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Catchment-Scale Governance in Northern Australia: A Preliminary Evaluation

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Catchment-Scale Governance in Northern Australia: A Preliminary Evaluation

Abstract

Northern Australia covers vast and diverse landscapes comprising largely public and Indigenous tenures. Long-term Aboriginal and pastoral management, isolation and a challenging terrain and climate have shaped a landscape of national, if not international, conservation value. Northern Australia, however, also has a fragile economy, and there is tension amongst Indigenous, economic and conservation interests. Managed poorly, emerging conflicts could damage the real opportunities that each presents, resulting in major land and natural resource-use conflicts or unsustainable development. As healthy governance systems are the key to effective natural resource management (NRM), this paper presents a preliminary exploration of the health of NRM governance across Northern Australia, with a focus on the catchment scale. We analysed three focal catchments; the Fitzroy in the Kimberley region of Western Australia, the Daly in the top end of the Northern Territory and the Gilbert in north-western Queensland. We find that the governance of each catchment has different strengths and weaknesses depending on history and context. Common challenges, however, include shifting national and state/territory policy frameworks, fragmented funding of science and limited consensus building via spatial decision support. From this analysis, we explore potential reforms in catchment governance across this increasingly contested landscape.

Keywords

Northern Australia, governance systems, regional development, catchment management.

Cover Page Footnote

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Introduction

Northern Australia (Figure 1) is a massive area of approximately 2,773,000 km² across much of Queensland (Qld), the Northern Territory (NT) and Western Australia (WA). Several economic, environmental and social opportunities of national significance are emerging in these landscapes, including the empowerment of Indigenous communities, expansion in pastoral and agricultural industries, expanded mining, gas and urban development, a burgeoning conservation estate and new ecosystem service markets (JCU and CSIRO, 2013).

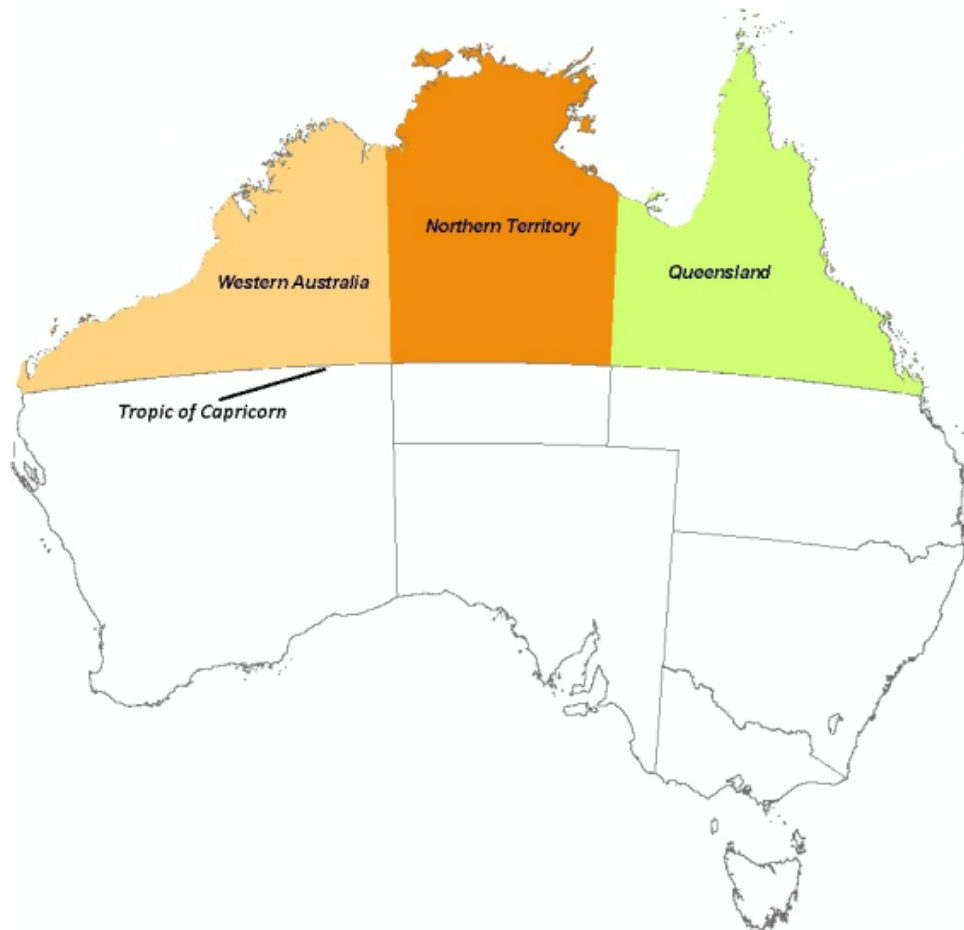


Figure 1: Northern Australia (Source: JCU and CSIRO, 2013).

The region is different from the developed south of Australia in that it is largely comprised of Indigenous and public good tenures compared with more extensive private ownership (JCU and CSIRO, 2013). More distant governments (versus local planning authorities), representing the wider Australian public interest, have also had higher levels of influence over decision making for land and water use. There has been limited localised consensus building, and combined with a challenging terrain and physical climate, the result has been a fragile economy, a threatened landscape of international conservation value and tensions between Indigenous, economic and conservation interests. Managed well via trade off analysis, the above interests and opportunities can complement each other, delivering the foundations for a vibrant and resilient economy and environment. Problems within the north's governance systems, however, could result in major resource use conflicts and unsustainable economic development.

The risk of poor landscape outcomes raises questions as to whether the current system of natural resource governance in northern Australia is up to the task of concurrently providing security for all competing interests *and* ensuring a prosperous and sustainable future. This paper explores this question and the potential for longer term governance reform that may deliver more balanced social, economic and environmental outcomes. While the opportunities for such reform are tangible, the governance of northern Australia's landscape is fragmented, involving multiple local councils and the WA, QLD and the NT Governments; all overlain by a broader Commonwealth jurisdiction (Dale, 2013a).

In this regard, we adopt Parker and Braithwaite's (2003, p. 119) societal-wide view of governance as the "intentional shaping of the flow of events so as to realise desired public good". This view sees governance as a systemic concept mediated by power relationships; various processes of bargaining and negotiation among differing interests in society leading to particular system outcomes (Dorcey, 1986; Emerson et al., 2011). Several authors (e.g. Folke et al., 2005; Paavola et al., 2009) have attempted to describe the dynamics of governance systems, often considering them to be framed by a range of linked governance themes, scales, domains and sub-domains. As such, governance is better considered a polycentric (not hierarchical) and fluid concept and outcomes from past poor decisions may challenge more enlightened governance in the future (Ostrom, 2008).

