Planning for Climate Change Northern Monsoon Cluster: Decision Making and Planning for Natural Resource Management

Natural resource managers are tasked with a range of challenging and sometimes competing management objectives but often have limited resources with which to achieve them. Natural resource management (NRM) objectives typically include conserving biodiversity, maintaining healthy ecosystems, achieving water quality targets and restoring degraded habitats. A key challenge is to identify where, when and how to implement effective activities to achieve these objectives with the least cost and impact on stakeholders. This project provided and tested an appropriate decision support framework for cross-realm planning and supporting synthesis of NRM plans to assist natural resource management groups in northern Australia successfully tackle this challenge.

Álvarez-Romero, J. G., V. M. Adams, R. L. Pressey, M. Douglas, A. P. Dale, A. A. Augé, D. Ball, J. Childs, M. Digby, R. Dobbs, N. Gobius, D. Hinchley, I. Lancaster, M. Maughan, I. Perdrisat. 2015. Integrated cross-realm planning: A decision-makers' perspective. Biological Conservation 191, 799–808

What is cross-realm planning?

We define integrated cross-realm planning as a process to guide the spatial allocation of management actions and land/water uses to achieve explicit environmental and socioeconomic objectives across multiple realms. General goals of cross-realm planning include maintaining key ecological processes connecting realms, limiting cross-realm threats that compromise conservation or socioeconomic objectives, and balancing the benefits and trade-offs resulting from management decisions. The concept is founded on the general principles of systematic conservation planning, including complementarity between priority management areas and actions, cost-effective solutions to achieving objectives, and transparent and repeatable methods for prioritising management areas/actions or allocating uses (Kukkala and Moilanen 2013). Cross-realm planning also calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently (Pierce et al. 2005). Effectively, this means integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios (Moilanen et al. 2011); this in turn requires a multidisciplinary approach to planning and new decision-support frameworks to guide and facilitate this transition (Reyers et al. 2010). Our definition includes approaches with the same broad goals, including ‘integrated land-sea conservation planning’ (Álvarez-Romero et al. 2011), ‘ridges-to-reef planning’ (Lipsett-Moore et al. 2010) and ‘catchment-to-coast planning’ (Smith et al. 2011), but is wider in scope and aims to capture the full complexity of planning for multiple interconnected realms.

Why a new planning framework?

While there have been important advances in theoretical approaches to cross-realm planning (Adams et al. 2014; Álvarez-Romero et al. 2011), practical advice on their application for decision-makers is generally lacking. Importantly, existing conceptual and operational frameworks are generally developed in academic settings without the participation of decision-makers responsible for implementing plans. To address this limitation, we assembled a group of applied researchers and decision-makers to discuss the requirements and challenges of integrated cross-realm planning. Together, we developed a new operational framework based on current theory, but reflecting the structure and detail required to facilitate its accessibility, application, and potential for adaptation to different contexts.

An operational framework for applied cross-realm planning

We developed and tested a novel operational framework that incorporates considerations relevant to achieve full integration of planning across realms and offers practical guidance to decision-makers (**Figure 1**). Our framework was broadly based upon leading systematic conservation planning frameworks (Groves et al. 2002;

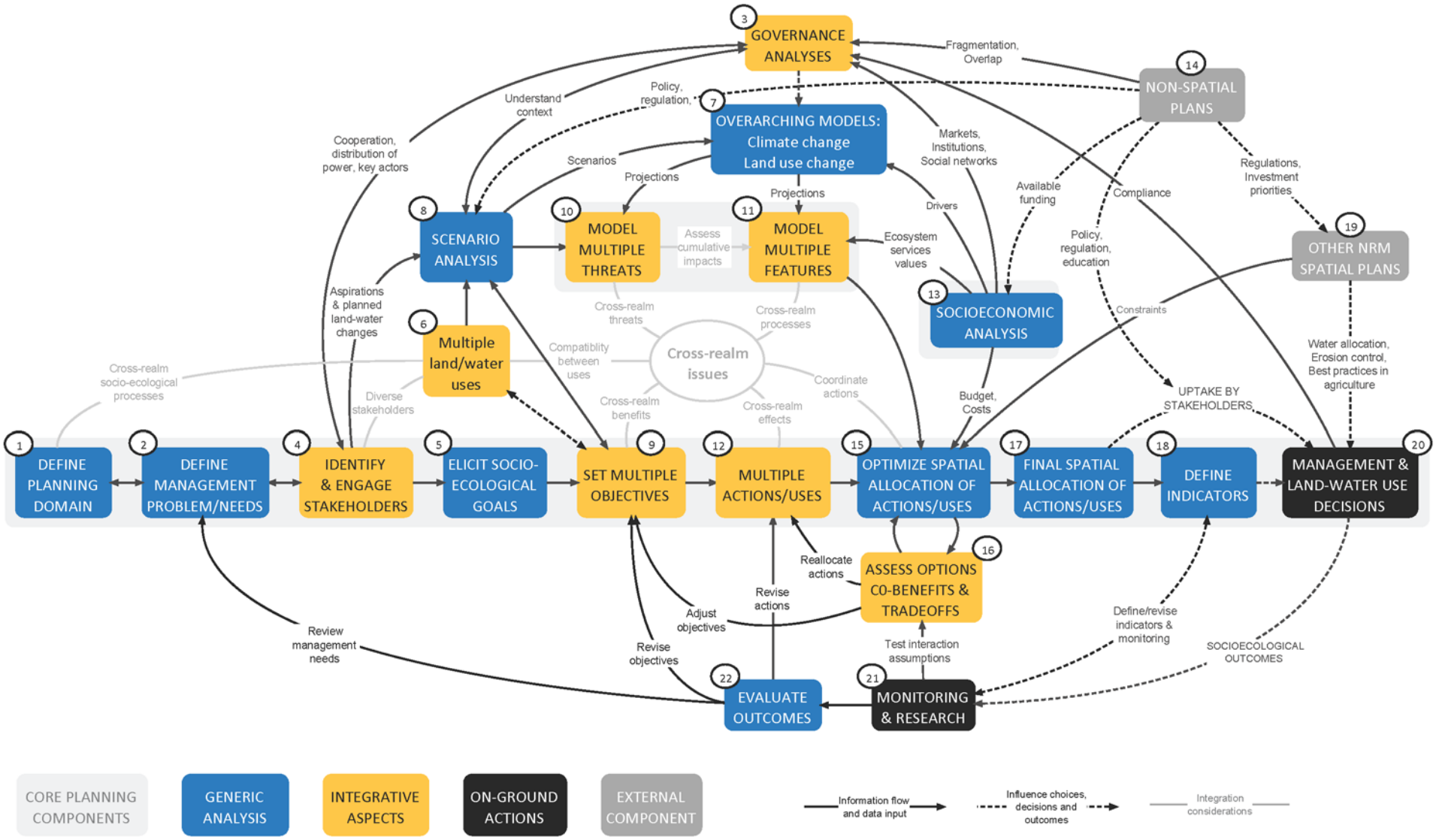
Lehtomäki and Moilanen 2013; Pressey and Bottrill 2009), particularly those relevant to cross-realm integration (Adams et al. 2014; Álvarez-Romero et al. 2011; Klein et al. 2010), while considering key operational aspects conducive to implementation (Knight et al. 2006). The framework reflects key considerations that decision-makers and the academic literature identified as fundamental components of cross-realm planning, but provides an in-depth and sequential conceptualisation of the information and analyses required to move from single- to cross-realm planning. It recognises the types of analyses available, such as scenario planning and cumulative impact assessments, and the appropriate points in the planning process to consider these analyses. The core planning components (from defining the problem through to implementation) reflects activities that most decision-makers currently undertake for single-realm planning. Expanding to planning across realms requires enlarging core components to include integrative analyses, as well as undertaking additional components.

Using the framework to summarize and document NRM plans in Northern Australia

In order to document the NRM bodies planning processes we invited all employees associated with the planning processes to undertake semi structured interviews with us (total of 6 employees). We used the operational planning framework to structure our interviews. For each stage of the planning framework we asked the NRM representatives to discuss with us whether they had undertaken that stage, to describe the process they undertook, and to discuss constraints or issues associated with the process. We summarized the interviews by each planning framework stage and returned the summarized tables to the respondents and asked them to check that we had accurately captured their responses. We iteratively checked and updated the summary tables until all respondents confirmed that the tables accurately reflected their planning processes.

Our interviews with the five NRM bodies identified that all planning stages in the framework are relevant to their planning processes and that the layout of the stages accurately reflects the step wise processes that they are undertaking. Furthermore, no missing steps were identified through the interviews. The summaries of the NRM plans are presented in the following tables. The summaries are living documents that can be updated through time to accurately capture the plans' updates and changes.

Figure 1. An operational framework to guide integrated cross-realm planning



Some components are common to single-realm planning exercises (blue), while others were identified as critical integrative components (yellow) that will require significant changes to current planning. External components (grey), such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management, but can also be the starting point of planning (e.g. policy mandate). Numbers suggest a sequence of planning components, but the order in which these are undertaken (and their inclusion/exclusion) can change with planning aims, context and resources. Feedback arrows indicate where later stages can generate information that will allow revising, adjusting and/or reviewing analyses and decisions, which will lead to refining plans. This reflects the adaptive management approach identified by decision-makers and the literature as critical to cope with limited knowledge about social-ecological systems (e.g. regarding cross-realm processes), ongoing attrition of assets, and emerging management opportunities or constraints. Designing adequate indicators and monitoring programs is thus essential to assessing the social-ecological outcomes of management interventions required to adjust plans.

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Application of the cross-realm planning operational framework in the Burdekin Dry Tropics NRM planning process

Stage and analyses	Burdekin Dry Tropics NRM planning	Challenges and notes
1. Define planning domain: Define the region or area across which management areas are assessed and compared for investment in actions (e.g. protection, fire management, erosion control, weeding) to achieve explicit objectives (e.g. species conservation, livelihoods, development). This can be defined based on biophysical features (e.g. catchments, bioregions), political or management boundaries (e.g. districts, shires, NRM regions) or a combination of these depending on the planning goals.	The Burdekin Dry Tropics region is primarily defined by the catchment area of the Burdekin River, but also includes the Black, Ross, Haughton and Don catchments (~146,000 km^2). The region includes associated coastal and marine areas, extending into nearshore marine waters and includes Magnetic Island and the Palm Islands.	In the context of systems planning this is not a simple geo-spatial process. There is recognition of different systems boundaries for resources, people, cultural groups etc. and also that many boundaries are appropriately 'fuzzy'. We have used a multi-stakeholder group to help define the lists of 'Frames' to consider in building a 'domain' and then to list elements within each frame.
2. Define management problem/needs: Identify and describe the key conservation and/or natural resource management issues in the region (e.g. weeds, feral animals, bush fires, erosion, water quality and quantity, pollution, vegetation clearing) that can be addressed by actions identified in the plan, these include threats to the natural and socioeconomic assets of interest (e.g. species, wetlands, productive soils, cultural sites)	In 2013 NQ Dry Tropics initiated a process to design a conceptual (non-statutory) planning framework, which broadly aims to generate motivation and guidance for action. A review of the 2005 NRM plan found that the plan was ineffectual for many aspects of planning including being useable, adaptive and empowering. NQ Dry Tropics responded to this by using the conceptual framework to migrate the 2005 plan to a continuously updated planning process which will be more adaptive and is accessible to the public through a wiki site and thus aims to be more useable and informative.	NQ Dry Tropics has been working on a non-statutory planning process, with no compliance frameworks/penalties for inaction and no agencies with a charter to drive NRM action. The plan is about generating motivation and enthusiasm for action. It must demonstrate to those who would be involved that it helps them get to where they want to be and that this is the result of an immediate, definite and positive process.
3. Governance analysis: The governance context, defined by existing institutional, political, and socioeconomic decision systems, will influence management and decisions about uses of land and water across realms, and will dictate which types of funding and actions are feasible. This stage aims to understand the current or potential overlap, gaps and coordination between institutions with jurisdictions over the region (including across terrestrial, freshwater and marine realms) and how these interactions can affect management decisions and prioritisation of actions when planning.	One of the components of the planning process is to promote a governance process that allows people to speak on the behalf of a diverse community and reduce the prevalence of few interest groups. This includes describing existing governance arrangements and defining agreed roles, rights and responsibilities within the NRM planning process. This is, how planning decisions will be made, how people will be represented by leaders and the faculty of the leadership group to influence, lobby or modify the plan based on performance.	Key to the NRM planning process is establishing a process which allows people to speak on the behalf of an eclectic community and which is not compromised or biased by big established interest groups (industry and government).

4. Identify and engage stakeholders: Identify organisations and/or people (e.g. agencies, resource users, NGOs, residents, scientists) who will affect or be affected by management actions or contribute to the planning process, including implementation and monitoring of actions. This stage is critical to consider the diversity of views and preferences of stakeholders when developing the plan, to maximise uptake, promote ownership, and develop feasible and cost-effective actions to achieve planning objectives.	Dry Tropics NRM has long-term relationships with stakeholders. For the ongoing planning process, the framework includes a consultation process to design the plan, which includes: mechanisms to ensure continuation of ongoing participation; plan adaptation through crowd-sourcing; and promotions process to encourage participation during implementation. The process aims to: establish what needs to be discussed and a common lexicon, ensure a two-way consultation process, early engagement and ensure people understands what they are participating in.	Key to successful and meaningful engagement include: establishing what needs to be discussed, developing a common lexicon, making the consultation a 2-way process, getting people involved early and making sure people understand what they are participating in.
5. Elicit social-ecological goals: Identify the collective visions of aspirations, such as representation and persistence of biodiversity, improved livelihoods, and maintenance of ecosystem services. This broad statements of what the plans aim to achieve then need to be translated into - preferably quantitative - objectives (e.g. SMART) that will guide the allocation and prioritisation of actions and monitoring of progress.	The planning process involves defining target setting criteria (trajectories, rather than SMART target setting process), which can be defined through consultation, analysis of community interests and small technical panels. Goals will have the form of high-level aspirational targets/objectives and vision statements, based on updated past goals and objectives. The process will also look at potential synergies with other planning instruments. There is no assumption that a set of fixed actions, if delivered on time and budget, will achieve the desired outcome. The process aims to find consensus and getting somebody to take a level of ownership/responsibility for setting targets.	As above, in the process of defining goals, is critical to promote consensus-building and getting stakeholders to take a level of ownership and responsibility for setting targets.
6. Multiple land and water uses: Associated with diverse stakeholders are multiple uses of land and water with varying levels of compatibility, which requires understanding the benefits and costs of potential uses across stakeholders, sometimes geographically distant (e.g. farmers and fishers). This stage mainly consists in mapping the main land/water uses across the planning region and exploring the potential links between stakeholders with interests or jurisdiction over terrestrial, freshwater and marine realms. This will be the basis of later analysis to identify and assess the co-benefits and trade-offs resulting from land/water management decisions.	Agriculture is the biggest land use and the biggest employer in rural areas of the region. A large per cent of the region comprises grazing, but there are large areas dedicated to sugarcane and horticulture (with potential to expand). The largest population (~200,000 people) is Townsville and its surrounding peri-urban areas. Further expansion of urban and ports are issues of concern. Other major industries include mining and tourism. There are 16 Traditional Owner and Aboriginal groups in the region. Multiple land and water uses will be recognized explicitly in the context library and will reflect regular interaction/update of the library by stakeholders.	Main issue is the tendency to favour historical vested interests and narrowing of access rights to fewer individuals with less connection or empathy for the landscape or resources system.
7. Overarching models: Of special concern are the effects of climate change on ecological processes and threats, including changes in species distributions (including invasive species), fish migration, rainfall (linked to sediment and nutrient runoff, flooding, droughts), and sea level rise (linked to coastal salinization). Future land (and water) uses will be constrained by these changes and threats can be accentuated (at least in some regions) or mitigated through appropriates land/water uses. Therefore, it is necessary to understand and compile available and appropriate models of climate and land use change that can influence land use/management decisions.	This is included in the online tools. Mostly it is non-specific analysis of catchment condition and is also in the Context library information. It aims to be linked to a decision support tool which is a product to be used for derivative mapping, etc. (under the Learning Kitbag section). Main considerations include deciding what tools to include on the site and how to guide people to their use in a simple way.	Key considerations include deciding what tools to prioritise for inclusion on the site and how to guide people to their use in a simple way.

