Project Closure SP 2003-004

Project Rangelands Restoration: developing sustainable management systems for the conservation of biodiversity at the landscape scale in rangelands of the Murchison and Gascoyne bioregions--managing fire and introduced predators

Ecosystem Science

Project Core Team

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Project status as of April 28, 2020, 9:08 a.m.

Closure pending approval of closure form

Document endorsements and approvals as of April 28, 2020, 9:08 a.m.

Project Team	granted
Program Leader	granted
Directorate	required

Project Rangelands Restoration: developing sustainable management systems for the conservation of biodiversity at the landscape scale in rangelands of the Murchison and Gascoyne bioregions--managing fire and introduced predators

Closure goal

terminated

Closure reason

Following a recent review of management, tenure, operations and research at Matuwa (Lorna Glen), a decision was made to terminate the two related SPPs (2003/004 and 2012/024) that cover current Science and Conservation operations (Rangelands Restoration) and replace them with a single, consolidated, updated SPP reflecting future research directions and operational research activities at Matuwa (Lorna Glen). This SPP (2003/004), primarily focused on 'threatening processes' – introduced predators and fire. A separate SPP (2012/024) (Keith Morris - Animal Science) deals specifically with the fauna reintroduction component of the Rangelands Restoration project. These SPPs, and associated operations, are a productive collaboration between Biodiversity and Conservation Science, Regional and Fire Management Services, and Conservation and Ecosystem Management Divisions, and Martu Traditional Owners. It is an 'active adaptive management' project rather than research *per se.*

Aims of SPP 2003/004 (Note: key aims only - re-worded from the original document):

1. Develop and implement cost effective, broadscale and sustained control measures for foxes and feral cats.
2. Develop and implement a monitoring protocol to evaluate the effectiveness of management actions on a select suite of native terrestrial fauna (reptiles and small mammals).
3. Develop and implement operational strategies for implementing a patch-burn mosaic to prevent large, damaging wildfires and to promote habitat diversity.
4. Undertake fire ecology research of selected fauna and flora assemblages.

Key publications and documents

Written products linked with SPPs 2003/004 and 2012/024 – Rangelands Restoration

1. Algar, D., Onus, M. and Hamilton, N. (2013). Feral cat control as part of Rangelands Restoration at Lorna Glen (Matuwa) – the first seven years. Conservation Science WA 8: 367-381.
2. Baynes A (2006) Preliminary assessment of the original mammal fauna of Lorna Glen station. 7 p.
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4. Burrows, N.D. (2005). Lorna Glen rangelands Field Ecology Centre: A vision. DEC report.
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6. Burrows ND (2007) Biodiversity conservation adaptive management project: Department of Environment and Conservation, project title: Arid zone fauna restoration, Lorna Glen, Earaheedy rangelands conservation parks. Department of Environment and Conservation, Kensington, WA. 10 p.
7. Burrows, N.D. (2007). Rangelands Restoration; Partnerships in integrated environmental management in the WA Rangelands. DEC Report.
8. Burrows, N.D. (2007). Operation Rangelands Restoration: an adaptive management project. DEC Report.
9. Burrows N (2011) Using observers on horseback to monitor bilby (Macrotis lagotis) and other animal activity at Lorna Glen: results of a trial carried out 29-31 March 2011. Department of Environment and Conservation, Kensington, WA. 11 p.
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13. Burrows N, Hearle G, Woods T, Liddelow G (2011) Lorna Glen introduced predator monitoring: 22-26 July 2011, post-bait data summary. Department of Environment and Conservation, Kensington, WA. 6 p.
14. Burrows N, Liddelow G (2011) Lorna Glen introduced predator monitoring: data summary, 23-27 June 2011. Department of Environment and Conservation, Kensington, WA. 4 p.
15. Burrows N, Liddelow G (2012) Aerial baiting to control introduced predators on Lorna Glen, winter 2012. Department of Environment and Conservation, Kensington, WA. 11 p.
16. Burrows N, Liddelow G (2012) Lorna Glen introduced predator monitoring: pre-bait survey 28 June-2 July 2012. Department of Environment and Conservation, Kensington, WA. 7 p.
17. Burrows, N., Dunlop, J. and Burrows, S. (2012). Searching for signs of bilby (Macrotis lagotis) in central Western Australia using observers on horseback. Journal of the Royal Society of W.A. 95: 167-170.
18. Burrows N, Ward B (2012) Lorna Glen introduced predator monitoring, 27-31 January 2012. Department of Environment and Conservation, Kensington, WA. 6 p.
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20. Burrows, N and Butler, R. (2013). A fire management plan for Lorna Glen and Earaheedy. DEC Report.
21. Burrows N, Liddelow G (2013) Breach of the Lorna Glen fauna refuge compound by a feral cat: chronology and lessons learnt. Department of Parks and Wildlife, Kensington, WA. 8 p.
22. Burrows N, Liddelow G (2013) Lorna Glen introduced predator and mulgara monitoring: pre-bait survey 8 June-11 June 2013. Department of Environment and Conservation, Kensington, WA. 8 p.
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25. 2014 Aerial Baiting. Department of Parks & Wildlife, Kensington, WA. 8 p.
26. Burrows N, Liddelow G, Jackson V and Thoomes E (2015). Matuwa introduced predator control program; 2015 aerial baiting report. 13 pp.
27. Burrows N, Liddelow G and Thoomes E (2016). Matuwa introduced predator control program; 2016 aerial baiting report. 9 pp.
28. Burrows N and Thoomes, E (2017). Effectiveness of aerial and ground baiting on introduced predators on Matuwa (Lorna Glen), winter 2017. 24 pp.
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30. CALM (2003) Prospecting, pastoralism and preservation - conserving the wildlife of Lorna Glen: September 3-12, 2003 : expedition briefing (PAMPHLET). Department of Conservation and Land Management, Kensington, WA.
31. Chapman TG (1962). Hydrology survey at Lorna Glen and Wiluna, Western Australia. Division of Land Research and Regional Survey Technical Paper 18, CSIRO, Melbourne. 47 p.
32. Chapman TF (2012). Microclimate and soil properties of older bilby diggings at Lorna Glen rangelands restoration project (ABSTRACT). *In: Australian Rangeland Society 17th Biennial Conference: Kununurra, Western Australia, 23-27 September 2012* 61.
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Macrotis lagotis foraging pits. Australian Zoologist 37; 529-534.
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39. Chapman TF (2015). Comparison of soils and plants on the active and relic parts of a recolonized burrowing bettong (*Bettongia lesuer*) warren. Pacific Conservation Biology 21; 298-306.
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41. Chapman TF and Burrows N (2015). Lorna Glen (Matuwa) small vertebrate fauna monitoring program 2002-2010; preliminary analysis and review. Internal Report, Department of Parks and Wildlife, WA.
42. Chapman TF, Cowan M, Burrows N (in press) Effects of a conservation program on vegetation and small vertebrate fauna during a rangeland restoration program in Western Australia's goldfields
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64. Morris K, Orell P, Cowan M, Broun G (2007) Reconstructing the mammal fauna of Lorna Glen in the rangelands of Western Australia, 2008-2016. Department of Environment and Conservation, Woodvale, WA. 11 p.

