Project Plan SP 2019-069

Structured Decision Making for optimal feral herbivore management for biodiversity conservation in the Kimberley

Animal Science

Project Core Team

Supervising Scientist	Megan D Barnes
Data Custodian	Megan D Barnes
Site Custodian	

Project status as of July 7, 2020, 8:27 a.m.

	Approved and active

Document endorsements and approvals as of July 7, 2020, 8:27 a.m.

Project Team	granted
Program Leader	granted
Directorate	granted
Biometrician	granted
Herbarium Curator	not required
Animal Ethics Committee	not required

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Biodiversity and Conservation Science Program

Animal Science

Departmental Service

Service 6: Conserving Habitats, Species and Communities

Project Staff

Role	Person	Time allocation (FTE)
Supervising Scientist	Megan D Barnes	0.4
Research Scientist	Janine Kinloch	0.15

Related Science Projects

SP2018-073 Spatial analysis and modelling
SP2012-027 North Kimberley Landscape Conservation Initiative: monitoring and evaluation

Proposed period of the project

May 1, 2020 – Dec. 31, 2021

Relevance and Outcomes

Background

The benefits of integrated landscape management are variable across threatened taxa, which have variable susceptibility to threats and responses to management. Priority Threat Management identified introduced predator control, introduced herbivore control, weed management and fire management as cost-effective actions for managing DBCA assets in the Kimberley (Cawardine 2012, Cons Letters 5(3)196:204). Feral herbivore control was identified as a cost-effective threat management strategy for conserving many threatened and endemic species in the Kimberley, particularly it's small mammal fauna, but the current program is not optimised spatially, rather regional staff annually design a logistically efficient approach within existing budget.

Efficiency and cost-effectiveness could be increased by optimising delivery of this high cost process to maximise biodiversity benefits through two key improvements: (1) characterisation of utility thresholds (i.e. the thresholds at which efficiency and impact decrease below a useful level) to inform; i.e. how much shooting is enough, and (2) impact focused spatial action planning, to identify spatially explicit management strategies that balance the conservation needs of multiple species while accounting for other funds and opportunities in that timestep

Structured Decision Making (SDM) is a formal collaborative process designed to facilitate decision making in multi objective, value-laden contexts characterized by limited resources, uncertainty, and difficult trade-offs such as these (Gregory 2012). Challenges in the Kimberly that met these criteria were collaboratively identified with Kimberley region staff. Emerging from this process domains of management that would benefit from the application of structured decision making were identified. Three of these key challenges are 1) optimising herbivore management to minimise cost while ensuring the program continues to meet biodiversity goals, 2) understanding and characterising synergies and trade-offs, and identifying thresholds to change management (e.g. the most cost-effective strategy may have poor outcomes for particular sites or assets), and 3) understanding the utility of monitoring in this context.

Aims

The aim of this research is to apply Structured Decision Making collaboratively with the Kimberley region and district fauna managers, BCS scientists, and stakeholders to identify cost-effective feral herbivore control strategies.

(1) evaluate the costs and benefits of existing and proposed herbivore control strategies

(2) understand and characterise synergies and trade-offs among alternative management strategies for herbivore control

Expected outcome

Support cost-effective herbivore management, define decision triggers, identify high-value information (and in so doing inform monitoring and research), and support transparency and accountability in the Kimberley landscape management portfolio.

Contributes to the following BCS strategic goals and key deliverables including:

- Biodiversity, conservation and recovery programs are based on scientific knowledge – Recommendations regarding conservation actions necessary to maintain sustainable populations, or recovery of, targeted species including the management of threatening processes; recommendations regarding the conservation status of targeted species; purpose-specific optimal monitoring strategies
- Understanding of the effects and opportunities for mitigation of pressures and threats to terrestrial ecosystems – recommended strategies to enhance the resilience of native fauna to habitat disturbance.
- Scientific knowledge is available to inform adaptive management and decision making – development of decision support tools to improve capacity to make timely and effective management decisions.
- Conservation advice is based on scientific information – translation of research outputs in formats appropriate to the target audience to encourage adoption.
- Effective science partnerships enhance conservation outcomes - identification of external collaborative conservation research opportunities to deliver on shared goals.

Knowledge transfer

Anticipated Users:

- Kimberley Region
  - Regional Nature Conservation Leader, Kimberley – development of nature conservation plans and species recovery plans.
  - Operational staff – inputs into the implementation of feral herbivore removal programs
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- Nature Conservation Officers – incorporation into threatened species and feral species monitoring program
- DPIRD - incorporation into control programs

Transfer Strategy

- The research is explicitly trans-disciplinary, directly engaging regional staff and other stakeholders to co-design the research, utilising structured decision making to facilitate participatory research to maximise utility of the research, uptake of findings and opportunities for the publication of results and communication of outcomes.
- Publication of methods in a report designed specifically for Kimberley stakeholders.
- Spatial products and/or database to inform future removal programs.
  - Updating would depend on ongoing resourcing by the Region.
- Publication of results and methods in scientific journal.
- Presentation of research at an appropriate northern forum.

