Project Order, Variations and Research Progress

Project Title: Priority threat identification, management and appraisal

This document contains three sections. Click on the relevant section for more information.

1 Original Project Order

Project Order
Proforma 2012

1. Short Project Title (less than 15 words)

Project 1 – Threat identification

Long Project Title	Priority threat identification, management and appraisal
GISERA Project Number	B1 1215
Proposed Start Date	October 2012
Proposed End Date	September 2015
Project Leader	Tara Martin

2. GISERA Research Program

☒ Biodiversity Research ☐ Marine Research ☐ Land Research

☐ Water Research ☐ Social & Economic Research

3. Research Leader, Title and Organisation

Tara Martin
Senior Research Scientist
CSIRO Ecosystems Sciences

GISERA Gas Industry Social & Environmental Research Alliance

4. Summary (less than 300 words)

This project provides underpinning science to understand the key threats to biodiversity across Queensland's CSG development region and the conservation management actions to abate these threats to achieve the greatest biodiversity benefit. The identification of threats and actions will draw on past research and expertise, and will undertake new empirical research where current knowledge is lacking. Then the relative cost-effectiveness of taking different management actions for improving the probability of persistence of species and threatened ecosystems across the study region will be estimated. The likely biodiversity outcomes under specific management scenarios including a 'do nothing' scenario and the suite of actions and funds required to achieve persistence, or conversely, the best use of a limited budget to maximise expected ecological benefit will also be estimated.

5. Budget Summary (From Excel Budget Pack worksheet "Project Plan Summary")

Expenditure	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	2015/16 Year 5	Total
Labour	-	183,828	266,916	282,191	72,192	805,128
Operating	-	36,810	36,531	48,181	18,750	140,272
Total Costs	**-**	**220,638**	**303,447**	**330,372**	**90,942**	**945,400**
CSIRO		220,638	303,447	330,372	90,942	945,400
Total Expenditure		**220,638**	**303,447**	**330,372**	**90,942**	**945,400**

Expenditure per Task	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	2015/16 Year 5	Total
Task 1		220,638	303,447	330,372	90,942	945,400
Total Expenditure		**220,638**	**303,447**	**330,372**	**90,942**	**945,400**

Cash Funds to Project Partners	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	2015/16 Year 5	Total
CSIRO		175,680	175,680	117,120	117,120	585,600
Total Cash to Partners		**175,680**	**175,680**	**117,120**	**117,120**	**585,600**

Source of Cash Contributions	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	2015/16 Year 5	Total
APLNG		175,680	175,680	117,120	117,120	585,600
Total Cash Contributions		**175,680**	**175,680**	**117,120**	**117,120**	**585,600**

In-kind Contribution from Partners	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	2015/16 Year 5	Total
CSIRO		44,958	127,767	213,252	-26,178	359,800
Total Cash Contributions		**44,958**	**127,767**	**213,252**	**-26,178**	**359,800**

	Total Funding over all years	Percentage of total Budget
Australia Pacific LNG	585,600	62%
CSIRO	359,800	38%
Other		
Total Project budget	**945,400**	**100%**

Task	Milestone Number	Milestone Description	Funded by	Participant Recipient	Start Date (mm-yy)	Delivery Date (mm-yy)	Fiscal Year	Fiscal Quarter	Payment $
Task 1	1	on signing of contract	GISERA	CSIRO	Oct-12	Dec-12	2012/13	Quarter 2	189,080
Task 1	2	on completion of literature review	GISERA	CSIRO	Jan-13	Jun-13	2012/13	Quarter 4	94,540
Task 1	3	on completion of stakeholder engagement	GISERA	CSIRO	Jul-13	Dec-13	2013/14	Quarter 2	189,080
Task 1	4	on completion of spatial data mapping	GISERA	CSIRO	Jan-14	Jun-14	2013/14	Quarter 4	94,540
Task 1	5	on submission of two manuscripts	GISERA	CSIRO	Jul-14	Dec-14	2014/15	Quarter 2	189,080
Task 1	6	on acceptance of prospectus and final report	GISERA	CSIRO	Jan-15	Sep-15	2015/16	Quarter 1	189,080

6. Other Researchers (include organisations)

Researcher	Time Commitment (project as a whole)	Principal area of expertise	Years of experience	Organisation
Richard Fuller	0.1	Conservation planning	15	CSIRO/UQ
Martine Maron	0.1	Landscape ecology	15	UQ
Tara Martin	1.0	Ecological modelling	14	CSIRO

7. GISERA Objectives Addressed

Research that improves and extends knowledge of environmental impacts and opportunities of CSG-LNG projects, enabling the CSG-LNG industry to better meet the expectations of relevant communities and the broader public.

