity Conservation Act*, Cth 1999), regional plan accreditation requirement and a common aspiration for Regional Bodies charged with coordinating the regional NRM planning process (McDonald *et al.* 2005a).

design and application of participatory approaches to judge regional NRM performance¹³. Negotiating measures and processes to judge performance that ensures accountability and encourages collaborative learning poses many challenges in the cross-cultural and multi-stakeholder setting of NRM delivery occurs across Northern Australia (Whitehead *et al.* 2000). Stakeholders often use different measures to appraise the success of a given management response to protect the same regional asset (Margoluis and Salafsky 1998; Borrini-Feyerabend *et al.* 2000; Robinson *et al.* 2005). Efforts to design and implement participatory monitoring and evaluation processes that allow for ongoing review, learning, and improvement by all parties concerned remain uncommon.

Objectives

This case-study draws on experiences and innovations being considered in Kakadu National Park to apply adaptive management principles and approaches to develop, review and improve Indigenous NRM partnerships.¹⁴ The objectives of this case study are to:

- Outline features and steps of Country-based management to implement and evaluate NRM partnerships developed between Traditional Owners and Kakadu National Park staff; and
- Highlight principles and approaches of County-based management that can be applied to Indigenous partnerships developed for regional delivery of NRM.

Approach

This case-study draws on work done in collaboration with Traditional Owners and Kakadu National Park staff which contributed to the development of the Kakadu Feral Animal Strategy. This included a number of meetings and Country-based workshops held around the Park and a trial in implementing steps of Country-based decision-making into feral animal planning and management in the Southern District of Kakadu. Details about Country-based management are available in *Managing for Country – Decision-Making Guidelines for Joint Management of Feral Animals in Kakadu National Park* (Robinson *et al.* 2006a).

Managing for Country guidelines were developed to provide Kakadu's joint managers with a co-operative and responsive planning approach to implement the Kakadu Feral Animal Strategy. In the 4th Plan of Management for Kakadu National Park, the Board of Management set out the "end" or central goal that it aimed to achieve through strategic joint management of feral animals.

...a strategy for managing feral animals in Kakadu in the future is needed. Feral animal control is an important part of weed management and an important part of preventing erosion and protecting sensitive habitats. A feral animal management strategy needs to take into account that Kakadu comprises a range of habitats of differing sensitivity to disturbance and differing susceptibility to invasion by weeds, and that different clans of traditional owners have differing views on feral animal management on their lands (Kakadu National Park (4th) Plan of Management, p. 85).

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¹³ The 2005 review of accredited Regional NRM plans highlighted a widespread recognition that a robust framework for monitoring and evaluation (M&E) is an essential tool to provide regional stakeholders with feedback on the appropriateness and progress of on-ground actions in meeting targets. Yet plans reviewed highlight very little detail on specific activities and mechanisms needed to design and implement such a framework (McDonald *et al.* 2005b). Government guidelines for regional plans and regional investment strategies also offer little guidance for the design and implementation of participatory M&E of management effectiveness or improvement of resource condition.

¹⁴ This case-study report will be published in Robinson, C.J., Whitehead, P.J., and D. Smyth, in press. Country-based management in Kakadu National Park – a new approach to managing feral animals in an Indigenous-owned protected area. *Geographic Research*.

Support for this approach is re-iterated in the current (draft) 5th Kakadu Plan which maintains a focus on managing impacts that feral animals have on Kakadu's natural and cultural values and recognition that there are diverse views on the impacts feral animals have to these values, and how feral animals should be managed. Criteria used to design and evaluate an effective feral control program therefore needed to accommodate:

- Different views on levels of feral animal damage judged as unacceptable;
- Negotiated input to decide the most cost-effective control actions needed to address achieve agreed control targets; and
- Variability in the focus and intensity of on-ground actions in different areas in the region.

It was recognised that a Country-based approach to joint management in Kakadu was needed because there are important aspects of decision-making that need to be considered when assessing the 'health' of Country, the pressures on the condition of Country, the special opportunities available in a region and the nature of the challenges to realise opportunities to support Country-based management – all of which are needed when framing and prioritising management targets in terms of these pressures and challenges¹⁵.

The Country-based management framework

Country-based management is an adaptive management framework developed to recognise Indigenous customary laws in joint decision-making processes. This requires consideration of

- how authority and responsibilities are exercised and obligations met;
- how information is obtained and knowledge created and communicated;
- how past experience and knowledge is utilised;
- how the diversity of values is recognised and applied; and
- how or if decisions can be implemented within the formal and informal institutions and management structures that currently exist or may be built in the Park.

The Country-based management framework has been designed to compliment the purpose and functions of each step of the adaptive management cycle.

Each step should contribute to decision-making processes and outcomes that:

- Reflect the relationship of Traditional Owner groups to the cultural and physical landscapes of the region;
- Ensure Traditional Owners are able to express their views in decision-making;
- Support Traditional Owner responsibilities and efforts to care for their Country and maintain healthy ecosystems;
- Support the economic well-being of Traditional Owners, including rights to continue harvesting resources and develop opportunities to benefit from their land where these activities do not detract from other (natural, social and cultural) values of the region that the regional NRM process has committed stakeholders to protect;
- Be developed and implemented at an appropriate scale, to be decided by Traditional Owners in consultation with regional bodies and NRM stakeholders and matched to an agreed objective;

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¹⁵ Features of the assessment and planning steps of the adaptive management cycle have also been canvassed for the negotiation of Indigenous NRM partnerships in the Great Barrier Reef (see Robinson *et al.* 2006b).

- Facilitate cooperation between neighbouring clans and language groups, for management of all values of importance to them;
- Guide the operational relationship between Traditional Owners and regional bodies; and
- Provide building blocks for future NRM plans.

Country-based management in Kakadu National Park

The Country-based management framework has been developed by Indigenous and non-Indigenous NRM partners in a unique region of Northern Australia. Kakadu National Park has been nominated as a World Heritage Area of its natural and cultural values. It is a protected area jointly managed under the terms of the *Environment Protection and Biodiversity Act 1999* (Cth) which gives statutory recognition to the Park Lease Agreement and the Plan of Management. The legislation provides for an Aboriginal majority on the Kakadu Board of Management. In conjunction with the Direction of National Parks and Wildlife, the Board is responsible for preparing and overseeing decisions under a Plan of Management (Lawrence 2000).

Even so, there are many issues affecting joint management of this World Heritage Area that can be related to efforts to design and evaluate effective Indigenous partnerships through regional NRM. As with other regions established under the NHT2 / NAP program, the Kakadu region comprises of a number of Indigenous and non-Indigenous clan and language groups who have a complex of economic, social and religious rights and responsibilities to areas and resources under customary law (Press *et al.* 1995). For some Indigenous people, Country is their clan estate, for others Country may be a larger area for which responsibility is shared with other members of their language group. The key significance of the concept of Country for natural resource planning and management is that it recognises the connections and responsibilities of particular groups of people, and their associated values, to particular areas of land and sea.

Kakadu is also a region comprised of Aboriginal people who are Traditional Owners of parts of Kakadu, Aboriginal people who have residential rights according to Aboriginal custom and recent Indigenous arrivals from outside the region but connected through social networks or employment opportunities. Many challenges faced by Kakadu's joint managers to ensure NRM decisions appropriately engage and impact Indigenous organisations and people in echo concerns identified by many regional body Board members and planners¹⁶.

While Kakadu Traditional Owners enjoy considerable decision-making power through formal laws and policies, there are still some social and economic issues that challenge Indigenous people's capacity to ensure NRM program design and delivery is negotiated, strategic, accountable and fair. Despite the plethora of government inquires and economic opportunities provided by mining and tourism interests in the region, the Kakadu Region Social Impact Study: Community Action Plan found that Kakadu's Aboriginal residents were subject to extreme socio-economic difficulties and were, on average no better off than other Aboriginal communities in the Northern Territory (Kakadu Region Social Impact Study 1997). These social and economic realities, coupled with the challenges associated with cross-cultural translation and integration of NRM aspirations, is an issue that Kakadu NRM partners share which other regional communities across the savannas of Northern Australia.

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¹⁶ CRC Healthy Savanna Planning Systems Planners Workshop, Brisbane, March 2005; *Strategies to Improve Regional Planning Arrangements: Perspectives from the Queensland Regional Groups Collective*. Tropical Savannas CRC Healthy Planning Systems Workshop, June 2005

Similar to other regions of Northern Australia, Indigenous NRM partnerships in Kakadu are affected by the challenge of designing effective and appropriate management strategies for diverse and dynamic physical and cultural landscapes. Some biological, physical and cultural features have changed dramatically over the past 200 years, while other attributes have changed little. Changes include the impact of changing fire regimes that have found to have important implications for biodiversity conservation. New plants and animals, including feral animals and weeds, have also spread and had a range of ecological, economic and cultural impacts. People have seen and reacted to change in different ways, so that there are many views of the best approach to management (Whitehead *et al.* 2000). Along with other Indigenous people across Northern Australia who have responsibilities for Country and important roles in management of resources, Kakadu's Traditional Owners have had to adapt to these changes. Traditional Owners draw on a mix of their Indigenous laws, knowledge, and historical experience to respond to changes on their Country, while also dealing with a wide array of expectations and demands from those who now have an interest in protection or exploitation of the region's values.