8. Scenario analysis: Cross-realm planning calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently. Effectively, this means identifying and integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios. Scenario planning can allow for the envisioning of multiple futures that include different impacts of threats on assets and actions on threats, and thereby inform achievement of objectives by feasible actions/uses.	One proposed type of analysis to inform land-water use decisions is scenario analysis. NQDT aims to use scenario planning on a landscape basis and apply it to analysis of broad topical sub-plans. For example – the Long term Reef Plan 2050. Does the plan represent a reasonable scenario for effective retention of the values and uses of the reef? Results of scenario planning exercises can be reported as contextual information. The scenario planning process as documented in a guide to how to use scenario planning would constitute a tool in the learning kitbag. The plan has the capacity/architecture for this, but limited time and resources mean this process may take some time to be realized.	Major constraints are time and funding to design and run useful scenario planning processes that go beyond feel good exercises for participants. The plan has the capacity/architecture for this but we are a long way from actually doing it.
9. Set multiple objectives: Cross-realm planning requires integrating multiple objectives for conservation and development (e.g. biodiversity, ecosystems services, agriculture). Conservation objectives for single realms are well described (e.g. maintain species populations, represent habitats, increase production), but objectives for multiple realms are less common (e.g. protect representative marine and terrestrial habitats while also reducing land-based threats to the marine environment). Likewise, cross-realm socioeconomic objectives are generally missing (e.g. achieve land development and coastal fisheries goals through catchment management and land/water use that minimise downstream impacts). This stage entails translating broad goals into, preferably quantitative (SMART) objectives. These include realm-specific (terrestrial, freshwater, marine) and cross-realm objectives that will influence the allocation of actions across realms based on understanding cross-realm threats and ecological processes, and the costs and benefits of different land/water uses to stakeholders.	The planning process avoids using rigid objectives with respect to multi-criteria analysis and planning. Scenario planning is seen as an alternative form of decision making which is more flexible in terms of time frames and listed analytics criteria. Other tools can be facilitated in learning kitbag. For example a carbon sequestration ready reckoner which examines two party contracting and third party interests as a basis for robust outcome generation. The idea of SMART targets is included in the Management Strategy, but time-bound targets are not promoted, instead the use of trajectories is preferred. The process aims to move away from prescriptive actions (unpopular and unlikely to implement) to objectives based on a cooperative, motivational and continuous planning process.	A key challenge is to identify ways to move away from a prescription on actions, which nobody wants to or will follow) to set the foundation for an affirmative, cooperative and motivational continuous planning culture.
10. Model multiple threats: When planning for resource management it is important to consider multiple threats to the social-ecological systems. Threats can be associated with current land/water uses, such as modified water flow or vegetation clearing, but can derive from past or distant uses (e.g. feral animals, altered fire regimes and water flows). Managing some threats, such as feral pigs, will benefit production and conservation across multiple realms through mitigating local (e.g. soil erosion) and downstream (e.g. water quality) problems. There are likely to be varied interactions between threats and assets/uses of management interest. The potential interactions between threats (e.g. additive, synergistic, antagonistic) call for assessing, quantifying and/or modelling cumulative impacts, as well as co-benefits or trade-offs between management actions to mitigate threats.	A register of bio-physical information and social values as well as known system processes such as threats or interactions between bio-physical features like cross-realm processes will be placed in the context library and will inform the management strategy. However, the plan conceptualizes 'threats' as 'key drivers of change'. This non-punitive and systems approach recognises the need to deal with the 'big issues' (or all efforts on small issues will be swamped), but also aims to avoid inaction due to conflict (i.e. avoid view of human uses as antagonistic to conservation).	Key consideration when identifying and mapping threats is to avoid potential inaction due to conflict and antagonistic human behaviour. Is it important to avoid mechanistic thinking when dealing with a systems' process.

11. Model multiple features: Multiple threats will influence multiple assets in various ways. Identifying the sources of threats and the assets they influence across realms therefore underpins decisions about where, when and how to act. Assets of interest in a region include ecosystems and species with different conservation significance, but will also include, for example, areas with high suitability for agriculture or grazing and sites of cultural or recreational importance. This stage requires planners to identify the assets that are the main focus of the management plan, and may require compilation of data from historical records, monitoring programs, modelling exercises, stakeholders-based mapping, etc. This requires discussing with stakeholders which are these features and available data.	A register of bio-physical information and social values as well as known system processes such as interactions between bio-physical features like cross-realm processes will be placed in the context library and will inform the management strategy. The planning framework recognises that this is an ongoing process of learning and refinement and updating of approaches and information. It is not something that should be done cyclically every 10 years when planning is done but as and when it is needed and the resources of people, funds and concern appear.	Important to understand this is not a once-only process, and will likely require defining a process for further refinement and updating of data; unfortunately, this is not undertaken periodically and is undertaken opportunistically as resources and concerns appear.
12. Multiple actions and uses: Threats will affect assets in different ways and can propagate across realms, thus decision-makers will likely need to employ a portfolio of management actions that will suit the requirements of different assets and mitigate local and cross-realm threats cost-efficiently. Along with prescribed actions, decisions about land and water uses should reflect the desired balance between socioeconomic opportunities and conservation needs. An integrated plan thus needs to identify, prioritise and coordinate the locations and types of actions and uses. Prioritisation of multiple actions and uses across space and time allows plans to meet objectives for multiple outcomes, which take into account the benefits and costs across diverse stakeholders and realms.	The planning process is not “protectionist” of assets; instead, it follows a systems value and use/services management approach. In this way it does not aim to identify (and prioritise) specific and rigid set of actions. The current planning process is built under the general principle that prioritisation of actions is appropriate where there are limited and defined resources for allocation and the decision maker has the discretionary power to use that resource, which is rarely the case for NRM work.	Prioritisation is only appropriate where there is a limited and defined resource for allocation and the decision maker has the discretionary power to use that resource; this rarely is the case for NRM work.
13. Socioeconomic analysis: The socioeconomic context of the region will dictate the type of actions that are feasible to implement and inform the assumptions of overarching models (e.g. land use change, ecosystem services). There are a number of potential analysis that can inform planning at this stage, including social network analysis (stakeholders’ collaboration and power dynamics), market (drivers of change), ecosystem services (values), spatial variation of management costs (inform priorities). These studies will be informed by non-spatial plans (e.g. available funding).	Social analysis is part of the design and implementation of the investments exchange element within the online tools for the plan. Funding limitations has made the initial work to be basic and targeted rather than sophisticated or comprehensive.	Funding limitations has made the initial work to be basic and targeted rather than sophisticated or comprehensive.

14. Non-spatial plans: External components, such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management. This will constrain and influence the uptake of planning recommendations by stakeholders, dictate research and planning priorities (e.g. based on current budgetary allocations, funding streams), inform other spatial planning processes (e.g. water and land use allocation) through investment priorities and regulations. Planners need to be aware of these non-spatial plans and work within the opportunities and limitations that these may impose directly or indirectly on the plan.	One of the five components of the planning process is an Investments Exchange. The investments exchange will map existing non-spatial plans like policies and funding strategies to help link projects and programs to strategy targets and available resources or interested investors.	None
15. Optimize spatial allocation of actions and uses: Planning with objectives across multiple realms is uncommon and generally based on concurrent and/or sequential optimisation in terrestrial, freshwater and/or marine realms. This stage consists in integrating information derived from previous stages and optimising the allocation of actions and land uses across realms (e.g. using Marxan, Marzone, C-Plan, Zonation). Outputs of this stage are maps depicting cost-effective allocation of actions and land uses that balance social and ecological objectives across multiple realms. Rather than static and unique "optimal" solutions, these maps are likely to be alternative maps under different climatic/land use change scenarios and/or different budgetary or policy constraints. Available tools allow to consider some cross-realm threats (e.g. downstream impacts on aquatic ecosystems), but further research and tools are needed to optimize actions across multiple realms.	*Will not be using spatial prioritization but assets/projects might be prioritized with other tools. The current planning framework recognises that a community owned plan with no statutory base and no dedicated financial base for action choice and implementation does not require optimisation. Rather, it is an opt-in process of motivation and recognition. If a group or individual is interested in an aspect of NRM and this is supporting of the broad aspirations of NRM in the region and not antagonistic of other NRM interests, then it needs to be recognised, affirmed, supported and networked to the human, financial and material resources available in the group.*	N/A

16. Assess cobenefits and tradeoffs: Managing one realm can affect ecosystems in linked realms, which can result in co-benefits, if management achieves objectives in two or three realms more efficiently, or trade-offs, if management in one realm compromises the achievement of objectives in another. To quantify co-benefits and trade-offs, it is necessary to have an understanding of how assets respond to potential actions and how actions applied in one realm can propagate to others. Response curves (e.g. persistence of species and ecosystems across realms under different levels of threats) can be incorporated into optimization algorithms to allocate multiple actions to mitigate threats across realms. When possible, the outputs of optimization tools should be assessed (or ideally integrated) to other tools to assess ecological (e.g. effects of water extraction on aquatic species) and economic (e.g. production) outcomes to assess proposed management and land use alternatives.	N/A	N/A
17. Final spatial allocation of actions and uses: Based on alternative maps depicting the allocation of land use and management actions, managers – in consultation with stakeholders – can select a configuration that balances socioeconomic and environmental goals across realms. Depending on the expected output of planning, this map can be in the form of a catchment management and/or land use plan.	Tools in the Learning kitbag are intended to show where it is best to act to address the drivers on asset structure and function. For example, where to control weed infestations and how to approach this for a particular landscape or weed type. This are not 'finalised' but a living process of learning and education using practical tools.	Among strengths of NQ Dry Tropics planning approach are that the plan does not provide final/rigid allocations of actions, rather a platform to support a living process of learning and education using practical tools.
18. Define indicators: Once the management plan has been determined, the planning team should determine the social, economic and/or ecological indicators that will be used to assess the achievement of plan objectives and adjust management actions (including the overall plan) accordingly. This process should include an explicit procedure to revise and update (if necessary) the plan. Preferably, indicators should be conceptualized early in the planning process to ensure objectives are clear and can be measured using readily-available data (e.g. remotely-sensed) or can be obtained using existing or new monitoring programs (e.g. led by researchers, users and/or agencies). Indicators can be refined based on research and monitoring.	One of the five components of the planning process is a Learning Kitbag. The learning kitbag will develop tools and skills to facilitate improved NRM delivery. The learning kitbag will provide a MERI process that will feed into updates of the context library and management strategy as monitoring and evaluation proceed. The MERI process for is being defined using contributing processes. The transition governance group is using a rubric process to identify what success looks like for each of the four key elements of the planning framework. Consultation with the community includes generic identification of concerns which help define the scope of interest in indicators. Specific trajectory target setting exercises are being done with technical experts in the field of interest. Different organisations are being given custodial rights to monitor major natural resource features or assets of interest – EG. Reef Check for the Reef. A review of achievements against the previous NRM plan goals and objectives is being used to ensure continuity and coverage of enduring issues.	None

19. Other NRM spatial plans: Planners should be aware of existing spatially-explicit plans that inform uses of land and water. These plans will constrain and/or serve as the legal mechanism to implement the plans. Examples of such plans are water allocation, erosion control, weeding plans, prioritization of farms to implement best farming practices. These plans will influence uptake of the plan and should be considered when optimizing the allocation of actions and land uses, but not necessarily constrain this process.	The plan makes provision for a listing of these plans in the first instance and an analysis of their links. This means describing the extent and nature of the dependencies between these plans and the NRM plan.	None
20. Management and land-water use decisions: Depending on the nature of the planning outputs (e.g. guidelines, statutory), the proposed plan will then guide the on-ground allocation of land/water uses and management actions in the planning region by the relevant stakeholders (i.e. uptake) and determine the allocation of available funding.	The management strategy will describe general actions and approaches to achieving the objectives and goals set out in strategy and supported by data and analyses stored in the context library. The management strategy will thus specify and support direction of on ground implementation of projects. The Management strategy will set out the process of continuous planning, including how strategic decisions about NRM will be made (Governance) how involvement in NRM will be promoted and what online information tools will be make available to facilitate cooperation and learning about NRM. It will lay out a Vision, aspirational and broad strategic objectives but will not prescribe detailed management actions needed to achieve these objectives.	The process is for people to self-nominate initiatives and projects and behaviours which contribute to the objectives as entries (pledges) in the investments exchange and for the governance group to affirm and recognise these initiatives or to discount them as inconsistent (perverse) with respect to the management strategy.
21. Monitoring & research: Plans should include a monitoring program to periodically assess the progress and achievement of plan objectives using identified indicators. Monitoring should consider using existing research (e.g. long-term monitoring) and land/water assessment programs (e.g. land condition assessments), as well as available tools and data (e.g. remotely-sensed indices, water quality) to facilitate assessment and – if needed – adjustment of the plan. Participation of users (e.g. on-farm monitoring of biodiversity and land/water condition) can improve long-term effectiveness and promote stakeholder uptake and ownership. Monitoring will serve to test assumptions about responses of assets to threats and the effectiveness of prescribed actions. Consequently, actions/uses can be reallocated in updated plans.	One of the five components of the planning process is a Learning Kitbag. The learning kitbag will develop tools and skills to facilitate improved NRM delivery. The learning kitbag will provide MERI process that will feed into updates of the context library and management strategy as monitoring and evaluation proceed. The MERI process aims to ensure the plan is appropriate, adequate, effective and efficient in the use of the content of the Management Strategy as the baseline and analytics of crowd sourcing activity on the Wiki as a primary mechanism of data input.	None

22. Evaluate outcomes: Using the information derived from monitoring programs and assessment of effectiveness of actions, plans can be revisited to redefine and/or reallocate management actions and uses. This information can also serve to assess and – I necessary – adjust objectives, either because they are inadequate or are not providing information that will allow managers to assess the health of the system. This information ultimately can serve to revisit the broad management problems/needs and assess the relevance of the planning goals under new circumstances.	One of the five components of the planning process is a Learning Kitbag. The learning kitbag will develop tools and skills to facilitate improved NRM delivery. The learning kitbag will provide MERI process that will feed into updates of the context library and management strategy as monitoring and evaluation proceed. The plan divides the Learning Kitbag concept into MERI and Decision tools and guides components. However, in practice there are no real 'boundaries' in the Wiki with respect to searching for the information or the analytics used to support governance group decisions on changes that are needed.	None

Application of the cross-realm planning operational framework in the Gilbert River catchment and Northern Gulf NRM planning processes