Informing government, regulators and policy-makers on key issues regarding policy and legislative framework for the CSG-LNG industry.

8. Program Outcomes Achieved

Details are provided in *Section 13. Project Objectives and Outputs.*

9. Program Outputs Achieved

Details are provided in *Section 13. Project Objectives and Outputs*

10. What is the knowledge gap that these research outputs will address?

A key piece of knowledge that is currently missing in terms of actions for landscape restoration is knowing the amount of a particular vegetation type that must be conserved to ensure its long-term persistence. Outcomes of this project will identify where to manage threats across the study region to maximise biodiversity benefits for minimum cost and determine a priority set of actions to take in each sub-bioregion to maintain wildlife and vegetation communities in the long-term.

11. How will these research outputs and outcomes be used by State Government and other managers?

The priority actions arising from this initial project will be used to guide future terrestrial biodiversity research. The results will be published in peer-reviewed journals as well as presented in a report targeted at decision makers within governments, non-government organisations and corporations with the potential to invest in threat management in the region. Akin to a prospectus, the report will provide investors in threat management with a list of investment options and projected returns on these investments with respect to conserving wildlife and vegetation communities across the study region. This is a tried and tested approach (Carwardine et al 2011, 2012).

12. Project Development (1 page max.)

The project was developed in consultation between Australia Pacific LNG and CSIRO staff, and with expert input from GISERA's Research Advisory Committee. Discussion among these stakeholders identified that threat risk assessment and decision making is key to informing biodiversity management as development unfolds. However, our knowledge about these threats was identified as a key limiting factor. Hence, there was broad agreement that a core component of the early projects in the terrestrial biodiversity theme should be a full threat appraisal and mapping exercise to determine where the risks to biodiversity lay and expand our knowledge of landscape ecology in the region.

13. Project Objectives and Outputs

The objectives of the study are to (i) determine how much of each vegetation type needs to be protected in the region to ensure long term biodiversity persistence, (ii) identify and assess the cost-effectiveness of threat management actions for improving the persistence of wildlife and vegetation communities in the study region over 50 years, (iii) estimate the likely outcomes for wildlife and vegetation communities of a 'no management' scenario and the minimum level of funding required to support management actions to avoid likely wildlife and vegetation community losses and secure species over 50 years, assuming thresholds of <50% persistence probability indicates a species is likely to be lost and ≥90% indicates a species is likely to be secure, and (iv) estimate the maximum number of wildlife species that can be improved to above each of these thresholds if only part of the budget required to avoid wildlife losses were available.

Outputs include:

- Information on how much protection is needed for various threatened ecosystems across the CSG development region
- Prioritised set of management actions to abate threats in southern Queensland
- Foundational threat management planning tools in place.

14. Project Plan

14.1 Project Schedule

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
1	Sign contract	Tara Martin	Oct 12	Dec 12	
2	Complete literature review	Tara Martin	Jan 13	Jun 13	1
3	Engage stakeholders	Tara Martin	Jul 13	Dec 13	2
4	Map all data spatially	Tara Martin	Jan 14	Jun 14	3
5	Submit two manuscripts to scientific journals	Tara Martin Tara Martin	Jul 14	Dec 14	4
6	Produce action prospectus and final report	Tara Martin	Jan 15	Sep 15	5

Task 1.

TASK NAME: Sign contract

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Oct 2012 – Dec 2012

BACKGROUND: Contract needs to be signed to allow project to proceed.

TASK OBJECTIVE: To sign the contract.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Signed contract.

Task 2.
TASK NAME: Complete literature review

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jan 2013 – Jun 2013

BACKGROUND: Declines in both threatened and common species are accelerating within and outside protected areas (Leverington et al. 2010; Woinarski et al. 2011), due to an array of pervasive threats including invasive species, changed fire regimes, livestock grazing, urbanisation and mining (Rands et al. 2010). To restore and maintain functioning ecosystems with ecologically effective populations of native species, threats need to be managed irrespective of whether the land is freehold tenure, crown or other (Woinarski et al. 2007). In developing and implementing threat management plans for a region, governments and other investors must be able to discern between alternative threat management actions using transparent information on the likely costs, risks and

benefits of taking action compared to inaction (Possingham et al. 2001; Carwardine et al. 2011, 2012).

A full literature review on this topic will be completed to underpin the scientific basis of the project.