Consequently, the task of analysing governance across northern Australia is an extensive one; a job worthy of detailed analysis at a wide range of scales from the whole of northern Australia, to states/territories, regions, catchments, local governments, sub-catchments, communities, properties and even down to paddocks. Given the depth of analysis required, for the purposes of this paper, we have chosen to focus on the catchment-scale as it is the scale at which local and broader interests intersect and within which land and water issues can be considered jointly (Allan and Johnson, 1997). Catchments also tend to be the scale at which NRM issues intersect with wider economic and social agenda.

We also need, however, to consider the impact that governance at other scales has on catchments. Additionally, assessing governance across all northern Australian catchments would itself be a massive task, so we restrict our attention to three focus catchments; the Fitzroy (WA), the Daly (NT) and the Gilbert (Qld) (Figure 2). These focal catchments were selected because they all face potential conflict between irrigation, mining, pastoral, Indigenous and conservation needs *and* because they present opportunities for emerging ecosystem service markets that are now set to influence northern landscape management (CSIRO, 2012).

Method

To better define the context of catchment scale governance in the three focal catchments, we applied a systemic analysis framework developed by Dale, Vella and Pressey et al. (2012) and Dale, Vella and Potts (2013). This framework identifies structural and functional aspects at risk of failure within any governance system. Our team of fourteen was intentionally diverse, uniting eight researchers (including spatial analysts, governance specialists, social network analysts, geographers and biologists) and six practitioners (catchment planners, managers and NRM extension providers). All team members also had extensive practical experience in northern Australia. The team undertook the analysis through three one-week structured workshops over an 18 month period, interspersed with iterative writing and document review processes. This involved working through a three-step process as outlined below.

Step 1: Describing the System's Structural and Functional Characteristics

Dale et al. (2013) outline the need to explore the structural (vision and objective setting, research and assessment, strategy development, implementation and

monitoring, evaluation and review) and functional (decision capacity, connectivity and knowledge use) aspects of any governance system. Our first team workshop drew on the experience and knowledge of the team's members and the literature to populate a matrix describing the structural and functional aspects of governance for each catchment. All three matrices were refined in the following two team workshops and via out-of-session drafting. Applying this descriptive approach to key aspects of governance in the focal catchments set the foundations for the application of consistent evaluative principles in Step 2.

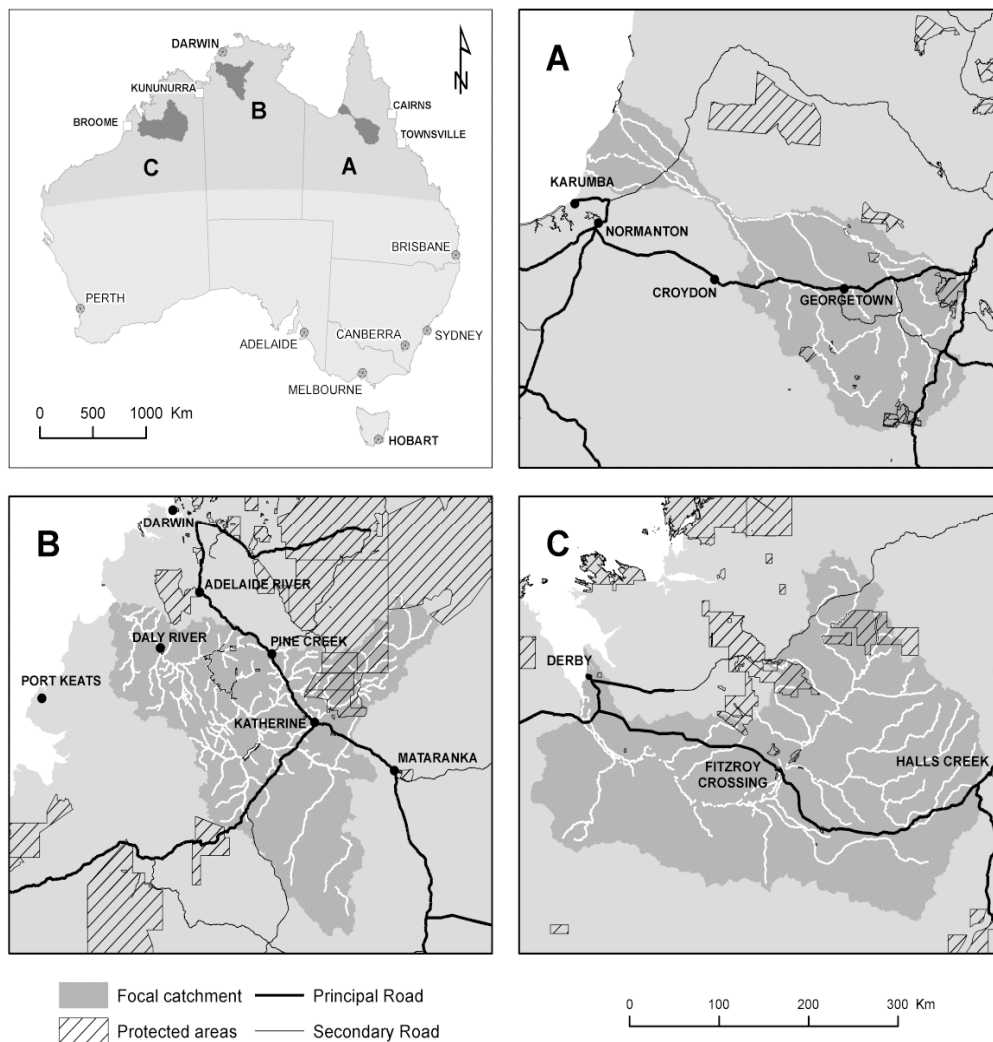


Figure 2: The three northern Australian focal catchments selected for governance analysis. A. Gilbert River, Qld; B. Daly River, NT; C. Fitzroy River, WA.

Step 2: Applying a Common Set of Evaluative Principles

Building on Step 1, the descriptive matrices were used to facilitate appraisal of the governance system of each catchment through the application of a robust set of core evaluative questions (consolidated from Dale et al., 2013). These evaluative questions were designed to explore the health of identified structural/ functional components of the system. The concept of governance health (Dale et al., 2012) is applied to describe the likelihood or otherwise of governance systems and their key components failing to deliver intended systems outcomes (e.g. biodiversity protection, water quality targets). The key guiding questions applied (Table 1) enabled a consistent analysis of structural and functional elements of the system.

Step 3: Building Recommendations as a Basis for Reform

Working through Steps 1 and 2 of this framework enabled the preliminary identification of potential strategic reforms with regard to the overall system of governance for catchment management in northern Australia. We did this through our diverse research team workshops, while also constantly referring back to the literature on the theory/practice of governance reform. In particular, major issues identified in Step 2 that were found to be consistent across the catchments were identified then the team explored potential solutions for improving catchment governance from the national to the local scales. The results emerging from the application of this final step constitute the discussion section of this paper.