Key findings for delivery of regional NRM

Country-based management is not designed to 'fix' the physical elements of Country, but recognises the importance of protecting a region's cultural values, including the maintenance of healthy social relations, and recognition of rights and responsibilities to areas of land and sea. What constitutes 'real' change, and 'improved' management practice cannot be based solely on un-negotiated environmental and economic criteria based on prevailing orthodoxy that NRM partners have had no opportunity to 'test'. Rather, criteria used to judge the success of shared NRM strategies, the process used to undertake this assessment, how to determine what can be learnt from past experiences, and how NRM partners should respond to these lessons will require ongoing negotiation and review in ways that give proper weight to a wider array of values.

Country-based management provides an adaptive approach that compliments the objectives and processes of regional delivery of NRM. This approach recognises that a target might be appropriate or an action might work, but recognises the need to test both the target set and methods of achieving it and collect evidence through monitoring and evaluation, to test assumptions and to measure how well the management arrangement or intervention has actually worked from the perspectives of all those with rights and obligations. This review can then inform and improve future management targets and programs.

Country-based management also encompasses tools and approaches that can be used by Indigenous and non-Indigenous NRM partners to negotiate, integrate and review new knowledge and management approaches. For example, rather than focusing only on the damage caused by the presence of feral animal populations in Kakadu, discussions amongst Traditional Owners and Bininj / Mungguy (Aboriginal) and Balanda (non-Aboriginal) Park staff have needed to consider the challenges to management of important values that might be caused by the absence of long-established feral animal populations and the economic and cultural benefits that feral animal management could offer.

Country-based management requires a number of steps to be considered, which are summarised below (for more details see Robinson *et al.* 2006a)

A preliminary assessment of the array of values under threat, and the nature of the threats

This assessment should encourage processes for decision-making that reflect different perspectives on the costs, benefits and impacts of NRM decisions. Evaluation of program success in the Kakadu context, for example, highlighted that the success of control programs was judged on a wide range of defined environmental, economic, social and operational criteria. As well as obvious and well-recognised environmental issues, assessment of feral animal management performance needed to consider the multiple of (positive and/or negative) impacts that feral animals have for a particular region or place, and the need to take into account Traditional Owners' roles in managing for Country, rather than simply involving Indigenous people in achieving objectives and methods determined independently of their concerns.

Protocols for Indigenous engagement

The appropriate Traditional Owners to involve in a particular NRM management issue might emerge over time through an adaptive approach which will involve ongoing review as better understanding of interests and concerns is accrued. The roles of different Traditional Owners involved in this process might change as decisions are made and discussed amongst community stakeholders within a region. This sort of approach will be particularly important for NRM issues (such as feral animals) which move through Country and have a range of values and impacts in different places.

Some NRM discussions and decisions will evoke debate and the contribution of different and changing views amongst and between Indigenous and non-Indigenous decision-makers. Decision-making protocols to guide input into decision-making may also need to be made. The advantage of an adaptive approach to Indigenous NRM partnerships is that it reduces the pressure on getting agreement to set the 'right' initial target (cf. Robinson et al. 2006b). The process for reaching agreement can be reviewed and the outcomes considered together. The important issue is to use all interactions to make progress towards better understanding of all the factors needed to improve, and keep on improving performance.

Setting targets and implementing plans for Country

This step requires Indigenous and non-Indigenous NRM partners identifying the factors that are impeding or driving change to effective NRM partnerships. Are the best systems and process for NRM partnerships being used, given the legal and financial constraints under which these partnerships are operating? What areas of management need attention to improve the capacity of NRM partners to undertake this work? What strategies are likely to be most cost-effective?

The experiences developing Country-based management for feral animal management in Kakadu highlighted that it is critical to establish clear, measurable and achievable NRM targets that reflect agreement over priority issues and areas. Consultations undertaken with Bininj/Mungguy and Balanda Park staff in Kakadu also highlighted the need for proper consultation to ensure effective implementation of targets. Capturing the diverse range of input encountered through participatory approaches is often problematic. This is particularly the case when these contributions reflect different knowledge and value systems; there are tensions within and between stakeholder groups, or where there is little suitable secondary socio-economic data to assist with verification of that input to decision-makers. For example, Bininj/Mungguy people in Kakadu hold a number of views about different feral animals and their impacts on places in the landscape (see Robinson *et al.* 2005). Although some feral animals (such as cane toads) are regarded as 'bush threats' that damage the health of country, other feral animals are considered good 'bush tucker' and valued as an important food source or, like horses, loved as 'bush pets'.

Country-based plans focused on the operational issues and joint manager responsibilities needed to implement, review and report on agreed targets. For example, negotiations in Kakadu highlighted the need to consider the unique control options for culling different species in different areas when weighing up the costs and benefits of a particular control program. What people and resources are available to provide input into Country-based planning and decisions, facilitate the planning process and inform planning objectives and actions also need consideration.

Reviewing the effectiveness of agreed Country-based decisions

A critical feature of Country-based management is that Indigenous NRM partnerships are often negotiated in the absence of certainty. Initial management goals and actions will be based on limited knowledge of what is the 'best' target, approach and joint management process to ensure effective operations. In Kakadu for example, this includes a lack of comprehensive information about the nature and level of damage feral animal species cause to habitats and sites on Country. It also includes a lack of information about how Kakadu's joint managers will evaluate feral animal actions and partnerships. Initial management priorities and targets will probably need to be revised. This step also addresses the need to build trust between NRM partners – particular for efforts to develop management solutions and evaluation approaches that incorporate scientific, Indigenous and other knowledge.

The application of a systems-based approach to standard State of Environment 'pressure-condition-response' reporting provides a useful approach to develop a cross-cultural evaluation framework for Kakadu. A systems-based approach emphasises the complexity of natural resource management – in this case, joint management arrangements (Bosch *et al.* 2003). It recognises that existing and fragmented knowledge about feral animals and impacts needs to be integrated and that this knowledge needs to be based on a range of sources, including science and management experience. Such an approach can be applied to evaluate:

- **health of Country indicators** that measure the current threats or pressures to agreed target areas; indicators that measure the condition or current state of Country; and
- **managing for Country indicators** to describe performance in developing joint management responses to feral animal damage in these agreed target areas.

Indicators to measure changes to health of Country and the performance of joint management responses will need to incorporate government indicators designed to monitor and report on the progress and success of NRM programs. Informal or locally-based indicators may also prove to be useful to review and improve day-to-day joint decision-making. For example, environmental and cultural indicators identified by Traditional Owners to monitor health of Country in the southern region of Kakadu included amount of bush tucker (such as yams) available, water quality in billabongs, and level of Traditional Owner access to sites (based on number of visits and access to vehicles to reach these places).

Indicators developed to measure the performance of managing for Country can draw on principles developed to evaluate other natural resource management arrangements and planning systems (see McDonald *et al.* 2005a). These principles relate to the context of management, inputs, processes as well as the outputs and outcomes of management actions and focus on the need for:

- open, fair and inclusive decision-making processes and procedures,
- structures and processes to cater for divergent views and values but also ones that build a collaborative learning environment,

- accountability of decision-makers,
- coherence and appropriateness of management priorities, targets and implementation,
- management and planning decisions that are based on Indigenous, scientific and technical knowledge,
- planning and management approaches to be adaptive, and
- planning and management approaches to be effective.

Reporting on reviews to all decision-makers

Although the evaluation of regional NRM across the savannas highlighted that many stakeholders are sceptical of the value of existing reporting arrangements there is general agreement that a reporting process to review agreed NRM decisions is critical to encourage collaborative learning and improved NRM (McDonald *et al.* 2005b). Transparent and participatory reporting processes can offer an important mechanism for stakeholders to contribute to reviewing the performance of NRM partnerships and delivery systems.

Conclusion

As regional NRM delivery shifts into the implementation and review stages of the adaptive management cycle, there is a need to design and support participatory approaches to integrate information and knowledge systems between NRM stakeholders and ensure community support for NRM decisions and investment. Country-based management offers an approach to support Indigenous and non-Indigenous partner efforts to negotiate measure, review and improve on their joint NRM partnership programs and activities.

Experiences from the efforts to design Country-based management for joint management of feral animals in Kakadu highlights that a collaborative approach to adaptive management needs to accommodate different perspectives about what constitutes a ‘healthy landscape’, what activities are needed to achieve this landscape condition, and also judgements of partnership performance. Such processes should encourage NRM partners to learn from their own and each other’s experience, adapt responses and partnerships based on knowledge gained, and utilise evaluations for continual improvement of NRM management activities and approaches.

The objectives and steps of Country-based management might offer some useful approaches for regional body and other NRM stakeholder efforts to engage Indigenous people in the each step of the adaptive management cycle that characterises regional NRM delivery. Experiences from regional NRM delivery across Northern Australia highlight that it is not a simple task to design and activate processes which enable all stakeholders to learn from experiences to create and refine partnerships, adapt responses to problems using knowledge gained, and continue to improve regional NRM delivery performance. Country-based management opens up flexible and responsible objectives and partnership arrangements that enable Indigenous people to be involved in improving the health of Country and building healthy partnerships as experience and trust grows.