TASK OBJECTIVE: To produce a literature review.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A literature review covering the latest developments in the field. If sufficient depth is found in the literature, there may be a case for submitting the review to a scientific journal.

Task 3.
TASK NAME: Engage stakeholders

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jul 2013 – Dec 2013

BACKGROUND: Engage stakeholders to assess the threats to biodiversity emerging in the region, estimate level of certainty about how these threats operate, and determine which conservation management activities will best mitigate the risks to biodiversity.

TASK OBJECTIVE: To gain expert stakeholder input, an expert elicitation workshop, similar to those previously held to support work in Western Australia, will be conducted.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Expert-derived assessments of risks to biodiversity, together with a series of costed potential actions to abate those risks. A further benefit of this approach is that the engagement of multiple stakeholders will be achieved.

Task 4.
TASK NAME: Map all data spatially

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jan 2014 – Jun 2014

BACKGROUND: The landscape ecology and threat assessment components of this project all rest on a foundation of spatial data, and so a comprehensive spatial database needs to be constructed to align all of these data. As well as building a database of existing field data and threat layers, all data collected will be mapped spatially to inform and underpin the resource prioritisation component of the project.

TASK OBJECTIVE: To produce a comprehensive spatial database of threats, actions, costs and biodiversity responses.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A spatial database in ArcGIS format.

Task 5.
TASK NAME: Submit two manuscripts to scientific journals

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jul 2014 – Dec 2014

BACKGROUND: Results from experimental work will be written up for publication in scientific journals.

TASK OBJECTIVE: To produce at least two scientific manuscripts detailing the literature review, and core results from the project. This yields international scientific credibility and is important to underscore the robustness of the project and its results.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Two scientific manuscripts.

Task 6.
TASK NAME: Produce action prospectus and final report

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jan 2015 – Sep 2015

BACKGROUND: Project reporting is a key deliverable, and this is especially important in this project where the production of a prospectus will be a key communication tool aimed at helping to inform policy.

TASK OBJECTIVE: To produce a final report together with a glossy prospectus akin to that produced for the Kimberley by the same project team.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Final report and prospectus.

15. Budget Justification

The budget for this project has been approved by GISERA's Research Advisory Committee and Management Committee.

16. Project Governance

Project management tasks and dissemination activities are specified in *Section 14 Project Plan*.

17. Communications Plan

General communication will be managed by GISERA.

18. Risks

At this stage no unmanageable risks particular to this project are foreseen.

Capacity to deliver: All project staff have sufficient experience to lead and supervise the various activities and ascertain the research outcomes. Therefore the impact of unplanned key staff departure is low and can be mitigated.

19. Intellectual Property and Confidentiality

Background IP (clause 10.1, 10.2)	**Party**	**Description of Background IP**	**Restrictions on use (if any)**	**Value**
Ownership of Non-Derivative IP (clause 11.3)	CSIRO			
Confidentiality of Project Results (clause 15.6)	Project results are not confidential.			
Additional Commercialisation requirements (clause 12.1)	Not Applicable			
Distribution of Commercialisation Income (clause 1.1)	Not applicable			
Commercialisation Interest (clause 1.1)	**Party**		**Commercialisation Interest**	
	Australia Pacific LNG			
	CSIRO			

GISERA Gas Industry Social & Environmental Research Alliance

20. Approval from Project Parties

In signing this Document you are committing your organisation to provide the specified funds, personnel and the required in-kind contributions.

Australia Pacific LNG

SIGNED for and on behalf of Australia Pacific LNG, exercising authority delegated by the GISERA Management Committee

Dan O'Sullivan

by
in the presence of

.....
Signature of witness

SYLVIA RAINERI
.....
Name of witness

12-4-13
.....
Date

CSIRO

SIGNED for and on behalf of CSIRO, exercising authority delegated by the GISERA Management Committee

W.M. Lonsdale

DR MARK LONSDALE

By ~~Dr Dan Walker, Acting~~ Portfolio Leader
in the presence of

.....
Signature of witness

LINDA LEAVITT
.....
Name of witness

19/4/2013

2 Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the National GISERA Alliance Agreement.

The table below details variations to research Project Order.

Register of changes to Research Project Order

Date	Issue	Action	Authorisation
19/04/13	Research project start date delayed; milestone dates require rescheduling	All milestone dates rescheduled to reflect later project start date; timing of milestones relative to start date not altered.	Peter Stone
25/02/15	Project leader requested that delivery date of milestone 5 (scientific papers) and milestone 6 (final report) be switched. This will result in finalisation of report first, followed by preparation of scientific papers/	Milestone 5 will be pushed back to April 2016 and milestone 6 will be moved forward to July 2015.	
14/06/16	First manuscript completed, but second one is still in early draft form.	Milestone 5 will be pushed back to July 2016.	