Stage and analyses	Gilbert planning	Northern Gulf NRM planning	Challenges and notes
1. Define planning domain: Define the region or area across which management areas are assessed and compared for investment in actions (e.g. protection, fire management, erosion control, weeding) to achieve explicit objectives (e.g. species conservation, livelihoods, development). This can be defined based on biophysical features (e.g. catchments, bioregions), political or management boundaries (e.g. districts, shires, NRM regions) or a combination of these depending on the planning goals.	The planning region was defined as the Gilbert River catchment, which shares ecological, socioeconomic, and cultural values with other catchments in northern Australia (Northern Gulf in particular)[1-4], and faces similar threats, including extensive grazing, altered fire regimes, and invasive species[5]. The catchment faces potential conflict between development and conservation[6-8], and offer opportunities for emerging stewardship programs that may play an important role in the conservation of North Australia's biodiversity[9,10].	The planning region was defined as the Northern Gulf (NG) region, given this is the region which the Northern Gulf Resource Management Group (NGRMG) is tasked with providing advice for resource management decisions. The region covers the Norman, Gilbert, Staaten and Mitchel catchments (~197,946 km2) and includes terrestrial, freshwater and coastal-marine ecosystems. A marine area of 160 nautical miles is considered, extending from Port of Karumba in an arc to include both Southern Gulf and Northern Gulf NRM regions for a joint costal and marine study (defined in the absence of clear definition on how far NRM regions should extend into the marine environment).	The northern half of the Mitchell catchment is included in a "Joint Management Area" and shared between Cape York NRM and NGRMG, based on old CYPLUS line. This causes some challenges in both duplication of effort and how the two NRM Plans deal with this area.
2. Define management problem/needs: Identify and describe the key conservation and/or natural resource management issues in the region (e.g. weeds, feral animals, bush fires, erosion, water quality and quantity, pollution, vegetation clearing) that can be addressed by actions identified in the plan, these include threats to the natural and socioeconomic assets of interest (e.g. species, wetlands, productive soils, cultural sites)	The catchment has high conservation value and provides important ecosystem services, but is threatened by many factors[11-14] including invasive animals[15-24], weeds[25-30], grazing[31-34], changes to fire regimes[35-45], and erosion. The effects of these threats vary depending on their spatial distribution and co-occurrence of species and ecosystems. Therefore, it is essential to manage key threats to maximise benefits for multiple species and ecosystems[11,28,46]. Additional concerns include the long-term sustainability and social-ecological impacts of mining and the potential conflict between development (e.g. irrigated agriculture, mining) and conservation, coastal fisheries and Traditional uses.	Key management problems and needs include: determining investment priorities for regional NRM, with limited and shrinking financial resources; managing and/or offsetting impacts of large resource based development; promoting adoption of sustainable land management across the NRM region, which is dominated by large leasehold grazing enterprises; facilitating an environmental economy; leveraging science and research of ecological processes to address paucity of data, directed to where the most critical gaps in knowledge are; and meaningfully engaging community in NRM.	Defining management problems is not trivial given that NRM planning can be widely defined and can encompass community, grass roots, science based and policy levels. Among (and within) organisations there are diverse views on the aims of the NRM Plan. Common themes include catchment health, including soils, weeds and pests, erosion, fire and grazing impacts, water quality, biodiversity and Traditional cultural knowledge.
3. Governance analysis: The governance context, defined by existing institutional, political, and socioeconomic decision systems, will influence management and decisions about uses of land and water across realms, and will dictate which types of funding and actions are feasible. This stage aims to understand the current or potential overlap, gaps and coordination between institutions with jurisdictions over the region (including across terrestrial, freshwater and marine realms) and how these interactions can affect management decisions and prioritisation of actions when planning.	A governance analysis was conducted to understand the overall context for the plan, and to identify strengths and weaknesses in natural resource management governance in the catchment that should be taken into account in the planning process[47]. The analysis stressed the tension amongst Indigenous, economic and conservation interests, and pointed to shifting national and state/territory policy frameworks, fragmented funding of science and limited consensus building via spatial decision support[8].	The governance analysis of the Gilbert River catchment was undertaken with a northern Australia vision and the findings for the catchment can be relevant and in some cases a reflection of the governance context in the Northern Gulf region. However, it might be necessary to do a critical analysis of these findings and identify differences that might be relevant to place the region-wide assessment in context.	Governance in the Northern Gulf region is dominated by Shire councils who have a closer proximity to communities than in urban LGAs and provide the primary source of employment in many centres (per capita much more people involved in councils). However there capacity is financially limited and largely directed at road maintenance. In this context NGRMG has higher community profile and influence in governance of region than in urban counterparts.

4. Identify and engage stakeholders: Identify organisations and/or people (e.g. agencies, resource users, NGOs, residents, scientists) who will affect or be affected by management actions or contribute to the planning process, including implementation and monitoring of actions. This stage is critical to consider the diversity of views and preferences of stakeholders when developing the plan, to maximise uptake, promote ownership, and develop feasible and cost-effective actions to achieve planning objectives.	Grazing is the most extensive land use in the catchment, thus pastoralists are a key stakeholder group in the catchment. Other stakeholder groups include farming, fishing, tourism, mining, government agencies, environmental NGOs, and researchers working in the region. A social network analysis is underway to study collaboration networks of organisations participating in NRM in the catchment. This analysis aims to identify key stakeholders, understand collaboration, and inform engagement activities for NRM planning purposes.	The main stakeholder groups identified for the Northern Gulf are similar to the Gilbert catchment, including: graziers, farmers, fishermen, miners, traditional owners, tourism operators, conservationists, local government and scientists; other relevant stakeholder might also be identified through the social network analysis underway for the Gilbert.	This step is not difficult in a region which has a population of ~10,000 people. Stakeholders in the wider Northern Gulf region are the same as the Gilbert catchment, but notable differences include the peri-urban communities, and the horticulture and cane industries of the Upper Mitchell catchment.
5. Elicit social-ecological goals: Identify the collective visions of aspirations, such as representation and persistence of biodiversity, improved livelihoods, and maintenance of ecosystem services. This broad statements of what the plans aim to achieve then need to be translated into - preferably quantitative - objectives (e.g. SMART) that will guide the allocation and prioritisation of actions and monitoring of progress.	Broad management goals drafted from the survey to pastoralists undertaken by James Cook University, in collaboration with the Northern Gulf Resource Management Group. These goals mainly refer to the priorities of the grazing industry, including production and management of environmental problems (focused on pests, weeds, fire, overgrazing and erosion). These goals were discussed with land managers and other members of the community through feedback sessions. This consultation process ensure broad goals broadly reflect stakeholders' aspirations and vision regarding NRM in the catchment.	The NRM planning process included a review of science and social/ economic assessments which was peer reviewed. This resulted in an extensive list of recommendations from both the experts and the literature. A prioritisation process will be developed and underpin the community engagement process, to identify regional themes and regional scale strategies, with a sub level of capacity building/ science and research and on-ground works targets and associated projects and partners. Ultimately the NRM Plan aims to produce a succinct suite of regional strategies which direct NRM investment and leverage partnerships around 6-10 key NRM issues.	In the context of the NRM planning process this relates to "community values" which are diverse and pull in different directions, or tend to fall back on motherhood statements which will be common to all of rural/ regional Australia. However the NGRMG attempted to overcome this using alternative strategies, including creating a video journal of "words which describe the Gulf values", developed over the course of 2015 during the engagement. These narratives aim to inform the planning process, followed by a prioritisation process which actually pins down where the majority of people would like to see investment directed.
6. Multiple land and water uses: Associated with diverse stakeholders are multiple uses of land and water with varying levels of compatibility, which requires understanding the benefits and costs of potential uses across stakeholders, sometimes geographically distant (e.g. farmers and fishers). This stage mainly consists in mapping the main land/water uses across the planning region and exploring the potential links between stakeholders with interests or jurisdiction over terrestrial, freshwater and marine realms. This will be the basis of later analysis to identify and assess the co-benefits and trade-offs resulting from land/water management decisions.	Main land use in the Gilbert catchment is grazing of natural vegetation, but there is some small-scale horticulture and cropping. Other less extensive land uses with potential local and downstream impacts include mining and residential. There is interest and some potential for irrigated agriculture, hence potential for conflict among pastoral, conservation, and Traditional uses. Overgrazing and fires can contribute to soil erosion with local and downstream impacts (e.g. on water quality and fisheries). Fishing in the rivers and coastal areas is an important use of resources in the catchment, as well as recreational use of water bodies and range areas. Emerging markets, including carbon storage/sequestration and biodiversity stewardship may become relevant.	The Northern Gulf region consists of 4 main bioregions (Gulf plains/ Einasleigh Uplands/ Cape York and Wet Tropics) and from a socio-economic perspective four main land uses: grazing lands, coastal lands, intensive agriculture (mainly MDIA) and Tablelands- mixed use, peri-urban areas. These areas have distinct and different land and water use issues, although there are many which are at the catchment scale.	To some extent, the planning process relies on the Gilbert catchment bioregional planning process to determine this, as it provides a useful start point and template which can be extended to the other 3 catchments. The use of SNA is being considered as part of this process to assess links between stakeholders in the larger NG region.

7. Overarching models: Of special concern are the effects of climate change on ecological processes and threats, including changes in species distributions (including invasive species), fish migration, rainfall (linked to sediment and nutrient runoff, flooding, droughts), and sea level rise (linked to coastal salinization). Future land (and water) uses will be constrained by these changes and threats can be accentuated (at least in some regions) or mitigated through appropriates land/water uses. Therefore, it is necessary to understand and compile available and appropriate models of climate and land use change that can influence land use/management decisions.	The main concerns around climate change regard changes in rainfall and temperature, with potential regional impacts on droughts, flooding, and wildfire regimes. Climatic variations could be accompanied by changes in the distribution of native and invasive species. Changes in water flow regimes can affect in-stream and coastal ecosystems. Salinization of coastal areas has been raised as a concern. Current climatic models are too coarse in resolution to resolve changes at subcatchment scale, hence are not included in scenarios as part of the planning process in the catchment.	The Monsoonal North cluster will result in a set of down-scaled regional climate projections for Northern Gulf, which will provide a basis for identifying critical risks for NGRMG planning. NGRMG is engaged in spatial modelling to locate vulnerable and resilient areas in the landscape, and natural assets under higher risk due to climate change. However, the engagement activities will focus at planning for recent weather events rather than future scenarios to engage the community in planning for adaptation and mitigation. The decision making framework (Gilbert case study) can provide a decision making framework for the NRM Plan.	Several Stream 2 projects are very useful in this regard, and will be used as inputs into the NRM Plan. This includes spatial modelling (customised for NG needs) or biodiversity and invasive plants, downscaled climate projections, carbon modelling, and assessment of regional drivers, among others.
8. Scenario analysis: Cross-realm planning calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently. Effectively, this means identifying and integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios. Scenario planning can allow for the envisioning of multiple futures that include different impacts of threats on assets and actions on threats, and thereby inform achievement of objectives by feasible actions/uses.	The major land/water use change expected in the Gilbert catchment is development of extensive irrigated agriculture. CSIRO's outputs (FGARA) used to assess alternative scenarios of development. These could be further refined using information on likely land use changes collected from land managers in the catchment. CSIRO undertook a broad assessment of impacts of reservoirs on regional ecosystems (inundation) and water extraction on aquatic ecosystems. Analysis focus on exploring potential configurations of pastoral, agriculture and conservation uses to achieve conservation (including species) and development goals.	This content and framework will depend on the next 3 months of project and engagement design. At present, half way through the project, and NGRMG activities to date have been focused on extensive literature and science review, culminating in a regional assessment of the region, and subsequently expert review of this material. Almost completed NGRMG Traditional Engagement which ran concurrently with the literature review over the course of 2014. During 2015, focus on engagement design, culminating in the "future, strategic planning" part of the plan, including (maybe) the use of broad scenarios for grazing lands/ coastal areas/ intensive agriculture and peri-urban areas.	The use of broad scenarios to map possible futures has not been explored and could do with some consideration and discussion.
9. Set multiple objectives: Cross-realm planning requires integrating multiple objectives for conservation and development (e.g. biodiversity, ecosystems services, agriculture). Conservation objectives for single realms are well described (e.g. maintain species populations, represent habitats, increase production), but objectives for multiple realms are less common (e.g. protect representative marine and terrestrial habitats while also reducing land-based threats to the marine environment). Likewise, cross-realm socioeconomic objectives are generally missing (e.g. achieve land development and coastal fisheries goals through catchment management and land/water use that minimise downstream impacts). This stage entails translating broad goals into, preferably quantitative (SMART) objectives. These include realm-specific (terrestrial, freshwater, marine) and cross-realm objectives that will influence the allocation of actions across realms based on understanding cross-realm threats and ecological processes, and the costs and benefits of different land/water uses to stakeholders.	The planning project aims to prioritise management actions to increase the persistence of terrestrial biodiversity in the Gilbert catchment. Thus objectives were set for prioritisation regarding the management of key environmental threats in the region (pests, weeds, overgrazing, fire) to achieve the conservation and production goals. Quantitative objectives derived from goals defined with pastoralists and other members of the community during feedback sessions. These objectives reflect spatial requirements for persistence of species and ecosystems threatened by pests, weeds, overgrazing and altered fire regimes, while addressing the production issues identified by land managers. Additional objectives may include: preventing and controlling erosion to minimise soil loss, maintain grass cover, and maintain/improve water quality (in-stream and downstream); storing or sequestering carbon; protecting areas under a stewardship program, etc.	The Northern Gulf NRM Plan encompass four components: 1. Regional assessment (evidence base) 2. Engagement outcomes 3. Regional Strategies (succinct suite including grazing lands/ coastal and marine/ horticultural and peri-urban communities/ areas), under which will sit: a) Rationale (hyperlinks to evidence base) b) Education/ capacity building targets c) Operational works targets d) Science and research targets e) Potential partnerships f) Potential projects g) Monitoring and evaluative frameworks 4. Internal operational & governance plan	It is important to be realistic about what a process like this can actually achieve and influence, and what it cannot. It is thus important to be cognisant of the dynamic and unpredictable governance, policy and funding environments, under which NRM groups operate. The proposed multi-objective approach (se column on left) responds to this and states broad, high-level regional strategies and then lines up potential targets, partners and projects underneath them like "cabs in the rank" ready to drive off if and when opportunities become available. These should however all relate to the broad regional strategies, which will also become the charter for NGRMG.

10. Model multiple threats: When planning for resource management it is important to consider multiple threats to the social-ecological systems. Threats can be associated with current land/water uses, such as modified water flow or vegetation clearing, but can derive from past or distant uses (e.g. feral animals, altered fire regimes and water flows). Managing some threats, such as feral pigs, will benefit production and conservation across multiple realms through mitigating local (e.g. soil erosion) and downstream (e.g. water quality) problems. There are likely to be varied interactions between threats and assets/uses of management interest. The potential interactions between threats (e.g. additive, synergistic, antagonistic) call for assessing, quantifying and/or modelling cumulative impacts, as well as co-benefits or trade-offs between management actions to mitigate threats.	The project focuses on five key threats, mapped as follows: pests and weeds (ALA Database); pest and weed ~10-50km resolution maps indicating extent and density derived from QLD and National surveys (ERIN-SEWPaC, WoNS); property-scale pest and weed extent and density (Gilbert Survey); MaxEnt ~1km suitability maps for weeds (Weed Futures, Macquarie University) and pests (CTBCC, JCU); grazing pressure based on land condition (using remotely-sensed cover) as proxy, provided land cover changes linked to natural variability are considered[48,49]; wild fire threat is based on frequency of late-season (hot fires) and interval between fires, which can be estimated based on remotely-sensed fire scar history (NAFI); and erosion, which can be modelled using SedNet.	The NRM Plan focuses on climate risk to natural assets (determined by a combination of modelling and a risk matrix) and a regional resilience rating around social benchmarks (Allan Dale's work). It also identifies key threatening processes to land, flora, fauna, freshwater and coastal and marine processes in the regional assessment.	NGRMG used asset-based approaches to regional assessment, which includes identifying key threatening processes for fauna/ flora/ coastal and marine/ freshwater systems. This is limited from a systems perspective, but as this is how the literature and data is arranged, and essentially this assessment is a literature review; chose this approach for ease of review. This has been reviewed by 40 + experts who also tend to have "assets" based expertise. However, the NGRMG is looking to use a systems based approach to both the engagement and future planning to model and understand threats in the region. To some extent, this will also rely on the social benchmarks work as a base line.
11. Model multiple features: Multiple threats will influence multiple assets in various ways. Identifying the sources of threats and the assets they influence across realms therefore underpins decisions about where, when and how to act. Assets of interest in a region include ecosystems and species with different conservation significance, but will also include, for example, areas with high suitability for agriculture or grazing and sites of cultural or recreational importance. This stage requires planners to identify the assets that are the main focus of the management plan, and may require compilation of data from historical records, monitoring programs, modelling exercises, stakeholders-based mapping, etc. This requires discussing with stakeholders which are these features and available data.	Based on objectives, landscape features to be targeted for management/protection include: terrestrial species (MaxEnt suitability maps) and refugia against climate change (CTBCC) and QLD regional ecosystems (DSITIA). Information regarding land species ranges is available from the Species of National Environmental Significance Database (DotE). Other features to target include agriculture (FGARA) and grazing potential (DAFF). A second stage will aim to develop an integrated multi-objective plan targeting aquatic species & ecosystems (Griffith University) and soil/vegetation carbon (CDU, CSIRO).	Currently NGRMG has used CLiMAS modelling tool (based on ALA and Wildnet data, as well as weeds) a Zonation analysis for climate risk, any Marxan modelling which comes out of the Gilbert catchment Bioregional planning, as well as a risk model for aquatic biodiversity (Stream 2) and hopefully an existing wetlands prioritisation model. Investigations currently are being made into options for preliminary modelling of erosion risk.	NGRMG is aiming to work directly with stakeholders to identify which assets (partially been done in NG regional assessment). The spatial analysis work also includes identifying areas with highest refugia value under climate future scenarios.