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Knowledge Transfer

Aim 1: Introduced predator control

Annual winter broad-area aerial baiting of introduced predators (targeting feral cats and foxes) using the Eradicate bait commenced in 2003. Baiting prescription and the methods used to evaluate effectiveness are described by Algar *et al*. (2013). After 2014, for various reasons, trail cameras were introduced to evaluate baiting effectiveness replacing the spoor (footprint) count method. For details, see Burrows *at al*. 2016 and 2017.

Fox density on Matuwa was very low prior to initial baiting in 2003 and following baiting, foxes were virtually eradicated, or reduced to very low levels; since 2003, fox sightings / signs have been rare. Wild dogs, although not specifically targeted, were impacted by the baiting – while there was year-to-year variation, overall, baiting initially reduced their activity by about 50%, but they had usually recovered by the next annual baiting operation. Feral cats were the main target for control. As can be seen from Figure 1 below, we were initially very successful at controlling feral cats, reducing them to a very low density (TAI < 10), but since about 2012/13 despite annual baiting, the cat density has been increasing. Currently, it is at ~87% of the level prior to commencement of aerial baiting in 2003; historically, baiting has maintained the cat density at about 40-45% of the unbaited value on average. Reasons for this increase in cat density could be (from Burrows *et al*. 2017);

- There has not been a prolonged 'drought' period in the rainfall record since 2005, with there being only one year (2009) that rainfall was <200 mm (Fig. 6). While exceptionally wet years drive productivity in the arid zone, prolonged drought years equally drive famine and contraction.
- Since the 1990s the decadal mean annual rainfall has been over 300 mm; prior to this it was mostly 200-250 mm, so the trend is one of increasing rainfall, no doubt leading to increasing prey availability and increasing fecundity of feral cats (and wild dogs).
- Increasing incidence of bait shyness as a result of sub-lethal dose. Bait uptake trials over the last few years show very low levels of uptake.
- A more disconcerting possibility is that 'natural selection' is operating. We have long known that a proportion of cats (around 25-30%) in a bait naïve population, are 'bait wary' and will not pick up baits. It is possible that this innate wariness (risk aversion) of some individuals could be a genetic disposition and that some 14 years of annual baiting has selected for a higher proportion of 'bait wary' individuals in population? This suggestion needs further investigation as it has serious ramifications for long term baiting effectiveness.