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8 Evaluating Outcomes: Regional investment in weeds management in the savannas ¹⁷

Jenny Bellamy, Dan Metcalfe and Nigel Weston

Introduction

Invasive plant species (weeds) are recognised as one of the most serious threats to northern Australia's primary production, biodiversity conservation and cultural values. Weeds are plants that have entered Australia or a region from elsewhere and which now have detrimental effects on economic, social and environmental values in a wide range of situations and ecosystems (ARMCANZ *et al.* 1999). They have the potential to reduce farm and forest productivity and profitability, alter ecosystem function and displace native species and significantly threaten the long term sustainability of all agricultural and natural resources, including the loss of biodiversity (e.g. Australian Biosecurity Group 2005; Groves *et al.* 2005; Sinden 2004). Weed management therefore is an essential and integral part of sustainable resource use and management. Moreover new weed related problems are continually emerging that require an adaptive response.

Preventing or controlling the introduction and spread of weeds and other biological threats to biodiversity is one of the areas of activity that define the scope of the Australian Government's (AG) Natural Heritage Trust (NHT) investment. Substantial public and private investments are being made through this framework to protect and improve the natural resource base and valued assets from a range of threats including weeds. The likely outcomes of this investment and its effectiveness in achieving change in the threats posed are yet to be assessed. Moreover, there are particular challenges in assessing weeds outcomes in the northern Australian context of long timeframes for responses, large regional size, high regional variability, low population base and multi-dimensionality of impact.

This case study focuses specifically on the tropical savanna areas and draws on recent research underpinning a national evaluation of the Australian Government's (AG) investments through the NHT regional delivery model (i.e. NHT2) (see Bellamy *et al.* 2005). This work was undertaken in collaboration with regional natural resource management (NRM) bodies in four NHT regions in northern Australia (Northern Territory, Northern Gulf, Desert Channels, and Wet Tropics). Specifically it aims to:

- Develop a practical framework for assessing the likely effectiveness of regional investment in weeds outcomes that has relevance to a range of other NRM outcomes; and
- Contribute to an improved understanding of the issues underpinning the effectiveness of regional investments in weeds outcomes in northern Australia.

Objectives

Regional investments under the NHT2 delivery model are made on basis of an accredited, integrated regional NRM plan and a regional investment strategy (RIS) developed by a region

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¹⁷ This case study was undertaken by Jenny Bellamy (currently University of Queensland and formerly CSIRO Sustainable Ecosystems), Dan Metcalfe (Weeds CRC/CSIRO Sustainable Ecosystems, Atherton) and Nigel Weston (formerly Rainforest CRC, Cairns).

through a partnership approach. Institutional arrangements relevant to regional NRM planning and in particular for weed management vary significantly across state and territory jurisdictions, for example in relation to:

- Implementation of NHT2 (e.g. content and timing of NHT2 agreements)
- The legacy of pre-existing regional NRM institutional context (e.g. degree of devolution and level of development of regional approaches across the different Australian jurisdictions)
- Weed management arrangements (e.g. roles and responsibilities of multiple players/bodies).

In this context, this case study explores four key questions:

1. How to evaluate the multi-dimensional outcomes of investment in regional weed management that can support a practical and adaptive approach in the savanna regions?
2. How are weeds being addressed in regional NRM plans and investment strategies in northern Australia?
3. What is the likely impact of the regional NRM investment approach on opportunities and challenges for achieving regional weeds outcomes?
4. Are there some examples of innovative approaches to achieving weed outcomes through regional investment in savanna regions of interest to other regions?

Approach

This case study focuses on the Australian Government's investments through NHT2 in weed-related activities only involved (see Bellamy *et al.* 2005 for more details):

- i. **Savanna Overview** – focussing on seven northern Australian savanna regions with an accredited regional NRM plan under the NHT as at July 2005 (i.e. Northern Territory, Northern Gulf, Southern Gulf, Desert Channels, Burdekin Dry Tropics, the Fitzroy and the Wet Tropics. This overview involved:
 - A rapid desk top review of relevant regional NRM plans; and
 - An overview of institutional arrangements by state/territory specifically for (a) weeds management and (b) regional NRM.
- ii. **Regional Case studies** – a more detail assessment of the effectiveness of these investments for four selected NRM planning regions in northern Australia (i.e. Northern Gulf, Desert Channels, Northern Territory and the Wet Tropics NHT regions). The case studies involved personnel from the regional bodies in each of the NHT regions and were based on:
 - A more detailed desk top review of NRM plans and Regional Investment Strategies (RIS) and related documents supported by interviews and interactions with regional body members as well as assessment by regionally-based weed experts from the Weeds CRC;
 - An assessment of summary data provided by DEH/AFFA on funded weed-related activities/projects

Notably, weeds outcomes of regional investments may be either:

- a primary objective of targets, management actions and investments through regional NRM plans and strategies (e.g. on-ground action for weed control and management) or,
- a secondary objective of targets, management actions and investments (e.g. protecting native vegetation or restoring biodiversity function, maintaining or restoring cultural value, or removal of barriers to fish movement).

Key Findings

Evaluating the likely outcomes of investment in regional weeds management in the savanna regions?

A practical framework for evaluating the multi-dimensional outcomes of the regional approach to investment in weed management that can support an adaptive approach was applied to the four regional case studies. There are eight key elements of this framework:

- i. How weeds are viewed as a problem or threat to the region in the regional NRM plan and investment strategy. For example:
 - Is the scope of recognition of the threat from weeds to regional assets (e.g. to the value of biodiversity conservation, sustainable agriculture, healthy waterways, and cultural assets) comprehensive and why?
 - Are both agricultural and environmental weeds considered and why?
- ii. The scope of weed management intent of the regional plan and investment strategy (i.e. as identified in RCTs, MATs, MAs)? For example:
 - To what extent are local priorities versus national or state priorities for weeds management being addressed and why? Is the regional approach ‘value adding’ to national/state priorities and targets?
 - What is the degree of recognition of matters of environmental significance in the approach to achieving weeds outcomes?
 - Are others’ roles and responsibilities for weed management within a region recognised and to what degree does the regional approach complement or value add to these?
- iii. The ‘on-ground’ strategy for prioritising weed-related investments:
 - Is the weed investment prioritisation approach species-based, ecosystem/prioritised landscape-based, or zonal/subregional or a combination of these? Why?
 - Does this strategy address the major pathways of weeds diffusion/spread?
 - Relevance of ‘on-ground’ strategy in contributing to a reduction in the major threats posed by weeds to the value of regional assets as identified in the plan?
- iv. The focus of ‘on-ground’ weed management investment in practice:
 - Is the scope of the types of investment in weeds management sufficiently comprehensive (i.e. on-ground works, resource assessment, planning or capacity building)?

- What is the strategy for on-ground weed management –is it focused on control, containment, eradication or prevention or a mix and why?
 - Is the regional investment in weed management strategic (versus targeted control) - does it contribute to prevention/early response (versus cure)?
- v. The regional funding and leverage patterns for weeds management:
- How does the regional investment in weeds outcomes fit in the bigger picture of overall investment for weed management in the region?
 - Will it add value to or complement other investments in weeds management?
 - Is it addressing gaps in weed management within the region?
 - Is it leveraging additional funding for regional weeds outcomes?
- vi. Cross-regional and/or cross-jurisdictional linkages in relation to weeds management:
- Is it contributing to the development and implementation of regional weeds strategies or strategic pest management plans?
 - Are linkages or coordination with other regional planning initiatives relevant to weeds management across borders/jurisdictions adequate to ensure that pathways of weed diffusion/spread are addressed?
- vii. Regional investment in monitoring, evaluation and reporting (MER) for weed management in practice:
- What is the role of regional investment in MER for weeds management?
 - How does it fit into the overall regional approach to M&E of weed management?
 - Does it contribute to enhancing the knowledge base suitable for an adaptive approach to the regional management of weeds?
 - Does it contribute to the integration of M&E outcomes into decision-making on weeds management in the region?
- viii. Likely effectiveness and achievement of planned weeds outcomes:
- What is the focus of the regional investment approach to weed management:
 - On enabling outcomes (e.g. enhanced social capital and regional institutional capacity for addressing weed problems in a more effective, knowledgeable and strategic that reduce potential threats posed by weeds)?
 - On specific improvements in resource condition (e.g. reduced distribution and abundance of invasive plant species through on-ground weed control and management in targeted areas)?
 - Will the investments address the strategic risks and barriers that might influence the effectiveness of pathways of weed diffusion?
 - Are factors/risks which may undermine regional investments in weed management (or alternatively may mobilise action in regional communities) being recognised and addressed?

How are weeds being addressed in regional NRM plans and investment strategies in northern Australia?

Overall, there is a greater emphasis placed on weed-related activities and weeds outcomes in northern Australia NRM regional investment strategies and other NHT2 regional investment streams than is the case for those for southern regions of Australia. For example (see Bellamy *et al.* 2005):

- All of the seven savanna NHT regions with an accredited regional NRM plan have a primary commitment to weeds-related targets and actions (that is all savanna regions have weeds embedded in at least one RCT of their accredited plan which contrasts with only 72% (i.e. 32) of the southern regions.)
- In terms of a primary commitments to national priorities and targets (e.g. Weeds of National Significance or WONS)), 33% of savanna regions have a primary commitment (i.e. WONS are specifically identified in RCTs or MATs of the regional plan) which contrasts with only 14% of the southern regions.
- Savanna regions have a relatively high regional NRM investment in weeds outcomes. The Desert Channels is currently investing over 20%, the Wet Tropics over 11% and the Northern Territory about 7% of their current regional funding allocation in activities where weeds are the primary purpose. Nationally, these are exceptions and contrast sharply with other regions across Australia where overall weeds as either a primary or even a secondary objective are not a major focus of regional budget allocations.