12. Multiple actions and uses: Threats will affect assets in different ways and can propagate across realms, thus decision-makers will likely need to employ a portfolio of management actions that will suit the requirements of different assets and mitigate local and cross-realm threats cost-efficiently. Along with prescribed actions, decisions about land and water uses should reflect the desired balance between socioeconomic opportunities and conservation needs. An integrated plan thus needs to identify, prioritise and coordinate the locations and types of actions and uses. Prioritisation of multiple actions and uses across space and time allows plans to meet objectives for multiple outcomes, which take into account the benefits and costs across diverse stakeholders and realms.	The initial prioritization analysis focus on actions to mitigate the key threats identified for the catchment, including: on-farm pest control, weeding, fire management, and fencing-off areas. The cost-effectiveness of different actions was assessed using Gilbert data and discussed with managers. The combination of features of management or conservation value and presence of threats served to identify areas for the implementation of these actions.	This activity will be the focus of the 2015 engagement program and be determined by workshop.	A prioritisation of management actions underpins engagement. However, it is uncertain whether there will be support and resources allocated to the final NRM Plan to undertake any of the priority actions identified through planning process.
13. Socioeconomic analysis: The socioeconomic context of the region will dictate the type of actions that are feasible to implement and inform the assumptions of overarching models (e.g. land use change, ecosystem services). There are a number of potential analysis that can inform planning at this stage, including social network analysis (stakeholders' collaboration and power dynamics), market (drivers of change), ecosystem services (values), spatial variation of management costs (inform priorities). These studies will be informed by non-spatial plans (e.g. available funding).	Knowledge of management costs is limited by little or no breakdown of costs by activity (e.g., fire control, weeding, and revegetation). An ideal system would estimate costs of individual management actions for a given set of landscape characteristics and objectives at the resolution of individual properties or management units (e.g., paddocks). The main goal of the Gilbert survey was to identify the factors driving management costs in pastoral properties. The project explored methods to obtain detailed, accurate data on the costs of managing these areas, and produce data that will serve as a model for NRM in the region. The main outputs are spatially-explicit models of costs for individual actions; these models are one of the inputs to optimise the spatial configuration of actions to achieve management objectives at minimum or near-minimum cost.	This analysis largely relies on a socio-economic benchmarks work (regional resilience indicators), which will be further ground-truthed by NGRMG's community consultation.	The suggested Social Network Analysis can also provide an input into this assessment. The Gilbert planning should also be useful, but costs breakdown appears to be inconclusive from the survey results. Ultimately many grazing enterprises are impoverished, so it is assumed that graziers have no capacity to carry costs of NRM initiatives.
14. Non-spatial plans: External components, such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management. This will constrain and influence the uptake of planning recommendations by stakeholders, dictate research and planning priorities (e.g. based on current budgetary allocations, funding streams), inform other spatial planning processes (e.g. water and land use allocation) through investment priorities and regulations. Planners need to be aware of these non-spatial plans and work within the opportunities and limitations that these may impose directly or indirectly on the plan.	N/A	NGRMG contributed to an EDO Qld subcontract, which identified key policy and legislative reforms affecting the realm of NRM, which has fed into the planning framework. The literature/science review included a review of all relevant strategies and policies to the region.	N/A

15. Optimize spatial allocation of actions and uses: Planning with objectives across multiple realms is uncommon and generally based on concurrent and/or sequential optimisation in terrestrial, freshwater and/or marine realms. This stage consists in integrating information derived from previous stages and optimising the allocation of actions and land uses across realms (e.g. using Marxan, Marzone, C-Plan, Zonation). Outputs of this stage are maps depicting cost-effective allocation of actions and land uses that balance social and ecological objectives across multiple realms. Rather than static and unique "optimal" solutions, these maps are likely to be alternative maps under different climatic/land use change scenarios and/or different budgetary or policy constraints. Available tools allow to consider some cross-realm threats (e.g. downstream impacts on aquatic ecosystems), but further research and tools are needed to optimize actions across multiple realms.	Followed a systematic conservation planning approach[50] to allocate actions in specific areas to achieve management objectives, while minimising costs[51]. Uses Marxan[52] conservation planning tool designed to optimise the spatial configuration of actions to achieve defined objectives at minimum or near-minimum cost[53]. The prioritisation involves merging features of management or conservation value (species, ecosystems, productive areas) and maps of threats (pests, weeds, fire, grazing) to identify areas where features most affected by these threats coincide and where implementing specific actions (at lowest cost) is needed. Identified potential responses of species and ecosystems to threats using expert elicitation techniques[54,55] and use this information to generate response curves[56] that describe the relationship between probability of persistence of species/ecosystems and threat intensity.	NGRMG has undertaken some spatial modelling for planning, including a refugia analysis, storm surge analysis and weeds analysis. This could be expanded to run a basic erosion risk analysis, and wetlands prioritisation process, capacity pending.	Refer to line 11; yet to see how modelling will influence prioritisation but watching this space carefully.
16. Assess cobenefits and tradeoffs: Managing one realm can affect ecosystems in linked realms, which can result in co-benefits, if management achieves objectives in two or three realms more efficiently, or trade-offs, if management in one realm compromises the achievement of objectives in another. To quantify co-benefits and trade-offs, it is necessary to have an understanding of how assets respond to potential actions and how actions applied in one realm can propagate to others. Response curves (e.g. persistence of species and ecosystems across realms under different levels of threats) can be incorporated into optimization algorithms to allocate multiple actions to mitigate threats across realms. When possible, the outputs of optimization tools should be assessed (or ideally integrated) to other tools to assess ecological (e.g. effects of water extraction on aquatic species) and economic (e.g. production) outcomes to assess proposed management and land use alternatives.	ONGOING	PENDING: there should be a way of identifying synergies and gaps through the planning process, and designing programs which capitalise on the synergies and filling critical gaps. This may simply rely on identifying "communities of alignment" or "coalitions of the willing" around key region wide issues. The SNA and community engagement my assist in identifying where these exist.	As per left column, NGRMG will be grouping feedback/management actions into broad areas and then making an assessments of where synergies exist. Ultimately if the broad NRM agenda does not achieve community buy in and works in isolation, it will be limited in effectiveness, so this area is essential part of NGRMG's planning, engagement, and implementation.
17. Final spatial allocation of actions and uses: Based on alternative maps depicting the allocation of land use and management actions, managers – in consultation with stakeholders – can select a configuration that balances socioeconomic and environmental goals across realms. Depending on the expected output of planning, this map can be in the form of a catchment management and/or land use plan.	The ultimate goal of the planning project is to generate a catchment management plan that outlines conservation and production goals and objectives, and that identifies the management actions and prioritise areas for implementation of those actions. Ideally, the plan will inform on-farm management and NRM investment in the catchment (e.g. through NGRMG programs, NRM funding priorities).	Strong interest exists around emerging environmental economies, so part of the NRM Planning may be to develop a framework for development offsets, nature refuges and stewardship payments through spatial prioritisation.	NGRMG will use spatial prioritisation to identify areas, but in reality willing and cooperative land managers will be the ones that attract the investment into on-ground works. The Gilbert planning could be customised to the wider context of NG NRM region.

18. Define indicators: Once the management plan has been determined, the planning team should determine the social, economic and/or ecological indicators that will be used to assess the achievement of plan objectives and adjust management actions (including the overall plan) accordingly. This process should include an explicit procedure to revise and update (if necessary) the plan. Preferably, indicators should be conceptualized early in the planning process to ensure objectives are clear and can be measured using readily-available data (e.g. remotely-sensed) or can be obtained using existing or new monitoring programs (e.g. led by researchers, users and/or agencies). Indicators can be refined based on research and monitoring.	N/A	There will be a suite of measures to manage progress against defined objectives, including (not limited to): (a) monitoring social media and regional newsfeeds; (b) on-ground monitoring (limited); (c) bi-annual review of regional resilience benchmarks; (d) annual phone surveys; (e) internal operations through annual reporting (how well NGRMG operation/extension activities aligns with stated goals and targets and if not, why not, e.g. unrealistic targets).	It is important to identify practical indicators to monitor attitudes, uptake, corporate performance, governance etc. This is challenging and will require commitment from the whole of NGRMG to adopt and maintain, and continue to track and adapt the planning accordingly.
19. Other NRM spatial plans: Planners should be aware of existing spatially-explicit plans that inform uses of land and water. These plans will constrain and/or serve as the legal mechanism to implement the plans. Examples of such plans are water allocation, erosion control, weeding plans, prioritization of farms to implement best farming practices. These plans will influence uptake of the plan and should be considered when optimizing the allocation of actions and land uses, but not necessarily constrain this process.	N/A	N/A	NGRMG is aware of other plans and working on it, but incorporating it all into one framework is challenging.
20. Management and land-water use decisions: Depending on the nature of the planning outputs (e.g. guidelines, statutory), the proposed plan will then guide the on-ground allocation of land/water uses and management actions in the planning region by the relevant stakeholders (i.e. uptake) and determine the allocation of available funding.	NGRMG can continue collaborating with land managers to guide and support the implementation of priority actions (including looking for funding) set out in the plan. Actions will be in the form of coordinated on-farm management, under a catchment-wide framework. Outcomes of actions, in terms of achieving defined objectives (and broader goals), can be monitored using the selected indicators. Ideally, catchment-scale indicators should refer to the region-wide (Northern Gulf) NRM priorities.	N/A	It is difficult to assess how much funding will be available as it depends on a variety of things, such as funding cuts, commitment within and outside of the company to ongoing NRM priorities. Dealing with uncertainty in this realm makes it difficult to follow a clear process.

21. Monitoring & research: Plans should include a monitoring program to periodically assess the progress and achievement of plan objectives using identified indicators. Monitoring should consider using existing research (e.g. long-term monitoring) and land/water assessment programs (e.g. land condition assessments), as well as available tools and data (e.g. remotely-sensed indices, water quality) to facilitate assessment and – if needed – adjustment of the plan. Participation of users (e.g. on-farm monitoring of biodiversity and land/water condition) can improve long-term effectiveness and promote stakeholder uptake and ownership. Monitoring will serve to test assumptions about responses of assets to threats and the effectiveness of prescribed actions. Consequently, actions/uses can be reallocated in updated plans.	Potentially, the Northern Gulf Resource Management Group can develop, in collaboration with land managers, a monitoring program that combines large-scale (e.g. based on state-of-the art remotely sensed indicators of land condition) and on-farm periodic assessments to collect the information required to evaluate achievement of management objectives based on defined indicators. Such a program could support or be incorporated into a region-wide (Northern Gulf) stewardship program and/or ongoing land management monitoring programs (e.g. MLA, DAFF).	PENDING	This will be thoroughly investigated at the conclusion of the project. 6 months has been allowed for simply for this after the Plan has been adopted.
22. Evaluate outcomes: Using the information derived from monitoring programs and assessment of effectiveness of actions, plans can be revisited to redefine and/or reallocate management actions and uses. This information can also serve to assess and – if necessary – adjust objectives, either because they are inadequate or are not providing information that will allow managers to assess the health of the system. This information ultimately can serve to revisit the broad management problems/needs and assess the relevance of the planning goals under new circumstances.	PENDING	Components of the plan should be reviewed: (a) annually (internal operations/ community phone surveys/ analysing social media and regional news feeds); (b) bi-annually (regional resilience indicators/ field surveys/ environmental accounts/ hard data); and (c) every 5 years (major review of entire process, including relevance of evidence base and re-visit regional communities) resulting in new suite of updated strategies/ targets.	N/A

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Application of the cross-realm planning operational framework in the Southern Gulf NRM planning process

Stage and analyses	Southern Gulf NRM REGION planning	Challenges and notes
1. Define planning domain: Define the region or area across which management areas are assessed and compared for investment in actions (e.g. protection, fire management, erosion control, weeding) to achieve explicit objectives (e.g. species conservation, livelihoods, development). This can be defined based on biophysical features (e.g. catchments, bioregions), political or management boundaries (e.g. districts, shires, NRM regions) or a combination of these depending on the planning goals.	Southern Gulf NRM region, which is mainly in Qld but extends into the NT. No Qld money can be spent in NT. No active projects in NT, but collaborations with Roper River Land Care. Cross-regional project collaboration with Northern Gulf Resource Management Group. Collaborations with Fitzroy Basin Association (e.g. Carbon Offsets) and NQ Dry Tropics, but neither of these include on-ground works. Assets of interest are Land, Sea, Air, Water, Inland waters, Coasts and marine resources, Cultural Heritage, Community capacity, Biodiversity. Limitations on working on water resources and riparian zones within banks as these come under the Water Planning Act, which states these are a State responsibility. So local Government will not partner projects in these areas.	
2. Define management problem/needs: Identify and describe the key conservation and/or natural resource management issues in the region (e.g. weeds, feral animals, bush fires, erosion, water quality and quantity, pollution, vegetation clearing) that can be addressed by actions identified in the plan, these include threats to the natural and socioeconomic assets of interest (e.g. species, wetlands, productive soils, cultural sites)	"Southern Gulf Catchments is the region's only community-based organisation that has the sole purpose of working with all land managers to address large and complex natural resource issues at the landscape level - building collaboration, gathering and sharing information and brokering funding for on-ground work." The plan aims to identify priority NRM issues in the Southern Gulf NRM region, along with opportunities and partnerships to improve management of and protect natural resources. It is also a communication tool to attract investment from funding bodied, including, but not restricted to, Commonwealth and State governments. It will thus work as a brokering tool.	
3. Governance analysis: The governance context, defined by existing institutional, political, and socioeconomic decision systems, will influence management and decisions about uses of land and water across realms, and will dictate which types of funding and actions are feasible. This stage aims to understand the current or potential overlap, gaps and coordination between institutions with jurisdictions over the region (including across terrestrial, freshwater and marine realms) and how these interactions can affect management decisions and prioritisation of actions when planning.	N/A	

4. Identify and engage stakeholders: Identify organisations and/or people (e.g. agencies, resource users, NGOs, residents, scientists) who will affect or be affected by management actions or contribute to the planning process, including implementation and monitoring of actions. This stage is critical to consider the diversity of views and preferences of stakeholders when developing the plan, to maximise uptake, promote ownership, and develop feasible and cost-effective actions to achieve planning objectives.	Identify: Extensive stakeholder analysis of the first plan had been comprehensive. It identified the key sectors as: Grazing, Mining, Local Government, Coastal and marine, Indigenous community. Engagement: Existing stakeholders (members of SGC) were invited to participate. White pages were searched to broaden the response base. Pastoralists from across the region were contacted by phone. One or two representatives of each mine were contacted by phone. A separate project was undertaken to engage the Indigenous community. This involved meeting with the key members of each groups and letting them determine if they wanted to hold country based planning workshops. The approach here was based on Dermott Smyth's Land and Sea Country planning.	
5. Elicit social-ecological goals: Identify the collective visions of aspirations, such as representation and persistence of biodiversity, improved livelihoods, and maintenance of ecosystem services. This broad statements of what the plans aim to achieve then need to be translated into - preferably quantitative - objectives (e.g. SMART) that will guide the allocation and prioritisation of actions and monitoring of progress.	The key unit of the plan is the Strategic objectives. These are based on 21 priorities and existing targets from previous plan and consultation and internal evaluation to update. The new priorities include • Land production values • Inland waters and river systems • Pests and weeds • Air quality • Marine systems • Cultural values • Community capacity	
6. Multiple land and water uses: Associated with diverse stakeholders are multiple uses of land and water with varying levels of compatibility, which requires understanding the benefits and costs of potential uses across stakeholders, sometimes geographically distant (e.g. farmers and fishers). This stage mainly consists in mapping the main land/water uses across the planning region and exploring the potential links between stakeholders with interests or jurisdiction over terrestrial, freshwater and marine realms. This will be the basis of later analysis to identify and assess the co-benefits and trade-offs resulting from land/water management decisions.	The plan is cognisant of multiple benefits, e.g. Improve ground cover to • improve production/productivity • protect soil • protect water quality • protect biodiversity and fisheries down-stream Detailed actions are being prepared for each Strategic objective. These are seen as pathways to delivery. They may be very specific, such as Control specific Rubber vine outliers to general, such as Manage ground cover to protect soil resources. They are also likely to include partnership building exercises.	