3 Progress against project milestones

Progress against milestones are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the National GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic Light Reports and descriptive Project Schedule Reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:
   - Green:
     - Milestone fully met according to schedule.
     - Project is expected to continue to deliver according to plan.
     - Milestone payment is approved.
   - Amber:
     - Milestone largely met according to schedule.
     - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
     - Milestone payment approved for one amber light.
     - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.
   - Red:
     - Milestone not met according to schedule.
     - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
     - Milestone payment is withheld.
     - Project review initiated and undertaken by GISERA Research Advisory Committee.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project Schedule Table

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
1	Sign contract	Tara Martin	May 13	Jul 13	
2	Complete literature review	Tara Martin	Aug 13	Jan 14	1
3	Engage stakeholders	Tara Martin	Feb 14	Jul 14	2
4	Map all data spatially	Tara Martin	Aug 14	Jan 15	3
5	Submit two manuscripts to scientific journals	Tara Martin	Feb 15	Jul 16	4
6	Produce action prospectus and final report	Tara Martin	Aug 15	Jul 15	5

Project Schedule Report

Task 1.

TASK NAME: Sign contract

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Oct 2012 – Dec 2012

BACKGROUND: Contract needs to be signed to allow project to proceed.

TASK OBJECTIVE: To sign the contract.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Signed contract.

PROGRESS REPORT:

The contract has now been signed, and the project released for research to commence. CSIRO has also appointed the post-doctoral fellow who will assist on the project.

Task 2.

TASK NAME: Complete literature review

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jan 2013 – Jun 2013

BACKGROUND: Declines in both threatened and common species are accelerating within and outside protected areas (Leverington et al. 2010; Woinarski et al. 2011), due to an array of pervasive threats including invasive species, changed fire regimes, livestock grazing, urbanisation and mining (Rands et al. 2010). To restore and maintain functioning ecosystems with ecologically effective populations of native species, threats need to be managed irrespective of whether the land is freehold tenure, crown or other (Woinarski et al. 2007). In developing and implementing threat management plans for a region, governments and other investors must be able to discern between alternative threat management actions using transparent information on the likely costs, risks and benefits of taking action compared to inaction (Possingham et al. 2001; Carwardine et al. 2011, 2012).

A full literature review on this topic will be completed to underpin the scientific basis of the project.

TASK OBJECTIVE: To produce a literature review.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A literature review covering the latest developments in the field. If sufficient depth is found in the literature, there may be a case for submitting the review to a scientific journal.

PROGRESS REPORT:

A literature review has been prepared identifying the imperative, rationale and range of approaches that can be applied to prioritize the management of biodiversity in the Brigalow Belt.

The literature review frames the need for biodiversity in a global context identifying a range of anthropogenic impacts, such as habitat loss and fragmentation. The emergence and expansion of energy industries, such as Coal Seam Gas, into many farming regions, will compound existing

threats to biodiversity in a region, and also bring new ones. This is particularly so in multiple-use regions where new threats can have synergistic and cumulative effects on the biodiversity. Multiple-use regions are often severely cleared and fragmented making it impractical to create new, large and connected protected areas. Therefore alternative approaches are required for improving the long-term persistence of biodiversity through managing threats across tenure boundaries.

Prioritization of scarce conservation management resources amongst the approaches available is critical for success. Allocating too little amongst poorly prioritized tasks is likely to be ineffective at best. Unfortunately most important biodiversity regions in Australia and throughout the world lack a prioritized set of threat management actions to assist decision makers in allocation decisions. The few examples that do exist are focused on relatively ecologically intact regions, such as the Kimberley in Western Australia. The objective in this project is to develop such an approach for the Brigalow Belt region in Queensland, which is one of the most ecologically transformed areas in Australia. The Brigalow Belt region has been subjected to historical broad scale clearing of native vegetation since mid-1800s for different uses: pastoral, agricultural, urbanisation, and more recently mining activities, which are expected to expand in the coming decades. Despite land use change and ongoing threats to biodiversity the region retains great importance in terms of its biodiversity, with 147 threatened species and 100 communities listed as threatened. While current conservation efforts in the region are important, they are expected to be insufficient in to maintain biodiversity values in the face of these increasing threats.