Based on the four detailed savanna case studies (Northern Territory, Northern Gulf, Desert Channels, Wet Tropics), approaches to savannas weed management through regional investment are examined below using the framework identified previously.

a. Weeds as threats to the value of savanna assets

Fifteen of the twenty national priority weed species (i.e. WONS) are recognised as a threat to savanna assets (i.e. hymenachne, lantana, parkinsonia, mesquite, mimosa, prickly acacia, rubber vine, parthenium, bitou bush, bridal creeper, pond apple, salvinia, athel pine, cabomba and alligator weed). In addition, a significant range of regionally significant or state declared weeds are also recognised as well as some weeds of particular local concern. In the four savanna regional NRM plans and investment strategies, these weeds are recognised as threats to the value of:

- Biodiversity (e.g. displacement of native vegetation and inhibiting regeneration; impacts on conservation effects such as species composition and richness and impacts on amenity value);
- Agricultural production (e.g. reduced pasture productivity from soil acidification or alteration of nutrient recycling patterns, toxic affects on stock, interference with operations, impacts on market access due to contamination, increased costs of control, and increased risk of fire); and
- Healthy waterways (e.g. impacts on riparian vegetation, water quality for aquatic organisms and domestic use, infrastructure, visual amenity).

However only the Wet Tropics NRM plan explicitly recognises weeds as a threat to the value of cultural assets (i.e. as an impact on species of cultural significance and on values of landscapes or sites of cultural significance).

Both agricultural and environmental weeds are recognised across the savannas as having significant effects on regional income streams. The ongoing threat of new introductions of weeds are commonly recognised from adjacent regions as well as overseas and through the agricultural and garden/nursery industries. Many weeds however are seen as indicators of pastoral land management issues – which raises the management question of whether ‘the weed’ is the problem per se or an artefact of poor land management.

b. Weed management intent of NRM plans and investment strategies

The four regional strategies are dominantly investing in achieving a more strategically planned and more coherent approach to regional weeds management that incorporates national weeds management initiatives (e.g. for the containment of prickly acacia, rubber vine and parthenium) and existing local government initiatives within and between NRM regions. These investments involve extensive and ambitious containment and control targets through a suite of diverse commitments to activities including:

- on-ground weed control activities;
- some mapping or resource assessment of weed distribution and abundance;
- management actions for regional capacity building and/or the development/communication of best practice guidelines; and
- actions related to coordinating/enhancing existing weeds management approaches or initiating integrated regional pest management planning.

The Wet Tropics is one of only two NRM regional plans across Australia with weed-related targets or actions for addressing weed impacts on cultural assets and it is the only one in the savanna region. Differences in approaches across the savannas reflect also historical legacies with both Desert Channels and the Wet Tropics having existing high quality and strategic regional collaborations for pest management, in contrast to the Northern Gulf and the Northern Territory who are investing in fostering their initiation.

c. Dominant ‘On-ground’ strategies for prioritising weed investments

The three larger regions (Desert Channels, Northern Gulf and Northern Territory) are taking a predominantly species-based approach to prioritising weed investments (that is RCTs and/or MATs have a primary focus on named weeds such as the 20 WONS, declared weeds, regional environmental weeds of significance, etc.). This approach in part reflects the existence of significant investments in containment lines for major national threatening weed species (e.g. prickly acacia, rubber vine and parthenium) and that these regions cover enormous areas with only small rural populations and limited resources. In contrast, the Wet Tropics NRM region is adopting a dominantly prioritised landscape-based approach (i.e. RCTs and/or MATs with a primary focus on weed management in focussed or priority areas of the landscape). This latter approach addresses weeds in conjunction with other regional resource management issues versus treating weeds as an isolated issue on its own and emphasises the need to address threatening processes and looking after the future of the land after weed control.

d. Management focus of investment in practice (tactical to strategic scale)

Prevention or early intervention are recognised as the most cost effective techniques for addressing invasive weeds (e.g. ARMCANZ *et al.* 1999). On-ground strategies from more tactical (control or containment) to more strategic (eradication or prevention) are:

Control	Reduction in the local distribution, abundance, vigour or fecundity of an established weed, may include complete removal of a weed from a small (e.g. riparian zone or property-scale) area
Containment	Activities limiting an established weed's distribution to within described boundaries
Eradication	Complete removal of a weed from a substantive area, including of viable propagules as well as of existing vegetative stages, such that re-infestation cannot occur from that population or metapopulation
Prevention	Inhibition of new infestations of a weed of known distribution into a defined area or within a defined time period (e.g. wash down facilities, fencing cattle from sensitive areas)

Eradication is an unlikely outcome for most weed species in the savannas given the enormity of the scale of existing weed problems. Containment is a major on-ground weed management strategy in three of the case study savanna regions which is in contrast with the most common approach across Australia of control and prevention. The dominant on-ground management focus of regional investment in both the Desert Channels and the Northern Territory is containment of priority species with a secondary focus on the prevention of spread of new invasions. The Wet Tropics focuses also on prevention of ingress of new species but it is also investing in control and eradication of some high profile declared weeds. In contrast, the Northern Gulf is taking a more tactical but community-based approach with a primary focus on strategic weed control (e.g. managing groundcover to limit weed infestations through building fuel loads and maintaining a competitive sward) and a secondary focus on containment (e.g. preventing weed seed spread through wash-down facilities).

e. Regional Funding and leverage patterns

In the tropical savannas, weeds are a relatively major focus of regional NHT investments compared with other areas of Australia. Importantly that investment is being used to lever additional funding for weeds management from a range of other funding sources. However, the major focus of this regional investment and related leveraged funding is predominantly for existing weeds issues through containment or prevention of spread as well as focussed weed control activities. Emerging weeds however are significantly under-resourced and risk becoming serious problems before being funded

f. Cross Regional and Cross-jurisdictional linkages

Of critical importance for regional weeds outcomes in the savannas are the linkages between regional investment and local government through regional pest management planning. The development of regional weeds strategies or regional strategic pest management planning is a clear commitment in the Desert Channels and Northern Territory regional NRM plans, and its a key management target for the Northern Gulf and Wet Tropics regions (where regional pest management strategies already exist) through collaboration with local government. Planned regional investments (except in the NT case) are also supporting a more coordinated and strategic response to weed management between regions. The NT NRM region, however, is investing in a project to evaluate joint-management approaches for weeds across tenures which is a critical issue for the savannas. Notwithstanding these investments, an emerging issue is the apparent lack of regional collaboration between weeds and feral animal management, which have significant potential to support each other particularly in remote areas.

g. Weeds Monitoring and Evaluation

The monitoring of weed distribution is seen to be largely the responsibility of the state/territory governments, though with very little core funding in place for monitoring, it is predominantly opportunistic. Systematic or strategic monitoring of weed problems in savanna regional NRM plans and investment strategies is generally lacking, the exception being in the Northern Gulf region with its community-based satellite-based weed mapping activities (see (iv) below). Notwithstanding key emerging issues for M&E of weeds and their management in the savannas are:

- Common gaps exist in knowledge of the threats posed by weeds at a decision-making level suitable for prioritising and supporting on-ground management actions within a region.
- The loss of key technical skills/knowledge emerging for weed identification and for change in weed infestation accompanying the reduction in permanent staff on many stations and a growing dependence on contract staff who may change from year to year and generally lack the local knowledge to monitor weeds or detect new incursions.
- The common lack of regional capacity (funding, human resources, skills / knowledge) for early detection of weed problems; and
- A lack of a capacity for an adaptive approach to regional weeds management due to a largely ad hoc or non-existent approach to M&E.

What is the likely impact of the AG's regional NRM investment approach on opportunities and challenges for achieving regional weeds outcomes?

Weeds are clearly a regionally significant and widely distributed threat in the tropical savannas. Most weeds of significance have social, agricultural and economic impacts in addition to their environmental threats. Planned regional investments through NHT2 in the savannas have the potential to make a huge difference in terms of weed management, in particular supporting a change to a more strategic and coordinated regional approach and the initiation of much on-ground work. One suggestion is that an important difference under NHT2 is that applications can be made by a central body, which has been much more successful than having to depend on the community in a disadvantaged region (e.g. large size, small population, major weeds issues) to make cogent applications individually. The result has been a 'late start' in a number of key weed management areas, so the likely outcomes of the last three years' funding are not fully apparent.

The challenges and opportunities for weeds management are not uniform across Australia or for savanna regions. Regional context is all important and, significantly, NHT2 regional delivery is not a system operating in isolation because:

- It is an integral part of the regional NRM governance system that has evolved in a region over a long time frame involving all three spheres of government.
- It is only one of several AG/federal government investment mechanisms of relevance to weeds management. For example, other AG investment mechanisms include: Envirofund (local/community component of NHT2); the community support component of the National Landcare Program (NLP); WONS initiatives; the National Weeds Program (originally under NHT1); and more recently the Defeating the Weeds Menace initiative and the National Water Fund.

- There is a diverse range of other investment mechanisms relevant to weeds management operating in any region, the most important being state and local government agency activities and also research bodies (such as CRCs).