7. Overarching models: Of special concern are the effects of climate change on ecological processes and threats, including changes in species distributions (including invasive species), fish migration, rainfall (linked to sediment and nutrient runoff, flooding, droughts), and sea level rise (linked to coastal salinization). Future land (and water) uses will be constrained by these changes and threats can be accentuated (at least in some regions) or mitigated through appropriates land/water uses. Therefore, it is necessary to understand and compile available and appropriate models of climate and land use change that can influence land use/management decisions.	CSIRO climate projections are being used to identify resilient habitat using the spatial decision support tool CLIMAS.	The value of decision support tools, such as INFER, was recognised for more complex areas. However, land use in Southern Gulf Catchments is relatively simple (mostly grazing and Aboriginal land, with small areas of high impact mining), so complex tools would not deliver value for money.
8. Scenario analysis: Cross-realm planning calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently. Effectively, this means identifying and integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios. Scenario planning can allow for the envisioning of multiple futures that include different impacts of threats on assets and actions on threats, and thereby inform achievement of objectives by feasible actions/uses.	N/A	
9. Set multiple objectives: Cross-realm planning requires integrating multiple objectives for conservation and development (e.g. biodiversity, ecosystems services, agriculture). Conservation objectives for single realms are well described (e.g. maintain species populations, represent habitats, increase production), but objectives for multiple realms are less common (e.g. protect representative marine and terrestrial habitats while also reducing land-based threats to the marine environment). Likewise, cross-realm socioeconomic objectives are generally missing (e.g. achieve land development and coastal fisheries goals through catchment management and land/water use that minimise downstream impacts). This stage entails translating broad goals into, preferably quantitative (SMART) objectives. These include realm-specific (terrestrial, freshwater, marine) and cross-realm objectives that will influence the allocation of actions across realms based on understanding cross-realm threats and ecological processes, and the costs and benefits of different land/water uses to stakeholders.	No quantitative objectives were set. Instead, the plan's objectives defined directions of improvement. The previous plan had made the mistake of setting quantitative targets and timeframes for outcomes that were beyond the control of SCG. So it was set up to fail. SGC has no jurisdiction over environmental condition; it can only facilitate improved practices. It is also a low-capacity group with few staff and resources. The strategic objectives of the new plan are therefore designed to be used to identify whether a proposed project aligns with SGC's priorities. Quantitative objectives can then be set at the project scale. The plan therefore provides a framework within which quantitative objectives can be set at an operational scale.	

10. Model multiple threats: When planning for resource management it is important to consider multiple threats to the social-ecological systems. Threats can be associated with current land/water uses, such as modified water flow or vegetation clearing, but can derive from past or distant uses (e.g. feral animals, altered fire regimes and water flows). Managing some threats, such as feral pigs, will benefit production and conservation across multiple realms through mitigating local (e.g. soil erosion) and downstream (e.g. water quality) problems. There are likely to be varied interactions between threats and assets/uses of management interest. The potential interactions between threats (e.g. additive, synergistic, antagonistic) call for assessing, quantifying and/or modelling cumulative impacts, as well as co-benefits or trade-offs between management actions to mitigate threats.	The overall plan is informed by regional experience and a knowledge of the literature. Where this literature has included conceptual or populated models, their findings have been taken into account. More sophisticated models are unlikely to change the priorities or how to address them, as the Southern Gulf is a relatively simple system, with obvious issues. So models would not have a high cost-benefit return.	
11. Model multiple features: Multiple threats will influence multiple assets in various ways. Identifying the sources of threats and the assets they influence across realms therefore underpins decisions about where, when and how to act. Assets of interest in a region include ecosystems and species with different conservation significance, but will also include, for example, areas with high suitability for agriculture or grazing and sites of cultural or recreational importance. This stage requires planners to identify the assets that are the main focus of the management plan, and may require compilation of data from historical records, monitoring programs, modelling exercises, stakeholders-based mapping, etc. This requires discussing with stakeholders which are these features and available data.	The overall plan is informed by regional experience and a knowledge of the literature. Where this literature has included conceptual or populated models, their findings have been taken into account. More sophisticated models are unlikely to change the priorities or how to address them, as the Southern Gulf is a relatively simple system, with obvious issues. So models would not have a high cost-benefit return.	
12. Multiple actions and uses: Threats will affect assets in different ways and can propagate across realms, thus decision-makers will likely need to employ a portfolio of management actions that will suit the requirements of different assets and mitigate local and cross-realm threats cost-efficiently. Along with prescribed actions, decisions about land and water uses should reflect the desired balance between socioeconomic opportunities and conservation needs. An integrated plan thus needs to identify, prioritise and coordinate the locations and types of actions and uses. Prioritisation of multiple actions and uses across space and time allows plans to meet objectives for multiple outcomes, which take into account the benefits and costs across diverse stakeholders and realms.	Detailed actions are being prepared for each Strategic objective (e.g. include land production values, inland waters and river systems, marine systems). These are seen as pathways to delivery. They may be very specific, such as Control specific Rubber vine outliers to general, such as Manage ground cover to protect soil resources. They are also likely to include partnership building exercises.	Limitations on working on water resources and riparian zones within banks as these come under the Water Planning Act, which states these are a State responsibility. So local Government will not partner projects in these areas.

13. Socioeconomic analysis: The socioeconomic context of the region will dictate the type of actions that are feasible to implement and inform the assumptions of overarching models (e.g. land use change, ecosystem services). There are a number of potential analysis that can inform planning at this stage, including social network analysis (stakeholders' collaboration and power dynamics), market (drivers of change), ecosystem services (values), spatial variation of management costs (inform priorities). These studies will be informed by non-spatial plans (e.g. available funding).	The first plan was extensive (five volumes), had a thorough consultation schedule and identified 21 priorities. Therefore this plan builds off of the previous plan.	
14. Non-spatial plans: External components, such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management. This will constrain and influence the uptake of planning recommendations by stakeholders, dictate research and planning priorities (e.g. based on current budgetary allocations, funding streams), inform other spatial planning processes (e.g. water and land use allocation) through investment priorities and regulations. Planners need to be aware of these non-spatial plans and work within the opportunities and limitations that these may impose directly or indirectly on the plan.	All regional plans covering SGC and adjoining areas have been consulted in the revision of the new plan, including •Gulf Regional Development Plan •RDA Road Map •Indigenous Land and Sea Management plans •Local Government Pest Management plans Operational plans are also routinely incorporated at the operational level, e.g. •Threat Abatement Plans •Weed Management Strategies •Back-on-track Threatened species prioritisation	
15. Optimize spatial allocation of actions and uses: Planning with objectives across multiple realms is uncommon and generally based on concurrent and/or sequential optimisation in terrestrial, freshwater and/or marine realms. This stage consists in integrating information derived from previous stages and optimising the allocation of actions and land uses across realms (e.g. using Marxan, Marzone, C-Plan, Zonation). Outputs of this stage are maps depicting cost-effective allocation of actions and land uses that balance social and ecological objectives across multiple realms. Rather than static and unique "optimal" solutions, these maps are likely to be alternative maps under different climatic/land use change scenarios and/or different budgetary or policy constraints. Available tools allow to consider some cross-realm threats (e.g. downstream impacts on aquatic ecosystems), but further research and tools are needed to optimize actions across multiple realms.	Models and decision-support are sought for specific objectives, such as prioritising actions. SGC has a decision support matrix for threatened species work, which identifies actions that have multiple benefits. It has also used expert elicitation for mapping priority areas for offset planning. This process identified high value conservation areas and their assets to identify where a development triggers a requirement for investment in offset conservation actions and where these actions should be undertaken. Starting with a map of these areas based on WildNet data, expert elicitation was used to refine the map (add, remove or extend areas or add or remove values for those areas).	

16. Assess cobenefits and tradeoffs: Managing one realm can affect ecosystems in linked realms, which can result in co-benefits, if management achieves objectives in two or three realms more efficiently, or trade-offs, if management in one realm compromises the achievement of objectives in another. To quantify co-benefits and trade-offs, it is necessary to have an understanding of how assets respond to potential actions and how actions applied in one realm can propagate to others. Response curves (e.g. persistence of species and ecosystems across realms under different levels of threats) can be incorporated into optimization algorithms to allocate multiple actions to mitigate threats across realms. When possible, the outputs of optimization tools should be assessed (or ideally integrated) to other tools to assess ecological (e.g. effects of water extraction on aquatic species) and economic (e.g. production) outcomes to assess proposed management and land use alternatives.	N/A
17. Final spatial allocation of actions and uses: Based on alternative maps depicting the allocation of land use and management actions, managers – in consultation with stakeholders – can select a configuration that balances socioeconomic and environmental goals across realms. Depending on the expected output of planning, this map can be in the form of a catchment management and/or land use plan.	a) The majority of priorities in the revised SGC plan are thematic rather than spatial with the exception of some specific sub-projects including the Strategic Offset Investment Corridor Mapping – Gulf Plains and Mitchell Grass Downs bioregions initiated and developed by SGC in an attempt to fill information gaps. b) Spatial data are currently too sparse to be informative, but even if available would be unlikely to change priorities c) All priorities are considered equal at the plan level. Prioritisation will occur at the operational level, and will be determined by a range of factors, likely impact, funding round priorities, capacity to deliver, community interest etc. The threatened species decision support explicitly weights such criteria to determine best investments at any point in time. d) Priorities will have detailed profiles of the issue and actions required. Priority areas are identified for specific activities where these exist. E.g. potential biodiversity corridors, offset locations, weed eradication, control and containment areas. Other priorities are spatially bound, e.g., improving grazing practices to increase ground cover will be restricted to grazing lands. So profiles will only be accompanied by a map where this is appropriate.

18. Define indicators: Once the management plan has been determined, the planning team should determine the social, economic and/or ecological indicators that will be used to assess the achievement of plan objectives and adjust management actions (including the overall plan) accordingly. This process should include an explicit procedure to revise and update (if necessary) the plan. Preferably, indicators should be conceptualized early in the planning process to ensure objectives are clear and can be measured using readily-available data (e.g. remotely-sensed) or can be obtained using existing or new monitoring programs (e.g. led by researchers, users and/or agencies). Indicators can be refined based on research and monitoring.	Indicators will be defined to answer questions such as: • Have we managed to attract investment? • Have we established successful partnerships as planed? • How many projects have been completed? • How many of the actions have been completed? • Have the actions had the desired effect on the strategic objectives?	
19. Other NRM spatial plans: Planners should be aware of existing spatially-explicit plans that inform uses of land and water. These plans will constrain and/or serve as the legal mechanism to implement the plans. Examples of such plans are water allocation, erosion control, weeding plans, prioritization of farms to implement best farming practices. These plans will influence uptake of the plan and should be considered when optimizing the allocation of actions and land uses, but not necessarily constrain this process.	N/A	
20. Management and land-water use decisions: Depending on the nature of the planning outputs (e.g. guidelines, statutory), the proposed plan will then guide the on-ground allocation of land/water uses and management actions in the planning region by the relevant stakeholders (i.e. uptake) and determine the allocation of available funding.	SGC's current activities are consistent with the priorities of the previous plan and are thus consistent with the revised plans a priorities have not changed greatly. However, the previous plan was too unwieldy and ambitious to implement. The revised plan will be more cognisant of the region's capacity to deliver. This plan will guide investment by identifying potential actions and delivery partners, but not dictate an implementation schedule.	Plan implementation is dependent on attracting investment from major funding bodies (Australian National Landcare Program, Qld Department of Natural Resources and Mines) and partners (BHP, Glencore) and the Offsets program. Priorities of these programs and partners and level of investment change from year to year. So setting a firm implementation schedule would be unrealistic. It is not expected that the priorities will change greatly in a five year period, as a five-yearly review will probably focus on the plan's linkages and partnerships. Actions will be updated annually.

		Plan review will also be undertaken if required by major funding bodies.
21. Monitoring & research: Plans should include a monitoring program to periodically assess the progress and achievement of plan objectives using identified indicators. Monitoring should consider using existing research (e.g. long-term monitoring) and land/water assessment programs (e.g. land condition assessments), as well as available tools and data (e.g. remotely-sensed indices, water quality) to facilitate assessment and – if needed – adjustment of the plan. Participation of users (e.g. on-farm monitoring of biodiversity and land/water condition) can improve long-term effectiveness and promote stakeholder uptake and ownership. Monitoring will serve to test assumptions about responses of assets to threats and the effectiveness of prescribed actions. Consequently, actions/uses can be reallocated in updated plans.	Monitoring and evaluation of the plan will be at the strategic level, e.g. • Have we managed to attract investment? • Have we established successful partnerships as planed? • How many projects have been completed? • How many of the actions have been completed? • Have the actions had the desired effect on the strategic objectives? There will also be monitoring and evaluation at the operational strategy, which will be updated more regularly than the plan. The operational strategy will identify the type of monitoring that should be undertaken for each project and location of monitoring sites.	
22. Evaluate outcomes: Using the information derived from monitoring programs and assessment of effectiveness of actions, plans can be revisited to redefine and/or reallocate management actions and uses. This information can also serve to assess and – I necessary – adjust objectives, either because they are inadequate or are not providing information that will allow managers to assess the health of the system. This information ultimately can serve to revisit the broad management problems/needs and assess the relevance of the planning goals under new circumstances.		

Application of the cross-realm planning operational framework in the Territory NRM planning process 2010 plan

Stage and analyses	Territory NRM REGION 2010-2015 planning	Territory NRM REGION 2015-2020 planning
1. Define planning domain: Define the region or area across which management areas are assessed and compared for investment in actions (e.g. protection, fire management, erosion control, weeding) to achieve explicit objectives (e.g. species conservation, livelihoods, development). This can be defined based on biophysical features (e.g. catchments, bioregions), political or management boundaries (e.g. districts, shires, NRM regions) or a combination of these depending on the planning goals.	Planning domain was all of the Territory and considered marine (NT coastal waters based on jurisdiction), freshwater and terrestrial realms (and to some extent atmosphere – air quality, climate change, emissions) and consciously included human realm in terms of capacity. Plan included local government and EPA concerns such as waste disposal and toxic materials. Support for inclusion of these elements has fallen away because of changes in stakeholder base and jurisdiction. Also plan was closely linked to some NT Government programs that no longer exist (e.g. Territory Growth Towns). The net result is a move away from dealing with urban development and industrial compliance.	The plan revision will focus on regional delivery and provide a stronger framework for regional action.
2. Define management problem/needs: Identify and describe the key conservation and/or natural resource management issues in the region (e.g. weeds, feral animals, bush fires, erosion, water quality and quantity, pollution, vegetation clearing) that can be addressed by actions identified in the plan, these include threats to the natural and socioeconomic assets of interest (e.g. species, wetlands, productive soils, cultural sites)	The plan is for all Territorians working in NRM. It identifies priorities and pathways and partnerships to address these priorities. Program logic workshops to come up with aspirational goals/values/objectives. Came up with an overarching vision statement for the plan. "Territorians working together to manage our environment's natural, cultural and economic values for the benefit of all."	Overarching value statement remains: "Territorians working together to manage our environment's natural, cultural and economic values for the benefit of all."
3. Governance analysis: The governance context, defined by existing institutional, political, and socioeconomic decision systems, will influence management and decisions about uses of land and water across realms, and will dictate which types of funding and actions are feasible. This stage aims to understand the current or potential overlap, gaps and coordination between institutions with jurisdictions over the region (including across terrestrial, freshwater and marine realms) and how these interactions can affect management decisions and prioritisation of actions when planning.	For this plan did not do an explicit governance analysis. However a policy and legislative review was undertaken identifying the legal environment in which NRM operates in the Territory. Also, lead and contributing organisations were identified for each MA.	This is recognised as important and is likely to be addressed for the 2016-20 plan, with a governance framework developed for each program, indicating who will lead the program and key participants and how they will interact.