Table 1: The matrix used to guide targeted analytical points of inquiry in focal catchments.

Function/ Structure	Decision Making Capacity	Connectivity	Knowledge Use
Visioning and Objective Setting	<ul style="list-style-type: none"> • Do capacities exist to set higher aspirational or condition targets? • Do the relevant stakeholders have adequate knowledge, financial, human & infrastructure resources? • Do key institutions involved have strong corporate governance/continuous improvement systems? 	<ul style="list-style-type: none"> • Are relevant stakeholders actively connected to decision-making? • Are visions/objectives aligned to higher and lower scale visions/objectives? • Are collaborative frameworks for setting visions/objectives well designed? • Are there frameworks for bargaining and negotiation over setting visions/objectives? 	<ul style="list-style-type: none"> • Are all forms of information available for vision and objective setting? • Are traditional and historical knowledge sets being applied? • Are appropriate decision support tools in place to support scenario analysis?
Research and Assessment	<ul style="list-style-type: none"> • Are there strong research and analysis capacities in place to inform other structural components of the system? • Are there strong environmental, economic and social research and analysis capacities in the system? 	<ul style="list-style-type: none"> • Are there strong collaborative linkages between research institutions? • Are there effective research brokerage and communication arrangements? • Are collaborations in place to integrate socio-economic and physical research? 	<ul style="list-style-type: none"> • Are there systems in place for long term knowledge synthesis and retention? • There are broad research priority setting exercises that need to be refined? • Are all forms of information available for system decision making?
Strategy Development	<ul style="list-style-type: none"> • Do capacities (knowledge, financial, human and infrastructure resources) exist in the system to set strategic targets? • Do the key institutions involved have strong corporate governance and improvement systems? 	<ul style="list-style-type: none"> • Are all relevant stakeholders connected to strategy decision-making and strategies aligned to visions/ objectives? • Are collaborative frameworks for setting strategies well designed? • Do strategies integrate a solutions mix? 	<ul style="list-style-type: none"> • Is there social, economic and environmental knowledge relating to the assessment of the efficacy of key strategies? • Are decision support tools available to scenario test alternative strategies?
Implementation	<ul style="list-style-type: none"> • Are there capacities to implement a broad mix of strategic solutions? • Do the implementation players have the financial and human resources required? • Do key institutions have strong corporate governance and improvement systems? 	<ul style="list-style-type: none"> • Are there effective integration arrangements between policy/delivery? • Do different components of the solution mix collaborate? • Are there effective research brokerage arrangements to support implementation? 	<ul style="list-style-type: none"> • Are there research efforts to inform improvements in implementation? • Are local and traditional knowledge sets informing implementation? • Are implementation-related data sets being managed and retained?
Monitoring, Evaluation and Review	<ul style="list-style-type: none"> • Are there effective monitoring and evaluation capacities in the system? • Are there collective monitoring alliances? • Are there reporting capacities to enable high levels of accountability? 	<ul style="list-style-type: none"> • Are there integration arrangements between objective setting and monitoring? • Are evaluative and review mechanisms linked to long term monitoring? • Are monitoring and reporting systems able to influence strategic resource allocation? 	<ul style="list-style-type: none"> • Are the system's social, economic and environmental outcomes being monitored? • Are monitoring and evaluation data being retained into the long term?

Results: Three Northern Focal Catchments

A broad summary of the overview results of the analytical Steps (1 and 2) undertaken by the research team are outlined for each of the catchments below.

The Gilbert River Catchment:

The Gilbert River is 46,411 km² and has a mean annual flow of 5,580 GL; around 2,500 GL above the northern Australia average (Larson and Alexandridis, 2009). The largest town (Georgetown) is located some 400 km from the nearest cities (Cairns and Townsville) and 1,800 km from Qld's capital. Its population is estimated to be fewer than 1,000 people, with a very small proportion (1.6%) being Aboriginal. Tenure in the catchment is dominated by pastoral leasehold, followed by Aboriginal land, and a very small proportion of private properties. Most of the catchment is dedicated to extensive cattle grazing on native pastures with four Indigenous groups represented. Some mining is localised in the upper catchment, but new exploration and development is underway (e.g. for uranium). While agriculture occupies a negligible area, expansion of irrigated agriculture, including dam construction, is proposed for the upper catchment.

Catchment NRM is focused on modifying grazing practices to improve land condition, addressing both productivity and biodiversity. Threats to catchment health include weeds and feral animals, extensive soil erosion and periodic major fires contributing to land and water degradation. The Northern Gulf Resource Management Group (NGRMG), a regional NRM group comprised of key stakeholders, has worked for some 15 years with graziers, Aboriginal groups and local governments to develop NRM plans directed to implement improved grazing practices, fire and pest management. While this higher scale planning includes the Gilbert catchment, there is no cohesive catchment plan for the river.

Implementation of these broader regional programs has been facilitated by the development of improved spatial data management, manuals and extension for best land management practices, and more recently, the emergence of monitoring of biodiversity and land condition. NRM in the region has also been informed by extensive research, facilitated by strong links between locals and major research institutions. There is, however, no long-term regional research agenda which integrates local and scientific knowledge.

The foundations for improving NRM practice adoption are strong due to close collaboration between NGRMG and local stakeholders, though several catchment-scale issues remain. In particular, there is no systematic catchment-focussed planning approach that recognises the need to: (1) address threats that go beyond the boundaries of individual properties, including downstream effects of land uses/practices (e.g. degraded water quality); (2) explore the interactions among threats and different management actions; and (3) protect or restore natural values (e.g. vegetation types or key species) of regional and national significance.

Improved catchment planning would require better coordination with state/Commonwealth environmental and development policies (e.g. water and vegetation management). Until now, state/Commonwealth environmental and development policies have been mostly centrally-driven from Brisbane or Canberra. This more centrally-driven approach has eroded the trust and support of pastoralists in some Commonwealth and state initiatives. Thus, with new irrigation and mining-based development about to commence in the Gilbert, addressing region-wide problems will require a systematic assessment of the potential benefits and costs of different forms of development. Local needs as well as knowledge of land capability need to be incorporated in this process in order to prevent further land and water degradation for limited economic benefit.