As such, the way in which a regional NRM planning approach for weeds management recognises this and fits strategically into the regional context is critical for achieving weeds outcomes. It is not surprising therefore that to-date regional investments in invasive weeds are predominantly focusing on ‘enabling’ outcomes (e.g. enhancing social capital and regional institutional capacity to manage weeds) and only to a minor extent on resource condition outcomes per se (e.g. reduced distribution and abundance of weeds).

In sum, the key *likely* weed-related outcomes in the savannas from the Australian Government’s regional investments under NHT2 are regional specific but include:

- Contributions to a more strategic and regionally coordinated approach and alignment of priorities on weeds management both in terms of on-ground actions and data collection/sharing;
- Contributions to the development of a more strategic framework for guiding regional investment in weeds outcomes;
- Increased collaborative efforts on weeds management between neighbouring regional bodies as well as enhanced intra-regional partnerships;
- Increased community capacity for on-ground control/mitigation works and monitoring of weeds in savanna regions;
- Increased community involvement in weeds management including monitoring and control activities;
- Leveraging of considerable support from landholders in the savannas for weeds management; and
- A potential reduction in the current abundance and/or extent of weeds of some high regional profile.

Although regional investment in weeds outcomes is not the sole solution to the threats posed by weeds, it has the potential to be a vital part of the solution. The degree to which these likely weeds outcomes will be achieved through regional NHT investment is largely dependent on a number of region-specific factors including:

- The priority that weeds have relative to other NRM issues and threats in the region.
- The perceptions that the regional body and key stakeholders have of the role and responsibilities of other agencies in the management of weeds (e.g. in Northern Gulf region some conflicting views exist with some perceiving weed management as a government responsibility, whilst others seeing themselves as ‘grass farmers’ who harvest with cattle, so take responsibility for weed management upon themselves); and
- The extent to which a number of emerging issues or risks that threaten the likely outcomes are addressed, including:
 - Lack of resources and technical capacity to adequately manage the enormous existing weed presence (may lead to a worsening situation);

- Gaps in regional understanding of the threats posed by weeds and the required actions needed to support investment decision-making and strategic targeting of on-ground activities at the regional level;
- The potential for the impact of some key projects to fail to be realised due to the apparently low value placed on follow-up works over the potential lifetime of seeds in the seedbank, and very limited resourcing for lead time to permit planning rather than action;
- In terms of gaps in investment, newly emerging or sleeper weeds are under-resourced with slow responses from State and National levels exacerbating potential problems, and risk becoming a serious problem before being adequately addressed;
- A legacy of the complex and evolving arrangements for weed control and management across jurisdictions is confusion and lack of clarity of roles and responsibilities on weeds within a region. This includes the limited collaboration between weeds and feral animal management which may lead to duplication of effort or oversight of linked areas;
- Disagreements over the relative significance of some weed species (e.g. national versus state or local priorities, and agricultural versus environmental weeds) may lead to those species becoming a greater problem to deal with in the future than would currently be the case;
- Regions geographically outside key nationally recognised containment zones for specific weed species (e.g. WONS) being unable to source funding to address these threats to a region, which risks increased levels of infestation and failure to take early intervention (e.g. in Northern Gulf);
- Failure to identify either weeds of cultural significance or of concern to regional indigenous value may lead to lack of recognition for their management in regional NRM investment strategies; and
- Failure to address the garden sector as the major source of many introduced plants that may become naturalized and pose significant threats to regional assets.

Innovative approaches to achieving weed outcomes through regional investment in savanna regions

Some examples of innovative approaches to achieving weed outcomes through regional investment in the savanna regions relate to practical regional weed containment strategies, community-based monitoring and evaluation, coordination of integrated regional pest management and incorporating threats to cultural assets in NRM planning. They are summarised in the table below and see Bellamy et al. 2005 for more detailed information.

<p>Weed containment strategies at a regional scale</p>	<p>Strategic wash-down facility (Northern Gulf Region)</p> <p>Aims to strategically reduce the incidence of new weed infestation sites, and minimise the introduction of new species through the installation of washdown and interpretative facilities that highlight weed seed spread along key highways in the region. It focuses also on improving community and visitor awareness and responsibility for preventing weed transfer both within and between regions by informing people about threatening weeds, vectors of travel, and methods of mitigation for service providers, community, tourists, and industry organisations.</p> <p>Integration of the biological Control of <i>Mimosa pigra</i> with other control options (Northern Territory region)</p> <p>Extends current research on biological control of mimosa aimed at limiting spread by reducing seed production and reducing impacts by decreasing the plant's ability to compete with existing vegetation to its integrated implementation on-ground. The emphasis of integrated management work ranges from developing integrated control techniques to the wise use of wetlands to manage reinvasion following clearance of dense mimosa stands.</p>
<p>Community-based M&E of weeds</p>	<p>Satellite Mapping (Northern Gulf Region)</p> <p>Problems exist in the savannas with early identification of new weed infestations associated with a reduction in permanent staff on many stations, and a growing dependence on contract staff for mustering who may differ from year to year and so not notice changes in land condition. This initiative uses detailed satellite imagery in partnership with land managers to benchmark the current state of the landscape for future monitoring of land condition and trend. Land managers develop GIS maps of their properties, and are encouraged to regularly update weeds information using a GPS handset. Interpretation of high resolution satellite imagery also aids remote monitoring of weed infestations.</p>
<p>Integrated Regional Coordination of pest management</p>	<p>Cross Catchments Weeds and Feral Animal Initiative (Desert Channels)</p> <p>Coordination of stakeholder collaboration and cooperation for the strategic and integrated management of weeds and feral animals including improve existing spatial data on distribution and abundance of pest plants and feral animals to underpin strategic planning and implementation at all levels (property to regional)</p>
<p>Addressing Weeds Threats to Cultural Assets in Regional NRM Planning</p>	<p>Aboriginal Cultural & Natural Resource Management Plan (Wet Tropics)</p> <p>This plan developed in May 2005 identifies weeds as a cultural issue, and highlights the different values that Aboriginal people may use to determine the significance of a particular weed species and recognises the need to incorporate these values and priorities in pest management and catchment planning. The plan facilitated the development of a Resource Condition Target in the Wet Tropics NRM plan addressing the impact of weeds and pests on Aboriginal cultural values and assets..</p>

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9 Regional investment patterns and trends in NRM

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Introduction

Since the late 1990s, the Commonwealth and State governments have increasingly devolved natural resource management (NRM) responsibilities to regional NRM bodies (Roth 2002). This move towards regional planning aims to adopt a more holistic and integrated social, economic and environmental governance approach. It seeks to involve communities and regions in the planning process in order to harness the capacity of those closest to problems on the ground (RIWG 2005; McAlpine *et al* in press). Under this regional delivery model, investment is made on the basis of accredited regional NRM plans and Regional Investment Strategies (RISs), driven by two funding programs; the National Action Plan for Salinity and Water Quality (NAP) and Natural Heritage Trust Extension (NHT2). To date, the Australian Government has committed an investment of \$4.4 billion over eight years via these two funding programs (Australian Government 2005).

RISs are a new way of investing in NRM outcomes. They are business plans which are being used to attract and guide investment in the regional NRM plans. They set the investment priorities in NRM by providing details of the specific actions, costs and timeframes that area required to implement a regional NRM plan and achieve targets (Queensland Government 2006). RISs have been developed by regional community-lead bodies and their stakeholders in accordance with strict Commonwealth and State government criteria and guidelines.

This case study evaluates the proposed NHT and NAP investment in the Northern Territory and in Queensland's 14 NRM regions for the 2004 to 2007 funding period. Most of these NRM regions now have accredited NRM plans and RISs. However, it is important to note that it is only early days of implementation and the Northern Territory and Queensland's regional bodies are at very different stages of maturity. Whilst some are already in their second year of implementation (e.g. the Queensland Murray Darling Committee had their NRM plan accredited in July 2004), the Cape York NRM region is still awaiting accreditation of both its NRM plans and RIS¹⁸. The NRM plan and RIS of the Northern Territory were accredited in May and June 2005 respectively.

Objectives

This case study analyses indicative funding as proposed in the RISs of Queensland's and the Northern Territory's regional NRM bodies. The primary objective of this analysis is to gain a critical understanding of the income and expenditure patterns and trends of NRM investment in Queensland and the Northern Territory. Since it is still early in the implementation process, it is difficult to assess whether any actual on-ground and resource condition outcomes have been achieved yet by the new regional delivery model.

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¹⁸ Since the time of writing, the Australian and Queensland Governments have announced funding for a NRM Strategy for the Cape York region.

Therefore, an analysis of indicative investment in the RISs is a useful indicator of anticipated outcomes on the ground. The specific aims of this case study are to:

- explore in which locations and in what sequence investment is planned;
- determine strategic intent (what kind of programs do regions spend their money on); and
- determine how government funding priorities are translated into resource condition outcomes.

Analysing and tracking some of the broader trends and patterns in proposed expenditure contributes to benchmarking progress against outcomes criteria in the broader project evaluation framework. This case study is a discrete piece of work that forms part of the Healthy Savanna Planning Systems project, a detailed evaluation of regional planning arrangements for natural resource management, which has been undertaken since late 2003 (see McDonald *et al.* 2005).

