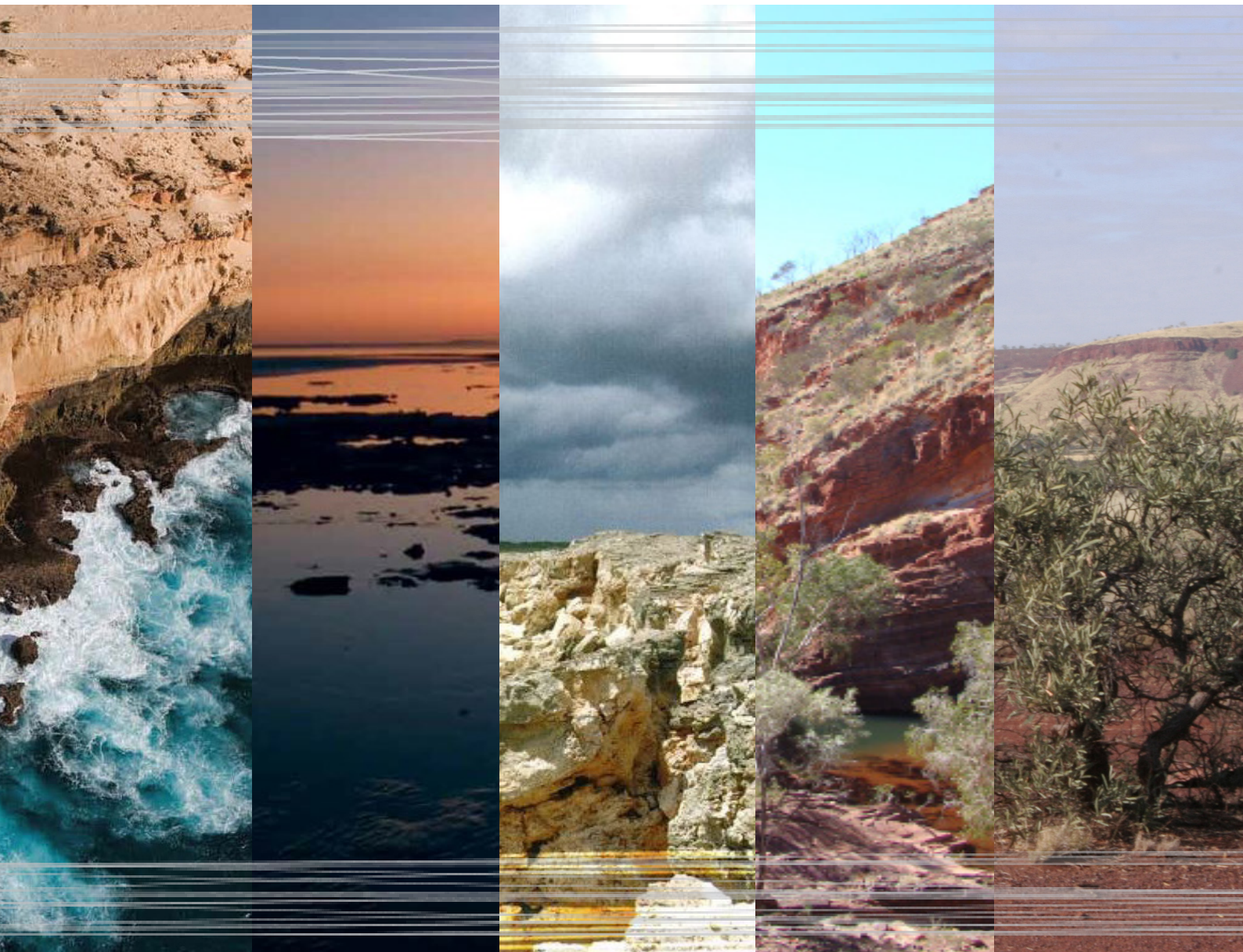


FINAL REPORT

Caring for Our Country 2009-13



Rangelands NRM
Western Australia



Achievements of
Rangelands NRM Co-ordinating
Group
under
Caring for Our Country
Funding
2009-13

September 2013



CARING FOR OUR COUNTRY

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List of Abbreviations

BMT	Base Milestone Table
CfOC	Caring for Our Country
DAFWA	Dept. of Agriculture and Food Western Australia
DEC	Dept. of Environment and Conservation
DPaW	Department of Parks and Wildlife
ESRM	Ecologically sustainable rangelands management
GPS	Global positioning system
ha	Hectare
km	Kilometre
MVT	Monsoon Vine Thickets
NRM	Natural resource management
PAR	Participatory action research
PEC	Priority ecological community
PMMC	Pilbara Mesquite Management Committee
RTFF	Roads, tracks, firebreaks, and fences
RNRM	Rangelands NRM
TAFE	Technical and Further Education
TEC	Threatened ecological community
TEK	Traditional ecological knowledge
TO	Traditional owner
WoNS	Weeds of national significance
WWF	World Wildlife Fund

Introduction

Background

Caring for Our Country (CfOC) is an Australian Government initiative that seeks to achieve an environment that is healthier, better protected, well managed, resilient and provides essential ecosystem services in a changing climate. The program funds projects across the country to achieve national targets of improved biodiversity and sustainable farm practices. The funding supports regional natural resource management groups; local, state and territory governments; Indigenous groups; industry bodies; land managers and farmers; Landcare groups; and communities. The funding provided for the period 2008-2013 targeted improved strategic outcomes across six national priority areas:

- the National Reserve System;
- biodiversity and natural icons;
- coastal environments and critical aquatic habitats;
- sustainable farm practices;
- natural resource management in northern and remote Australia; and
- community skills, knowledge and engagement.

Rangelands NRM Co-ordinating Group Inc. (hereafter referred to as Rangelands NRM) is a non-government organisation which supports and encourages the sustainable use of our natural resources – land, flora and fauna, fresh water, and coastal marine environment. Rangelands NRM is responsible for the establishment, management, evaluation, and communication of many natural resource management activities and projects. Rangelands NRM has received Australian Government Caring for Our Country (CfOC) funding since 2008.

Rangelands NRM is the largest of the 54 NRM regions in Australia. It covers around 85 per cent (2,266,000 sq. km) of the WA State's land mass, and 75 per cent of the coastline. Due to the vast size of Rangelands NRM, programs are delivered through seven recognised subregional areas: the Kimberley, Pilbara, Gascoyne, Murchison, Goldfields, Nullarbor, and Desert, which correspond to the rangelands IBRA regions.



This Report

This report outlines the significant achievements of activities managed by Rangelands NRM against expected contribution to the CfOC targets, through a discussion of how well targeted evaluation questions have been addressed across most of the national priority areas. The results have been determined through monitoring and evaluation of a series of measurement activities including:

- review of activity logs to assess planned vs. actual activity;
- establishment and annual recording of monitoring sites including photographic evidence;
- comparison of baseline data against progressive outcomes to determine how actual project results compare against expected results;
- ground-truthing of baseline data;
- ongoing comparisons against baseline data by project participants;
- review of lessons learned register;
- land manager interviews and survey of other stakeholders;
- interviews and survey of participating and other community groups;
- review of engagement process and feedback from traditional owners involved;
- monitoring and recording of fire incidents including severity and frequency of late dry season wild fires;
- fire scar analysis;
- review of register of workshops and other events including participant numbers and feedback forms; and
- review of management registers including enquires and applications, communications/publications, volunteers, and community engagement status.

Although the CfOC program was run over 5 years (2008/09 to 2012/13) the first year of the program was interim and discrete, with one year projects delivered; these are not included in this report. Only projects run between 2009/10 and 2012/13 are described here.

Through this document references will be made to the Base Milestone Tables (BMT) 1, 2, and 3. These were effectively the summaries of the planned achievements of the CfOC programs and used for reporting purposes. Each BMT number refers to a specific period of the overall program, that is:

- BMT 1 deals with the period 2009/10-2010/11;
- BMT 2 is 2010/2011-2012/13; and
- BMT 3 covers 2011/12-2012/13.

Biodiversity and Natural Icons

Reduce the impact of weeds of national significance (WoNS)

Weeds of National Significance (WoNS) and emerging weeds have an impact on biodiversity values and primary production, particularly grazing management, within the WA rangelands. In order to address these impacts, work has been undertaken with pastoralists and land owners to implement control programs within the Pilbara, Southern Rangelands, and Kimberley regions (Table 1).

The Base Milestone Tables (BMT) 1, 2, and 3 show the contributions that have been made to this target through achievements within the Ord, Roebuck Bay in the Kimberley, and Fortescue and De Grey catchments in the Pilbara (Table 2) through:

- chemical, mechanical, and fire control of Mesquite and Parkinsonia;
- surveying and mapping of key satellite infestations of weeds of national significance (WoNS) – Mimosa, Parkinsonia, Prickly Acacia, and Mesquite;
- reducing the impact of Rubber Vine and Parkinsonia in core infestations and containment lines; and
- development of a community management plan for weeds and feral animals.

Table 1: Activities contributing to Rangelands NRM impact on the reduction of WoNS

Projects contributing to this target:	Project ID
Pilbara WoNS Stages 1 and 2	PJ09202, PJ110201
Ngurrawaana Rangers – Stage 2	PJ09203
West Kimberley Nature Project Stages 1 and 2*	PJ09401, PJ110401
Dampier Peninsular Fire Management	PJ09405
Aerial survey of WoNS of the lower Fitzroy River	PJ09406
Wallal Parkinsonia control	PJ09407-5
Anna Plains Parkinsonia Control	PJ09407-6
Thangoo Mesquite control	PJ09407-7
Control of Fitzroy River Mesquite	PJ09514-3
Community Management Planning for Invasive species in the Ord River Floodplain	PJ10601
Managing Parkinsonia on the Fortescue by Ngurrawaana Rangers	PJ110205
Integrated Weed Management in the Ord Catchment)	PJ110601
Corralling the Coral Cactus at Tarmoola *	PJ110810
Rubber Vine eradication on the lower Fitzroy River Stage 1	PJ111401
Dampierland invasive weed control grants *	PJ111403-3 to PJ111403-5
Total funding: \$1,969,691 # # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Table 2: Summary of contributions to CfOC target – reducing the impact of WoNS

Approved objectives (hectares/plans/land managers)	Actual quantity achieved		
	BMT1	BMT2	BMT3
Mesquite and Parkinsonia controlled in the Pilbara (De Grey and Ashburton catchments)	51,000 ha		
WoNS mapped and control implemented in the Fortescue River Catchment	2,000 ha		
Satellite infestations of WoNS controlled across the Kimberley	435,000 ha		
ESRM plans include actions targeting satellite infestations of WoNS across 2 pastoral land	5 plans		
87 Land managers to protect buffer zone of Ord river floodplain's and turtle nesting sites off the Dampierland coast		189 land managers	
Protect 3,592 hectares of buffer zone of Ord river floodplains and turtle nesting sites off the Dampierland coast.		48,368 ha	
100,000 ha of Parkinsonia containment lines along riparian zones, surveying and mapping of infestation		110,000 ha	
Reduce the impact of Parkinsonia and Rubber vine in 100,120 hectares (combined)		75,370 ha	
100 ha Rubber Vine eradication of core infestation		117 ha	
20 ha Rubber Vine eradication of containment line (outlier)		25 ha	
Survey and treatment of outlier infestations of Mimosa, Parkinsonia, Prickly Acacia and Mesquite around Ord, Pilbara, Roebuck Bay and Lower Fortescue River			77,600 ha
TOTAL: Contributions of 799,480 ha, 189 land managers, and 5 ESRM plans have been made to reducing the impact of WoNS through Rangelands NRM projects funded under CfOC since 2009			

A map of the works undertaken (Figure 1) reveals the extent of the work to address WoNS and the focus placed on activities along important waterways and coastal areas of the Pilbara and Kimberley rangelands.



Figure 1: Map identifying the locations of activities to reduce the impact of Weeds of National Significance

An assessment of these activities focussed on the following evaluation questions.

To what extent has the project been successful in controlling WoNS in the Pilbara?

The focus of work on WoNS in the Pilbara has been to effectively and strategically control Mesquite and Parkinsonia, the major invasive species in the area, through regional co-ordination and active management. Projects within the Pilbara have been undertaken in collaboration with pastoral station lessees, resource companies, and Local Government Authorities with on-ground works conducted across pastoral stations and along the river systems.