New systematic and more efficient and effective approaches to conservation priority setting have been developed in the last years that can help to prioritize conservation management in fragmented regions such as the Brigalow belt. Decision science has become the basis of novel strategies and frameworks used to prioritise species, locations and more recently, actions in which to invest to improve the long term persistence of the biodiversity in a region. The approach requires the following basic principles of decision science: (i) a clear objective; (ii) a well-defined set of actions from which a subset will be chosen as priorities; (iii) a model of system behaviour to relate actions to their contributions toward meeting the objectives; (iv) the consideration of resource constraints. Structured Decision-Making (SDM) – the application of decision science – uses tools such as expert elicitation and cost-effectiveness analyses in order to collect and evaluate information to advice on the most efficient use of resources.

Recent research has shown the utility of threat identification and appraisal. Due to the novelty of these tools and their application, there are many areas for possible improvement. For example, the approach may be improved by considering a finer resolution of costs and biodiversity persistence parameters and improving expert estimates by combining them with empirical information using Bayesian Belief Networks. The adaptability of the approaches to uncertainties and future challenges and changes after implementation is also an area of rich research potential.

The next steps following from the literature review are to refine the exact form of cost-effectiveness analyses that will be applied within the region. In particular the balance across an individual species or broader ecosystem approach, potentially using a combined approach will need to be settled. This will depend in part on the more detailed information that will be acquired in the stakeholder engagement phase of the project relating to conservation objectives, threats and available resources. Some useful datasets already exist to assist with decision analysis, however a complete set of empirical data for making informed decisions for this region are unavailable. This currently challenges decision-making in the region and will form a key role in stakeholders engaging and informing the project. The project will now shift into the stakeholder engagement phase, gathering the necessary links and networks to provide a region-wide analysis of alternative actions for managing threats to the biodiversity of the Brigalow region.

The literature review is publicly available on the GISERA website Priority threat identification, management and appraisal: Literature review.

Task 3.

TASK NAME: **Engage stakeholders**

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jul 2013 – Dec 2013

BACKGROUND: Engage stakeholders to assess the threats to biodiversity emerging in the region, estimate level of certainty about how these threats operate, and determine which conservation management activities will best mitigate the risks to biodiversity.

TASK OBJECTIVE: To gain expert stakeholder input, an expert elicitation workshop, similar to those previously held to support work in Western Australia, will be conducted.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Expert-derived assessments of risks to biodiversity, together with a series of costed potential actions to abate those risks. A further benefit of this approach is that the engagement of multiple stakeholders will be achieved.

PROGRESS REPORT:

The primary vehicle for structured engagement with stakeholders was an expert elicitation workshop held on October 15-17 in Brisbane. The workshop supported steps 3-5 in the following structure for engaging and eliciting information from expert stakeholders:

1. Collection/review of data from literature, existing databases
2. Engage experts and stakeholders on the biodiversity and management in Queensland
3. Identification of key threats and processes in collaboration with experts and stakeholders
4. Identify potential strategies (e.g. weed management) for improving biodiversity persistence
5. Refine the data gathered from existing literature and through a structured elicitation process with experts on the likely benefits, feasibility, and costs and actions that make-up each strategy*
6. Assess ecological cost-effectiveness (expected benefits per unit cost) of strategies
7. Extension of science, including recommendations for management

The workshop process involved working with a range of experts in small focus groups to identify the costs, success and benefits of different management actions during three days starting at 9:00am and finishing at 5:00pm each day. Our participant pool targeted experts on the Brigalow Belt bioregion ecology. Over 30 experts attended from academia, local, region and state governments and environmental organisations. Experts were asked, through the expert elicitation process above, to estimate, for each feature (species, endangered ecosystem and cultural site of significance) in the Brigalow Belt bioregion, the probability of persistence over 50 years with and without implementation of each management action. We discussed estimates of the costs and

feasibility of undertaking each management action, considering their experience of previous and existing management activities and spatial variants such as land tenure and remoteness.

In preparation for the workshop several meetings were held with different stakeholders (threatened species unit from the Qld Government, UQ, Qld herbarium) to inform the process and gather background data.

The main threats according to the literature were identified in advance of the workshop. The first structured activity of the workshop discussed and modified the key threats in the region. For the most part threats and management strategies are consistent with the literature review and previous studies. The issue of creating a common vision across all of the stakeholders has emerged as a new and highly desired overarching supporting strategy necessary for the others to succeed. It is unclear whether this is a product of the highly fragmented landscape and multiple land use trade-offs. This action may have arisen from some frustration that some experts had addressed broadly similar workshops (albeit less focused and structured) with little impact on regional biodiversity.