Approach and Caveats

This case study is based on a desktop review of RISs for the Northern Territory and Queensland's NRM regions. It is **not** an evaluation of government funding streams prior to the implementation of RISs (e.g. foundation funding, priority action funding) and it also does not include an analysis of other Commonwealth and State government funding sources (eg. National Landcare Program, Envirofund, etc.), which are available sources of income for regional bodies. The focus of this analysis is a desktop review of indicative funding as set out in the RISs of Queensland and the Northern Territory. The RISs were investigated for specific aspects of expenditure, including proposed expenditure in output categories, investment programs and proportion allocated to cover core operational costs.

There are some caveats to this study which need to be considered and could be addressed through further research. These caveats can broadly be divided into three types including:

a) Time based caveats

- For example, two of Queensland's regional bodies, NRM SEQ and SEQ WCG, merged into one regional group called 'SEQ Catchments' in early 2006. Before this merger, both groups had their individual 12 months accredited RIS. Now, they have a combined RIS with indicative funding for an 18 months investment period (January 2006 to June 2007). This changed investment period makes it impossible to compare SEQ Catchments with the RISs of the other regional bodies for this analysis.
- The regional body of the Northern Territory has undergone significant restructuring over the past twelve months. In December 2005, the Natural Resource Management Board (NRMB) for the Northern Territory was formally incorporated to take over responsibilities from the Landcare Council of the Northern Territory.

b) Definition based caveats

- Many regional bodies have recently redefined what constitutes 'on-ground works'. As part of NRM reforms in New South Wales, Catchment Management Authorities (the equivalent to regional bodies in Queensland) must direct 80% of funds to on-ground works at the time Catchment Action Plans are developed. In Queensland, several regional bodies have adopted the New South Wales

definition for on-ground works, which reflects a broader view of activities that have a direct and closely linked relationship to 'ground level' action (QMDC Inc 2005)

- Until now, reporting is only being undertaken for single attributes. Regional bodies are limited in the way they split the funding up amongst specific projects. This may lead to misrepresentations of where money is actually invested. It should also be noted that the Queensland State Government is currently putting procedures in place that will allow regional bodies to report for multiple outcomes.

c) *Financial data quality caveats*

- The analysis is only as good as the financial data it is based on. The desktop review found some inconsistencies in the RISs that could not be addressed.
- The format and structure of the RISs differ substantially between regions, making investment comparisons often difficult. For example, some RISs report their financial figures over a 27 month investment period (eg. South West NRM), whilst others report over a 36 months funding period (eg. Southern Gulf).
- The way in which indicative expenditure is reported varies from region to region. Whilst some regions report to distinct assets, such as biodiversity, weeds and salinity, others have very broad funding programs.

It is also important to point out that NHT and NAP funding obtained through the RISs is only part of the story. Regional bodies have access to a range of other funding sources for NRM projects. In fact, regional bodies are being encouraged to actively pursue other sources of funding and also rely on in-kind contributions.

Key Findings

Indicative funding in Queensland and the Northern Territory

An analysis of indicative funding in Queensland and the Northern Territory provides important information about the way available funding is split across the 15 NRM regions. This allows making some general statements about geographical NRM priorities within the northern part of Australia.

Total indicative funding for Queensland's NRM regions from 2004-05 to 2006-07 is \$146,600,000 (Queensland and Commonwealth Government 2005). Of this total amount, 74% has been allocated to NAP/NHT regions, while 26% has been assigned to solely NHT funded regions. In the Northern Territory, the total amount of proposed investment is \$20,958,000 for the same time period, 93% being NHT funding and 7% being NAP funding (SKM 2005). Figure 1 shows the amount of indicative funding that has been allocated for each NAP/NHT and NHT region in Queensland and the Northern Territory.

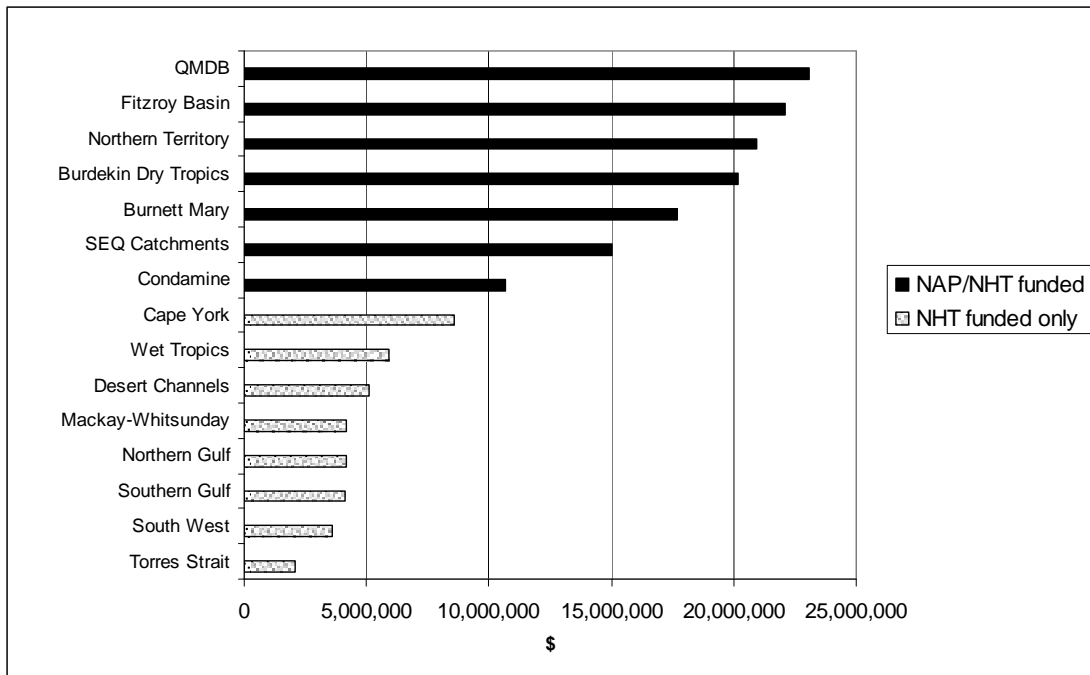


Figure 1. Indicative funding for the Northern Territory and Queensland's NRM regions 2004-05 to 2006-07

(Adapted from Queensland and Commonwealth Government 2005)

Regions that have received the largest amount of indicative funding include QMDB, Fitzroy, Northern Territory, Burdekin, Burnett Mary and SEQ Catchments. Interestingly, two regions in Queensland have been allocated more indicative funding than the whole of the Northern Territory. The allocation of indicative funding also shows that NAP/NHT regions are much better funded than only NHT funded regions. Figure 1 clearly shows the spatial trend of well-funded coastal and Reef catchment regions on the one hand, and 'funding deprived' remote rangelands regions in more central locations on the other hand.

Output categories

In 2003, the Monitoring and Evaluation Working Group of the Natural Resource Management Ministerial Council agreed to introduce a set of standard reporting categories for outputs from activities (Commonwealth of Australia 2005). Altogether, four types of output categories were identified that are meant to provide a meaningful description of the focus of activities supported through NAP and NHT investments. Regional bodies are required to assign one of these categories to each activity proposed for investment. Table 1 provides an overview of the output categories and a standard description of products and services purchased through activities.

Table 1. Overview of Output Categories

Output Category / Activity Type	Activities which:	Standard Outputs
Resource assessment	Inform capacity and decision making through applied science, data collection, analysis and modelling	<ul style="list-style-type: none"> • Baseline, trend and condition for targets • Decision support tools • Investigations (surveys, mapping and data analysis) • Research and development studies
Planning	Structures and sequence priorities and actions through plan development, using resource assessment data and minor studies, and expert and community inputs	<ul style="list-style-type: none"> • Improved practice codes or guidelines • Integrated catchment or sub-catchment plans • Property management plans • Species Recovery Plans
Capacity building	Develop people's decision making capabilities and motivate their involvement through the dissemination of information and knowledge to all levels	<ul style="list-style-type: none"> • Awareness raising activities • Facilitation, motivation and support activities • Skills and training activities
On-ground activities	Conduct works or actions to achieve resource condition outcomes	<ul style="list-style-type: none"> • Conservation by agreements • Indigenous vegetation protected by fencing • Revegetation with indigenous vegetation • Riparian and waterway health • Management of significant species or ecological communities • Significant pest control • Soil management

(Source: Commonwealth of Australia 2005)

In Queensland, the analysis of RISs found that the majority of proposed funding has been allocated to the output category 'on-ground activities'. 2 shows proposed expenditure according to output categories for a selection of Queensland's NRM regions for 2004-05. Evidently, the majority of proposed funding goes to on-ground works. This is particularly apparent for the Fitzroy Basin Association, which has allocated more than 60% of its available funding to on-ground work. The other regions have usually allocated half of their available funding to on-ground activities. 'Planning' usually receives the smallest amount of funding (approximately 10% of funding in each region), while funding for 'resource assessment' and 'capacity building' is more variable.