Tasks and Milestones

Milestone	Task/Components	Responsibility
Problem Formulation (June 2020 – July 2020)		Project Leader and Kimberley Region
LFH Occurrence (July 2020 – October 2020)	Source data from previous feral herbivore removal programs or monitoring from DBCA Kimberley Region or DPIRD.	Kimberley Region, Other Scientist, Project Leader
	Undertake spatial compilation and modelling to identify feral herbivore occurrence and hotspots using track logs and other available data.	Other Scientist
Focal species identification (July 2020 – October 2020)	See study design for details	Project Leader supported by other scientist for any spatial components
Workshop 1: Conduct Workshop in Kimberley Region (October 2020)	Identify objectives, constraints, barriers, and values.	Project Leader and Kimberley Region
	Focal species selection	
	Create theory of change to explain susceptibility of focal species	
Occurrence of focal species (October 2020 – January 2021)	Undertake spatial modelling for key flora species	Other Scientist, Project Leader
	Source existing SDMs for focal species	Other Scientist, Project Leader
Workshop 2: Conduct Workshop in Kimberley Region (Feb 2020)	Validate SDMs	Project Leader, Kimberley Region, Other Scientist
	Develop feasible spatially explicit alternatives in collaboration with Kimberley staff and relevant stakeholders	
	Develop theories of change	
Alternatives Development (Jan 2021- March 2021)	Workshop 2	Project Leader and Other Scientist
	Evaluate exposure of focal species to feral herbivores.	Project Leader, Kimberley Region, Other Scientist
	Produce spatially explicit products identifying areas of flora and fauna habitat likely impacted by large feral herbivores	Project Leader and Kimberley Region
Cost Estimation (March 2021-April 2021)		Kimberley Region and Project Leader

Estimating Benefits of control (May-August 2021)	Identify impact thresholds (Literature review, analysis of existing data and expert opinion)	Project Leader and Kimberley Region
	Test multiple model approaches (see study details)	Project Leader and Kimberley Region
Multi-Criteria Decision Analysis (August-October 2021)	Strategy Evaluation	Project Leader Project Leader
Trade-off Analysis		Project Leader and Kimberley Region
Write Publication (October -December 2021	Report, Paper and potentially spatial products	Project Leader, Kimberley Region, Other Scientist

References

Kinloch, J., 2019. The feasibility of using Tracklog data to determine Feral Herbivore hotspots and surveillance effort in Pilbara conservation areas. Department of Biodiversity, Conservation and Attractions, Perth.

Pintor, A., Kennard, M., Álvarez-Romero, J.G., Hernandez, S., 2019. Prioritising threatened species and threatening processes across northern Australia.

Study design

Methodology

The research will be conducted in a Structured Decision Making Framework. Using track log data, and other opportunistically acquired occurrence data (e.g. staff observations, feral scan), we will estimate feral herbivore distribution and occurrence and identify hotspots of activity using methods developed in the Pilbara (Kinloch, 2019). The structured decision making process will be supported by collaborative workshops to identify, document and incorporate the full suite of objectives, constraints and barriers, incorporate diverse values, and collaboratively design feasible alternative management strategies.

To support a spatially explicit decision model, the project will collate, process, and serve aerial shoot track log data from DBCA, and other control data from across the region, developing repeatable data pipelines. Biodiversity assets (Native species and communities) negatively impacted by each of the Large Feral Herbivore taxa (LFH) targeted for control will be identified through a combination of expert knowledge, review of recovery plans, grey and published literature. For each, the susceptibility to LFH will be documented in collaboration with regional experts. Occurrence of impacted species will be modelled using a combination of minimum convex polygons, kernel density estimates and habitat suitability and species distribution models depending on data availability for the species, building on and incorporating recently developed models generated by the NESP Northern Hub (Pintor et al., 2019). A cost evaluation template will be developed and costs estimated based on existing program costs in collaboration with the region. A set of feasible management strategies will be collaboratively developed with Kimberley staff and the expected cost and benefit of each evaluated. A range of models will be explored for predicting expected benefit including structured elicitation, a bayesian belief network model, and GLMM's, depending on data availability for the final set of species identified as susceptible. Cost-effective strategies for multiple taxa will be evaluated using a spatially explicit Multi-Criteria Decision Analysis, and trade-offs strategies across multiple taxa evaluated.

Biometrician's Endorsement

granted

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

not required

Data management

Data will be archived with metadata following best practice Data Management Protocols, e.g. https://www.usgs.gov/about/organization/science-support/survey-manual/5029-fundamental-science-practices-preservation at https://data.dpaw.wa.gov.au/ within 6 months of project completion. Code will be archived on GitHub and made publicly available upon project completion. This will exclude any code relating to modelling of track logs as this is deemed as sensitive by State Government (see below).

Spatial data will be managed and archived according to procedures developed by the Remote Sensing and Spatial Analysis Program. Spatial data products will be identified and mechanisms to distribute to key users will be discussed with the Region. Spatial data relating to flora Species Distribution Models will be identified in order for it to be utilised by other projects in the Region and BCS. The data will be provided in a format that it can be used by the Open Source software QGIS.

Non-spatial data products will be stored in a database, and archived on the relevant departmental server. Non-sensitive unique data products will be published and assigned a DOI.

Sensitive data relating to removal programs will be kept secure and the Kimberley Region will be consulted if requested by external parties.

Budget

Consolidated Funds

Source	Year 1	Year 2	Year 3
FTE Scientist	0.6	0.55	
FTE Technical			
Equipment			
Vehicle			
Travel	3000	3000	
Other	180	180	
Total	3180	3180	

External Funds

Source	Year 1	Year 2	Year 3
Salaries, Wages, Overtime			
Overheads			
Equipment			
Vehicle			
Travel			
Other			

Source	Year 1	Year 2	Year 3
Total			