The control of Parkinsonia has been strategically focussed on the headwaters of catchments and isolated areas where small infestations have occurred. These include small, discrete infestations on the upper Fortescue River and Mundabullangana Creek, and treating the headwater infestations on the Oakover and Nullagine Rivers (De Grey Catchment) and the Ashburton Catchment.

Mesquite control has been conducted in those areas most at-risk from spreading by human assisted means, including along major roads and station driveways, and around areas where there is high access by the public. Substantial works have been undertaken at Fortescue River Mouth Camping Grounds and access road, the Ashburton River camping ground (9 Mile Pool to 3 Mile Pool) and around the Old Onslow town site.

Weed control

Data collected during all programs suggests that 70% of plants controlled were seedlings less than 1 metre tall, with 450,000 Mesquite plants killed and in excess of 100,000 Parkinsonia plants controlled during the works. In addition, two surveys along 700 km of the Pilbara rivers and

associated Gascoyne catchments have been completed, with both Mesquite and Parkinsonia discovered along 120 km of the Yannarie River.

Photographic monitoring undertaken throughout the project is providing evidence that suggested that kill rates of 85% or better have occurred across all infestations treated. Sites which were mechanically treated have shown a lower kill rate than those treated by herbicides; however, mechanical treatment was implemented in areas with a higher density of Mesquite (Figure 2). This has highlighted the importance of follow-up treatment of sites controlled of Mesquite.

Pilbara weeds

Kill rates of 85% or better
have occurred across all
infestations treated

Interviews with pastoralists on stations where effort has been focussed on weed management and the co-ordinator of the Pilbara Mesquite Management Committee (PMMC) have indicated that both the productivity of the pastoral land and biodiversity have improved as a result of the activities.

*"We're starting to recover a lot of the grasslands now, which is obvious, more cattle and native trees, and where there was big thickets of Mesquite, we've got gums and stuff growing back. There's some obvious signs of recovery from the land where it was pretty badly degraded before from the Mesquite. ... The more land we can recover, the more cattle we can recover. In the climate we're in, we need to make money to be here. And if we can't make money, we can't be here, and the Mesquite will just get away"*ⁱ

*"With the mechanical control, I'm finding I'm getting really good germination of the plants and I hate to say it but buffel grass certainly takes off. So that even though it's minimum disturbance, once we get rid of the Mesquite, the seed gets in there and I'm getting really good results of regeneration. On the areas that previously in the thickets where I'm pushing up with the machine was unusable, I'm now getting acres and acres of country that I can graze again already."*ⁱⁱ

*"So when we remove weeds from the landscape, we actually find that there's a great regeneration in pastures and native vegetation back into our region. Also a greater diversity of fauna actually moves back as well when that vegetation returns. So we find production increases after you remove the weeds because we're getting more grass coming up and therefore we're able to actually graze more animals across an area."*ⁱⁱⁱ

Work has been undertaken towards implementation of a new biological control agent targeting Parkinsonia. One release of the new looper (nicknamed UU) was conducted at Mardie Station, with more of the agents being produced by CSIRO and the PMMC for further releases in Spring 2013. Survivability is the first aim with in-field monitoring pit in place so that impacts of the control agents will be determined as they are noticed. A full understanding of the impact is not expected for several years.



Figure 2: Mechanically treating moderate to dense hybrid Mesquite infestations at Mardie Station with specialised dozing equipment © Linda Anderson 2012

Livestock and vehicle movements through infested areas are the main causes of weed dispersion. To help manage this quarantining of cattle prior to movement has also been adopted. The process of withholding stock in temporary yards for a number of days prior to movement into clean paddocks reduces the risk of gut movement of seeds, and has provided an additional measure to stop the spread of Mesquite.

"So it's really important for us to get back as much land as we can, and keep as much clean land as we can to run our cattle on. If we haven't got clean land, we have to quarantine cattle going out, which is very expensive. We have to hold them for seven days in the yards, feed hay, and that's just more cost to us. So we need to get as much clean area as we can so our cattle can be in clean areas, and get trucked wherever they need to go directly without having to be quarantined and all that."^{iv}

Awareness raising

Several publications have been released to ensure that current knowledge on how to establish, undertake, and evaluate best practice control programs for both Mesquite and Parkinsonia is available for any person to access and use. These documents have been updated since initially published, to include new information on available techniques and developments with biological control agents.

Feedback from those involved however, indicates that the most effective way of obtaining buy in from land managers is to allow them to gain a first-hand perspective of the full impact that a heavy infestation of weeds can have.

"But to actually show people what happens if it gets away is the biggest tool we ever had. I've had guys come to meetings and not dismiss it, but say, yes, yes, we'll get onto it, and then you ask them to come in and have a cup of tea, and come and show them the thick stuff and they go back with a very different concept of what they've got to do...They don't really get how bad it gets until you take them and show them some of the bad stuff. And

then all of a sudden, you'll get a very different reaction than you will get at a meeting, or giving them a pamphlet or anything"^v

"For me, the biggest thing that we've been able to do to get land managers to recognise that they have a weed problem and that they really need to do something about it is to bring them to a place like this at Mardie Station where we have the single largest Mesquite infestation in all of Australia and show them exactly how bad this infestation can get if you don't get on to early management. We've actually managed to get a few of our key stakeholders involved in now investing thousands of dollars a year into weed programs because all we simply did was brought them here and showed them how bad it can get."^{vi}

Skills enhancement

Work undertaken to enhance skills has resulted in twenty project participants completing practical training sessions on weed identification, safe use, and handling of herbicides, spraying techniques, and monitoring tools. These skills were subsequently utilised by trainees conducting on-ground surveillance and control programs. Seven people have undertaken TAFE courses and are now registered Licensed Pest Technicians with the Health Department and five Indigenous people from the Nyinyaparli traditional owner group undertook registered ChemCert training and worked alongside professional contractors to control Parkinsonia in the Upper Fortescue catchment. This will be an ongoing relationship with more people trained and skilled in weed control. (PJ09202, PJ110201)

Training in weed management has had additional benefits for the Ngurrawaana traditional owners. The ranger group are now working on country so successfully that their community is benefitting and they are seeking further training and work.

"...foremost is the community. I mean there's people now that have been trained. They're now providing. They're breadwinners for their family, so it creates a social upliftment of the community in terms of skills development as well. We're now embarking on a land management and certification - conservation certification course. So for the community it's huge. For the environment, I think, it's probably one of the most important projects."^{vii}

"...we're getting a lot of feedback from outside the community itself, so other people that want to get involved in the Ngurrawaana rangers program. What we're trying to do is establish a strong communication and bring people back out in country and help us to eradicate these Parkinsonia weeds... we're slowly seeing a lot of changes while we're out in country."^{viii}

A priority issue for the traditional owners is the control of *Parkinsonia aculeate* in the Ngurrawaana lease area along the Lower Fortescue River – the subject of a Management Strategy prepared by the Department of Water in 2008. Twelve rangers received training in weed management, first aid, and chemical handling to build their skill base prior to undertaking ground survey work to identify and record infestations. Once planning had been completed the rangers implemented a spray and eradication process along 3 km of the Fortescue River. Survey work had identified large, dense infestations of Parkinsonia. The plan was amended to tackle these heavy infestations first and then to progressively move onto less densely infested areas. As the access into these riverine thickets was a challenge a smaller area of treatment was achieved than originally planned with resulting management of Parkinsonia across more than 150 ha of river bank.

The Ngurrawaana traditional owners have a strong desire to partner with others to keep their country healthy. This Indigenous community has a group of young men and women that have previously undertaken natural and cultural resource management activities and have gained skills in, and shown a desire to, build their capacity to address contemporary natural resource management issues. A Cultural Heritage and Conservation Co-ordinator has been jointly funded with Rio Tinto and Rangelands NRM to build the ranger program into a sustainable program so that the Ngurrawaana Community can manage their country.

"...we really learn a lot from this program and what the Parkinsonia really do to the river catchment. It's a widespread plant that's everywhere and all other catchments as well. But down here we saw it really stopped us from going into the river because of the thorny, spiky [bushes] and stuff like that. Pretty hard to get down to our fishing spots and stuff like that...the main important thing is getting people back out in country and seeing the country, how it changes on how we do these sort of things, so what we're trying to establish is to walk forward for the future with rangelands to – not also just benefit us, but benefit Ngurrawaana itself."^{ix}

Of equal importance to the environment outcome was the enhancement of engagement seen through this project. The nationally recognised training gained by the rangers through this project has led to a request to further enhance their skills through additional Certificates 1 and 2 training in Conservation and Land Management. This will commence in late 2013. This additional training will provide them with a sound basis for marketing their skills and seeking Fee for Service work off country. (PJ110205)

To what extent has the project been successful in controlling WONS in the Kimberley?

The focus of the activities undertaken within the Kimberley has been on both WONS (Rubber vine, Prickly Acacia, and Parkinsonia) and emerging weeds such as Neem and Coffee Bush. This work has incorporated survey, mapping, identification, and targeted control of infestations that have been intermittently controlled for a number of years.

Rubber Vine

Rubber vine is a vigorous climbing woody perennial vine that colonises areas, aggressively forming impenetrable thickets and dense canopies. It smothers and chokes native vegetation, preventing both human and animal access and damages ecosystems by reducing biodiversity. Infestations generally start along waterways and from there spread to the surrounding country. Impenetrable thickets can form, replacing native vegetation and pasture and providing feral animal harbourage. The invasion of Rubber vine to key environmental assets, biodiversity, indigenous culture, tourism, recreation, the pastoral industry, and agriculture is a significant threat. The only known infestations of Rubber vine in WA are found at two areas within the Kimberley region – the southern end of Lake Argyle in East Kimberley and the lower Fitzroy River near Willare (West Kimberley).

The program to eradicate Rubber vine in the West Kimberley has progressed well through a combination of aerial search and ground control. This has identified that the initial estimation of the infestation area was too low and it actually covers approximately 6,000 ha not 4,000 ha, as believed at the commencement of the work.

The survey work has identified that many infestations are located in hard to reach places that had not been previously found, such as within dense scrub and paper bark thickets; therefore the full extent of the problem had not been previously realised. In some newly surveyed areas only a few plants were located but in others hundreds or thousands of seedlings, forming a dense grove, were found. As a result, tracks have now been created to provide enhanced access.

The reliability of the aerial search has been significantly increased through use of an innovative chart plotter grid system that ensures straight search tracks with constant 50 metre spacing. Even greater tracking precision will be possible in future work through planned use of a tracking guidance system similar to that used in aerial spraying. The improvements in aerial search methodologies have resulted in a reduction of 40 percent in vines with an increased probability of detection (the likelihood that a specific target will be identified given the search parameters employed, environmental conditions and searcher characteristics and skills). In these intensive search areas a reasonable level of confidence is held that all breeding plants were detected – a priority of aerial searches – with a good cost to benefit ratio. Empirical modelling shows that helicopter searches resulting in a high probability of detection are one sixth of the cost of ground searches.

It is becoming apparent when undertaking repeat control activities in sites that generally the seed load is diminishing. Fewer dry seed pods are being located indicating that a smaller number of seeds have been released. Significantly fewer breeding vines remain in the infestation area. This together with removal of adult vines, capable of developing into breeding vines in subsequent years, greatly diminishes the capability of ongoing spread. The team undertaking the on-ground work have noticed a significant change in the landscape both in the return of biodiversity and the access by traditional owners.

"It's had a big change, cos Rubber vine will wreck the country and it's died right down."^x

"Where it has been removed and local plants are coming back, and they are growing back stronger. And what the Rubber vine has actually taken out – strangling the plants – making its more of its habitat... It's easier access to get through for hunting and all that. Not having to combat with the rubber vine in a way. Getting more animals around."^{xi}

Construction of Quantum GIS software tools has been completed. This is an important step forward as it will enable systematic desktop search of Nearmap images for target plant species such as Parkinsonia, Rubber vine, and calotropis (Rubber bush). Testing of the Nearmap imagery has been achieved through leaving individual target plants uncontrolled and comparing the imagery with GPS and visibility data. This has eliminated the risk that Rubber vine cores exist outside the known Rubber vine infestation area.