4. Identify and engage stakeholders: Identify organisations and/or people (e.g. agencies, resource users, NGOs, residents, scientists) who will affect or be affected by management actions or contribute to the planning process, including implementation and monitoring of actions. This stage is critical to consider the diversity of views and preferences of stakeholders when developing the plan, to maximise uptake, promote ownership, and develop feasible and cost-effective actions to achieve planning objectives.	Stakeholder identification: Territory NRM has long-term relationships with NRM stakeholders across the NT. This includes all peak bodies involved in NRM, as well as many of the smaller groups. It directly funds pastoral land care facilitators and some of the activities of Indigenous ranger groups. Its open call funding rounds held from 2005-2010 also identified stakeholder individuals and organisations. Territory NRM could largely draw on these stakeholder groups to engage Territorians at an individual level. However, efforts were also made to engage individual stakeholders by holding and advertising public events through mass media, as well as advertising opportunities for plan input etc. Territory NRM also has an email newsletter that is sent to all subscribers. Territory NRM therefore acts as an umbrella organisation in some activities, where it invites sector representatives from stakeholder groups that are representative of a broad stakeholder base, and works directly with individuals. This multi-level engagement has been reflected in planning activities throughout. Engagement strategy: As the plan is a plan for all Territorians, stakeholder engagement was from the start and throughout: invitation to be part of plan, workshop, invited/supported submissions into the plan. During plan – held workshops to prioritize MAs with stakeholders. Final stage: did road show and invited replies/submissions on draft plan. It also gathered information from experts with a wide range of NRM backgrounds (e.g. land managers, scientists, fishers etc.) for assessment and prioritisation.	Stakeholder identification: Territory NRM has long-term relationships with NRM stakeholders across the NT. This includes all peak bodies involved in NRM, as well as many of the smaller groups. It directly funds pastoral land care facilitators and some of the activities of Indigenous ranger groups. Its open call funding rounds held from 2005-2010 also identified stakeholder individuals and organisations. Territory NRM could largely draw on these stakeholder groups to engage Territorians at an individual level. However, efforts were also made to engage individual stakeholders by holding and advertising public events through mass media, as well as advertising opportunities for plan input etc. Territory NRM also has an email newsletter that is sent to all subscribers. Territory NRM therefore acts as an umbrella organisation in some activities, where it invites sector representatives from stakeholder groups that are representative of a broad stakeholder base, and works directly with individuals. This multi-level engagement has been reflected in planning activities throughout. Engagement strategy: Stakeholder groups and experts were involved in the assessment of target and MA delivery through the 2010-2015 plan review. Individuals will be involved in identification of new MAs and indicators. Experts will be engaged in identification of new strategies (medium-term targets).
5. Elicit social-ecological goals: Identify the collective visions of aspirations, such as representation and persistence of biodiversity, improved livelihoods, and maintenance of ecosystem services. This broad statements of what the plans aim to achieve then need to be translated into - preferably quantitative - objectives (e.g. SMART) that will guide the allocation and prioritisation of actions and monitoring of progress.	Program logic workshops were run to come up with aspirational goals/values/objectives for five asset groups (Terrestrial biodiversity, Land, Inland waters, coastal and marine, Communities, NRM institutions and knowledge). Stakeholders didn't have ownership over previous planning process so workshops were built to engage them in this new planning process. A review of the previous plan was undertaken and brought this review together with larger review of relevant documents,	The 2016-2020 plan will build goals off of the existing 19 LTTs. In preparation for the 2016-20 plan, LTTS were renamed Outcomes, MTTS as strategies and Management Actions as Actions. This sets up the structure of the new plan in which MAs will be more specific and indicators more measurable.

	stakeholder engagement/submissions etc which helped inform the program logic workshops. This process resulted in long term targets (goals), medium term targets (objectives) and actions. Out of this process 19 long term targets (overarching goals) – the goals for the plan out to 2030 – were developed. Medium term targets (MTTs 2011-2015) were also identified that were steps along the way to achieving LTTs and these tended to be more regionally-focused and qualitative than LTTS. MAs were identified that would help deliver each target. These were either Territory-wide (particularly in relation to policy, planning or governance reform) or region-specific. Measures of achievement were also developed for each MTT.	
6. Multiple land and water uses: Associated with diverse stakeholders are multiple uses of land and water with varying levels of compatibility, which requires understanding the benefits and costs of potential uses across stakeholders, sometimes geographically distant (e.g. farmers and fishers). This stage mainly consists in mapping the main land/water uses across the planning region and exploring the potential links between stakeholders with interests or jurisdiction over terrestrial, freshwater and marine realms. This will be the basis of later analysis to identify and assess the co-benefits and trade-offs resulting from land/water management decisions.	Principal of plan was to consider whole of system and support best practice management and this included considering threats/values/people connections across systems. For example, feral buffalo control for healthy water ways. Plan data was not spatial in nature- data wasn't good enough or wasn't available so some actions are spatial but would have come out of stakeholder engagement. Land and water uses, threats, features were all identified through engagement process and definition of goals/objectives/actions and were typically not place based or spatial. Actions are spatial where the known assets are spatial (e.g. agricultural land, Gamba Grass). At the project level, Prioritise NT http://138.80.128.232/prioritize was used to identify areas for action. E.g. assessment of management of priority weeds for wetland conservation showed resulted in funds going to Barkly Landcare for Parkinsonia work on Lake Woods.	Principal of plan will continue to consider whole of system and support best practice management and includes considering threats/values/people connections across systems.
7. Overarching models: Of special concern are the effects of climate change on ecological processes and threats, including changes in species distributions (including invasive species), fish migration, rainfall (linked to sediment and nutrient runoff, flooding, droughts), and sea level rise (linked to coastal salinization). Future land (and water) uses will be constrained by these changes and threats can be accentuated (at least in some regions) or mitigated through appropriates land/water uses. Therefore, it is necessary to understand and compile available and appropriate models of climate and land use change that can influence land	Consideration of over-arching models was a-spatial. The 2010-15 plan identified climate change as an issue, and included targets for improved understanding of its impacts. Climate change was rated as the lowest priority in the community consultation and of moderate priority in the expert elicitation. No data were available and no models used. However, the plan focused on building resilience that would be required to address climate change and other challenges.	The 2016-20 plan will be informed by climate change projections. The plan will be spatially enabled, but it has not yet been decided if this will be a communication or a prioritisation tool. No decision on what tools will be used.

use/management decisions.		
8. Scenario analysis: Cross-realm planning calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently. Effectively, this means identifying and integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios. Scenario planning can allow for the envisioning of multiple futures that include different impacts of threats on assets and actions on threats, and thereby inform achievement of objectives by feasible actions/uses.	N/A	There is very little information on how models would be used. It would be good to present scenarios to the community and see if these changed their priorities and proposed actions.
9. Set multiple objectives: Cross-realm planning requires integrating multiple objectives for conservation and development (e.g. biodiversity, ecosystems services, agriculture). Conservation objectives for single realms are well described (e.g. maintain species populations, represent habitats, increase production), but objectives for multiple realms are less common (e.g. protect representative marine and terrestrial habitats while also reducing land-based threats to the marine environment). Likewise, cross-realm socioeconomic objectives are generally missing (e.g. achieve land development and coastal fisheries goals through catchment management and land/water use that minimise downstream impacts). This stage entails translating broad goals into, preferably quantitative (SMART) objectives. These include realm-specific (terrestrial, freshwater, marine) and cross-realm objectives that will influence the allocation of actions across realms based on understanding cross-realm threats and ecological processes, and the costs and benefits of different land/water uses to stakeholders.	Objectives were set based on the previous plan review and broader stakeholder engagement process. These were medium term outcomes which were more regional or intermediate and below that are management actions which can be more place based or people based and specific. Plan review and broader objective setting process: Interviewed three experts for each management action to review (asked 1) progress made towards target? 2) has target been achieved 3) was target realistic and should it be pursued or not given this?) – from this, ticked off the ones achieved (2), got rid of resource condition targets as didn't feel had capacity to actually assess progress towards these targets or that TNRM was in position to necessarily influence these targets, got rid of actions that weren't realistic. With the remaining actions, synthesised/audited against other actions identified in other plans, some were then got rid of if they weren't relevant or identified during the consultation process and others were reworked based on stakeholder engagement to get to the final product of the 100 management actions (objectives for the plan).	Stakeholder groups and experts were involved in the assessment of target and MA delivery through the 2010-2015 plan review. Individuals will be involved in identification of new MAs and indicators. Experts will be engaged in identification of new strategies (medium-term targets).

10. Model multiple threats: When planning for resource management it is important to consider multiple threats to the social-ecological systems. Threats can be associated with current land/water uses, such as modified water flow or vegetation clearing, but can derive from past or distant uses (e.g. feral animals, altered fire regimes and water flows). Managing some threats, such as feral pigs, will benefit production and conservation across multiple realms through mitigating local (e.g. soil erosion) and downstream (e.g. water quality) problems. There are likely to be varied interactions between threats and assets/uses of management interest. The potential interactions between threats (e.g. additive, synergistic, antagonistic) call for assessing, quantifying and/or modelling cumulative impacts, as well as co-benefits or trade-offs between management actions to mitigate threats.	Consideration of threats was a-spatial.	TBD – plan is underway and will build off of the 2010-2015 process (consideration of threats is a-spatial). MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.
11. Model multiple features: Multiple threats will influence multiple assets in various ways. Identifying the sources of threats and the assets they influence across realms therefore underpins decisions about where, when and how to act. Assets of interest in a region include ecosystems and species with different conservation significance, but will also include, for example, areas with high suitability for agriculture or grazing and sites of cultural or recreational importance. This stage requires planners to identify the assets that are the main focus of the management plan, and may require compilation of data from historical records, monitoring programs, modelling exercises, stakeholders-based mapping, etc. This requires discussing with stakeholders which are these features and available data.	Consideration of features was a-spatial.	TBD – plan is underway and will build off of the 2010-2015 process. MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.
12. Multiple actions and uses: Threats will affect assets in different ways and can propagate across realms, thus decision-makers will likely need to employ a portfolio of management actions that will suit the requirements of different assets and mitigate local and cross-realm threats cost-efficiently. Along with prescribed actions, decisions about land and water uses should reflect the desired balance between socioeconomic opportunities and conservation needs. An integrated plan thus needs to identify, prioritise and coordinate the locations and types of actions and uses. Prioritisation of multiple actions and uses across space and time allows plans to meet objectives for multiple outcomes, which take into account the benefits and costs across diverse stakeholders and	Consideration of actions was a-spatial. Identified 142 detailed Management Actions (MAs) to address priority issues from plans or as submitted by interested parties. Information in action included: Description, Activities, Justification, Location, Stakeholders, References, Actions needed first, Actions to follow, Scale and timeframe, Persons contributing to action text.	TBD – plan is underway and will build off of the 2010-2015 process. MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.

realms.			
13. Socioeconomic analysis: The socioeconomic context of the region will dictate the type of actions that are feasible to implement and inform the assumptions of overarching models (e.g. land use change, ecosystem services). There are a number of potential analysis that can inform planning at this stage, including social network analysis (stakeholders' collaboration and power dynamics), market (drivers of change), ecosystem services (values), spatial variation of management costs (inform priorities). These studies will be informed by non-spatial plans (e.g. available funding).	This step was not formally undertaken, however it was informally captured in the priority setting process in which each action has a full description that also draws upon governance arrangements relevant to the action or who might implement the action.		TBD
14. Non-spatial plans: External components, such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management. This will constrain and influence the uptake of planning recommendations by stakeholders, dictate research and planning priorities (e.g. based on current budgetary allocations, funding streams), inform other spatial planning processes (e.g. water and land use allocation) through investment priorities and regulations. Planners need to be aware of these non-spatial plans and work within the opportunities and limitations that these may impose directly or indirectly on the plan.	N/A	N/A	

15. Optimize spatial allocation of actions and uses: Planning with objectives across multiple realms is uncommon and generally based on concurrent and/or sequential optimisation in terrestrial, freshwater and/or marine realms. This stage consists in integrating information derived from previous stages and optimising the allocation of actions and land uses across realms (e.g. using Marxan, Marzone, C-Plan, Zonation). Outputs of this stage are maps depicting cost-effective allocation of actions and land uses that balance social and ecological objectives across multiple realms. Rather than static and unique "optimal" solutions, these maps are likely to be alternative maps under different climatic/land use change scenarios and/or different budgetary or policy constraints. Available tools allow to consider some cross-realm threats (e.g. downstream impacts on aquatic ecosystems), but further research and tools are needed to optimize actions across multiple realms.	Each action was assessed by expert panel and community workshop (with some actions being merged or dropped and others created. The final list of 90 MAs were allocated an expert panel score and community priority score as follows a. Held two prioritization workshops (Darwin and Alice Springs) with representative stakeholders to review and prioritise MAs. Prioritization was done with weighting tool. Criteria used to develop scores were i. Plan alignment 1. Contribution to primary target 2. Contribution to additional targets ii. Impact assessment 1. Do nothing scenario 2. With action scenario 3. Scale and degree iii. Asset values addressed 1. Environmental 2. Economic 3. Cultural 4. Social iv. Likelihood of success 1. Effectiveness of action 2. Difficulty in undertaking action Final scores were ranked b. Held community workshops in each subregion (Darwin, Katherine, Tennant Creek and Alice Springs) to review and prioritise regional MAs Ratings can be used to identify priorities based on different contexts – for example if have money to fund community action you probably focus on high community rating actions. The plan is the Territory's plan (not TNRM's plan) so important that anyone to pick up the plan, look at the actions, see the ratings and then make a judgement based on that data as to what their priorities are out of the listed actions.	TBD – plan is underway and will build off of the 2010-2015 process. MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.

16. Assess cobenefits and tradeoffs: Managing one realm can affect ecosystems in linked realms, which can result in co-benefits, if management achieves objectives in two or three realms more efficiently, or trade-offs, if management in one realm compromises the achievement of objectives in another. To quantify co-benefits and trade-offs, it is necessary to have an understanding of how assets respond to potential actions and how actions applied in one realm can propagate to others. Response curves (e.g. persistence of species and ecosystems across realms under different levels of threats) can be incorporated into optimization algorithms to allocate multiple actions to mitigate threats across realms. When possible, the outputs of optimization tools should be assessed (or ideally integrated) to other tools to assess ecological (e.g. effects of water extraction on aquatic species) and economic (e.g. production) outcomes to assess proposed management and land use alternatives.	N/A	TBD – plan is underway and will build off of the 2010-2015 process. MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.
17. Final spatial allocation of actions and uses: Based on alternative maps depicting the allocation of land use and management actions, managers – in consultation with stakeholders – can select a configuration that balances socioeconomic and environmental goals across realms. Depending on the expected output of planning, this map can be in the form of a catchment management and/or land use plan.	N/A	TBD – plan is underway and will build off of the 2010-2015 process. MAs for the 2015-20 plan will be prioritised, but the method used is still to be decided (considering using Miradi Planning Software). Not decided if prioritisation will use spatial tools.
18. Define indicators: Once the management plan has been determined, the planning team should determine the social, economic and/or ecological indicators that will be used to assess the achievement of plan objectives and adjust management actions (including the overall plan) accordingly. This process should include an explicit procedure to revise and update (if necessary) the plan. Preferably, indicators should be conceptualized early in the planning process to ensure objectives are clear and can be measured using readily-available data (e.g. remotely-sensed) or can be obtained using existing or new monitoring programs (e.g. led by researchers, users and/or agencies). Indicators can be refined based on research and monitoring.	For each action metrics are listed to assess progress towards actions/medium and long term targets. Metrics were selected based on information from review/progress assessment on previous plan and expert input. No monitoring and evaluation strategy was put in place on completion of the plan. However, a plan review was undertaken in 2014. It measured progress at all three levels: LTTs, MTTS and MAs (see plan process summary).	New metrics will be developed for the 2016-20 plan. Emphasis will be on more indicators that can be measured by the community (as proposed by community), with a possible move towards resource condition measures. An M&E Strategy may be put in place on completion of the plan. This will be more likely if an ongoing planning officer position is created.

19. Other NRM spatial plans: Planners should be aware of existing spatially-explicit plans that inform uses of land and water. These plans will constrain and/or serve as the legal mechanism to implement the plans. Examples of such plans are water allocation, erosion control, weeding plans, prioritization of farms to implement best farming practices. These plans will influence uptake of the plan and should be considered when optimizing the allocation of actions and land uses, but not necessarily constrain this process.	N/A	
20. Management and land-water use decisions: Depending on the nature of the planning outputs (e.g. guidelines, statutory), the proposed plan will then guide the on-ground allocation of land/water uses and management actions in the planning region by the relevant stakeholders (i.e. uptake) and determine the allocation of available funding.	Territory NRM has custodianship of the plan, but this means its development and assessment, not its delivery. All NT NRM organisations have carriage of its objectives. TNRM has, however, contributed to plan delivery through • Building partnerships • Undertaking projects (e.g. Territory Conservation Agreements) • Funding groups (e.g. pastoral Landcare groups) • Funding activities (e.g. fire management by Ranger groups) Funding for Territory NRM activities comes from Federal Government with substantial in-kind support from NT Government. Carriage and funding for other plan activities comes from a wide range of organisations. Many activities are directly funded by the Federal Government (e.g. Working in Country Program, National Environment Research Program). Increasingly groups are sourcing external funds, either from philanthropic organisations or as fee-for-service. Fee-for-service work includes undertaking fire management for carbon credits and doing biodiversity surveillance.	For the 2015-20 plan, Territory NRM will have a role in bringing players together, facilitating collaboration and attracting investors. Territory NRM is also considering the publications that will be produced at the plan's completion, including whether these should include an investment prospectus.