While the above outlines the current status of catchment scale issues, Table 2 below outlines our analysis of the health of structural and functional aspects of governance at the catchment scale. In a structural sense, of particular note is the lack of united catchment-scale vision across federal, state and regional interests, the lack of cohesive research and development structures, reasonably strong implementation mechanisms within the catchment and an emerging focus on catchment scale monitoring and evaluation using condition indices. In a functional sense, while there is strong regional NRM capacity, state agency capacity is limited in this district and tends to be centrally-driven and applied. Research is well used by catchment stakeholders, but there is limited science capacity. Overall policy frameworks for supporting the capacity of regional (and consequently catchment-scale) aspects of community-based NRM are now weaker than in the past due to the recentralisation of NRM program delivery nationally since 2007.

Table 2: Structural/ functional analysis of the NRM governance system in the Gilbert River catchment.

Structure/ Function	Decision Capacity	Connectivity	Knowledge Use
Visioning and Objective Setting	<ul style="list-style-type: none"> One regional (NRM) group integrates stakeholders via a Regional NRM Plan. Two councils drive land-use vision. State not well resourced to engage in higher vision setting/objective setting. Major project development includes little local vision/objective development. Strong cross-Aboriginal Reference Group. 	<ul style="list-style-type: none"> Regional networks have potential for cohesive vision and objective setting. Two local governments do limited joint visioning, but NRM represented. Silo based vision/objective setting in state (veg, water, pest management). State objective setting for vegetation, water and biosecurity poorly integrated. 	<ul style="list-style-type: none"> Community open to new information and tools regarding vision and objective setting. Knowledge shared well by stakeholders. NG NRM is building strategic links to JCU and other institutions for objective setting. North Queensland Irrigation Agricultural Strategy (NQIAS) knowledge not well connected to regional/ catchment vision.
Research and Assessment	<ul style="list-style-type: none"> Strong (but distant) research capacities in universities, CSIRO and consultants. Localised research capacities in northern Queensland are patchy and declining. State/region differ on data ownership. C'wealth NRM model reduced capacity of NGNRM to influence research. 	<ul style="list-style-type: none"> NG NRM has capacity to broker strong linkages with research institutions. Culture of research world is not well oriented to deliberative partnerships. Need translation of scientific findings. Poor links between indigenous and historical knowledge and science. 	<ul style="list-style-type: none"> Good broad-scale data sets need integration. Reasonable framework for spatial analysis. Past focus on bio-physical analysis vs social. Has been some integrative research into socio-ecological systems. Not yet a clear set of regional research priorities to drive research investment.
Strategy Development	<ul style="list-style-type: none"> NGNRM has strategic capability. State has good technical capacity in regulatory strategy development. Local governments/regional development orgs tend to focus on development. Limited adjustment/market strategies. 	<ul style="list-style-type: none"> Planning/research being undertaken to explore strategy-based social networks. Strategic linkages between NRM and State have improved. Linkages between key strategies vary (e.g. vegetation, water, NRM). 	<ul style="list-style-type: none"> Good use of science and spatial data sets in NRM and Council strategy work. Good science and spatial data sets in State vegetation, water and biosecurity planning. NQ Irrigated Ag Strategy driving increase in knowledge required for decision making.
Implementation	<ul style="list-style-type: none"> Regulation strong but compliance weak. Tenure resolution strategies in place. Indigenous Land/ Sea Units emerging. Strong regional pest-action delivery. Biodiversity programs help stewardship. 	<ul style="list-style-type: none"> Few regulation delivery partnerships. Strong partnership based regional NRM. NG NRM integrates delivery programs. Low integration between State delivery programs (water, biosecurity, vegetation). 	<ul style="list-style-type: none"> Low catchment level use of spatial prioritisation or economic analysis in deciding on ground actions. High spatial prioritisation/data available at property level and increasing.
Monitoring, Evaluation and Review	<ul style="list-style-type: none"> Long term monitoring capacity low. Monitoring capacities weak for surface and ground water systems. Weak monitoring of biosecurity systems. Emerging opportunities in catchment and property-scale spatial monitoring. 	<ul style="list-style-type: none"> Intensive and integrated discussion re monitoring and evaluation still evolving. Emerging linkages to Wentworth Group Environmental Accounts systems. Weak links between state/national frameworks for resource monitoring. 	<ul style="list-style-type: none"> Some data sets strong (geo-physical) but still gaps in (biodiversity and water). Data not yet well oriented to long term M&E. Some monitoring of community resilience. Local perceptions around monitoring and changes being explored by NGNRM and JCU.

Daly River Catchment

The NT's Daly River catchment (approximately 53,000 km²) extends from the coastline south-west of Darwin to 250 km inland. Water licensed for consumptive use is some 68Gl, mostly for irrigated agriculture, with 3.4 Gl licensed for public water supply and 9 Gl for irrigated forestry. Most is extracted from groundwater (65Gl) (DLRM licensing register, March 2013). It is estimated that the total actual use is approximately 25 Gl per year, though this varies considerably dependent upon climatic conditions. The northern catchment is a two hour drive from Darwin and many residents visit for recreation. The catchment area is 29% Aboriginal land, 21% government land (predominantly national parks) and 50% pastoral leasehold and freehold (Larson and Alexandridis, 2009). The primary land use has been cattle grazing (native and modified pastures) and some small scale cropping.

Horticulture remains a small proportion of land use though there is increasing investment in properties (predominantly forestry) and further (groundwater-based) agriculture. This could result in a shift from family-based to corporate ownership. The Daly is a major tourism attraction, with Nitmiluk National Park at its core and iconic values for recreational fishing by local residents and tourists throughout the catchment. Currently there is limited mining, though redevelopment of a closed gold mine may pose a contamination risk if not well managed.

Until 2013, collective vision and objective setting in the Daly has been strong as the Daly River Management Advisory Committee (DRMAC) was created to work with relevant government agencies to advise on sustainable resource use/conservation. Established in 2006, DRMAC promoted high standards of land and water management and advised the relevant minister. Plans relating to natural resource use have been led by the relevant NT government departments with DRMAC involvement and public consultation. Composed of multiple stakeholder representatives and connected to research providers, DRMAC was able to support the use of best available knowledge and facilitate robust discussion of plans. The implementation of the Daly clearing guidelines (NRETAS, 2010) and water allocation plans, for example, relied on direct input from DRMAC.

In the absence of a more localised strategic NRM group, DRMAC played a critical role in supporting local community representation (except the mining and

energy sectors). This included three Indigenous landowner representatives selected by the Aboriginal Reference Group (ARG), which itself comprised twelve language groups. DRMAC's representative structure supported connectivity and maintained strong collaborations with research providers. The governance for vision and objective setting, research and assessment and strategy development across all structural components was healthy, with good corporate governance, connectivity and funding. The model was also cost effective and sustainable (costing approximately \$50 k p.a.; Ian Lancaster Pers. Com.).