The continued building of the knowledge of the team within the West Kimberley has led to an understanding of the life cycle of the Rubber vine plants in relation to ongoing spread. The team believes that unless Rubber vine finds the right micro-site, even large breeding vines seemingly do little damage. The most visible sign of breeding vines early in the dry season are the often hundreds and sometimes thousands of associated seedlings. The team's observations consistently show that generally few, if any, of these seedlings survive the following year. Many vines have obviously been seeding for a number of years but lack any associated juveniles or adults. Observation of the effect factors such as timing of weather events, rainfall level, hydro-geography, and soil types have on the survival of both seedlings and juvenile plants has also been made. These on-ground data may provide an explanation for the existence of strong healthy seeding plants with no associated

offspring. It appears that conditions need to be ideal for individual plants to survive into juvenile stages and then into adulthood but unless those conditions are replicated little, if any, germinants reach maturity. It is not known, however, how many seeds were dispersed large distances away from the parent plant and germinated in conducive micro sites. Most of the mature vines found during search activities were in the 6 year age bracket further supporting the hypothesis that the vast majority of the breeding vines found are from germination episodes resulting from seed dispersal. These observations need further research as they may be contrary to experience in other parts of Australia (e.g. Queensland where Rubber vine is endemic across large areas) and should not be accepted as definitive until further assessment is completed. (PJ111401)

Mesquite

Work was also undertaken to improve the management of Mesquite within the Dampierland IBRA. The only known infestation of Mesquite in the Fitzroy River Catchment is an isolated population on Yeeda Station near the Fitzroy River mouth. Work was undertaken to extend previous management by increasing the area of surveillance following the discovery of additional outliers. Proven techniques utilising helicopter and GPS were employed to find plants for control actions.

Analysis of the maps of previous control work revealed that, because of less structured helicopter survey techniques used, large plants has been missed in the earlier survey due to differing flight paths. Collaboration with a project undertaking Rubber vine control identified efficiencies in funding aerial surveys that searched for both Mesquite and Rubber vine. Using a predetermined flight path with spacing of no more than 50-60 metres, a detailed and exacting survey was conducted across nearly 8,350ha within the known Mesquite area searching for both Rubber vine and Mesquite. This resulted in identification of the location of 165 Mesquite plants. The Rubber vine survey covered an additional 25,750ha in which no Mesquite was observed, thereby providing a much wider Mesquite survey for no additional funds.

This collaborative work has shown that efficiencies can be obtained in amalgamating survey and control work across more than one species, and that implementing a predetermined and structured helicopter survey flight path during provides a more accurate result than leaving the pilot to approximate passes across the survey area. (PJ11403-3)

Also important in the planning and management of the works was the use of local knowledge and capacity to be flexible. This was highlighted when plants were seen during an aerial survey for Rubber vine in an area close to the Mesquite survey area.

"The benefits are exponential when local and/or knowledgeable personnel can be engaged to undertake on-ground work. In this case the same local personnel were involved in the Mesquite and Rubber vine surveys. This enabled outlier Mesquite to be picked up during a survey targeting Rubber vine and increased the effectiveness of this project with no additional resources required." xii

Prickly Acacia

Another Weed of National Significance that has been addressed within the Kimberley is Prickly Acacia (*Acacia nilotica*). This is a thorny shrub or tree that grows up to 10 metres in height that has been declared an eradication target for the entire state under the *Agricultural and Related Resources Protection Act 1976 (ARRPA)* because of its economic, environmental and social impacts. The effect on native pastureland is to create a barrier of thorny trees which can reduce pasture production and impact stock production. Environmental impacts include a loss of wildlife

habitat, erosion, and a decline in biodiversity. For Indigenous communities it can restrict traditional use of land and water, and limit access to recreation sites.

Control work has been undertaken on an infestation covering approximately 12,000 ha of remote Indigenous land on the western side of Cambridge Gulf in the East Kimberley, an area not easily accessible by vehicles. Whilst the infestation was largely confined to the East Kimberley, without the control work there is considerable potential for further spread and greater impact within the rangelands.

The results of this work has seen WA's largest infestation of Prickly Acacia weed reduced by 90 per cent in two years and a reduction in plants per hectare from 180 per 100 ha in 2010 to 119 per 100 ha in 2011 to only 5 plants per 100 ha in 2012 (Figure 3).

Ord weeds

WA's largest infestation
of Prickly Acacia weed
has been reduced by
90% in two years

Weed control programs have encouraged landholders to maintain that work into the future by reducing the threat to a level they are able to deal with. (PJ10601, PJ110601)



Figure 3: Results of control work on *Acacia nilotica* on Nulla Nulla © D Pasfield September 2012

Rubber bush

Rubber bush (*Calotropis procera*), an emerging weed, has now spread into Western Australia from the Northern Territory. Rubber bush poses a significant risk to pastoral land and has the potential to colonise large parts of the East Kimberley. The plant contains several toxic compounds and may be poisonous to humans and stock. Dense thickets of Rubber bush can form on disturbed and degraded soils, inhibiting access to watering points, bores, and dams. In order to address the effects of increasing infestations, a Rubber bush efficacy/best practice guide has been developed and will be distributed late 2013. (PJ110601)

Mimosa

Mimosa pigra control will need to be ongoing as germinations appear; it is expected that control will be required for over a decade due to seed longevity. Survey work has found plants outside the known control area on the Parry Lagoon floodplain and the eastern shore of Lake Argyle. It is expected that future work will find more plants in the region. (PJ10601)

Neem

Neem is an emerging weed of great concern in the Kimberley region. Introduced to the region in the 1980s, this drought resistant, bug resistant, fast-growing tree has spread rapidly throughout much of the Kimberley competing very successfully with native species. Birds readily eat the fruit and spread the seeds in their droppings, often at water and roosting sites.

Survey and control of this species, particularly mature fruiting trees that aid further spread, has been a priority within the Eighty Mile Beach region. Other weed species in the area that have been controlled in the area include Coffee bush (*Leucaena leucocephala*) which can create impenetrable thickets that push out native plants, and Parkinsonia. (PJ110401)

Engagement

Efficiency and effectiveness of the work undertaken across the Kimberley to address WoNS was leveraged by working in partnership with Pilbara Mesquite Management Committee, Dept. of Agriculture and Food Western Australia (DAFWA), the Kimberley Regional Biosecurity Group, and engaging personnel experienced in the area. One of the land holders involved highlighted the importance of working with other stakeholders.

"Talking to stakeholders about the survey and control and still undertaking the work at the required time (just prior to the onset of the wet) has raised awareness about Mesquite and the control program." ^{xiii}

This has also been seen through reports of members of the Indigenous communities reporting rubber vine outbreaks and initiating conversations about various weeds within their environment.^{xiv} These examples demonstrate an increase in awareness and also increasing involvement and ownership of invasive species programs.

Landholders and traditional owners have been successfully engaged in the mapping and planning processes through use of one-on-one sessions, workshops, and weed control training. The success of the engagement has also been seen in the level of information provided by land managers on weed locations and densities on their properties and elsewhere.

"... we now have members of the Indigenous community coming to see me and informing me of rubber vine they have found and also initiating conversation with me about their being upset about various weeds in their environment. I think this demonstrates an increase in awareness and also genuine involvement in the weeds program."^{xv} (PJ111401)

Landholders, ranger groups, Kimberley Land Council, and other stakeholders have been engaged and are implementing planned and strategic weed management in the Ord region with documented plans and templates in place to assist them. They have also prioritised target weeds and locations for control. The impacts of weeds on cultural and traditional values has also been identified and recorded. (PJ10601, PJ110601)

Work has also been undertaken to up-skill land managers within the Dampier Peninsular in invasive weed identification and control through involvement in training and on-ground works. Land managers were provided with new knowledge about different weed control techniques whilst controlling infestations of:

- Rubber vine;
- Parkinsonia; and
- Mesquite

This work was undertaken in conjunction with Regional Landcare Facilitator activities, with resulting 'flow on' opportunities to increase knowledge and skills via presentations to groups including the North Kimberley Land Conservation District Committee (LCDC) and the Kimberley NRM Group. (PJ111403-4 and -5)

To what extent have WoNS been controlled in the Southern Rangelands?

The Coral cactus (*Cylindropuntia fulgida* var. *mamillata*) and to a lesser extent Devil's rope (*Cylindropuntia imbricata*) are weeds of national significance that, together with several other varieties of opuntiod cacti, have become prevalent in the Leonora region of Western Australia. The invasive cacti have spread from the initial rubbish dump infestation over an area estimated to be 66 sq. km. The critical infestation covers an area of approximately 200 ha on Tarmoola Station; however, there are several other large infestations within the Leonora area, including the Gwalia town site.

A project was implemented to map, plan, and control the infestation through quarantine (fencing and human/animal/vehicle movement restrictions) and chemical control. Monitoring sites were also set up to measure the efficacy of different chemicals and rates of use. The project has only been underway for a short period and as such results of the control work are not yet available.

A further key component of the project was the instigation of a Cactus Forum. Key experts from Australia and overseas provided general information on effective control prior to visiting the site to provide tailored advice. The site visit resulted in an unexpected outcome when a renowned invasive cacti specialist from South Africa identified a variety of cacti not known to him. Samples of this cactus were obtained and taken away for further analysis in South Australia. Furthermore, several other species of cactus not recognised to be in WA, were identified on this field trip.

Invasive cactus

Several species of cactus not recognised to be in WA, were identified

The forum resulted in recognition of the need for a collaborative approach to cactus control. The event attracted a range of stakeholders and enabled networking and linkages to be made. As a result, impetus has been gained in the cactus working group, with the group seeking opportunities to address cactus issues in the Goldfields and maintain the community momentum gained through the forum. Media promotion of the forum has raised awareness of the extent of the cactus issue within the Goldfields region, with land managers actively seeking further information from both Rangelands NRM and other organisations involved in the management of the weed. (PJ110810)

To what extent are land managers demonstrating commitment to the on-going management of WoNS through implementation of their property management plans and/or other planned control activities?

Pilbara

A collaborative approach to planning the management and control of weed infestations was undertaken during the development of individual pastoral station Weed Action Plans within the Pilbara. These plans outline a five year action plan including targeted activities and resources required. Parameters for photographic monitoring sites, together with maps of aerial survey data collected and descriptions of methods for containment and control of Mesquite and Parkinsonia, form an appendix to every plan. This ensures that land managers always have a reference point for refreshing their knowledge. Weed Action Plans were revised following completion of control work, with amended maps and details of areas clean of weeds, new infestations located, and additional target actions for future control programs.

Working relationships between pastoral station lessees within the same catchment have been reinforced by focusing on a common problem which impacts on each land manager equally. Land managers consult with neighbours and treat infestations in parallel to each other, to ensure that the sources of the infestations – adult plants and those further upstream – are strategically controlled as a priority. Individual pastoral station maps have been published and collected data shared with land managers.

Commitment has been demonstrated through:

- more station staff asking for and participating in basic weed control training than expected;
- land managers actively requesting GPS recording equipment be made available on loan in order to track the progress of control programs;
- participants completing a locally run ChemCert course supported by Citic Pacific Mining, exceeded the original projected number of trained pastoralists throughout the project; and
- the development of strong partnerships with seven local resource companies with industry recognition and ownership of weeds on tenements. (PJ110201)

Kimberley

Aerial surveying and mapping has been used within the Dampierland to develop three year weed control plans for properties. This process has identified that infestations are often associated with old outcamps, rubbish sites, old bores, and the road ways.

What other activities/strategies might have been more effective?

The use of granular herbicide to treat isolated Mesquite was trialled in inaccessible sand dunes near Onslow, to determine its suitability for controlling Mesquite remotely (via helicopter and using rainfall as an activator). The initial treatment occurred in October 2010, with monitoring completed 12 months later. Results were extremely disappointing, with less than 5 per cent of plants dying and the effects of the herbicide only being seen on a further 10 per cent of plants (partial kill). A number of factors could have contributed to these results, and additional sites were established and treated to determine if alternative methods of dispersal or soil type would increase these results.