The workshop also worked to prioritize the relative effectiveness of different threats and managements across ecological communities. The experts indicated a significant difference in their expectations of management action effectiveness and uptake. We anticipate these differences will deliver strong differences in the relative cost effectiveness of actions across species and scales of implementation.

Task 4.

TASK NAME: Map all data spatially

TASK LEADER: Dr Tara Martin

OVERALL TIMEFRAME: Jan 2014 – Jun 2014

BACKGROUND: The landscape ecology and threat assessment components of this project all rest on a foundation of spatial data, and so a comprehensive spatial database needs to be constructed to align all of these data. As well as building a database of existing field data and threat layers, all data collected will be mapped spatially to inform and underpin the resource prioritisation component of the project.

TASK OBJECTIVE: To produce a comprehensive spatial database of threats, actions, costs and biodiversity responses.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A spatial database in ArcGIS format.

PROGRESS REPORT:

The threats identified and modelled in this project and for which the spatial data was assembled followed those identified by experts as impacting upon the persistence of threatened species in the Brigalow belt region over the next 50 years (see Task 3). These threats arise from a variety of sources, including agriculture, mining, development and adverse human behaviour, and include: land clearing/ habitat loss/fragmentation, changes to hydrology, invasive species (animals and plants), changes to fire regimes. Threats which are exacerbated by coal seam gas development primarily relate to vegetation clearing leading to landscape fragmentation, hydrology changes and pollution (e.g. sediment mobilization), invasive species, and in complicating the potential for fire regimes to be returned.

Spatial layers were designed to assemble and build on the information supplied at the expert elicitation workshop which identified the main threats, the potential management strategies that may improve the persistence of threatened biodiversity by addressing these threats and the cost and feasibility of implementing those strategies. Some of the outputs were revised post-workshop using relevant literature and follow up conversations. The subsequent outputs are summarized in a spreadsheet which sets out details of:

- The spatial layers that displayed each of the four main threats, with a link referencing to where we obtained it and important additional information (date when it was published, and georeferenced and projections when specified in the original metadata).
- The management strategies they are designed to abate (eleven threat management strategies were agreed upon by the experts.
- The estimated cost for implementing each management strategy at the region-wide scale due the widespread distribution of the threats.
- The estimated feasibility values (likelihood of uptake multiplied by the probability of success).

The biodiversity responses are represented by the fauna and flora species that will benefit from implementing the management strategies. This list was derived by identifying the species that occur in the Brigalow Belt bioregion and are listed in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), in the *Nature Conservation Act 1992* (NCA) and in the Queensland Government's "Back on Track" program followed by a expert checking process. The number of species by sub-region and the listing category is set out in Tables 1 and 2.

Task 5. (Switched with the original task 6)

TASK NAME: Produce action prospectus and final report

TASK LEADER: Dr Rocio Ponce Reyes

OVERALL TIMEFRAME: Jan 2015 – Sep 2015

BACKGROUND: Project reporting is a key deliverable, and this is especially important in this project where the production of a prospectus will be a key communication tool aimed at helping to inform policy.

TASK OBJECTIVE: To produce a final report together with a glossy prospectus akin to that produced for the Kimberley by the same project team.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Final report and prospectus.

PROGRESS REPORT:

A final report has been prepared for publication which presents a costed and prioritised set of threat management strategies for protecting 179 of the most threatened native plant and animal species of the Brigalow Belt bioregion in Queensland (i.e. the action prospectus). Twelve strategies were outlined (as described in Task 3) which were designed through a consultation process with 40 experts and stakeholders in biodiversity and land management of the region, using the best available scientific data and expert knowledge.

Within the Brigalow Belt, eight species have already been lost, including local extirpations of the eastern quoll and the northern bettong and global extinctions of species of the Darling Downs hopping mouse. A total of 147 species and 100 ecological communities are listed as threatened at the Queensland state level. The ecological community of Brigalow species which give the region its name has been cleared to approximately 5% of its original extent. Many land managers in the region are working to conserve and protect the significant ecological values of the region. With limited resources to spend on minimising future losses of species and restoring degraded populations, decisions are likely to benefit from a region-wide assessment of priority threat management options. A priority threat management approach has been used successfully elsewhere for prioritising strategies to manage threats in relatively intact landscapes (e.g. Kimberley (Carwardine et al. 2011) Pilbara (Carwardine et al. 2014; Chadés et al. 2015), Lake Eyre Basin (Firn et al. 2013; Firn et al. 2015)).