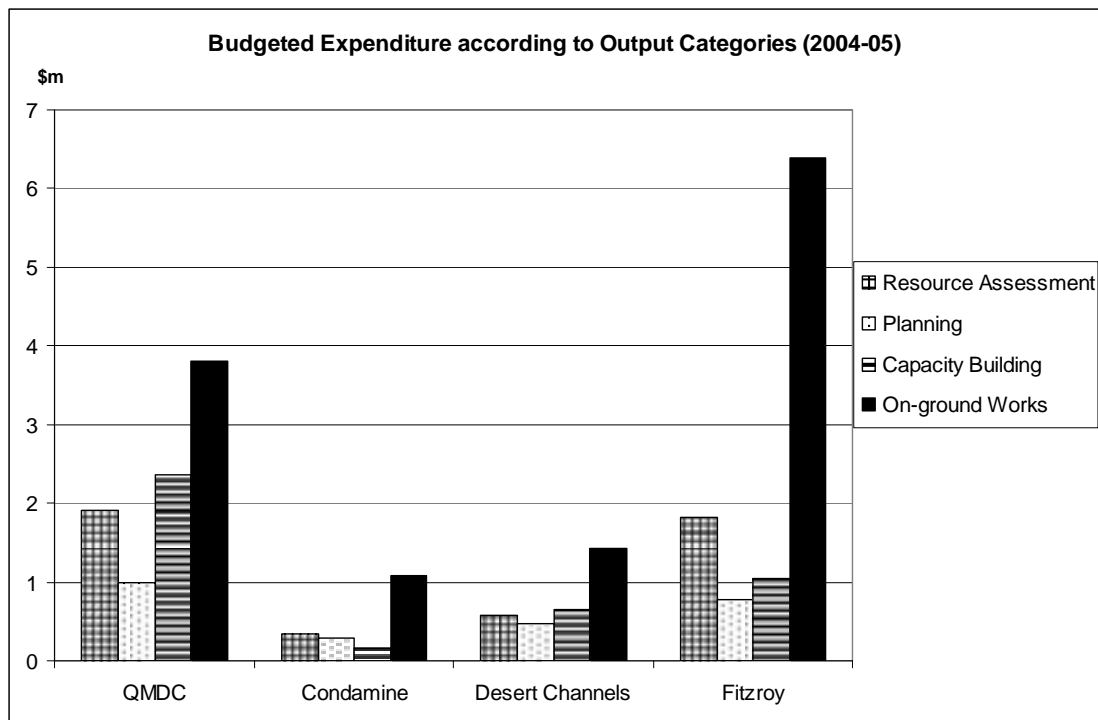


Figure 2. Proposed Expenditure according to Output Categories for selected QLD NRM regions (2004-05)

The RIS of the Northern Territory does not provide a breakdown of proposed expenditure to output categories for the year 2004-05. Instead, it offers figures on the proportion of investments allocated to each output category for the entire three year funding period. The breakdown of indicative funding to output categories has similarities to that of Queensland's NRM regions. The smallest amount of proposed funding goes to planning (9%), followed by resource assessment (19%) and capacity building (27%). On-ground works receives the largest amount of indicative funding (45%). However, this is a smaller proportion of funding going to on-ground works than what is given to that category in Queensland. Also, it is interesting to note that a greater proportion of indicative funding is directed towards capacity building in the Northern Territory than in Queensland.

Whilst Figure 2 above provides a snapshot of proposed funding according to output categories for 2004-05, it is also interesting to note the proportional change of funding over the three years of the investment period. Usually, indicative investment in the RIS initially focuses on promoting resource assessment, planning and capacity building, and then moves to on-ground activities at a later stage. An example of this proportional change of funding over the investment period can be observed for the Burnett Mary NRM region. Figure 3 shows a strong increase in investment in on-grounds works over the three years, which is apparently building on the initial planning and resource assessment focus.

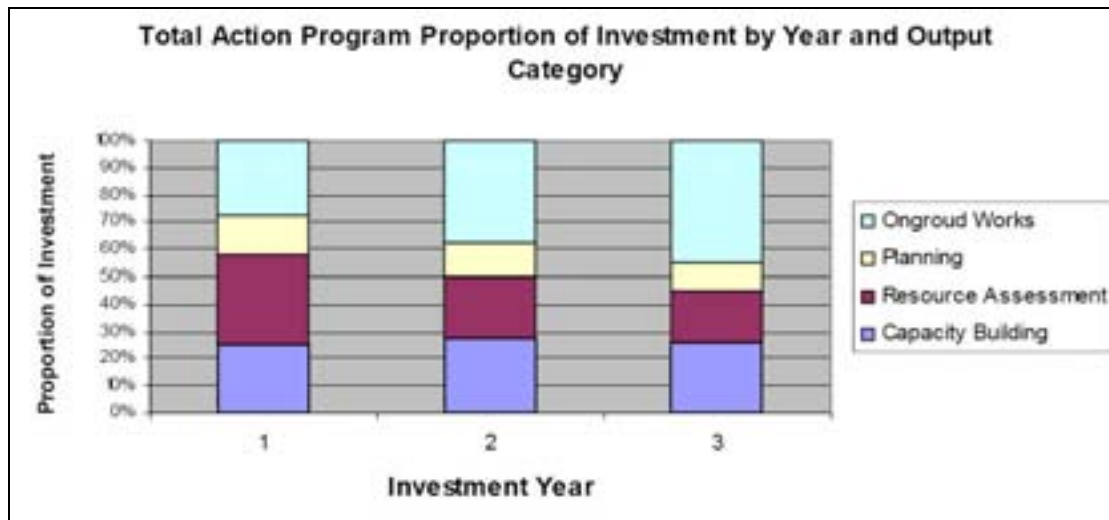


Figure 3. Trends in investment towards output category for the Burnett Mary NRM region

(Source: Burnett Mary Regional Group 2005)

Even though Figure 3 only shows the proportional change of funding over the three year RIS period for the Burnett Mary NRM region, it is generally representative for most NRM regions in Queensland and the Northern Territory. It is important to note that all output categories are important and have their own validity. Even though government agencies like to see a proportional increase of investment in ‘on-ground works’ activities over time, several reviews have shown that the other output categories are also necessary for the regional delivery model to work effectively. For example, a recent evaluation of regional planning arrangements by the Regional Implementation Working Group stated as a key recommendation that the Australian government should re-confirm their commitment to investment in capacity building’ (RIWG 2005: 29).

Figure 3 shows that investment into capacity building remains relatively constant through the three years for the Burnett Mary NRM region. As already discussed earlier, most NRM regions in Queensland and the Northern Territory invest a relatively large proportion of their available RIS funding for capacity building activities in order to raise public awareness of NRM issues. Interviews of regional body staff conducted in 2004 (the first year of the RIS period under investigation) showed that some NRM regions in Queensland started from a very low base of public awareness of NRM issues (McDonald *et al.* 2005). Regional bodies also reported that earlier capacity building efforts have increased awareness of NRM issues and have created a greater understanding of the region (McDonald *et al.* 2005).

Usually, in the first investment year, a greater proportion of proposed funding goes to planning activities since they support the development of regional NRM bodies, regional plans and investment strategies. A decline in investment for planning activities is apparent over the funding period.

Proposed investment into resource assessment activities follows a similar pathway. The main reason for this is that most regions initially have to overcome the lack of adequate information on natural resources. A recent study by McAlpine *et al.* (in press.) found that there are critical gaps in the resource condition information base in all of Queensland’s rangelands regions. The lack of an adequate information base was also one of the key challenges facing inland and reef catchment NRM regions, as identified by McDonald *et al.* (2005). This absence in adequate resource information requires most NRM regions to invest heavily in resource assessment in the earlier years of the funding period.

Focus of investment

Focus of regional investment is guided by desired National Natural Resource Outcomes and Matters for Targets, which were endorsed by the Natural Resource Management Ministerial Council in 2002 (NRM Ministerial Council 2003). They include NRM issues such as land salinity, soil condition, nutrients in aquatic environments and significant native species and ecological communities.

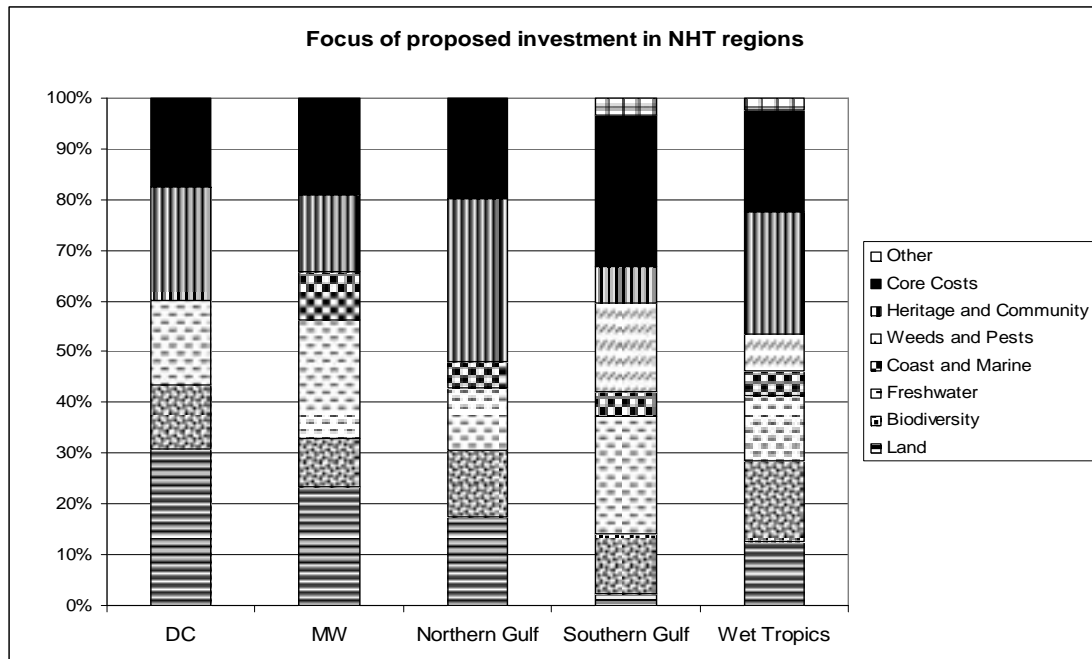


Figure 4. Focus of proposed investment in NHT regions (according to proposed expenditure in RISs from 2004 to 2007)

Figure 4 shows the focus of proposed investment in NHT-funded NRM regions for the three year RIS period. Overall, proposed expenditure across the various NRM issues is highly variable. While some regions propose to spend a large proportion of their funding for land-related activities (Desert Channels and Mackay Whitsunday), other regions intend to invest the largest part of their available funding in heritage and community programs¹⁹ (Northern Gulf and Wet Tropics). Proposed expenditure for biodiversity is relatively consistent across the NHT regions, with all regions intending to invest approximately 10% of available RIS funding for biodiversity outcomes.