An unexpected discovery highlighted by the Pilbara activities was Parkinsonia dieback. A confirmed presence was located on the Ashburton River and additional samples collected for confirmation from the Fortescue and De Grey Rivers. This has led to a new relationship being developed with the University of Queensland, the lead organisation spearheading research into spread, biology, and impacts of the dieback disease. (PJ110201)

Within the Kimberley the cut and paint method was found to be more effective in killing Parkinsonia than basal barking or spraying as this reduces the potential exposure of people and native plants to herbicide sprays carried by the wind. Where the soil is soft or the tree is small, plants, including roots were removed by hand or by using chains and vehicles. (PJ09401, PJ110401)

Native habitat managed to reduce critical threats

Areas across the WA rangelands have been managed on a landscape scale to reduce threats to biodiversity and enhance condition and connectivity. This has included conservation of endangered and vulnerable ecological communities, management of habitat loss and fragmentation, management of invasive species, reduction in late season wildfires, and limiting damage from pastoral production (Table 3).

Table 3: Activities undertaken to manage native habitat through address critical threats

Projects contributing to this target:	Project ID
WD – Kalyuku Ninti-Puntuku Ngurra Limited)*	PJ09301
WD – Central Desert *	PJ09302
WD – Project Management *	PJ09303
WD – Martu Lands DEC *	PJ09304
West Kimberley Nature Project Stages 1 and 2	PJ09401, PJ110401
Dampierland Indigenous Ranger Fee for Service *	PJ09404
Dampier Peninsular Fire Management *	PJ09405
Dampier peninsular regrowth control	PJ09409
EcoFire Stages 4 &5, 6 &7 *	PJ09501, PJ110501
Fire management at Christmas Creek sub catchment *	PJ09504
Erosion workshop	PJ09514-2
Keeping Desert Country Healthy	PJ110302
Western Desert – CDNTS	PJ110303
Western Desert – KJ	PJ110304
Western Desert – DEC	PJ110305
Red Dirt	PJ110301, PJ111201
Increasing skills for Aboriginal rangers to protect Kimberley Rock Wallabies	PJ110405
Rangelands Regional fire Forum	PJ110504
CDNTS Desert Fire Project	PJ111202
KJ Desert Fire Project	PJ111203
DEC Desert Fire Project	PJ111204
CSIRO Desert Fire Project *	PJ111205
Feral pig population definition and control on the Fitzroy River	PJ111403-1
Total funding: \$3,685,840 # # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Across BMT 1, 2, and 3 and competitive grant projects, total contributions have been made to this target through the following achievements within the Kimberley and Western Desert regions.

- Co-ordinating landscape scale approach to fire management to maintain the ecological integrity of the wider landscape.
- Protecting threatened monsoon vine thickets from wildfires and invasive species.
- Improved fire management and removal of feral animals so as to protect the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* listed Gouldian Finch, Greater Bilby, Black Flanked Rock Wallaby, and Great Desert Skinks.
- Development and delivery of targeted control programs and fencing for feral pig control and mapping the feral pig population to inform the development of a Weed and Feral Community Management Plan (Table 4).

Table 4: Summary of contributions to CfOC target – protecting native habitat through reducing critical threats

Approved objectives (hectares)	Actual quantity achieved			
	BMT1	BMT2	BMT3	Comp grants
Threatened Ecological Communities in the Dampierland protected from wildfires & invasive species	1,000 ha			
Addressing critical threats to biodiversity in the northern/central Kimberley	5,000,000 ha			
45,000 hectares of landscape to protect the EPBC Act listed Gouldian Finch through improved fire management		61,000 ha		
60,010 ha of Western Desert and Kimberley landscape to protect 14 EPBC listed species including Gouldian Finch and Greater Bilby through improved fire management and removal of feral animals.			80,897 ha	
Increase the area of native habitat and vegetation that is managed to reduce critical threats to biodiversity and enhance the condition, connectivity and resilience of habitats and landscapes				809,245 ha
TOTAL: Contributions of 5,952,142 ha have been made to protecting native habitat through the reduction of threats within the WA rangelands under CfOC funding provided since 2009				

A map of the works undertaken (Figure 4) reveals the large tracts of the Kimberley and Western Desert that have been worked on through the activities undertaken. Please note that due to the presence of culturally sensitive material in relation to locations of endangered species and water holes within the desert, the project areas are represented by the Native Title Determination borders rather than actual sites worked on.



Figure 4: Map identifying the locations of activities to manage native habitat to reduce critical threats

An assessment of the activities focussed on the following evaluation questions.

To what extent has the project protected Threatened Ecological Communities (TEC) (Monsoon Vine Thickets) on the Dampier Peninsula?

Monsoon Vine Thickets (MVT) are a Threatened Ecological Community restricted to the east and west coastal sands of the Dampier Peninsula. Vine thickets, whilst highly fragmented and variable, act as an ecological network and biological refuge for a diversity of fruiting plants that provide important habitat for frugivores such as Agile Wallaby, Rose Crowned Fruit Dove, Flying Foxes, and Great Bowerbirds. MVT patches are sensitive to fire, and if one MVT patch is lost to fire or significantly degraded, other patches can become further isolated. This reduces opportunities for bird and bat species to move between the patches and increases the likelihood that local species become extinct. Increasing the distances between patches can compromise the ecological processes operating throughout the entire ecological community. Other significant threats to MVTs are invasive weeds, feral cattle and donkeys, and human use such as off-road driving. MVTs are also an important traditional resource for Indigenous people and host reliable sources of bush tucker, medicine, tools, and other significant items. Many patches are important sites for Biidin (fresh water under the ground), camping, ceremonial areas, and law grounds.

Traditional owners and Indigenous ranger groups (Bardi-Jawi, Nyul Nyul, Karajarri, and Bardi Jawi Oorany) have been engaged to protect and conserve the threatened MVT community and wetlands in the Dampierland bioregion. Working in collaboration with Department of Parks and

Wildlife (DPaW, formerly Department of Environment and Conservation), Broome Botanical Society, the Society for Kimberley Indigenous Plants and Animals and Indigenous ranger groups, MVT Management Plans have been developed for areas covering over 1,000 ha and significant input has been made toward the Interim Recovery Plan for the ecosystem. These plans provide a comprehensive scientific and traditional ecological understanding of the values, threats, and functionality of the system and identify important recovery actions and processes. An ecologist has been engaged to further develop an understanding of fire history on the ecosystem and develop sound biological monitoring protocols to aid assessment and inform ongoing management.

Monsoon vine thickets

Fire scar and vegetation cover maps have been developed for all 79 MVTs on the Dampier Peninsula

Using the data collected through earlier work and separately funded research, fire scar and vegetation cover maps have been developed for all 79 MVT occurrences on the Dampier Peninsula. These were used to develop priorities and inform management planning with Indigenous rangers and traditional owners for MVT sites and other refugia on their countries. The co-operative fire management plan, developed with State emergency services, authorities has broadened the impact of the work and improved co-ordinated fire management in the Northern and central Dampier Peninsula. In addition, weeding activity plans have been developed, with advice sought from stakeholders such as Society for Kimberley Indigenous Plants and Animals, the Broome Shire, WA Department of Parks and Wildlife, and traditional owners.

Indigenous ranger groups have been provided with skills in ecological management through training in weed control, fire management, feral animal control, monitoring of natural and cultural areas, and collation of traditional knowledge about vine thicket plants. On-ground activities have resulted in Weeds of National Significance being controlled on more than 1,300 ha. Through using a combination of cool fuel reduction burns, management of fuel loads such as exotic and flammable grasses at the edge of patches, and fire breaks there has been a reduction in the incidence of late season hot uncontrolled fires which are devastating in these vine thicket communities. Native seeds have been harvested, propagated, and planted, thereby restoring degraded areas and improving habitat quality. Restoration and planting activities within degraded and fire-compromised patches have also been completed.

Landholder's engagement in the work has been confirmed by requests from land/lease holders on the outstations surrounding fire activities that buffer burns be undertaken along the tracks leading to the outstations. These strategic burns effectively 'break up' large sections of the country surrounding the vine thickets and spring sites and act as a wider buffer area. (PJ09409)

In early 2013, the Australian Government recognised the MVT ecosystem as Nationally Endangered under the EPBC Act. This was a major outcome of the collaborative work undertaken.

"This is the first listing of a Threatened Ecological Community in the Kimberley under the EPBC Act (1999), and recognises the national environmental significance of MVTs. Our collaborative research found that MVTs are under extreme threat from larger, hotter, more frequent fires than in the past. This threat, along with weeds, feral animals, clearing and development pressures are among the reasons they have been listed." ^{xvi}

How have the project activities contributed to habitat protection in savannah woodland and wetlands in the Kimberley?

Fire management

Fire management activities within the savannah woodlands of the central and north Kimberley have been in place since 2007. In that time, work undertaken has significantly changed fire patterns. An analysis of fire patterns between 2000 and 2012 indicates:

- a reduction in the incidence of late dry season fires (which are extensive and intense) from over 95 per cent to c. 40 per cent;
- the distance from any fire scar to the nearest unburnt vegetation is decreasing – the average distance from burnt to the nearest unburnt vegetation has been halved from 2 to 1 km;
- the availability of unburnt vegetation has doubled and is more evenly distributed – the average distance from burnt areas to nearest long unburnt vegetation has been reduced by two thirds from 4.5 km to 1.5 km; and
- increasing the spatial extent of old growth vegetation.^{xvii}

These fire pattern changes have been matched by improvements in biodiversity. Intensive monitoring of key biodiversity indicators at four properties in the EcoFire project area have shown that the observed changes in fire patterns are correlated with:

- increases in the abundance of ground-dwelling species such as Brown Quail, diurnal reptiles, small mammals (as long as introduced herbivore densities are concurrently controlled);
- improvements in the population health of grass-seed-eating specialists such as Gouldian Finches;
- increases in the population size of riparian bird specialists such as Purple-crowned Fairy-Wrens and Buff-sided Robins; and
- improvements in the characteristics of the soil surface and grass layer such as increased complexity on the ground surface, increased leaf litter loads, and increased biomass in perennial grasses.

Fire management

Fire management work undertaken in central and north Kimberley has significantly changed fire patterns and improved biodiversity

The work undertaken has successfully engaged with the landholders in the area, including pastoralists and Indigenous communities, who are all involved in the burn planning and delivery. The EcoFire project has also been a powerful communication tool with the work featuring in multiple presentations to a wide cross-section of audiences, publications (both technical and non-technical), and media. (PJ110501)

The central parts of the Dampier Peninsular are relatively inaccessible with wildfires burning for extended periods of time. The creation of firebreaks have provided ground access to remote parts of the landscape to assess and monitor fuel loads and land condition when planning overall seasonal fire strategies which will help with long term land care and management. Fire breaks also aid fire suppression (prescribed burning and back burning operations). Findings arising from the work undertaken to create firebreaks has identified the following.

- The removal of an increased number of stumps reduces regrowth considerably. Even though this has cost implications initially, it reduces the costs of maintenance.
- Areas of land that have been recently burnt are considerably faster and therefore less costly to establish firebreaks across, due to the reduced amount of organic growth. Although this may seem a contradiction in terms, the constant nature of bushfire activity in

this ecosystem means that fire events can be used as an opportunity to prevent future occurrences.

- There is a potential for unauthorised use of the firebreak by trespassers to conduct illegal activities. This has a negative impact upon both the ecosystem and pastoral enterprises and this contingency should be factored into planning processes.
- Chemical removal of regrowth from the firebreak, possibly by aerial means, has been successfully completed in the Northern Territory. The key advantage associated with aerial spraying is that it causes no soil disturbance whilst maintaining the integrity of the firebreak. Mechanical means (grading or ploughing) are slow, just as costly, and the increased activity creates greater opportunity for both erosion and transportation of weeds across the landscape – contractors completing earthmoving type activities pose a high risk of weed transportation and many are reluctant to fumigate machinery. (PJ09405)

Protection of ecological communities

The Dampier Peninsula is home to a number of nationally recognised threatened mammals and birds as well as State recognised threatened ecological communities. One of these, the Gouldian Finch, is a useful 'bio-indicator' as the bird is extremely sensitive to changes within the ecosystem. In conjunction with Indigenous rangers, work has been undertaken over several years to monitor this Finch population in order to improve on-ground management of landscape threats, including unplanned fires, weeds, and feral animals.

Information collated from a literature review of the Threatened and Priority Ecological Communities (PECs), threatened flora and fauna of the Dampier Peninsula, and shape files and locality records for all PECs, TEC's, and threatened species has been used to develop a plain English summary document for rangers. This, together with maps and descriptions of Gouldian Finch refugia and traditional owner input, has been used to develop comprehensive management plans for the Bardi Jawi rangers and the Nyul Nyul rangers. Posters and fridge magnets have been developed and distributed to ensure further reach and awareness raising and to encourage people to report sightings of Gouldian Finches on Bardi Jawi Country.