The final report describes the application of the priority threat management approach to the Brigalow Belt bioregion and yields a number of unique and useful discoveries of how to best protect its imperilled species. The report aims to support future conservation decision making in the Brigalow Belt region by:

(i) Presenting the a region-wide assessment of a costed set of management strategies for restoring and securing the persistence of the imperilled native species

(ii) Using cost-effectiveness ranking analysis and complementarity analysis to determine which strategies and groups of strategies offer the best return on investments for biodiversity under different budgets

(iii) Providing a flexible, rational and repeatable framework for appraising threat management strategies that can be updated as further information becomes available or to suit differing objectives.

The priority threat management approach involves a review of existing literature, data and methods for conservation decisions in the region (Carwardine et al. 2012) and a structured elicitation approach with experts and stakeholders. Much of the information necessary for defining and prioritising threat management strategies was collected as described in Task 3. The participants defined 10 technically and socially feasible strategies aimed at mitigating the landscape-scale threats to these species. They also defined a combined strategy which included all ten strategies and an additional strategy to develop a 'common vision' to strengthen conservation in the region. For each strategy, experts defined the actions required to implement the strategy and the associated financial costs over 50 years and the feasibility of implementation of each action on a scale from 0-100%.

Experts on the biodiversity of the region estimated the likelihood of functional persistence of each species in 50 years from a baseline scenario with no management strategies and with the implementation of each strategy, with and without the common vision. We then calculated the ecological cost-effectiveness of each strategy by its expected benefit (the improved persistence of species under the implementation of the strategy multiplied by the feasibility of the strategy) divided by its expected cost over 50 years. We used a complementarity analysis to assess which strategies present the best investments depending on budgets and thresholds for the functional persistence of species where the required budget to implement all strategies is not available.

The key findings presented in the report represent the action prospectus and are as follows:

- Without effective implementation of threat management strategies 21 species are at risk of becoming functionally lost from the region over the next 50 years, with persistence probabilities of less than 50%. Implementing the suite of management strategies outlined in this report, including the common vision, at an average annualised cost of $57.7 m / year could avert the loss of 12 of these species (e.g. koala, bridled nail tail wallaby and silver perch) from the region.
- In a highly transformed and fragmented region such as the Brigalow Belt, threat management strategies alone are insufficient to protect all imperilled species and in some cases may be prohibitively expensive. Even with implementation of all of the strategies outlined in this report, nine species including the northern hairy-nosed wombat and the Darling Downs earless dragon face greater than a 50% chance of functional loss from the region. Species-specific management responses are likely to be required to avoid the functional extinction of these species from the region.
- The most cost-effective strategies for improving the overall persistence of imperilled species in the region are the management of fire and invasive plants, at an average annual cost of $0.55 m and $1.53 m respectively. These strategies were ranked first and second for improving the persistence of native plants, animals and all 179 native species combined. Managing hydrology and identifying and protecting key biodiversity areas were ranked third and fourth most cost-effective overall and for native plants and animals separately.
- Mammals are by far the most threatened group of species considered, with half of the 14 mammal species assessed likely to be functionally lost from the region without management strategies. Ten of these species could be secured to at least a 50% chance of survival with implementation of all strategies. The most effective strategies for improving the persistence of mammal species were the management of fire and invasive animals. The management of invasive animals was a relatively expensive strategy ($12.7 m / year), involving a large subset of discrete actions. Targeted implementation of a subset of these actions could be undertaken to benefit specific species.
- The building of a common vision for the Brigalow Belt bioregion represented a critically important strategy over the next 50 years. The common vision strategy was estimated to cost only $0.2 m / year when averaged over 50 years and increased the feasibility of the others strategies resulting in likely improvements in species persistence. Without a common vision, two of the 12 likely losses from the region cannot be avoided through threat management. Almost every strategy
- Strategies become more cost-effective when implemented along with the common vision, indicating that the improvement in expected benefits generated by the common vision outweighed the additional cost of developing the vision. In most cases significantly more than $0.2 m / year could be cost-effectively spent on the common vision. The common vision enabled securing 115 species to above a 70% persistence threshold for just under

$20 m / year – a task that would cost $28.5 m / year without the common vision due to the many more strategies required.

- While we have harnessed the best available scientific and expert knowledge in this analysis, uncertainties exist around the costs, benefits and feasibility of management strategies. The cost-effectiveness ranks of strategies were relatively robust to the uncertainty in expert estimates of persistence, with fire management ranked consistently higher than all other strategies. A sensitivity analysis indicated that costs, feasibility and benefits had equal impact on the outcomes of the cost-effectiveness analysis.