The governance arrangements for implementation, monitoring and evaluation on the other hand were not as healthy across the structural components because these relied less on DRMAC as an advisory group informing direct government action and financial investment. There are some on-ground community-based natural resource delivery groups: one landcare group (Wangamaty) and several indigenous ranger groups, but the natural resource delivery capacity of community groups, traditional owner organisations, local authorities and land managers is not particularly strong. Where on-ground delivery is a NT Government agency responsibility (e.g. conservation estate management), most efforts tend to lack political commitment to implementation and are poorly coordinated over time and space, leaving major pest risks unaddressed.

Building on the above, Table 3 below outlines our analysis of the health of structural and functional aspects of governance at the catchment scale. In a structural sense, there have been strong structural arrangements for catchment visioning, strategy development and research, but weaker ones for implementation, monitoring and evaluation. In a functional sense, DRMAC capacity has been limited to visioning while NT Government agency capacity has been focussed on strategic planning. NT Government agency implementation and monitoring capacities have been weak, though there remains some capacity to better use pastoralist and traditional owners to deliver on ground outcomes. The key to general success, however, has been DRMAC's role as an integrative connector within the system, linking government agencies, researchers and the community. DRMAC, however, was vulnerable to changes in government priorities and required ongoing commitment to support its ongoing function. This weakness led to its closure in 2013 by the NT Government in favour of a NT-wide approach to community involvement in NRM.

Table 3: Structural/ functional analysis of the NRM governance system in the Daly River catchment.

Structure/ Function	Decision Capacity	Connectivity	Knowledge Use
Visioning and Objective Setting	<ul style="list-style-type: none"> • Strong vision/objective setting capacity (via DRMAC) that drew in major catchment interests. • DRMAC guides vision setting based on current status of natural resources as building blocks. • DRMAC was unique in that it reported directly to the relevant minister. Minister attended meetings. • Local government capacity was low and NT Govt vision/objective setting operated at policy scales. 	<ul style="list-style-type: none"> • Strong regional unifying influence in visioning through DRMAC linked to NT Regional NRM. • DRMAC members connected to organisations responsible for informing a wider constituency. • Strength of DRMAC grew from long history of functioning as a group and building trust. • ARG connected 12 language groups. • Use primacy makes mining poorly connected. 	<ul style="list-style-type: none"> • DRMAC gained much qualitative knowledge through representative members but quantitatively draws more information on single issues/interests. • Access to a full range of knowledge is constrained by DRMAC's ability to process a range of issues, so efforts tend to be more issue or project based. • Research capacities for catchment management are strong via CDU-based TRaCK Consortium.
Research and Analysis	<ul style="list-style-type: none"> • Historically cohesive research framework via Trop. Savanna CRC weakened after its closure. • Strategic research capacity in part replaced by Tropical Rivers and Coastal Knowledge (TRaCK). • Providers approached DRMAC to frame research and research brokerage capacities well advanced. 	<ul style="list-style-type: none"> • DRMAC had good relationship with a range of research providers and consultants. • Many research providers well connected in their catchment research agendas/approaches. • TRaCK supports integrating research/analysis. • Poor connectivity across research silos, but improving via Collaborative Research Network. 	<ul style="list-style-type: none"> • Data generally available/shared among groups. • Mining information a barrier to sharing knowledge (but mine plans will soon be publically available). • Traditional knowledge is strong but currently poorly integrated in decision making. • Agreement that traditional ecological knowledge and mining are major research gaps.
Strategy Development	<ul style="list-style-type: none"> • Capacity existed to influence decision making for strategy development (e.g. water and vegetation). • DRMAC had strong influence over decision making but reliant on government priorities/will. • Strong government strategy development capacity in some sectors (e.g. water, vegetation). 	<ul style="list-style-type: none"> • DRMAC was strongly connected into ministers, though departmental connections could fray. • DRMAC connected interests, which were at times conflicting, taking time to integrate. • DRMAC's member choice drove connections in departments/sectors, but changed over time. 	<ul style="list-style-type: none"> • Knowledge use in DRMAC strategy development was strong and connected to research providers. • Process relies on best available information and the interpretation from different groups. • Diverse knowledge sets were valued on DRMAC.
Implementation	<ul style="list-style-type: none"> • DRMAC was advisory so aimed for consensus on issues and government legislated/implemented. • Regulatory action dominates as cheaper, but poor compliance/education focus. • A neglected area is community groups being able to coordinate to make local decisions. • Planning strong, but implementation weak. 	<ul style="list-style-type: none"> • No strategic integration of community groups to align effort for implementation. • There is a lack of ownership on some issues resulting in poor implementation coordination. • Lack of catchment community ability to integrate and coordinate departmental efforts. 	<ul style="list-style-type: none"> • Implementation not supported by best knowledge/best practice information. • Real gaps exist in extending knowledge and support to smaller landholders in implementing best practices related to legislation. • Lack of good implementation models for knowledge transfer to on ground effort.
Monitoring, Evaluation and Review	<ul style="list-style-type: none"> • DRMAC adaptively reviewed outcomes vs plans. • There is a second level of monitoring on the ground in implementation of legislation. • Departments lack capacity to drive monitoring. • Stop-start implementation funding a real problem. 	<ul style="list-style-type: none"> • Fragmented monitoring across NRM strategies. • Poor linkages between national monitoring frameworks and catchment monitoring. • No strategic consideration of how indicators relate to people's actions vs. desired outcomes. 	<ul style="list-style-type: none"> • Current data sets not well oriented to long term monitoring and evaluation. • Current data sets not always good at supporting monitoring of plans for vegetation and water.

Fitzroy River Catchment

Located in north-western WA and covering some 93,830 km², the Fitzroy River is one of the largest unregulated river-floodplains in Australia with a mean annual discharge of around 6,150 GL (Puckeridge et al., 1998). Ecological function in this system is driven by intermittent river flows and short inundation of the floodplain (Jardine et al., 2012; Warfe et al., 2011). Permanent river pools provide important refugia that maintain biodiversity and critical ecological processes during the dry season (Close et al., 2013). The Fitzroy supports some 7,000 people (64% Aboriginal) mostly in two major towns (Derby and Fitzroy Crossing) located some 1,800 km from WA's capital (Larson and Alexandridis, 2009).

The Fitzroy River has limited anthropogenic disturbance owing to its remoteness and inaccessibility (Close et al., 2012; Pusey, 2011). The distinctive and rich aquatic ecosystems are recognised for their ecological value (Kennard et al., 2010). Major land uses include grazing (primary land use), tourism, mining and water resource development, while key threats include poor fire management and invasives (Close et al., 2012). There are four main Aboriginal language groups with connections to the Fitzroy (Toussaint et al., 2001) and hence traditional Indigenous use is also very important (Jackson et al., 2012, Close et al., 2013). Tourism is a major component of the local economy with north-western WA receiving close to 1 million visitors during 2006-07 (Clarke et al., 2009). Currently, mining is limited (e.g. diamond mining) but there is potential and interest in extracting other minerals (WA Dept. of Water, 2009). Division between stakeholder groups regarding the long-term socio-economic and environmental impacts of mining projects proposed or in progress (e.g. coal mining, gas and unconventional gas) presents major governance challenges in the region.