Survey and threat assessment of refugia sites has resulted in the development of protection and management plans. These have been prepared with relevant stakeholders, including traditional owners. A Gouldian Finch Survey and Records handbook for campers and the local community has also been developed. Surveys conducted in partnership with Bardi Jawi rangers, Bardi Jawi Oorany rangers, and World Wildlife Fund (WWF) have confirmed 11 Gouldian Finch sites with subsequent verification for the first time that the birds are breeding on the Dampier Peninsula.

Planning and on-ground work implemented throughout this project to improve the finch refugia, has resulted in endangered species recovery plan recommended management actions being put in place through the ranger's fire and weeding management work. This has also made direct measurement of the long term ecological success of the landscape scale fire and weed management work on the Gouldian Finch population and refugia health possible through integration of historical fire scar and vegetation change mapping. Breeding and nesting behaviour surveys conducted during the 2013 breeding season resulted in identification of a breeding site near Millagoon –

Ecological community protection

**11 Gouldian Finch sites
identified with verification
for the first time that the
birds are breeding on the
Dampier Peninsula**

confirming that the Finches breed on the Dampier Peninsula. During this survey, pilot habitat methods were trialled to assess tree hollow and grass resource availability for the finches in preparation for future assessments of habitat quality on the Dampier Peninsula. This resulted in updating Monsoon Vine Thicket (MVT) management plans and landscape scale fire management plans to support ongoing management of Gouldian Finch Refugia, including the incorporation of new knowledge about finch sightings and breeding habitat.

A longer term outcome of the knowledge gained about refugia sites on the Broome Peninsula and the relationship between bird banding and the Mangarr vegetation community has been the development of a nomination for listing as a State PEC. This application was successful and the Mangarr community has been listed as a Priority 1 Ecological Community. (PJ110401 PJ09401)

To what extent has the project protected threatened species in the Kimberley?

Traditional owners (TOs) of the North Kimberley have been provided with skills to enable them to undertake camera trapping surveys. This provided data to map the critical habitat and threats for two species rock wallaby listed as near threatened in the North Kimberley and Black-Footed Rock Wallaby in the south Kimberley. From this information, specific actions were identified for inclusion in Indigenous Protected Area plans of management and to inform State and Commonwealth recovery plans.

Training was provided to 23 Indigenous rangers on the use of sensor cameras, scat and animal identification, and plant collection and identification with a focus on set-up and use of sensor cameras for target wallaby species. Following the training, six areas were visited via trips on country over a total of 31 days. Within these six broad areas 59 survey sites were monitored:

- Edgar Range – 9 survey sites;
- Erskine Ranges – 8 survey sites;
- Lerida Gorge – 8 survey sites;
- Kalumburu and Carson River – 20 survey sites; and
- Dambimangari – 14 survey sites.

Sensor cameras, scat transects, and other techniques were used within the monitoring site to observe for wallaby presence/absence and additional information about threats (e.g. fire), habitat (e.g. shelter, vegetation), and the presence of other species. In addition, rangers took part in helicopter surveys to access remote country that has not been surveyed for more than 50 years. (PJ110405)

To what extent has the project protected threatened species in the Western Desert?

The Desert Rangelands region provides an important refuge habitat for at least six threatened fauna species, regionally important wetlands, and priority flora species. The primary focus of the Desert Rangelands program was to address the declining status of threatened species across desert country through empowering traditional owners to manage country and improve native habitat for threatened fauna species. Key to achieving this objective was the creation of opportunities for capacity building amongst traditional owners, sharing knowledge across generations, and linking traditional ecological knowledge (TEK) and contemporary scientific methods.

Increased evidence of threatened species, such as Bilbies and Great Desert Skinks, around Punmu and the nearby lake systems indicate that CfOC funded activities in the Western Desert have improved native habitat for threatened fauna species. Bilbies have also been found east of Jigalong, near the Canning Stock Route and within the Birriliburu determination. This has increased the enthusiasm of the Traditional Owners for this work and focussed their attention on targeted priority areas within the very remote areas of the Little Sandy and Gibson Deserts.

Data collection activities are building a substantial data set and mapping capability that will be important for future NRM activities. Scat collection and analysis is providing increasing evidence of the presence of species previously thought to be absent or out of range.

Health of the country

There is a perception, by the traditional owners, that the Western Desert country is getting healthier as a result of the project activities

Data collection also provides evidence of the perception, by the traditional owners, that the country is getting healthier as a result of the project activities. Simple assessment of the perceived traditional environmental status was undertaken at the time of water surveys, fire management activities, and fauna monitoring plots. Health of the fauna plots was recorded at 101 of the 102 sites surveyed in 2013. Of these 78 per cent (n=79) were assessed as being healthy, 20 per cent (n=20) were 'OK', and 2 per cent (n=2) were sick. Health of water sources was recorded at the 13 sites where the complete water monitoring sequence was completed. Of these, 92 per cent (n=12) were considered healthy and one (8 per cent) was considered sick. (PJ110301 to PJ110305)

Reasons for the perceived health or otherwise were not easy to capture in the current data logging system, however, so it is difficult to identify how these perceptions have been reached. At times, the reason for a healthy or sick country may be culturally sensitive and therefore not recorded; this also contributes to limited understanding of the information provided. (PJ110301 to PJ110305)

Interviews with traditional owners have also identified places where they feel the impact of the change in health of their country is most visible and how the change in health is manifested.

"Katjaru, round Katjaru. We burnt that last year and it's all back, it's good, green... cooka (wild game) all come back, lot a bush tuckers there. Well 11, it's all drying, too many thick Spinifex so we had to burn some of that... when we burned it, the other ranger boys all went back about a 2-3 weeks back and they found all the little animals, bilby, mungalongo all."^{xviii}

"...there's' lot of goannas and things, appears now and then, kangaroos, emus walking around. See that out there and it's a good place."^{xix}

"After the burning, they make flowers come out; lots and lots of flowers come out, wild flowers and all that. After the burning make the beautiful country, that's why it brings all the animals back..."^{xx}

When asked what they felt would happen to the country if the work wasn't undertaken the traditional owners indicated that environmental conditions would deteriorate.

"It would just die out, get sick again and all the animals would die out."^{xxi}

This observed level of threatened species presence has increased the enthusiasm of the traditional owners for this work and focussed their attention on targeted priority areas within this very remote area. A substantial data set and mapping capabilities have been built that will be important for future NRM activities. Scat collection and analysis is providing increasing evidence of species previously thought to be absent or out of range. (PJ110301 to PJ110305)

Martu have also used fire to manage the landscape over thousands of years. Over the past decades the frequency of human ignition fires across Martu country has decreased, due to a lack of access to a large portion of their country. The major burning activities in the Western Desert have focussed on the protection of known locations of threatened species or other sites of importance to the traditional owners. A range of methods have been used including on-ground burning from either vehicles or helicopters and aerial incendiary burning from both helicopters and fixed wing aircraft. Recent activities, using aerial access, have had a greater impact than those undertaken prior to 2012 as earlier on-ground burning was restricted to tracks or areas easily accessed by project staff and TOs.

The major burning activities have focussed on the protection of known locations of threatened species or other sites of importance to the traditional owners. Burns were implemented in a manner to prevent impact of fire on known locations of threatened species. Burning has generally been undertaken close to communities for hunting purposes and more recently from tracks in country further out as the Martu rangers travel more extensively. (PJ111201 to PJ111205)

Have the project activities directly or indirectly reduced critical threats to biodiversity and native habitat?

Managing critical threats to threatened fauna species was a focus of the activities although substantial on-ground actions were sometimes dependent upon related or linked projects. This CfOC funded work, however, was crucial to traditional owner understanding and support for separately funded control activities. Camels are one of the major factors resulting in overgrazing of desert country and the degradation of water sources.

"Water, sometimes we'll go out, rock hole each, we'll go out and we doing a testing water. We get a little water, test the water, some of them bad when we test it, some of them good. It's mostly camels making it bad..."^{xxii}

Significant progress has been made, through this project, in obtaining traditional owner consent for aerial culling and facilitating training for TOs in on-ground management using high calibre firearms. As a result of this engagement, activities funded under the related National Feral Camel Management Project have facilitated culling of over 2,000 camels.

A series of monitoring plots set up and managed under this project have nearly all (93 per cent) provided evidence of one or more signs of an invasive species (camel, cat, dingo or fox) with more than half (56 per cent) recording signs of recent movement. Interestingly, these records consist of all habitat types, including those where some species may not be expected to live. Scat analysis has also provided evidence of threats; however, there was no camel sign found in predator scats collected in 2012, whereas camel hair was found in dingo/wild dog scats collected between 2008 and 2011. This, combined with a reduction in fresh camel sign compared to previous years, could

be the result of camel culling, but may also be due to camel dispersment across the landscape because of high rainfall years. (PJ110301 to PJ110305)

Fire scar analysis between 1998 and 2012 has confirmed that within Martu managed landscapes there is an emerging trend with the results of more equal distribution of seral (intermediate habitat) stages compared to unmanaged areas, where fire regions by driven by lightning. This provides greater habitat diversity and increases resilience to large landscape level wildfires, although changes to the presence of threatened fauna species and Martu priority fauna species as a result of a reduction in the threat of large intense bushfire are not yet possible to determine. Further work and discussion with relevant agencies is required on how best to integrate the information from the fire activities with that of the threatened species data from the adjoining work. Ongoing engagement with fire planners prior to burning season, in order to better link the planned burning program records threatened species management data is required and make stronger connections between data collected on fire and plant diversity.

The project has empowered and encouraged Martu to burn country in as close to a traditional manner as possible. Confidence to burn continues to increase and more fire is being put into the landscape. The capacity of TOs to use traditional and non-traditional lighting techniques has increased. Martu need little encouragement to engage in traditional or contemporary fire management practices, but ongoing support of these practices with scientific monitoring and evaluation is required. (PJ111201 to PJ111205)

Has the extent and frequency of hot wildfires decreased as a result of increasing the number of burns and decreasing their average size?

The level of planned burns has increased across the project area over the life of this project with Martu across both determinations becoming increasingly confident about putting fire into the landscape in addition to their traditional hunting and foraging regimes. Planned burns have included priority Martu areas such as the Carnarvon Range, Eagle Bore, around Jilukurru (Durba Hills), near the Canning Stock Route, and to the west of the Percival Lakes. There were 19 recorded planned ignitions within the Jilukurru monitoring area in 2012, compared with a maximum of five for the 14 years previously. Work undertaken to increase technological literacy and demonstrate the importance of good data have also improved the accuracy of the information provided. The precise number of fires lit by Martu is difficult to calculate however, as some have gone unrecorded.

Whilst the introduction of heterogeneous fire patterns to the landscape was successful at a local scale, there was significant fire activity in the Western Desert areas throughout Summer 2012 and Summer 2013. This is likely due to a late dry season in 2012 followed two years of high vegetation growth following high rainfall. As such, the threat of large intense bushfire was realised and initial review of fire scar mapping indicates there has not been a reduction of wildfires on a regional scale.

Decreases in the average burn size have been assessed using remote sensing data. Satellite imagery for the period 1998 – 2012 was sourced to provide baseline fire history data for the measurement of changes. The determined project area for the fire boundary mapping (over 11 million hectares) covered approximately 4.25 Landsat satellite scenes for each of the 14 years within the time sequence. A method was developed by Department of Parks and Wildlife (DPaW) to extract burn boundaries from Landsat imagery. This was applied to imagery for each year to

extract the fire history for the area. This process allowed a fire scar history map to be produced for the period 2000-2012 with further analysis undertaken to extract metrics to assess indicators such as changes in the fire regime e.g. proportion burnt each year, average size of burns, and descriptive statistics for burn patches. The area boundaries had an independently visual assessment for accuracy plus sample field inspections and validation. This ensured that the resolution of the fire boundaries were of an accuracy that enabled both beneficial fire management decisions and communication.

The results of the remote sensing process provided a 15 year fire history of the area. This showed that the majority of the area has experienced wildfire in that time period. Fire scar analysis between 1998 and 2012 has confirmed that:

- there was a discernible trend towards smaller fires and fewer large fires in the Martu managed landscapes, in comparison to the lightning-dominated landscapes;
- the strength of this trend to mitigate the scale and impact of wildfires will be directly proportional to the extent and scale of Martu burning; and
- it will be necessary to patch-burn at least 10% of the area per annum, on an on-going basis, to mitigate large wildfires.