Interestingly, quite a large proportion of proposed investment has been allocated to cover core costs. Core costs encompass the critical operating associated with running the organisation and the Board of Directors (e.g. Board meeting costs, rent, travel, insurance, etc.). Most regions have put aside at least AUD 400,000 annually for core operating costs. Since NHT regions receive substantially less funding than NAP/NHT regions, the proportion of core costs is therefore much higher.

¹⁹ Heritage and community programs refer to a range of activities that relate to the protection of cultural heritage, the improvement of Traditional Owner involvement in regional NRM issues, and the strengthening of community awareness and participation in regional NRM activities.

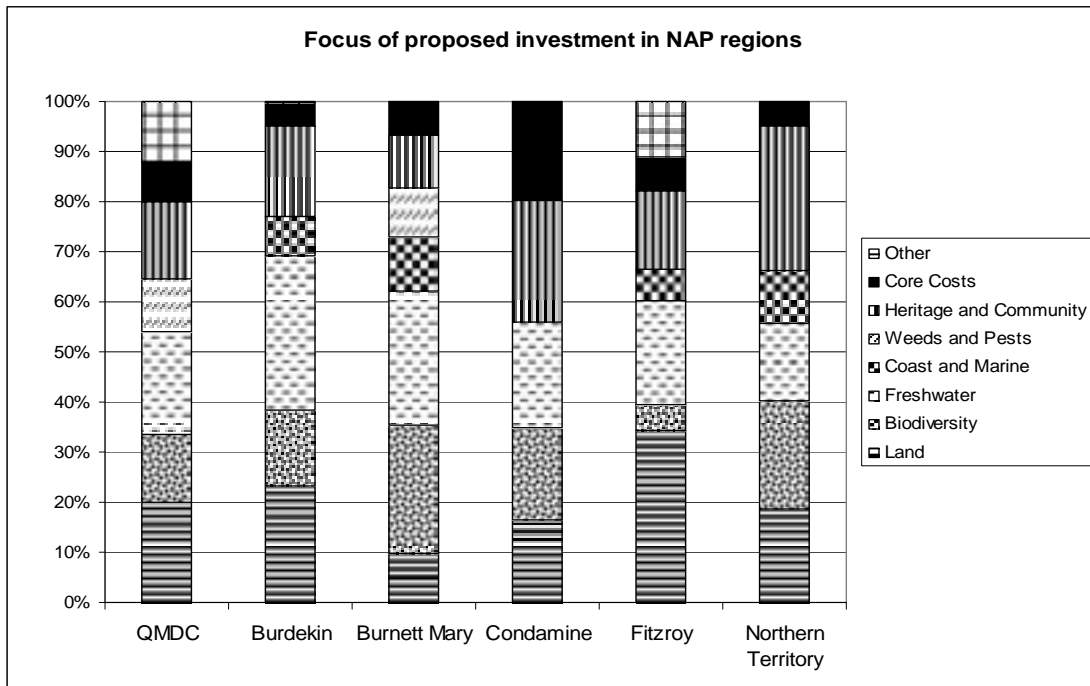


Figure 5. Focus of proposed investment in NAP/NHT regions (according to proposed expenditure in RIS from 2004 to 2007)

Figure 5 shows the focus of proposed investment in NAP/NHT-funded NRM regions for the three year funding period. Not surprisingly, all these regions indicate a large proportional expenditure for freshwater assets and land assets. This reflects the priority of the NAPSWQ in delivering improvements in the condition of soil and water resources. Furthermore, proposed spending on biodiversity outcomes is much more variable than for solely NHT funded regions, ranging from approximately 6% (Fitzroy) to 29% (Burnett Mary). Also, for most NAP/NHT regions, a smaller proportion of proposed investment has been allocated to cover core costs, which is related to the much larger amount of total RIS funding available to these regions.

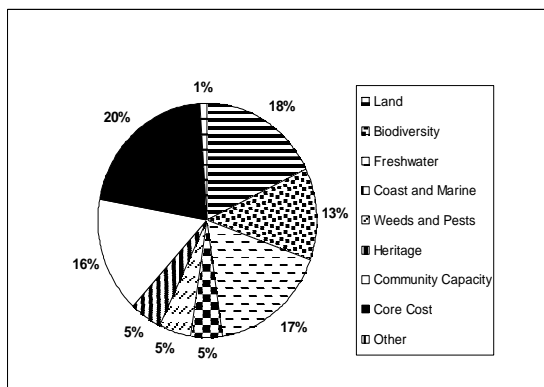


Figure 6. Focus of investment in NHT regions (according to proposed expenditure from 2004 to 2007)

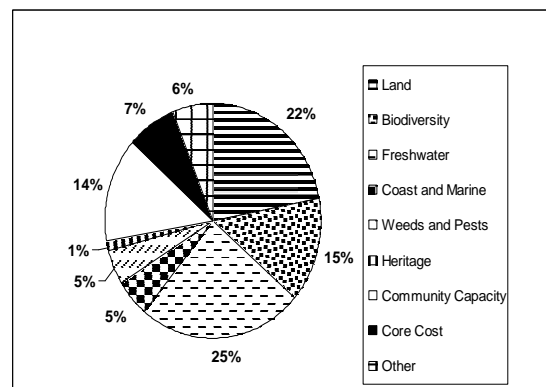


Figure 7. Focus of investment in NAP/NHT regions (according to proposed expenditure from 2004 to 2007)

NAP/NHT funded regions and solely NHT funded regions focus their proposed investment on similar issues, including the management of land, freshwater and biodiversity (see Figure 6 and Figure 7). However, the largest proportion of indicative funding in NAP/NHT regions goes to the management of freshwater (25%), whilst the largest proportion of funding in NHT regions has been allocated for the management of land (18%).

Proportional indicative expenditure for biodiversity, coasts and marine, and weeds and pests is fairly similar across all regions.

It is important to point out that NHT regions have allocated a greater proportion of indicative funding to heritage activities, which often focus on protecting Indigenous cultural heritage and engaging Indigenous communities in NRM (Desert Channels Inc 2004, Southern Gulf Catchments 2004). Figure 6 and Figure 7 also reconfirm that the proportion of indicative funding for core operational costs is much greater in NHT regions (20%) than in NAP/NHT regions (7%).

Conclusion

In conclusion, this RIS analysis has shown that there are interesting broader trends and patterns emerging in the way the Northern Territory's and Queensland's NRM bodies have allocated proposed expenditure over the three year funding period. First, there is a clear spatial divide between well-funded coastal and Reef catchment regions (NAP/NHT) on the one hand, and 'funding deprived' remote rangelands regions (solely NHT) in more central locations on the other hand. Since NHT regions receive substantially less funding than NAP/NHT regions, the relatively similar 'core operating costs' associated with running the organisation in NHT-only regions represent a much higher proportion of total expenditure than in the NAP regions, approximately 20% and 7% respectively.

Second, even though NAP/NHT and solely NHT funded regions spend their proposed investment on similar issues, their priorities lie in different areas. While NAP/NHT regions focus on the management of freshwater assets (25% of funds), NHT regions spend the largest proportion of their funding on the management of land assets (18% of funds). This may reflect the more natural state of northern rivers and a focus on protecting existing values related to water quality rather than on remediation.

Interestingly, NHT regions also tend to allocate a greater proportion of funding to cultural heritage outcomes, protecting Indigenous cultural heritage and engaging Indigenous communities in NRM. Biodiversity, not a traditional concern of most regional NRM groups unlike improving production or decreasing land degradation, attracts overall lesser funds, but also accounts for quite variable proportional investments across the regions.

Furthermore, the proportion of funding over the three years of the investment period changed from an initial focus on resource assessment, planning and capacity building, moving to on-ground activities at a later stage. Most regions show a strong increase in investment in on-grounds works over the three years to complement the early planning and resource assessment focus. This finding, however, is somewhat muddled due to a recent redefinition of what constitutes 'on-ground works' to reflect a broader view of activities that have a direct and closely linked relationship to 'ground level' action.

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