There has been increasing state and national interest in proposed broad-scale agricultural development, including the construction of large dams, isolated extraction from river pools for irrigation during the dry season (WA Dept. of Water, 2009) and inter-basin transfers (WA Dept. of Premier and Cabinet, 2004). Although not part of current government policy, large-scale water management under different use scenarios has been a recurrent topic. Despite some suitability for agriculture (~2,000 km² in the lower catchment), high flow variability limits the potential for irrigation to a fraction of the catchment (CSIRO, 2009).

Regional visioning and objective setting in the catchment is fragmented among stakeholders. There is a strong implementation focus on regulatory strategies, but poor compliance/implementation of best practices in NRM. In 2007 the FitzCAM (Fitzroy Catchment Action and Management) group was formed to incorporate a diversity of local views within a catchment-scale framework, though a lack of continuing funding saw the group disband in 2008. One of the main strengths of FitzCAM was its whole-of-catchment, cross-industry, multi-stakeholder representation. The resulting Fitzroy Catchment Management Plan (CENRM 2010) provided a sound foundation for the integration of objectives and research.

With the demise of FitzCAM, in contrast with the Daly and Gilbert River, the Fitzroy now lacks a key/major coordinating group as the regional NRM body (Rangelands NRM) covers all the northern half of WA. This means the region is often more driven by national and state planning (economic) agendas. Strategic planning is thus highly influenced and driven by state priorities, is generally poorly informed by local knowledge and does not necessarily reflect diverse catchment priorities. There is a strong implementation focus on regulatory strategies, but poor compliance/implementation of best practices in NRM.

A number of regional organisations undertake NRM and research activities within the catchment although without a coordinated body, regional visioning and objective setting in the catchment is fragmented among stakeholders. Research programs (i.e. TRaCK) and isolated studies have generally been driven by research institutions from distant towns and cities (see references herein).

Table 4 below outlines our analysis of the health of structural and functional aspects of governance at the catchment scale in the Fitzroy. In a structural sense, there have been only transient structural arrangements for integrated catchment visioning, but some single asset strengths within certain agencies/groups. Overall, however, there are relatively weak/poorly connected structural arrangements for research, strategy development, implementation, monitoring and evaluation. In the absence of coordinated structural arrangements, in a functional sense there is generally limited capacity within and connectivity among key stakeholders. There remain, however, opportunities to better support local government, pastoralists and traditional owners to deliver on ground outcomes. Given the existence of significant development potential in the Fitzroy, the catchment could be the subject of major conflict for land and water use and management in the future.

Table 4: Structural/ functional analysis of the NRM governance system in the Fitzroy catchment.

Structure/ Function	Decision Capacity	Connectivity	Knowledge Use
Visioning and Objective Setting	<ul style="list-style-type: none"> Strong visioning/objective setting capacity in five regional groups (Dept. of Environ. & Cons., Dept. of Water, Rangelands NRM, Pilbara Development Corp and Kimberley Land Council). Low local capacity within regional state agencies result in high levels of external decision making. Integrative regional capacities emerged with TRaCK support but now no durable resources. 	<ul style="list-style-type: none"> Core vision/objectives of different sectors tend to be divergent with no durable and integrated, whole of catchment focus. Regional groups doing vision setting often driven by state-wide vs. catchment priorities. 	<ul style="list-style-type: none"> Strong use of knowledge in vision and objective setting in major regional decision making bodies. Different groups rely on different knowledge sets. Research outcomes not always publicly available. Higher level decision making tends to be reactive and more politically vs. knowledge driven.
Research and Analysis	<ul style="list-style-type: none"> Strong research and analysis capacity in state but weaker in NRM body and locally. Strong foundations for traditional ecological/cultural knowledge within the region. Research is generally driven externally, with very low local capacity. UWA looking to improve research and development coordination capacity in region, but starting with teaching delivery. 	<ul style="list-style-type: none"> Some coordinative support from TRaCK for limited research brokerage, but no cohesive or long term science coordination/brokerage. Limited collaboration between local interests on research prioritisation and limited trust between groups on research and knowledge. Challenges in integrating strong local ecological knowledge with science, but emerging brokerage capacity within Indigenous Land and Sea Units operating in the region, (e.g. with Murdoch Uni, UWA and Madjulla Inc). 	<ul style="list-style-type: none"> Good broad-scale data sets available but data layers tend to be coarse/area specific. No agreed framework for integrating knowledge in priority setting and decision support. Focus has tended to be on bio-physical analysis versus social and economic, though some preliminary work undertaken by TRaCK. Low level of meta-analysis of data. Regional conceptual models weak.
Strategy Development	<ul style="list-style-type: none"> Regional strategy development capacity weak with fatigue among key players. Remoteness limits strategic decisions. Primary focus on only regulatory strategies. Currently limited market-related strategies. 	<ul style="list-style-type: none"> Poor integration across strategy development areas driven by state priorities. Regional strategies often not consensus driven. Large distances across the catchment means weak linkages between east-west communities. 	<ul style="list-style-type: none"> State level strategy development poorly informed by social knowledge. Strong science application within the Department of Water (DoW) strategy planning.
Implementation	<ul style="list-style-type: none"> Implementation framework is strong on regulation but weak on compliance. Tenure resolution capacity emerging. Capacity in Land and Sea Units emerging. Emerging capacity in pest management. Reactive decision making delivers limited large-scale implementation programs. 	<ul style="list-style-type: none"> No partnership-based approach in implementation of regulation. Better on-ground interactions between stakeholders occurs in implementation than at strategy and decision making levels. 	<ul style="list-style-type: none"> Little spatial prioritisation or economic analysis for actions. Limited knowledge in implementation priorities and delivery capacities.
Monitoring, Evaluation and Review	<ul style="list-style-type: none"> Monitoring capacity low in all sectors. No integrated regional monitoring capacity. 	<ul style="list-style-type: none"> Limited integrated discussion on catchment-scale monitoring and evaluation. 	<ul style="list-style-type: none"> Current data sets not well oriented to long-term monitoring and evaluation.