Fire management

There was a discernible trend towards smaller fires and fewer large fires in the Martu managed landscapes, in comparison to the lightning-dominated landscapes

Fire sizes in areas where active ignitions were undertaken as a part of the project were smaller than those across the broad landscape. This demonstrates a trend towards smaller fires in high fuel years when active management is undertaken. Findings indicated, however, that annual comparisons in the arid zone are poor indicators of effectiveness, as rainfall can be highly variable. In addition, using hectares as an indicator of fire effectiveness is crude, and does not necessarily provide an indicator of fire effectiveness. It is recommended that integration of remote sensing of fire activity and on-ground rapid assessment flora and fauna surveys be implemented to monitor the impact on biodiversity by planned fires.

Fire events in the 2011/12 and 2012/13 season highlight the importance of urgent need to establish a heterogeneous fire pattern both locally and at the scale of the Western Desert. There is also a need for further data analysis to understand the impact of the prescribed burns in 2012 in minimising impacts of wildfires.

Fire scar data across the region has proven to be a valuable communication and planning tool as remote fire scar data, in combination with maps, has allowed Martu to gain an understanding of the extent of fire over the project period. (PJ111201 to PJ111205)

One of the key aims of the desert fire activities was to trial the use of helicopters to access remote country as well as use fixed-wing aerial incendiary burning programs in order to manage fire at the landscape scale. Over the course of the project, Birrilburu TOs have been involved in fixed-wing and helicopter incendiary programs as well as use of helicopters to access remote country. Helicopters have been used to take people out to remote country and dropping them off to burn country until they are picked up again. This concept and new practice is already seeding ideas for future management of the country, with helicopters becoming an effective tool to locate sites, map country from the air, and enable easier ground access.

Martu are very positive about the use of helicopter; viewing helicopter use as an effective tool to access country that has no tracks, thus opening up large amounts of country. Satellite data indicated that a significant area was burnt through this activity. As such, helicopters should form part of a robust and effective fire management strategy that combines a range of fire tools to effectively undertake both targeted and broad scale fuel reduction burning. (PJ111201 to PJ111205)



Figure 5: Mosaic burning in the Martu determination, © Mathew Paterson, KJ

Has Martu perceptions of the health of country changed as a result of increasing the number of burns and decreasing their average burn size?

Martu have diverse criteria to assess health of country. Key criteria for Martu include access to and 'knowing' country through visits and the production of bush foods. In Martu world view, the health of country is significantly improved when Martu are travelling on, using, and learning about it. The fire based activities resourced Martu to visit distant lands and procure bush foods, hence contributing to an increased health of the country. Feedback collected through ethnographical research has also identified that burns conducted via the project were strongly associated with perceptions of improved health of the country. The project has resulted in a recognition of the ongoing importance of traditionally-derived fire practice to Martu, such as;

- burning as a common weekly domestic family motivated activity;
- the use of burning for purposes of bush food harvesting and production;
- burning undertaken for other reasons such as signalling to other family members or Martu, notifying spirits that you are approaching a cultural site, or calling for help. (PJ111201 to PJ111205)

Coastal environments and critical aquatic habitats

Address invasive species threats in high conservation value aquatic ecosystems

Work undertaken to protect the high conservation value aquatic ecosystems in the WA rangelands has focussed on management of the impact of invasive plants and pest animals; rehabilitation of degraded habitats and riparian corridors; improving water quality; and protecting threatened species and ecological communities in and adjacent to priority aquatic ecosystems (Table 5).

Across BMT 1, 2, and 3, total contributions have been made to this target through achievements within the Pilbara, Kimberley, and associated Ramsar sites, such as:

- survey, map, and control of WoNS in the Fortescue River Catchment, Ord River floodplain, Roebuck Bay, and Eighty Mile Beach;
- control of feral species in the Ord River floodplain and Eighty Mile Beach; and
- development of Ecologically Sustainable Rangelands Management (ESRM) plans (Table 6).

Table 5: Activities undertaken to address invasive species threat in high value aquatic ecosystems

Projects contributing to this target:	Project ID
ESRM at Lake MacLeod *	PJ09101
ESRM in the Fortescue *	PJ09201
West Kimberley Nature Project Stages 1 and 2 *	PJ09401, PJ110401
Roebuck Bay community engagement and protection of Ramsar values	PJ09402
Eighty Mile Beach Grazing Management *	PJ09403
Shire of Broome Anne St Restoration – Roebuck Bay	PJ09407-1
Tracking nutrient enrichment – Roebuck Bay	PJ09407-2
Protecting Ramsar values	PJ09407-3
Storm water quality – monitoring program for drainage management in Broome	PJ09407-8
Restoration and rehabilitation of Anne Street drain – Stage 2	PJ09407-9
Community Management Planning for Invasive species in the Ord River Floodplain	PJ10601
Protection of the Lower Ord Floodplain Ramsar Site	PJ10602
Roebuck Bay Working Group – Community engagement and protection of Ramsar values *	PJ110402
Feral pig population definition and control on the Fitzroy River *	PJ111403-1
Roebuck Bay – Coastal rehabilitation works and protecting roosting bird sites	PJ111403-2
Dampierland invasive weed control grants	PJ111403-3 to -5
Total funding: \$925,100 # # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Table 6: Summary of contributions to CfOC target – addressing invasive species in high value aquatic ecosystems

Approved objectives (hectares, land managers, community groups, and management plans)	Actual quantity achieved		
	BMT1	BMT2	BMT3
Invasive species mapped and pastoral properties implementing WoNS control plans through ESRM Property Management Planning (Gascoyne)	16 plans		
Invasive species mapped and pastoral properties implementing WoNS control plans through ESRM Property Management Planning (Pilbara)	18 plans		
WoNS mapped and control implemented in the Fortescue River Catchment	2,000 ha		
Ramsar foreshore managed for threat abatement	143,500 ha		
Control feral animals on 141,453 ha of Ord River Floodplains		53,000 ha	
Weed management, surveying and mapping to control infestations on 141,453 ha of Ord River Floodplains		141,000 ha	
Undertake weed control management, surveying and mapping of infestations		30,000 ha	
Weed management, surveying and mapping to control infestations of weeds on 50 ha of Roebuck Bay		50 ha	
Control foxes, cats (and other pests) on 30,000 ha of Eighty-Mile Beach		30,000 ha	
Engage five land managers to undertake weed control management, surveying and mapping at Eighty-Mile Beach		10 land managers	
Weed management, surveying and mapping to control infestations of weeds on 30,000 ha of Eighty-Mile Beach		30,000 ha	
Engage 15 community groups and local government through devolved grants to facilitate coastal management, planning and co-ordination of volunteers to restore and rehabilitate coastal and marine areas			16 community groups
TOTAL: Contributions of 429,550 ha, 10 land managers, 16 community groups, and 34 ESRM plans have been made to addressing the threat of invasive species through Rangelands NRM projects funded under CfOC since 2009			

A map of the works undertaken (Figure 6) highlights the extent of work completed across the central and northern rangelands of WA to address invasive threats in high conservation aquatic ecosystems.

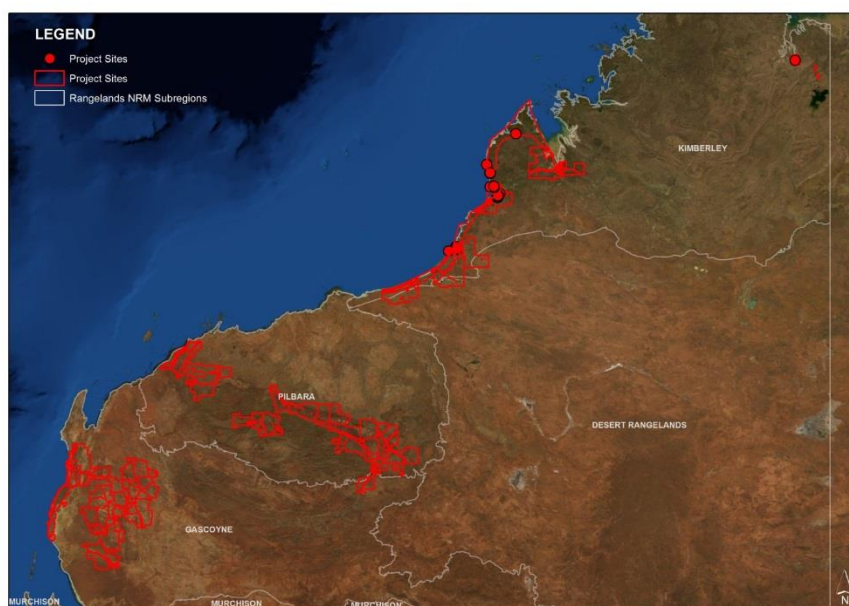


Figure 6: Map identifying the locations of activities to address invasive species threats in high value Aquatic ecosystems

An assessment of the activities focussed on the following evaluation questions.

How have project activities contributed to habitat protection along the Eighty Mile Beach Ramsar foreshore?

Eighty Mile Beach is one of the most important Australian sites for migratory shorebirds, or waders, and is recognised as a wetland of international importance under the Ramsar Convention on Wetlands. Tourism, visitor management groups, and other land managers within the Eighty Mile Beach coastal strip have been consulted and engaged in activities to control weeds, human use impact, and feral animal threats. This inclusive process has resulted in management of key threats to the site.

A management plan has been developed with the Karajarri rangers and stakeholders in the Port Smith (Purnturrpurnturr) area to collaboratively address weed outbreaks within Karajarri Jurrarr (Coastal Country) and control feral animals. This plan also included assessment of the Parkinsonia Control area at Glunjardiny (within Anna Plains) and follow-up and extension of management for additional outbreaks. As a result of this plan, Neem (*Azadirachta indica*) control and feral cat control has been undertaken and native plants have been given to the Port Smith Caravan park owners to use as replacements for Neem. Given that the Neem trees are seen as an important shade source, this staged replacement will require a longer timeframe. (PJ110401)

Together with on ground control, weed management activities have resulted in development of management plans and a "How to" guide for cutting and herbicide application to problem species such as Neem and coffee bush. In addition, indigenous plant species (donated by the Society of Kimberley Indigenous Plants and Animals) and accompanying information sheets have been provided to encourage alternative plantings.

Feral animal control has focussed on cat trapping as this is seen as the key priority within the region.

"The primary feral predator in the Kimberley is the domestic cat... The number of cats occurring in the Kimberley is unknown due to difficulties in survey, although a radio-tracking study at Mornington Wildlife Sanctuary suggests there is one individual per 3 km², each eating 5–12 native vertebrates daily. If this population density of cats occurred throughout the region there would be over 100,000 individuals present, consuming at least 500,000 native animals every day..."^{xxiii}

Ranger surveys and track records using i-Tracker or GPS has increased understanding of areas that cats frequent and the relative population density. This, together with a review of management actions, has identified activities that worked well and where improvement was required. The resulting adaptations to the approach taken to engage stakeholders have included resourcing of cat traps, training in humane trapping and euthanasia and disposal methods, and development of information packs and data collection processes. Where trapping has been less successful, evaluation has been undertaken to identify how methodologies can be refined. (PJ110401)

Land managers adjoining the Eighty Mile Beach area gained an understanding of the problems associated with overgrazing natural pastures and the resultant susceptibility to erosion through the provision of training aimed at minimising erosion in the sensitive dune regions. This focused on learning how to critically assess land, pasture, and forage condition; identify species; effectively undertake forage budgeting and calculating seasonal carrying capacity; estimate tree basal area; and estimate groundcover. (PJ09403)

Collaboration with Department of Parks and Wildlife (DPaW) and Kimberley Land Council's coastal tourism project resulted in the design and erection of eco-cultural signage for Eighty Mile Beach. These signs aim to improve awareness and knowledge of key areas along the coast to prevent damage to environmental and cultural assets from human use impacts. (PJ110401)

To what extent have threatening processes been controlled in Roebuck Bay Ramsar site?