After early baiting success, there are now strong signals in the long term monitoring data that since 2012/13, the feral cat population on Matuwa is steadily trending up as baiting, for whatever reason, becomes less effective, or is more variable from year-to-year in terms of knockdown. From the outset, baiting was always considered a

'holding action' while better control strategies were developed; at the moment, there is nothing on the horizon. Given that feral cats are a serious ongoing threat to arid zone fauna, further research is urgently needed to explore:

- Biological control including infectious diseases and engineered gene drive technology ('daughterless cats').
- Whether there is a genetic pre-disposition to 'bait aversion' as discussed above.
- Novel baits.
- In the interim, and because of the very significant coast of aerial baiting, this year (2018) a cost-effectiveness comparison will be made between aerial baiting and ground baiting using a bait machine designed and built by volunteer Errol Thoomes.

Aim 2: Monitoring the effectiveness of management actions on biodiversity (terrestrial vertebrate fauna).

As part of this 'active adaptive management' project, a network of 'Biomonitoring' sites was established in major landsystems on Matuwa to attempt to evaluate and quantify the effectiveness of management actions. Initially, these were established as biological survey sites but were later used as monitoring sites. A weakness of the protocol was a lack of a control, so comparisons were based on 'before and after' management actions.

The following statement, in reference to the Rangelands Restoration project, is from 'An assessment of Australia's biodiversity 2009, Report prepared by the Biodiversity Assessment Working Group of the National land and Water Resources Audit for the Australian Government:

Recent trends from an assessment of small mammal captures in spring has identified a significant increase in abundance over the period between 2002-2007 and this does not appear to be directly correlated with annual rainfall (Fig 2). Vegetation trend analysis over longer time frames using Landsat TM imagery, and the reassessment of a number of the Department of Agriculture rangeland monitoring sites positioned across the property, have shown an increase in vegetative cover. It is possible that this resource increase, resulting from a reduction in total grazing pressure may be driving this response. An analysis of all pit-trapped vertebrates from 24 sampling sites in 2002 compared to those caught in 2007 using the Wilcoxon's test for matched pairs, also shows significant change in both average site richness (T=53, P<0.028) and average site abundance (T=48, P<0.005) with both having increased over this five year period".

And from Chapman *et al.* (in prep.):

"*As part of a rangeland restoration program in the goldfields of Western Australia, we assessed historical changes in rainfall, vegetation cover and stock numbers. We also monitored small mammal and lizard populations after management interventions, including de-stocking and feral cat control. Our study demonstrated that rainfall was a strong driver of broad scale vegetation cover, stock numbers and small mammal and lizard populations. Captures of rodents, geckos and skinks were higher after days of high maximum temperature. De-stocking had no measurable effect on vegetation cover at the property scale or at the small fauna monitoring sites. The abundance and richness of mammals increased linearly after management intervention and one reason for this may be feral cat control, but this cannot be demonstrated from the present study, because we did not have a control site. Skinks, which are relatively unresponsive to changes in grazing, vegetation cover and predators, did not appear to respond to management intervention. Dragon and gecko populations declined and thus may have been disadvantaged by management intervention, but the reasons for this could not be established. The primary benefit of the Matuwa rangeland restoration program in this study was a significant short-term increase small mammal abundance and richness*".

Following the above data analysis and revision of the initial biodiversity monitoring protocol, a revised monitoring protocol was proposed (Chapman and Burrows 2015) but this has not yet been implemented and will form part of the new SPP for this project.

Fluctuations in mulgara density are likely driven by cat density and associated predation pressure (Figure 2), and seasonal (rainfall) conditions. With a slight lag, as cat density has increased, mulgara density has declined from peak densities measured in 2012 and 2013.

Aim 3: Fire management

A fire management plan which aims to a) mitigate wildfire impacts and b) create habitat diversity through diversity in vegetation structure has been prepared for Matuwa and is being successfully implemented by Goldfields Region and Wiluna Martu (Burrows and Butler 2011). Ryan Butler (Goldfields Regional Fire Coordinator) manages this operation and prepares brief Annual Reports on fire management activities and outcomes, which are filed at the Goldfields Regional office, Kalgoorlie. Proactive fire management (patch-burning) has already prevented potential serious damage by two lightning-caused wildfires.

Aim 4: Fire ecology research

While there has been some fire ecology research undertaken (see Langlands' publications, attached bibliography), there is opportunity for more work to be done on interactions between fire and 'grazing' in the predator proof compound, and interactions between fire, introduced predators and medium size mammals (such as bilby and mulgara) in the broader landscape.

Concluding remarks

The Rangelands Restoration project has been very successful in the following general areas:

- Conservation of rare and endangered arid zone mammals.
- Conservation of extant arid zone fauna and flora.
- Collaboration with Traditional Owners.
- Inter-departmental collaboration.
- Advancing knowledge of, and operational experience in, managing threats to arid zone biodiversity.
- Productive in terms of written products / outputs.

This project has further demonstrated the seriousness of feral cats as a major threat to arid zone fauna conservation and our limited capacity to mitigate this threat. In this context, the importance of predator-proof fencing as a key fauna conservation strategy has been well demonstrated by this project.

Dataset links

NA

Hardcopy location

Wildlife Science Library