Discussion

Results emerging from Step 3 of this analysis showed substantively different governance strengths and weaknesses among the three focus catchments. All have a different history, social and biophysical context, suggesting that interventions aimed at improving governance need to be catchment specific. There are, however, some very consistent themes concerning key structural and functional aspects of governance that will need particular attention across northern Australian catchments. In general, we found there were a number of higher level governance limitations that were currently impinging on the health of governance systems at national scale (i.e. national, state/ territory/ regional). We then found a range of consistent issues playing out at the catchment scale itself, right down to property scale. The following thematically summarises these findings and suggests preliminary pathways for reform across northern Australia. We do not discuss pathways for reform within the individual focal catchments.

A Stronger National Policy Framework for Catchment Management

Across the three focal catchments, this study has identified that common weaknesses in catchment governance (particularly vision and objective setting) emerged from a weak national policy framework. Healthy catchment governance requires clear national and state/territory policy leadership (via the Council of Australian Governments or COAG framework). This could be refined via any revamped North Australian Ministerial Forum. Such a forum could collectively drive agreed Australian government and state/territory efforts towards more adaptive and outcomes-focused approaches to NRM at the catchment scale. Something like a National NRM framework and strategy (or a northern Australian variant) could identify the importance of the north's landscape assets, set national targets and drive 5-10 year integrated investment programs for cohesive Australian and state/territory cabinet and treasury consideration.

With a strong framework and strategy in place, implementation efforts could then focus on mobilising resources within and across governments and aligning the NRM efforts of a wide range of industry and community sectors across the north. A genuinely collaborative Australian or northern Australian NRM framework and strategy would also need to be informed by state/territory objectives and regional NRM plans (and vice versa) in an iterative fashion. Such reforms could better

guide national NRM policy and investment arrangements in the longer term, but focussing them on northern Australian needs. Some core, longer term, flexible state/territory-wide and regional investments are also needed to mobilise more adaptive WA/NT/Qld Government, regional NRM, industry, local government and community capacities at catchment scale. Program/investment alignment across Australian, state/territory agencies would increasingly be required.

An Integrative System Mobiliser at Regional or Catchment Scale

Across the three focal catchments, our analysis has highlighted the critical importance of catchment-scale leadership emerging from a strong, inclusive and community-based body. We found that such bodies also need to enjoy the support of Commonwealth, state/territory and local governments and focus on building regional or catchment-scale consensus. There is value, however, in such bodies having a commitment from government, but a level of operational independence. They can provide the institutional foundations for spatial/trade-off analysis of economic, social and environmental values. With such devolved leadership within a governmental support framework, the following might be possible:

- The emergence of an inclusive catchment vision, objectives and strategies;
- A basis for Commonwealth, state and territory government engagement in setting, and being committed to, such a catchment vision;
- Capacity-building across key catchment stakeholders, building an improving understanding of catchment processes and priorities;
- Agreed regional-level engagement with regard to infrastructure placement and design within catchments; and
- Building of the capacity of local scale or community-based NRM groups to be more involved in implementation.

As catchment management requires inter-generational effort, the resourcing for such a key integrative player needs to be stable and sustainable. While the Northern Gulf NRM Group is well placed to carry out such a function in the Gilbert, DRMAC tended to play this role in the Daly. The Fitzroy, however, has generally lacked a strong integrative player. Rangelands NRM has an extremely wide regional responsibility and limited resources for catchment specific effort, though the TRaCK science team has played (a short term) role to a lesser extent in the past. Continuity in integrative capacity is key. Again, such groups can only

play a genuinely integrative role if they enjoy the support of both government, community and industry sectors within particular catchments.

A Focus on On-Ground Implementation

Across the three focal catchments, this study found that for catchment planning to be effective in northern Australia, such plans need to be seen as the start of an iterative process, with learning through implementation being the predominant focus. While current catchment plans can guide government and community policy intent, there is a common weakness in implementation. Reforming this will require an institutional rethink across Australian and state/territory agencies. In the national context, delivery-oriented funding programs have become very separated from planning. In the states/territory, there are real strengths in regulatory planning but weak compliance. National and state level retreats from integrated regionalism has reduced the capacity of catchment scale integrative players (e.g. Rangelands NRM, DRMAC and NG NRM) to mobilise effective and integrated implementation effort at the catchment scale. In the north, there are:

- Particular gaps in mobilising implementation of key major agreed actions (e.g. biodiversity, fire and pest management) at catchment scale;
- Small gains emerging in the local capacity of Indigenous ranger groups;
- Under-utilised NRM capacities in the pastoral sector and few market-delivery frameworks for the delivery of ecosystem service investment; and
- Continuing retractions in local power/responsibilities (e.g. federal programs, parks management) for on ground implementation.

Regional or Catchment-Wide Research Science Brokerage

Our analysis also found that there is a clear need for more partnership-oriented research to support policy and action at the catchment scale across northern Australia. A lack of continuity in research funding has seen the wind-down of integrated research in recent years. The culture in agency-based funding has also shifted to more centrally-determined and administered programs, while regional NRM groups also have fewer resources to invest in targeted catchment research (Noelene Iken, Pers. Com.). The decline of more regionally-based research brokerage models, however, has created opportunities for individual research institutions (e.g. CDU, JCU or UWA), giving rise to new models of research collaboration, such as TRaCK, which have been successful in securing support for

research across catchments (Inspiring Australia, 2012). Ongoing resource uncertainty, however, still limits the chance to institutionalise the long term and trusting partnerships required. Improving governance to stabilise research partnerships should be a high priority, with an emphasis on investment and bipartisan support for durable collaboration building. Such partnerships need to focus on improving the integration of scientific, Indigenous and local knowledge and on strengthening regional and local research capacity, even if it relies on the alignment of research capacities that exist well beyond the catchment boundaries. Such an approach will result in a greater likelihood that research will be relevant, trusted by all stakeholders and actually used to support catchment planning.

Addressing Land Use Conflict and Major Development in Catchments

Our analysis found that all three focal catchments face major project-based development pressures. Improvements in project assessment and associated mechanisms for approval of land use change therefore present an important opportunity to reduce conflict and enhance environmental outcomes. For major projects, and particularly in cases where there is potential for wider landscape conflict, problems between Commonwealth, state and local government assessment processes can become a major barrier to development *and* conservation investment. Hence, JCU and CSIRO (2013) recommended enhanced land use planning at regional scale, improved harmonisation among (and practice within) disjointed major project approval processes across northern Australia.

Building Spatial Information and Decision Support for Tradeoffs

Our analysis found that across all three catchments, the diversity of stakeholder preferences and land-and-water values across a catchment requires a good understanding of the potential co-benefits and tradeoffs between different land use and management options. In some cases, multiple values associated with a single area/site (e.g. carbon storage, biodiversity conservation and water storage) can be maintained through the same actions and in the same areas (e.g. protection of natural vegetation), leading to win-win situations. In other cases, the spatial distribution of a specific natural assets or divergent management strategies can compromise catchment outcomes. Consequently, trade-offs between different management strategies should be assessed. A more systematic approach to spatial analysis and decision-support can help managers assess these trade-offs.