Lyngbya majuscula blue-green algae blooms (Figure 7) have been experienced in Roebuck Bay since 2005. These are attributed to a number of environmental factors including increases in nutrient levels from pollution and urban run-off. *Lyngbya* prevents the growth of seagrass by obstructing the light reaching it. Decaying *Lyngbya* reduces the amount of dissolved oxygen in the aquatic environment, thereby affecting the entire food chain. *Lyngbya* blooms have been found to clearly lead to a population decline in benthic macro-invertebrates within Roebuck Bay's intertidal zone.^{xxiv} These small marine creatures are a vital source of food for the thousands of birds that migrate to the internationally important wetlands at Roebuck Bay each year.

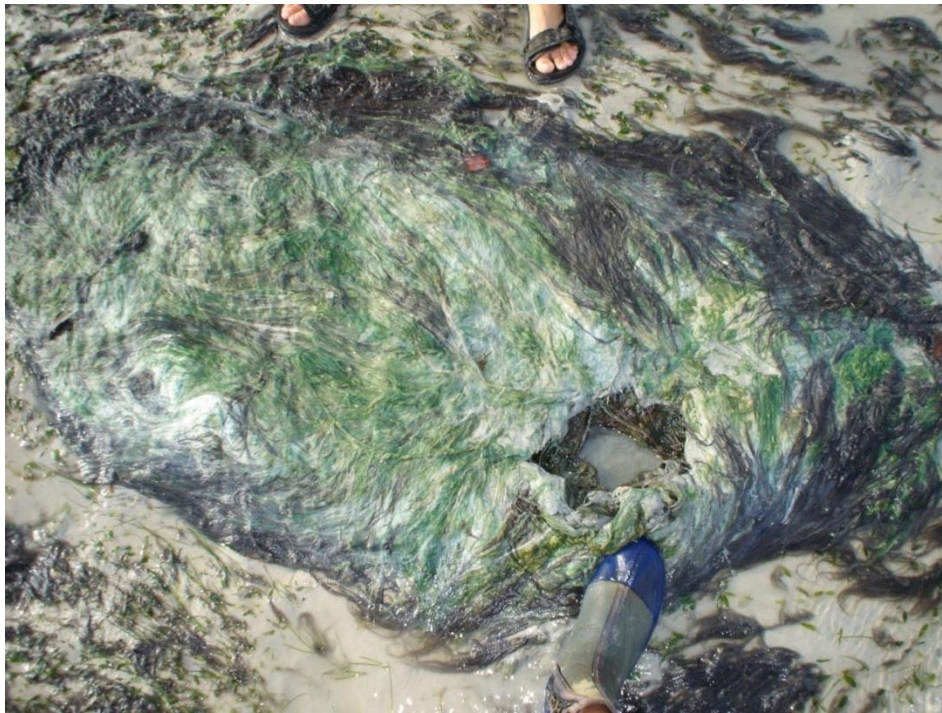


Figure 7: Lyngbya blooms on seagrass, Roebuck Bay, January 2006

Some seagrass beds store much larger amounts of carbon than first believed, and as such the continued loss of seagrass ecosystems will result in the release of far larger amounts of stored carbon into the atmosphere than previously estimated.^{xxv} Understanding and conserving these ecosystems is now even more important in helping reduce our global carbon emissions.

“...several elements that should be considered in order to address the development of blooms of Lyngbya majuscula in Roebuck Bay. It is not possible to control the bloom once it has developed, the appropriate approach is to implement management actions to prevent bloom formation in the first instance. These actions should target those mechanism and processes that are under human control.”^{xxvi}

Knowledge improvement

Activities undertaken to monitor the seagrass meadows have provided crucial information about the health of Roebuck Bay's marine life. A review of the available scientific literature has been conducted and this, along with information from other stakeholders, has been used to develop a preliminary monitoring protocol for Lyngbya within Roebuck Bay. Due to the absence of Lyngbya during the May 2012 monitoring sessions, this protocol was trialled on brown algae present in low density across the site. As a result of this trial, the monitoring protocol was revised and a pictorial step by step instruction guide and 'easy use' card were developed for use by volunteers. After the release of the research conducted by University of Western Australia, the methodology was adapted further to include reference pictures for Lyngbya dry mass weight. This will therefore allow for two types of Lyngbya measurement – weighing the wet weight within the field as well as estimating dry weight from photos. This additional information will feed into the research dataset, thereby increasing the level of data available for analysis. (PJ110401)

In order to measure the effect of the nutrient reduction activities, funding was provided to measure water quality; identify runoff patterns within Broome and surrounds; sample water to compare natural versus urbanised runoff coefficient and nutrient export rates; and quantify nutrient loading from different regions of Broome into Roebuck Bay with particular emphasis on collection during

significant rainfall events. Preliminary results confirm old Broome drains have the highest nutrient concentrations and drain geometry is important as run-off volume is more important than nutrient levels in terms of nutrient load to bay. This information has been used to advocate to the shire to adopt a drain management plan. Results have also confirmed that Lyngbya blooms in Roebuck Bay are triggered by a combination of concentrated heavy rains in December, followed by sunny days, warm temperatures, and the presence of sediments rich in nitrogen and phosphorous. The nutrient concentrations in the seawater were found to be above the Australian and New Zealand guidelines for fresh and marine water quality (ANZECC/ ARMCANZ). (PJ09407-2, PJ09407-3, PJ09407-8, PJ110402)

Roebuck Bay

Research has identified that run-off volume is more important than nutrient levels in terms of nutrient load to bay

In order to ensure cohesion and consistency between research studies, the Roebuck Bay Working Group (RBWG) has established a Roebuck Bay Research Steering Group. The Steering Group has met twice and has strong Yawuru support and interest. Following the development of Terms of Reference, the Steering Group has:

- developed Yawuru Protocols for Researchers which includes a flow chart;
- sought funds to undertake a review of all research that has been undertaken in the Roebuck Bay catchment; and
- identified gaps in research and produced a list of areas for research to be undertaken.

The aim of the initiative is to increase research on the Roebuck Bay catchment and interconnecting waters, provide opportunities for collaborative projects, and bridge knowledge gaps about Lyngbya. An excerpt from the Draft Terms of Reference identify that their mission:

"...is to encourage ethical and truly independent scientific research of the Roebuck Bay catchment and interconnecting waters. By encouraging an enhanced research effort, we are working towards bridging relevant knowledge gaps and generating reputable scientific information, all of which is available in a repository and shared with the wider community."^{xxvii}

Changes made

Work undertaken with the Broome Shire has resulted in improvements in drainage design standards aimed at improving water quality and silt drop-out and implementation of water quality testing of drains. The Shire has also ceased use of bobcats and loaders to maintain drains and taken steps to reduce the amount of nitrogen, phosphorous, sediments, and rubbish flowing through stormwater drains into the Roebuck Bay Ramsar site. Management practices are being tailored for each drain, with emphasis on reducing nutrient and sediment flow through the use of native grasses and plants to increase nutrient uptake and water flow. An ongoing, co-ordinated clean-up of drains is now occurring with the Broome Shire allocating two employees to clean rubbish from the drains before the wet season each year. (PJ09407-1 PJ110402)

Re-contouring and replanting of current drains has commenced and new drains have been designed as a series of landscaped cleaning basins to lessen water flow, with the overflow directed into Lake Broome. A list has been developed of native plants suitable for planting within drains to assist with improved water quality outcomes. It has been agreed that this will be adopted by both Broome Shire and LandCorp. The Drain Plant list is a living document that will change over time as the plants are tried and tested in the drains.

The Roebuck Bay Working Group advocated for a Broome Drain Management Plan. As a result the Shire is currently completing a drain audit, by monitoring water quality from first flush stormwater runoff. This will provide data on which drains need to be prioritised for re-engineering, replanting, and retrofitting.

Lobbying of the State Government and Water Corporation in relation to accepting industrial waste at their waste water treatment plant is underway and the Shire has now also begun to advocate such a change. This will allow the new industrial estate to go on sewer. Additional pressure put on the Water Corporation to establish more monitoring bores around on contaminated sites at Waste Water Treatment Plant South has been successful with 11 additional bores drilled in June 2013 and agreement to incorporate sampling during a spring high tide. Additional lobbying for stricter controls of land clearing through LandCorp has been very successful with LandCorp's Broome Manager becoming a member of the Roebuck Bay Working Group. It is anticipated that this will assist in reducing the large amount of runoff of pindan from cleared land and roads in Broome North. (PJ110402)

Collaboration has been further enhanced through facilitation of a Roebuck Bay Lyngbya Forum, where stakeholders (including traditional owners) involved with the monitoring, research, awareness raising, or infrastructural changes necessary to manage with Lyngbya blooms to come together to present their work. Attendees also discussed the issues encountered, opportunities for further collaboration, future actions required, and knowledge gaps. (PJ110401)

Additional work has resulted in stabilisation of the dunes system, reduction of the stressors for roosting shorebirds, reduction in sedimentation of the intertidal mudflats, and protection of the northern shores of Roebuck Bay through:

- restricting vehicle access (installation of bollards and barriers and track closures);
- creation of sustainable viewing points and beach access
- community awareness (signage and education and beach clean-up day);
- decreasing public thoroughfare (boardwalk beach access);
- rehabilitation of disturbed areas, including duplicate tracks and trails; and
- run-off control and erosion management through use of mesh to hold the soil surface and seeds in place until vegetation can take hold. (PJ09407-3, PJ111403-2)

To what extent have threatening processes been controlled in the Ord River Floodplain Ramsar site?

Feral animals

Within the Ord River floodplain region work has been completed to develop management plans, map feral animal distribution, and determine priorities. Following well-attended workshops landholders became engaged in feral animal trap development and location of animals, particularly feral pigs. An outcome arising from this engagement processes was a strong request from the community that only trapping should be employed in on-ground activities and that they be kept updated with the program. Overall, however, pig trapping in the Ord floodplains region has been unsuccessful due to recreational hunter pressure within the area and their impact on trapping efficiency. An extremely poor wet season in 2013 resulted in an inability to progress the work, however, the traps have been left on site and will be able to be utilised in the future if circumstances change. (PJ10601)

Weed management

Within the Ord river floodplain region, work has also been undertaken to survey and map weed infestations such as *Acacia nilotica*, *Mimosa pigra*, Mesquite, *Sicklepod senna*, Noogoora burr, Bellyache bush, and Rubber bush. This has resulted in the development of decision making tools such as management plans and a regional weed map. Mapping data has also been utilised at a broader level with distribution to external stakeholders such as the National Bellyache bush Co-ordinator for the purpose of mapping bellyache bush distribution at a national level.

Control work in the Ord region has identified that juvenile Mesquite is often prolific around adult trees. This, plus confirmation that multiple stems are often found to be part of the same plant and evidence that plants that had been previously treated with chemicals had regenerated with many new shoots, indicates that repeat treatment is required.

The survey work undertaken on the Ord River floodplains has identified previously unknown weed infestations on the Pentecost River, Parry Lagoons floodplain, and a large area covering over 2,000 ha on the eastern shore of Lake Argyle. These new outbreaks are also evidence that further work is required. (PJ10601)

To what extent have threatening processes been controlled in other high conservation value aquatic ecosystems?

Weed management – Lake Macleod and Fortescue catchment

Properties within the Lake MacLeod and Fortescue Catchment regions implemented ESRM plans that incorporated weed management strategies. Properties located in the Lake MacLeod catchment are generally able to manage weeds before they become a significant problem, however, work on *Cylindropuntia spp.*, an invasive cactus species, resulted in control of approximately 7ha of infestations within the waterways. In order to prevent the spread of cactus reaching the catchment again, control measures were conducted on five properties with an average of a 95 per cent mortality rate. Control of Mesquite (*Prosopis spp.*) has also been conducted throughout the catchment in collaboration with the regional Biosecurity group.

Two properties – representing 250,000 ha adjacent to the Millstream Pools in the Fortescue Catchment – developed sustainable weed management plans. These properties contain a large infestation of *Parkinsonia*. The implementation of the control work arising from the management plans is being undertaken through mining company funding and Indigenous rangers. In addition, 30 km of Fortescue river frontage is being protected from grazing through fencing and continued mustering. This stretch of the river incorporates the significant cultural and ecological sites of Dogger and Gregory gorges. (PJ09101, PJ90201)

Invasive species management – Fitzroy River

Small scale activities to reduce the impact of feral pigs in the Fitzroy River region have been more successful than those of the Ord River Floodplain region. Work was undertaken as a component of a broader collaborative research project between the University of Sydney, Australian Pork Ltd, and Department of Agriculture and Food WA to study the feral pig population of the Fitzroy River region. This was part of a project investigating emergency disease spread and control in feral pigs. The CfOC funded component aimed at:

- surveying actual pig numbers;
- undertaking control works; and

- assessing the most appropriate methods for control.