21. Monitoring & research: Plans should include a monitoring program to periodically assess the progress and achievement of plan objectives using identified indicators. Monitoring should consider using existing research (e.g. long-term monitoring) and land/water assessment programs (e.g. land condition assessments), as well as available tools and data (e.g. remotely-sensed indices, water quality) to facilitate assessment and – if needed – adjustment of the plan. Participation of users (e.g. on-farm monitoring of biodiversity and land/water condition) can improve long-term effectiveness and promote stakeholder uptake and ownership. Monitoring will serve to test assumptions about responses of assets to threats and the effectiveness of prescribed actions. Consequently, actions/uses can be reallocated in updated plans.	In 2014, the plan was reviewed by interview and small workshops with experts and organisational representatives as follows: a. MAs rated as Complete; On-track; Minor issues; Major issues; No longer priority b. Strategies (medium-term targets) rated based on i. Completion of contributing MAs ii. Measures of achievement c. Outcomes (long-term targets) rated based on i. Completion of contributing MAs ii. Measures of achievement iii. Condition of assets iv. Pressures, threat and uses	The plan metrics will be monitored to inform future planning proceses.
22. Evaluate outcomes: Using the information derived from monitoring programs and assessment of effectiveness of actions, plans can be revisited to redefine and/or reallocate management actions and uses. This information can also serve to assess and – I necessary – adjust objectives, either because they are inadequate or are not providing information that will allow managers to assess the health of the system. This information ultimately can serve to revisit the broad management problems/needs and assess the relevance of the planning goals under new circumstances.	The plan review will inform the new planning process. Based on the review the new plan will aim to: a. Broadly keep Long-term targets (as strategic directions) but refine where necessary. b. Develop new (probably fewer) and more specific MAs c. identify new more measurable indicators d. Have greater linkage between assets and pressures, threats and uses – particularly link threat reduction actions to an improvement in asset condition. e. Strengthen regional action plans to make them more of a working document for stakeholders to regularly engage – particularly to encourage adaptive management across sectors f. Move towards more specific outcomes (e.g. prevent spread of Gamba Grass beyond current distribution by year xxx) where known and where not known encourage knowledge growth to achieve more specific targets in the future.	

Application of the cross-realm planning operational framework in the Rangelands (WA) NRM planning process

Stage and analyses	Rangelands NRM (WA) planning	Challenges and notes
1. Define planning domain: Define the region or area across which management areas are assessed and compared for investment in actions (e.g. protection, fire management, erosion control, weeding) to achieve explicit objectives (e.g. species conservation, livelihoods, development). This can be defined based on biophysical features (e.g. catchments, bioregions), political or management boundaries (e.g. districts, shires, NRM regions) or a combination of these depending on the planning goals.	The Rangelands region of Western Australia, covering 85% (2,266,000 km2) of WA and 75% of the coastline. Assets covered are Land, Biodiversity, Wetlands and waterways, & Coastal and Marine.	
2. Define management problem/needs: Identify and describe the key conservation and/or natural resource management issues in the region (e.g. weeds, feral animals, bush fires, erosion, water quality and quantity, pollution, vegetation clearing) that can be addressed by actions identified in the plan, these include threats to the natural and socioeconomic assets of interest (e.g. species, wetlands, productive soils, cultural sites)	Rangelands NRM has developed a Strategic (organisational) Plan, the goal of which is "to facilitate the management of natural assets to support environmentally, socially and economically enriched communities within the WA Rangelands". Its purpose is "to facilitate collaboration and best practice in environmental outcomes for land and coastal resource managers in the Rangelands of WA". The Rangelands NRM Plan 2012-2015 achieves or contributes to two Strategic Plan objectives: •SO-01 "Publish a Regional Plan as the custodian on behalf of the WA Rangelands communities" which will provide "Clarity to the Region's prioritised natural assets to enable targeted investment." •SO-02 "Protect, improve and manage natural assets of the WA Rangelands" through Deliverable #1: "A defined decision-support prioritisation system". This is provided through the use of the INFFER framework.	
3. Governance analysis: The governance context, defined by existing institutional, political, and socioeconomic decision systems, will influence management and decisions about uses of land and water across realms, and will dictate which types of funding and actions are feasible. This stage aims to understand the current or potential overlap, gaps and coordination between institutions with jurisdictions over the region (including across terrestrial, freshwater and marine realms) and how these interactions can affect management decisions and prioritisation of actions when planning.	A formal governance analysis wasn't undertaken. However, Other bodies such as CRCs, Indigenous landholder groups, universities and government agencies were involved in the development of the plan, and while the plan sets out guidance for Rangelands NRM, in many cases it is aligned with and complementary to the plans, objectives and goals of these and other potential partner organisations, with whom project development and delivery is likely to be undertaken. A desktop review assessed a variety of Healthy Country Plans and other plans, either private or publicly available to help prioritise and guide natural resources management.	

4. Identify and engage stakeholders: Identify organisations and/or people (e.g. agencies, resource users, NGOs, residents, scientists) who will affect or be affected by management actions or contribute to the planning process, including implementation and monitoring of actions. This stage is critical to consider the diversity of views and preferences of stakeholders when developing the plan, to maximise uptake, promote ownership, and develop feasible and cost-effective actions to achieve planning objectives.	136 stakeholders at asset workshops region wide, and 52 in the Kimberley, included land managers, pastoralists, volunteer groups, Landcare groups, non-government organisations, traditional owner groups, local governments, state government agencies and researchers, who were selected for technical knowledge of local assets and threats to them. In addition, stakeholder input was elicited from previous involvement in planning done throughout the region by drawing on existing knowledge.	
5. Elicit social-ecological goals: Identify the collective visions of aspirations, such as representation and persistence of biodiversity, improved livelihoods, and maintenance of ecosystem services. This broad statements of what the plans aim to achieve then need to be translated into - preferably quantitative - objectives (e.g. SMART) that will guide the allocation and prioritisation of actions and monitoring of progress.	•Provide direction to Rangelands NRM regarding investment in managing highly valued natural assets to inform management, to benefit rangelands communities •Provide specific guidance for investment over the period 2014 - 2018 •To facilitate investments that consider a variety of values and scales, reflecting the scales, complexities and relative level of importance of assets in the context of the whole of the region •Identify targeted investment opportunities with a high likelihood of success •Provide an interactive plan that can easily be updated Specific to the Kimberley region: The Kimberley program aims to protect priority flora, vegetation communities, fauna and terrestrial aquatic and marine ecosystems and landforms by implementing a co-ordinated approach to fire management, controlling feral animals and containing new and emerging weed species, and supporting sustainable pastoralism and Indigenous ranger groups. Special places of significance such as micro refugia, priority wetlands and coastal dune systems will be protected in conjunction with support of traditional owner groups. Rangelands NRM will continue to work with the community to increase capacity to effectively plan, resource and implement on ground works to manage priority areas.	
6. Multiple land and water uses: Associated with diverse stakeholders are multiple uses of land and water with varying levels of compatibility, which requires understanding the benefits and costs of potential uses across stakeholders, sometimes geographically distant (e.g. farmers and fishers). This stage mainly consists in mapping the main land/water uses across the planning region and exploring the potential links between stakeholders with interests or jurisdiction over terrestrial, freshwater and marine realms. This will be the basis of later analysis to identify and assess the co-benefits and trade-offs resulting from land/water management decisions.	A whole of landscape approach has been adopted to promote collaborations and partnerships which address threats to nominated environmental assets and potential protects. Natural resource management at the landscape scape requires land managers to work collaboratively with neighbours and other stakeholders – to look beyond the political constraints of tenure. A number of criteria have been used to determine the strategic focus areas for Rangelands NRM at the landscape scale, acknowledging community interest and capacity, environmental assets, threatened species and communities, national and international interests, prior investment, productivity and the potential for sustainable rangelands management. These results were cross referenced against the	

	environmental assets that were identified as priorities during the 3 INFFER workshops. For example, the Kimberley program aims to protect priority flora, fauna and aquatic ecosystems by implementing a co-ordinated approach to fire management, controlling feral animals and containing new and emerging weed species. Special places of significance such as micro refugia, priority wetlands and coastal dune systems will be protected in conjunction with support of traditional owner groups. Three priority areas that incorporate identified assets were identified in the Kimberley (North Kimberley, West Kimberley and East Kimberley) where community and stakeholder interest in strong.
7. Overarching models: Of special concern are the effects of climate change on ecological processes and threats, including changes in species distributions (including invasive species), fish migration, rainfall (linked to sediment and nutrient runoff, flooding, droughts), and sea level rise (linked to coastal salinization). Future land (and water) uses will be constrained by these changes and threats can be accentuated (at least in some regions) or mitigated through appropriates land/water uses. Therefore, it is necessary to understand and compile available and appropriate models of climate and land use change that can influence land use/management decisions.	Both the potential impacts of a changing climate and the development of a future carbon economy were directly and specifically considered during the development of the plan. In time, a list of resources can be linked to each project and priority area in order to allow issues such as land use change and other drivers or models of change are likely to be considered in framing project proposals.
8. Scenario analysis: Cross-realm planning calls for integrating conservation prioritisations with established processes for water and land-use planning, traditionally undertaken independently. Effectively, this means identifying and integrating multiple objectives (e.g. biodiversity, ecosystems services, agriculture) and assessing the potential co-benefits and trade-offs between them under alternative development scenarios. Scenario planning can allow for the envisioning of multiple futures that include different impacts of threats on assets and actions on threats, and thereby inform achievement of objectives by feasible actions/uses.	N/A

9. Set multiple objectives: Cross-realm planning requires integrating multiple objectives for conservation and development (e.g. biodiversity, ecosystems services, agriculture). Conservation objectives for single realms are well described (e.g. maintain species populations, represent habitats, increase production), but objectives for multiple realms are less common (e.g. protect representative marine and terrestrial habitats while also reducing land-based threats to the marine environment). Likewise, cross-realm socioeconomic objectives are generally missing (e.g. achieve land development and coastal fisheries goals through catchment management and land/water use that minimise downstream impacts). This stage entails translating broad goals into, preferably quantitative (SMART) objectives. These include realm-specific (terrestrial, freshwater, marine) and cross-realm objectives that will influence the allocation of actions across realms based on understanding cross-realm threats and ecological processes, and the costs and benefits of different land/water uses to stakeholders.	Specific quantitative targets were not set, as these are considered to be most relevant and realistic at the project level. This plan is instead 'asset-based', focusing on specific places in the landscape, such as a wetland, an island, a vegetation community or an animal (or its habitat). In order to more easily allow investment that considers a variety of values and scales, assets are not presented in the traditional theme headings (Water, Biodiversity, Land, etc), but instead according to their scale and relative level of importance in the context of the whole of the region. There are three asset categories used in the Plan; Umbrella, Significant and Notable. •Umbrella Assets – large scale •Significant Assets - high to very high significance where there is potential for major investment or protection measures to maintain or enhance their values •Notable Assets - Identified as locally significant by community
10. Model multiple threats: When planning for resource management it is important to consider multiple threats to the social-ecological systems. Threats can be associated with current land/water uses, such as modified water flow or vegetation clearing, but can derive from past or distant uses (e.g. feral animals, altered fire regimes and water flows). Managing some threats, such as feral pigs, will benefit production and conservation across multiple realms through mitigating local (e.g. soil erosion) and downstream (e.g. water quality) problems. There are likely to be varied interactions between threats and assets/uses of management interest. The potential interactions between threats (e.g. additive, synergistic, antagonistic) call for assessing, quantifying and/or modelling cumulative impacts, as well as co-benefits or trade-offs between management actions to mitigate threats.	Carbon Farming and Climate Change were specifically considered and detailed in regards to each asset, and incorporated into the plan (refer to Asset Registers). No modelling of climate change or CFI was undertaken as part of the plan development as this was being undertaken at national levels. Priority assets were combined into Priority areas that included a number of asset values and threats. Actions in those areas will consider all asset values and threats and how these interact, with landscape scale projects designed to capitalise on opportunities for synergies, such as to incorporate the protection and/or restoration of different assets and the control or mitigation of different threats, whilst involving a range of different stakeholder and community groups in project development, implementation and monitoring.
11. Model multiple features: Multiple threats will influence multiple assets in various ways. Identifying the sources of threats and the assets they influence across realms therefore underpins decisions about where, when and how to act. Assets of interest in a region include ecosystems and species with different conservation significance, but will also include, for example, areas with high suitability for agriculture or grazing and sites of cultural or recreational importance. This stage requires planners to identify the assets that are the main focus of the management plan, and may require compilation of data from historical records, monitoring programs, modelling exercises, stakeholders-based mapping, etc. This requires discussing with stakeholders which are these features and available data.	Carbon Farming and Climate Change were specifically considered and detailed in regards to each asset, and incorporated into the plan (refer to Asset Registers). No modelling of climate change or CFI was undertaken as part of the plan development as this was being undertaken at national levels. Priority assets were combined into Priority areas that included a number of asset values and threats. Actions in those areas will consider all asset values and threats and how these interact, with landscape scale projects designed to capitalise on opportunities for synergies, such as to incorporate the protection and/or restoration of different assets and the control or mitigation of different threats, whilst involving a range of different stakeholder and community groups in project development,

	implementation and monitoring.
12. Multiple actions and uses: Threats will affect assets in different ways and can propagate across realms, thus decision-makers will likely need to employ a portfolio of management actions that will suit the requirements of different assets and mitigate local and cross-realm threats cost-efficiently. Along with prescribed actions, decisions about land and water uses should reflect the desired balance between socioeconomic opportunities and conservation needs. An integrated plan thus needs to identify, prioritise and coordinate the locations and types of actions and uses. Prioritisation of multiple actions and uses across space and time allows plans to meet objectives for multiple outcomes, which take into account the benefits and costs across diverse stakeholders and realms.	While the location, values and threats of assets have been identified, specific actions have not been specified in the plan; these will be determined in an asset by asset approach at the project development stage. However, many of the current region-wide (Table 3) and Kimberley projects (Table 4) specifically contribute to plan implementation, and recent project proposals align with the plan (i.e. incorporate identified assets and are based within identified priority areas) where relevant. In particular, the following projects are specifically aligned with the Regional Plan: From Table 3: • Planning Climate Change Regional Plan • Rangelands Regional Fire forum/s • CfoC 2013-18 Sustainable Pastoralism Project • Regional Landcare Facilitator Rangelands From Table 4: • Reducing nutrients entering Ramsar listed Roebuck Bay • Protecting the ecological and cultural values of Roebuck Plains • Water Quality monitoring to protect Roebuck Bay • ESRM for Roebuck Plains and Myroodah • Protecting Monsoon Vine Thickets on the Dampier Peninsular • Fire management to protect Gouldian Finch habitat • Protecting Munkayarra Wetlands • Rubbervine eradication in the Kimberley - East • Rubbervine eradication in the Kimberley - West It is not expected that all projects or priority areas will be funded. Key players have been identified in each of the priority areas and for many of the identified assets. Governance of potential projects will be addressed when investment is sought (e.g. whether Rangeland NRM is the proponent or a supporting organisation, and which other groups should be involved,

	and what their roles and responsibilities are in the project).
13. Socioeconomic analysis: The socioeconomic context of the region will dictate the type of actions that are feasible to implement and inform the assumptions of overarching models (e.g. land use change, ecosystem services). There are a number of potential analysis that can inform planning at this stage, including social network analysis (stakeholders' collaboration and power dynamics), market (drivers of change), ecosystem services (values), spatial variation of management costs (inform priorities). These studies will be informed by non-spatial plans (e.g. available funding).	This was incorporated during workshops by identifying assets that have high likelihood of securing landholder participation and strong support from other relevant organisations such as government agencies.
14. Non-spatial plans: External components, such as strategic NRM plans, legislation, and current best-practice guidelines, will influence planning through policies, regulations and funding opportunities enabling or constraining management. This will constrain and influence the uptake of planning recommendations by stakeholders, dictate research and planning priorities (e.g. based on current budgetary allocations, funding streams), inform other spatial planning processes (e.g. water and land use allocation) through investment priorities and regulations. Planners need to be aware of these non-spatial plans and work within the opportunities and limitations that these may impose directly or indirectly on the plan.	A desktop review assessed a variety of Healthy Country Plans and other plans, either private or publicly available to help prioritise and guide natural resources management.