Securing Equitable Capacity and Wider Stakeholder Engagement

Analysis across the three focus catchments reminds us that effective engagement results from all stakeholders having some equality of opportunity and ability to influence decisions. Achieving this requires an understanding of power relations between and within stakeholder and their relative capacity to effectively engage with and influence outcomes. Northern communities tend to be stable over time and engagement systems need to recognise this. Community-based NRM, built on local knowledge, has a recognised pedigree in delivering long-term success. Explicitly identifying agreement and conflicts and negotiating trade-offs between stakeholders is also key to securing outcomes.

Keeping in mind the lack of cohesive catchment scale plans in all three focal catchments, effective catchment or landscape scale planning systems can promote positive interactions between stakeholders, build long-term relationships and credibility and support effective local action by landholders or community groups. Catchment engagement is also able to help articulate community concerns and to develop a collective voice to influence decision-makers. In northern Australia, traditional owners and pastoral communities own or manage much of the land, and both have strong knowledge and good capacity in many cases to deliver NRM outcomes. Government agencies, alternatively, often have limited staff, funding, science or monitoring capacity and reach. Additionally, major development opportunities (especially mining) can arise suddenly, driven by powerful interests which may not be well engaged in local communities or catchment planning. Hence, building long term, trust-based relationships between stakeholders across northern Australian catchments is integral to successful NRM, allowing conflicting aims to be discussed and practical solutions devised.

Strong Indigenous Governance and Resolving Native Title

In all three focal catchments, we found that conflicts over land use and tenure remain strongly implicated in the ongoing social and economic disadvantage suffered by Indigenous people across the north. Indigenous-led tenure reform on Indigenous tenures, therefore, has a role to play in ameliorating this situation. Finding the means by which traditional owners can leverage their land and water assets to raise capital for social and economic development, including ecosystem management, offers great catchment-scale benefit. Support for an Indigenous-led

focus on the development of appropriate policy solutions needs to be based on supporting traditional owners to:

- Progressively resolve ongoing various title claims in Indigenous lands;
- Develop effective country-based planning systems and township-based land use planning;
- Explore the most appropriate tenure and financial mechanisms for facilitating investment; and
- Explore innovative governance models for managing wealth from Indigenous land development (NAILSMA, 2012; JCU and CSIRO, 2013).

Alternative Reform Approaches and Emerging Ecosystem Service Markets

Analyses across all three focal catchments remind us that Aboriginal and pastoral lands cover the majority of northern Australia's landmass. Nationally-significant environmental battles in these lands have emerged when southern policies conflict with local interests, undermining the trust that northern communities and industries have in governments (Productivity Commission, 2003). The approach to improved management of the region's vast landscapes must start with rebuilding trust and respect between communities and government regulators. This means governments and other stakeholders sitting down together to explore what they value, to examine the science, and to build a common understanding of issues. From here, all parties can co-design and jointly monitor implementation of the best approaches. As an emerging opportunity however, northern Australian landscapes also lend themselves well to being packaged and presented internationally within emerging regulatory and voluntary ecosystem services markets. Australia needs a framework specific to northern Australia if it is to secure front-row access to these markets (i.e. one focussed on the development of northern Australia as a special purpose ecosystem service market). The Australian Government's intention to incorporate the sequestration of biodiverse carbon into its emerging greenhouse gas abatement frameworks is a good start, and the soon-to-be-reviewed Carbon Farming Initiative (CFI) will present options for the better management of northern ecosystems (CSIRO, 2012).

Property-Scale Planning and Reform

Experiences across all three focal catchments suggest reform in the relationship between governments and individual land managers across northern Australia is a

priority to facilitate improved catchment management. Relationships once focussed on supporting rural enterprise have shifted to a focus on regulation (e.g. vegetation management legislation). The emerging plethora of regulatory instruments has resulted in a system where no one government agent can precisely articulate what is expected of land managers. Land managers find it hard to fully assess their regulatory obligations *and* government-based extension has contracted. Industry and government could reach agreement about a singularised approach to property management planning that starts with longer term enterprise profitability and simplifies the complexity of regulatory obligations. Enhanced regionalised service-delivery frameworks could also broker a wider range of government, not-for-profit and business services to support enterprises at property scale, including collective landscape-scale action. Finally, without diminishing standards, there could be significant consolidation of regulatory arrangements affecting property management (Dale, 2013).

Making Monitoring and Evaluation Work at the Catchment Scale

National and state support for effective and durable outcomes-oriented monitoring and evaluation (M&E) at the regional or catchment scale has always been weak in northern Australia, but is exacerbated by weakening and fragmented Australian, WA, NT and Qld Government efforts. Future support for building catchment M&E systems must address the indicators of importance to catchment landholders and managers, ensuring their relevance. If landscape-scale monitoring of environmental health *and* production economics can demonstrate the value of best practice management, it can provide impetus for change. Another consistent problem facing our focal catchments is that knowledge of flora and fauna, coastal and freshwater assets has few baselines and is patchy (Douglas et al., 2005). Hence, the use of an Environmental Accounting model could introduce a diverse selection of useful indicators within an accounting approach that is comparable across catchments (Wentworth Group, 2008). Through such an approach, a reference condition benchmark would allow different landscapes to be measured with indicators specifically suited to a particular location, avoiding the use of one set of indicators for different landscapes.

Conclusions

If we are to enhance social, economic and environmental outcomes in northern catchments and reduce conflict, then improved governance systems will be needed. From this preliminary assessment in three focal catchments in the north, we draw some consistent reform themes. However, we would recommend that particular reform attention should be targeted in those catchments facing significant development pressures and emerging opportunities. From this analysis, we consider that at a catchment level, such approaches would need to:

- Build a stronger foundation for integrated vision/objective setting;
- Jointly build a widely-supported, progressively-improving science base;
- Identify and define clear trade-offs between multiple land use objectives (e.g. identify prospective resources for development *and* high value cultural/conservation outcomes);
- Provide a basis for guiding emerging ecosystem service markets;
- Better integrate the planning required to maximise sustainable development outcomes;
- Give greater (bilateral) clarity regarding the assessment standards for major development projects; and
- Have strong links back to the budgetary processes of Commonwealth, state/territory and local governments, ensuring implementation.

Where undertaken prior to and in association with increasingly flexible tenure reforms, such an approach would provide a clear vision for the future of regional landscapes and communities that could guide development and conservation. More importantly, however, such an approach would also provide a stronger framework to support effective conflict resolution and enhance the willingness of both economic and conservation interests to invest in the future of the north.

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