The report sets out in detail the first region wide cost-effectiveness analysis of strategies to improve the persistence of 179 threatened species of the Brigalow Belt in Queensland. Priority management strategies for achieving other goals such as improvements in broader ecological values, ecosystem services, agricultural productivity or livelihoods may differ from those results we present. We note that while we attempted to consult a broad and representative group of participants some may have been unable or unwilling to participate. Hence the report should be considered as a flexible platform to which additional values and preferences can be included during decision making processes – for example, through the creation and implementation of a common vision approach.

A clear element of the prospectus actions in the report is the creation of a common vision to capture the need for a broad change in management and decision making to underpin biodiversity management in the Brigalow Belt over the next 50 years and beyond. The common vision for the region could be built at a relatively low cost by harnessing the collective energy and talent in the region and using a number of successful case studies on individual properties as models to propel change.

Supporting material for Task 5: Ponce Reyes, R., Firn, J., Nicol, S., Chades, I., Stratford, D., Martin, T., Whitten, S. and Carwardine, J. (2015) *Priority Threat Management for Imperiled Species of the Queensland Brigalow Belt,* CSIRO, Brisbane.

Task 6.

TASK NAME: Submit two manuscripts to scientific journals

TASK LEADER: Dr Rocio Ponce Reyes

OVERALL TIMEFRAME: Jul 2014 – Dec 2014 (Switched from original Milestone 5 and delivery revised to July 31 2016**)**

BACKGROUND: Results from experimental work will be written up for publication in scientific journals.

TASK OBJECTIVE: To produce at least two scientific manuscripts detailing the literature review, and core results from the project. This yields international scientific credibility and is important to underscore the robustness of the project and its results.

TASK OUTPUTS & SPECIFIC DELIVERABLES: Two scientific manuscripts.

PROGRESS REPORT:

Two scientific manuscripts have been produced and cleared for journal submission through CSIRO ePublish procedures. Both papers are now attached for the GISERA Director's approval prior to journal submission.

Manuscript 1: Conserving threatened species can be more cost-effective with a common vision

Abstract
More than 75% of the planet's terrestrial ecosystems have been altered by human activities since the industrial revolution. Nowadays high conservation value ecosystems are embedded in mosaics of land-uses and the number of species threatened with extinction is accelerating. In regions with diverse and conflicting land-use goals, finding solutions to this conservation crisis is challenging. 6 Improvements in conservation outcomes could be achieved by developing a stakeholder-driven common vision to align disparate values and decide implementation pathways, but the return on investment of 'working together' is rarely quantified. Here we illustrate a novel way to quantitatively evaluate the benefits of developing a common vision in a highly-contested landscape, by comparing the cost-effectiveness of conservation efforts with and without the vision. We discover that investing in a common vision increases the return on conservation management investment by 32%. With only 15.4% of the world's terrestrial area protected, our approach could provide guidance for more effective resource allocation for managing threats in contested regions where biodiversity and ecosystems services are at risk.

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Target Journal: Nature Ecology and Ecology

Manuscript 2: Ecological intactness and the costs of reversing biodiversity loss

Abstract

The extent and condition of native habitats varies from region to region around the world, and can profoundly impact the outlook for biodiversity conservation. Yet, nations are signatories of international agreements to reduce species declines and avoiding extinctions, and this can create tensions between resource use, economic development and conservation. Here we investigate how regional ecological intactness can impact not only the numbers of species threatened with extinction, but also the costs and feasibility of saving these species from extinction. For five regions in Australia, each with divergent degrees of ecological intactness, we quantify economic prosperity, the outlook for native species under current threats, the costs of managing these threats, and the number of species that are unable to be saved by threat management. We found that the cost of implementing management strategies increases as ecological intactness declines,

and species extinctions are imminent in less ecologically intact regions. However, these regions are home to more people, and tend to be more economically prosperous, than intact regions, which could create conservation opportunities. Our analysis reveals key patterns between ecological intactness and species persistence, knowledge which underpins the development and management of landscapes that deliver multiple benefits to people, including the preservation of nature.

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Target Journal: Conservation Letters- Policy Perspective

Other manuscripts are also drawing broadly on the results of this work. For example Rocio Ponce Reyes and Josie Carwardine are leading the preparation of a manuscript **A primer of Priority Threat Management for nature conservation**" which will draw on some of the findings of the Brigalow project among our other PTM studies.

Attachments: manuscripts and additional material.