15. Optimize spatial allocation of actions and uses: Planning with objectives across multiple realms is uncommon and generally based on concurrent and/or sequential optimisation in terrestrial, freshwater and/or marine realms. This stage consists in integrating information derived from previous stages and optimising the allocation of actions and land uses across realms (e.g. using Marxan, Marzone, C-Plan, Zonation). Outputs of this stage are maps depicting cost-effective allocation of actions and land uses that balance social and ecological objectives across multiple realms. Rather than static and unique "optimal" solutions, these maps are likely to be alternative maps under different climatic/land use change scenarios and/or different budgetary or policy constraints. Available tools allow to consider some cross-realm threats (e.g. downstream impacts on aquatic ecosystems), but further research and tools are needed to optimize actions across multiple realms.	Prioritisation followed a four step process using the tool INFFER: 1.Asset identification 12 INFFER asset identification workshops were held across the region with 3 in the Kimberley. INFFER™ was used at workshops to identify and filter assets against criteria to identify the most robust prospective projects in terms of their likelihood of success (called 'potential projects'). These had: •high significance •high levels of threat •good technical feasibility to address threats •high likelihood of securing landholder participation and strong support from other relevant organisations, such as government agencies. The workshops produced an initial list of assets (Asset Register) and a shortlist of prospective projects. Additional assets can be added and filtered through similar assessment. As assessments were sub-regional, a technical review panel ensured consistency asset scoring between subregions and combined assets that were nominated in more than one sub-region.In addition, ranger groups in the West and Central Kimberley identified approximately 38 Indigenous environmental/cultural assets which have subsequently been incorporated into the planning process. Assets were classed according to their scale and complexity as Umbrella, Significant or Notable Assets. Final list was distributed for workshop participants to review. 2.Information on assets was incorporated from a desktop study of existing plans and other documents 3.Incorporating Carbon Farming Initiative and Climate Change Assets were then further assessed with respect to •Potential implications of climate change on the relative values and threats •Whether a project to address threat(s) could generate carbon credits •Whether potential nearby carbon farming initiatives could have a negative impact on the success of a proposed project 159 Assets were identified in the Kimberley region. 121 have been through the filtering process (Table 1), through which 25 were selected as potential projects (Table 2). Three Priority areas were identified to assist selection of projects within the subregions (e.g. Kimberley) for investment in 2014-18, acknowledging the political landscape, a dynamic environment with climatic extremes and the diverse population base, and reflecting what is needed in the region to

	conserve special environmental areas, nurture enthusiasm and involvement and address threats affecting environmental assets. In addition, sustainable grazing on highly productive land systems are a priority in all subregions, independent of priority areas. Asset register was reviewed and revised through gap analysis, staff assessment and community response to the online draft plan.
16. Assess cobenefits and tradeoffs: Managing one realm can affect ecosystems in linked realms, which can result in co-benefits, if management achieves objectives in two or three realms more efficiently, or trade-offs, if management in one realm compromises the achievement of objectives in another. To quantify co-benefits and trade-offs, it is necessary to have an understanding of how assets respond to potential actions and how actions applied in one realm can propagate to others. Response curves (e.g. persistence of species and ecosystems across realms under different levels of threats) can be incorporated into optimization algorithms to allocate multiple actions to mitigate threats across realms. When possible, the outputs of optimization tools should be assessed (or ideally integrated) to other tools to assess ecological (e.g. effects of water extraction on aquatic species) and economic (e.g. production) outcomes to assess proposed management and land use alternatives.	N/A
17. Final spatial allocation of actions and uses: Based on alternative maps depicting the allocation of land use and management actions, managers – in consultation with stakeholders – can select a configuration that balances socioeconomic and environmental goals across realms. Depending on the expected output of planning, this map can be in the form of a catchment management and/or land use plan.	This Regional Plan is not intended to be all-encompassing. The resulting priority area maps (from step 15) provide an indication of where Rangelands is currently focusing effort. Program logics have been developed at the subregional level to ensure project development is undertaken in parallel the Rangelands Strategic Plan (2012 – 2015), which aims to protect, improve and manage the natural assets of the WA rangelands.

18. Define indicators: Once the management plan has been determined, the planning team should determine the social, economic and/or ecological indicators that will be used to assess the achievement of plan objectives and adjust management actions (including the overall plan) accordingly. This process should include an explicit procedure to revise and update (if necessary) the plan. Preferably, indicators should be conceptualized early in the planning process to ensure objectives are clear and can be measured using readily-available data (e.g. remotely-sensed) or can be obtained using existing or new monitoring programs (e.g. led by researchers, users and/or agencies). Indicators can be refined based on research and monitoring.	Indicators for monitoring have not been defined in the Regional Plan; these will be developed specifically for each project. Monitoring and evaluation of project achievements is and will continue to be measured against set goals and SMART targets, during project implementation and at project completion. Monitoring programs will be designed on a project-by-project basis to measure key outcomes – whether these are spatial (e.g. extent of habitat), state/condition change (e.g. improvement in vegetation condition through decreased weed cover) or improved capacity of Ranger groups to undertake identified tasks (e.g. effectiveness of weed control methods). Results of monitoring programs are and will continue to be evaluated in order that any learnings – be they from success or failure to achieve set targets and goals – can be integrated into future terms of the project and/or other, similar projects.
19. Other NRM spatial plans: Planners should be aware of existing spatially-explicit plans that inform uses of land and water. These plans will constrain and/or serve as the legal mechanism to implement the plans. Examples of such plans are water allocation, erosion control, weeding plans, prioritization of farms to implement best farming practices. These plans will influence uptake of the plan and should be considered when optimizing the allocation of actions and land uses, but not necessarily constrain this process.	A desktop review assessed a variety of Healthy Country Plans and other plans, either private or publicly available to help prioritise and guide natural resources management.
20. Management and land-water use decisions: Depending on the nature of the planning outputs (e.g. guidelines, statutory), the proposed plan will then guide the on-ground allocation of land/water uses and management actions in the planning region by the relevant stakeholders (i.e. uptake) and determine the allocation of available funding.	Many of the current region-wide (Table 3) and Kimberley projects (Table 4) specifically contribute to plan implementation, and recent project proposals align with the plan (i.e. incorporate identified assets and are based within identified priority areas) where relevant. Rangelands NRM will continue to implement the plan by seeking investment to support work in priority areas and to work with the community to increase capacity to effectively plan, resource and implement on ground works to manage priority areas.

21. Monitoring & research: Plans should include a monitoring program to periodically assess the progress and achievement of plan objectives using identified indicators. Monitoring should consider using existing research (e.g. long-term monitoring) and land/water assessment programs (e.g. land condition assessments), as well as available tools and data (e.g. remotely-sensed indices, water quality) to facilitate assessment and – if needed – adjustment of the plan. Participation of users (e.g. on-farm monitoring of biodiversity and land/water condition) can improve long-term effectiveness and promote stakeholder uptake and ownership. Monitoring will serve to test assumptions about responses of assets to threats and the effectiveness of prescribed actions. Consequently, actions/uses can be reallocated in updated plans.	This Regional Plan is a living document; ongoing development is a participatory process. The Plan will be updated annually as more information comes to hand through proactive regional engagement and the nomination of environmental assets using the INFFER process. The updates will incorporate a brief review of assets to determine whether scores against the filtering criteria have changed as a result of: a)New information becoming available b)Past actions on an asset impacting the condition or threat level c)Changes in the landscape that may affect asset significance d)New partnerships being made or land changing hands that may result in new or reduced opportunities for partnerships (socio-political aspect) e)Changes in priorities and/or funding of state agencies that result in either greater or decreased opportunities for partnerships and on ground works
22. Evaluate outcomes: Using the information derived from monitoring programs and assessment of effectiveness of actions, plans can be revisited to redefine and/or reallocate management actions and uses. This information can also serve to assess and – I necessary – adjust objectives, either because they are inadequate or are not providing information that will allow managers to assess the health of the system. This information ultimately can serve to revisit the broad management problems/needs and assess the relevance of the planning goals under new circumstances.	The updates to the assets through the review process may result in some assets being dropped from or added to the 'Potential projects' list. This will facilitate adaptive management based on project outcomes throughout project duration.

Table 1. Kimberly Asset List

1. Alexander Island
2. Annie Creek
3. Artesian Range
4. Beagle Bay
5. Broome Groundwater Area
6. Buccaneer Archipelago (Sunday Island Group) Sunday Strait
7. Byal Byal Freshwater Sawfish
8. Cable Beach
9. Camballin Barrage Pool
10. Camballin Wetlands
11. Canning Basin (Timor Basin)
12. Cape Domett turtle nesting beach
13. Carnot Peaks and Kings Peak
14. Central Gibb River Road gorges (e.g. Manning, Adcock Moll)
15. Chamberlain River Valley
16. Christmas Creek
17. Clay soil types
18. Coastal camping spots/free camping
19. Coastal Reserves including Kennedy Hill
20. Cockburn Ranges
21. Critical Weight Range mammal community - North Kimberley above 1000mm rainfall
22. Critical Weight Range mammal community - Carson River to Yampi Military Land
23. Critical Weight Range mammal community - Charnley River, Artesian Range (ex Beverley Spring Station)
24. Critical Weight Range mammal community - Mornington & Tablelands Stations
25. Cycads (ridge-loving Cycads on Fairfield Station)
26. Cypress Pine, Mt Elizabeth Station
27. Dampier Peninsula - Gouldian Finch
28. Dampier Peninsula - Greater Bilby Population
29. Dampier Peninsula - Inshore dolphins
30. Dampier Peninsula - Monsoon Vine Thicket on Coastal Sands TEC
31. Dampier Peninsula - Seagrass meadows
32. Dampier Peninsula - Water Resource
33. Dampier Peninsula - West coast
34. Devonian Reef
35. Dragon Tree Soak Nature Reserve
36. Edgar Ranges
37. Eighty Mile Beach
38. Fitzroy River - Lower reaches
39. Fitzroy River - on Mornington Station
40. Fitzroy River - Water Resource (industry groundwater in lower reaches)
41. Fitzroy River (Mardoowarra) - Entire system
42. Fitzroy River (Mardoowarra) - Fitzroy Crossing town area and old crossing
43. Fossil Soil Type
44. Frazier Downs Coastal Strip
45. Geikie Gorge
46. Gouldian Finch populations Wyndham and Ord Stage II
47. Gourdon Bay
48. Highly productive pastoral land in the Kimberley
49. Humpback Whale calving grounds
50. La Grange Groundwater Area
51. Lake Argyle
52. Lake Eda and other lake and wetland systems on Roebuck Station
53. Lake Gladstone
54. Lake Gregory (the lake itself)
55. Lake Kununurra
56. Lake Louisa
57. Lake Patterson
58. Lakes on Bulka Station

59. Lolly Well Springs and Bobbys Creek
60. Lower Liveringa (Water Reserve)
61. Mandora Marsh
62. Marion Downs spring-fed wetlands
63. May River (crossing)
64. Minyirr Park Coastal Reserve
65. Miriuwung Gajerrong DEC Reserve
66. Mitchell and Flinders Grasslands pastoral grazing land
67. Mornington destocked area
68. Munkayarra Wetland
69. Munro Springs Water and animal places
70. Myroodah Crossing
71. Nimalaica Wetland near Willie Creek
72. Nippa Dam (mountains around)
73. North Kimberley and Camden Sound Marine Parks
74. North Kimberley IBRA region
75. North Kimberley offshore islands (31 islands)
76. Nulla - Nulla
77. Ord River - Entire catchment
78. Ord River - Ramsar site including associated land system
79. Ord River - the lower part of the system
80. Ord River - Water resource (quantity)
81. Ord River Irrigation Area (ORIA)
82. P1 Public Drinking water source Area
83. Paruku Indigenous Protected Area (wetland complex)
84. Pender Bay including Pender Gardens outstation
85. Pepperpot Springs
86. Perennial Savannah Grasslands
87. Phillips Range
88. Pittosporum moluccanum
89. Purnululu NP/Bungle Bungles
90. Rainforest (North Kimberley) particularly on Bougainville Peninsula
91. Rainforest in the Kimberley
92. Riparian Vegetation Community
93. Roebuck Bay - Entire
94. Roebuck Bay - Faunal values
95. Roebuck Bay - Fish stocks (Table Species)
96. Roebuck Bay - Intertidal Mud flats
97. Roebuck Bay - Migratory shorebirds
98. Roebuck Bay - Seagrass meadows
99. Roebuck Bay & Willie Creek - Mangroves
100. Roebuck Plains Lakes/Wetlands chain
101. Salt Creek
102. Sandstone heath vegetation community
103. Savannah Woodland
104. Scaly Tailed Possum and Rock Ringtail
105. Sea Turtles - Across the region
106. Sir John Gorge
107. Small mammals, Golden Back Tree rat, Golden Bandicoot, Dunnarts
108. Sollomon Creek, Rock hide
109. Spectacle Hare Wallaby
110. TECs and PECs in Broome Peninsula and Dampier Peninsula
111. Tropical Rangelands
112. Tunnel Creek
113. Udialla Springs (Pastoral Lease)(Oongalkakda)
114. Vine thickets of the north and central Kimberley
115. Walyarta (Salt Creek)
116. Wetlands of the Great Sandy Desert
117. Wild Rivers in Kimberley
118. Willie Creek Wetlands (Nimalarragun)
119. Wood River/Rust Range Proposed Conservation Estate

120. Yalleroo Lakes
121. Yarp Lake System

Table 2. Kimberley Potential Projects

Asset number	Asset name
B019	Critical weight range mammal community - North Kimberley above 1000 mm rainfall
K031	Rainforest, north Kimberley, particularly on Bougainville Peninsula
K017	Purnululu NP / Bungle Bungles
B024	Dampier Peninsula - Monsoon Vine Thickets on Coastal Sands TEC
B043	Willie Creek wetlands (Nimalarragun)
F008	Mitchell and Flinders Grasslands pastoral grazing land
B030	TECs and PECs on Broome Peninsula and Dampier Peninsula
B054	Coastal reserves including Kennedy Hill
B025	Yarp Lake System
F009	Lakes on Bulka Station
B017	Sandstone Heath Vegetation community
B071	Rainforest in the Kimberley
K057	Ord River Irrigation Area (ORIA)
B035	Pittosporum moluccanum
F004	Christmas Creek
K039	Ord River Ramsar site including associated land system
B001	Munkayarra swamp
K027	Gouldian finch populations of Wyndham and Ord Stage II
B029	Lolly Well Springs and Bobbys creek
K024	Dampier Peninsula Water Resource
B061	Tropical rangelands
B015	Lower Liveringa (Water reserve)
F033	Sollomon Creek rock hide
K056	Critical weight range mammal community - Carson River to Yampi Military Land
D049	Pepperpot Springs

Table 3. Rangelands-wide projects

1. Planning Climate Change Regional Plan
2. Rangelands Regional Fire forum/s
3. Designing, Implementing, and Monitoring Landscape Scale projects Workshop
4. CfoC 2013-18 Sustainable Pastoralism Project
5. Royalties for Regions Carbon Awareness Project
6. Regional Landcare Facilitator Rangelands
7. Managing feed supply and groundcover in rangelands through nutritional shepherding

Table 4. Kimberley projects

1. State of Environment Report - Shire of Broome
2. Reducing nutrients entering Ramsar listed Roebuck Bay
3. Protecting the ecological and cultural values of Roebuck Plains
4. Water Quality monitoring to protect Roebuck Bay
5. ESRM for Roebuck Plains and Myroodah
6. Protecting Monsoon Vine Thickets on the Dampier Peninsular
7. Fire management to protect Gouldian Finch habitat
8. Nutritional EDGE workshops
9. Managing threats to protect the Purple Fairy Wren habitat

10. Cattle responses to Ecofire as a management tool - demonstrating the benefits
11. Protecting Munkayarra Wetlands
12. Developing NRM Opportunities in East Kimberley
13. Nyangumarta Ranger development
14. Rubbervine eradication in the Kimberley - East
15. Rubbervine eradication in the Kimberley - West
16. Kimberley Cattlemen's association
17. Increasing Land Managers Capacity to Manage Rangeland Condition in the Kimberley and Pil bara
18. Protecting the Logue River
19. Kimberley Coastal Devolved Grants