The activities focused on Alexander Island in the Fitzroy River – an area of 41,500 ha. This is a contained site and as such the impact of any work was measurable.

The results of the initial cull activities were that 187 pigs were shot over an area of 41,500 ha. This equated to removal of approximately 2.2 pigs per 100 ha from the environment at a cost of \$90.50 per pig. A follow up survey by the University of Sydney was undertaken to determine success of the cull. This identified that only 5 pigs were to be found in the area, leading to a 98% success rate in pig control. All additional pigs seen were shot.

Findings arising from the project identified that aerial shooting or poisoning is more effective than trapping. Additional data is still being considered, however, and once available efforts will be made to determine feral pig population distribution along the Fitzroy River and the most appropriate methods and locations for aerial culling in the Kimberley. (PJ111403-1)

Engage community organisations in coastal and marine rehabilitation, restoration, and conservation

Work has been undertaken to ensure that community groups, including Indigenous groups, are engaged in coastal protection activities across all key coastal and marine environments within the WA rangelands (Table 7).

Table 7: Activities undertaken to engage community organisations in coastal and marine rehabilitation, restoration, and conservation

Projects contributing to this target:	Project ID
West Kimberley Nature Project Stages 1 and 2 *	PJ09401, PJ110401
Roebuck Bay community engagement and protection of Ramsar values *	PJ09402
Tracking nutrient enrichment – Roebuck Bay *	PJ09407-2
Protecting Ramsar values *	PJ09407-3
Roebuck Bay Working Group – Community engagement and protection of Ramsar values	PJ110402
Protecting Roebuck Bay from Lyngbya – Ground water monitoring	PJ110404
Roebuck Bay – Coastal rehabilitation works and protecting roosting bird sites	PJ111403-2
Kimberley Coastal Devolved grants	PJ110902-1 to -3
Pilbara and Gascoyne Coastal Devolved Grants	PJ110903-1 to -3
Total funding: \$410,000# # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Across BMT 1, 2, and 3 contributions have been made to this target through the following achievements within the Kimberley, Pilbara, and Gascoyne.

- Community participation in coastal projects.
- Control of public access and disturbance of roosting shore birds.
- Implementation of devolved grants to facilitate coastal management, planning, and co-ordination of volunteers to restore and rehabilitate coastal and marine areas (Table 8).

Table 8: Summary of contributions to CfOC target – engaging community in coastal conservation

Approved objectives (organisations/groups)	Actual quantity achieved		
	BMT1	BMT2	BMT3
Community organisations participating in coastal projects	11 organisations		
Six groups to control public access and disturbance of roosting shore birds		6 groups	
Community groups engaged in coastal projects			14 groups
TOTAL: Contributions of 11 organisations and 20 community groups have been made to engaging the community in rangelands coastal conservation under CfOC since 2009			

A map of the works undertaken (Figure 8) reveals the extent of the reach of funded activities along the northern WA coastline.



Figure 8: Map identifying the locations of activities to engage community organisations in coastal and marine rehabilitation, restoration, and conservation

An evaluation of the activities focussed on the following evaluation questions.

How effective has the support provided been in ensuring the implementation of priority on ground works in Roebuck Bay?

The support provided by the community has been instrumental in the successes achieved to date in protecting Roebuck Bay. This support has been the result of co-ordinated awareness raising campaigns about the effects of the use of products high in nitrogen and phosphorous in Broome and how these can be reduced. The communication strategy has resulted in the development of a number of promotional and information tools. These include:

- fridge magnets delivered to all households and businesses in Broome;
- bookmarks to give students and library users with *Keep Our Bay Clean* campaign tips (Figure 9);
- a brochure on how to use fertiliser wisely in the garden that is available directly to the community and via local commercial gardeners and nurseries;
- two flyers about maintenance of a septic tank in Broome, so that septic owners understand how to look after their septic and reduce overflow and seepage of sewerage into the aquifer or stormwater drains;
- banners/blinds for use in schools, Broome library and community events;

- bi-monthly features on Roebuck Bay in the local newspaper;
- displays in Broome Library;
- placement of *Keep Our Bay Clean* tips on the Roebuck Bay website with more than 800 visits per year since being uploaded; and
- brochures on how to *Wash Your Car the Roebuck Bay Friendly Way* and *Gardening the Roebuck Bay Friendly Way* have been produced and uploaded onto Facebook and the website. Following community requests the gardening brochure has also been produced as a 12 page booklet to with more information, so they will succeed in growing natives and trapping water.

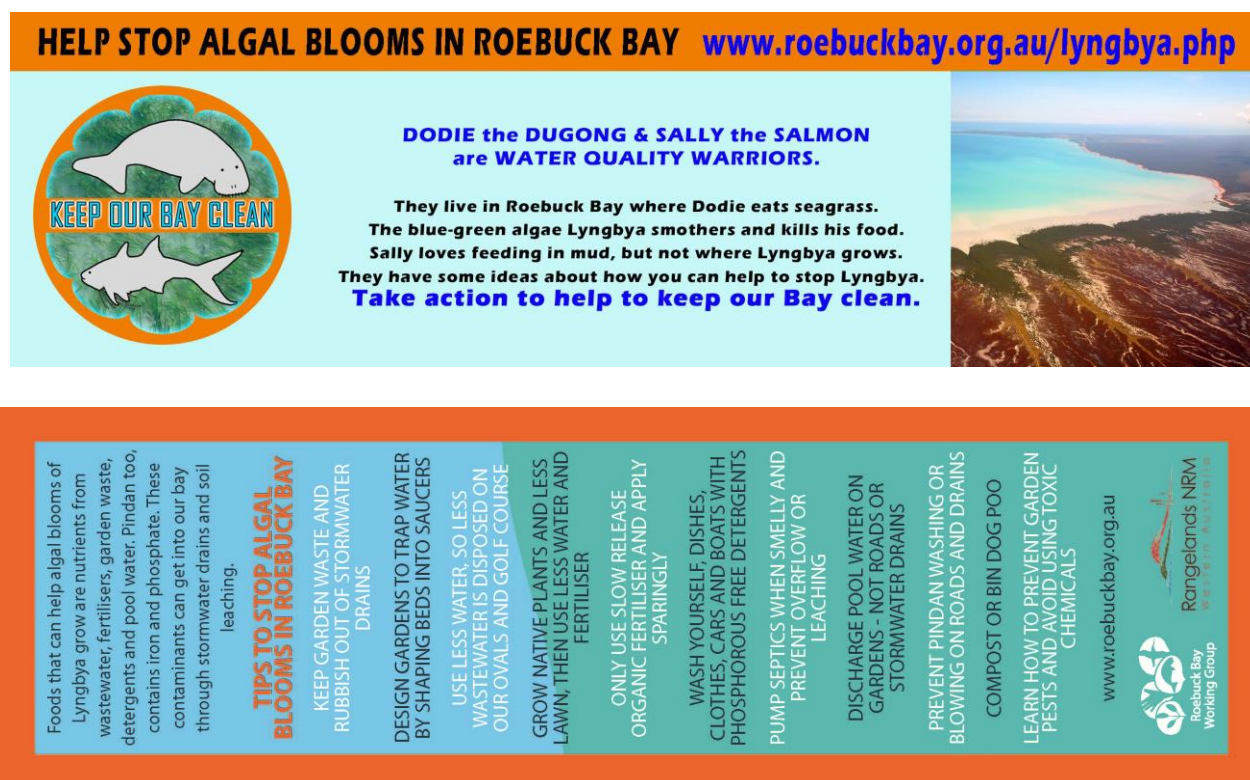


Figure 9: Bookmark used in promotion of work undertaken by Roebuck Bay Working Group

A short You Tube film – *A Blooming Good Film about Roebuck Bay*

(<http://www.youtube.com/watch?v=eVWdOndzNbc>) – has also been released to provide a

snapshot of the marine life in Roebuck Bay, the Lyngbya spread that has been worsening in recent years, and the triggers for these blooms. The film includes practical tips for the Broome community to reduce run-off and the flow of polluted groundwater into the Bay. The film was a collaborative effort between Yawuru Indigenous rangers, Roebuck Primary, and the Roebuck Bay Working Group. Agreement has been reached for the Department of Transport, Department of Environment and Conservation, and Nyamba Yawuru Buru organisations to display the film in their foyers. A third film is currently being produced about *Gardening the Roebuck Bay Friendly Way*. This will explain how to use water-wise, local natives which do not require fertiliser and trapping rainwater in local gardens.

School children within Broome have been fully involved in the work. Students from Roebuck and Broome Primary Schools and Broome Senior High have been involved in activities such as excursions onto the Bay's mudflats and presentations about the link between run-off and Lyngbya blooms. Children are identifying drain inlets requiring management and taking part in activities to stencil the

Keep Our Bay Clean logo beside the drain as a reminder to the community. There is wide endorsement of drain stencilling from Yawuru people and the State Government and encouragement for the project to continue working with all schools in Broome. An unexpected outcome of this community involvement is that the school students are now so engaged that they are regularly seen wearing Keep Our Bay Clean badges on their uniforms.



Figure 10: Primary school students stencilling drains in Broome ©RBWG 2012

Feedback from the community indicates that awareness is growing; with the word Lyngbya now widely known; the role of nutrients and sediments understood by some people attending Celebrate the Bay; and schools keen to get involved in drain stencilling. The use of social media has assisted in this awareness raising process. There has been a steep increase in visitation to the Roebuck Bay Working Group website and keen interest in the Roebuck Bay Facebook page, particularly during the Celebrate the Bay event. The communication tools have been loaded to the Facebook page and each of these has been accessed a significant number of times. Feedback has been received to indicate that people like Facebook because of the immediacy of the information available and they prefer it to mainstream news media. There is great potential to keep building knowledge through Facebook and through the use of films and high quality photos.

The 2012 Celebrate the Bay was a success with more than 400 people attending the displays and activities during the event. Feedback received was encouraging with indications that the event needs to continue.

"Loved the event, found out so much about Roebuck Bay, want to see it bigger next year and more advertised. Would like to see interconnected waters included."

"... the presentations and stalls were great and loved the telescopes. Want to see the event every year..."

"All kids should be going to Celebrate the Bay, really fascinating and lots of passionate people sharing their knowledge."

"Never knew Roebuck Bay held all this life, want this event every year."

"Great atmosphere and setting, great displays, presentations, interactive ones good..."

The event was filmed with inclusion of interviews with NRM managers in the region and an activity showing links between land-based pollution and algal blooms. The film includes tips on reducing rubbish and nutrient runoff (<http://www.rangelandswa.com.au/740/videos>). The film has also been shown weekly on Goolarri Television.

An online survey (<http://www.surveymonkey.com/s/GVJQSG7>) was developed to identify the outcomes of the awareness raising activities, through measurement of the level of community understanding in Broome about Lyngbya in Roebuck Bay. Results showed that:

- the Bay is valued for its natural beauty and shorebird diversity;
- the community have a very good awareness about Lyngbya blooms, with good general understanding of range of factors that could be contributing to the issue;
- the impact of Lyngbya on marine life and people is fairly well known; and
- the community is willing to try some or all of the measures that could help to reduce blooms.

The work of the Roebuck Bay Working Group was recognised as a winner in the 2013 WA Regional Achievement Community Awards and finalist in the 2013 WA State Landcare Awards. As a result, community awareness of the work extended beyond the Broome region. The awards acknowledge groups who show a proven passion and dedication to reducing environmental impacts in rural and regional areas. The award ceremonies, held in Perth, allowed the work to be showcased to a much wider audience. (PJ09402, PJ110402) +2013

Community engagement

Roebuck Bay Working Group was recognised as a winner of the 2013 WA Regional Achievement Community Awards

A Lyngbya Forum was co-hosted by Environs Kimberley and the Roebuck Bay Working Group on 1st July 2013 in order to further increase knowledge. Previous Lyngbya forums have proved successful as seen in through the research, monitoring, education, or infrastructural changes that have been made. The aim of this forum is to obtain a snapshot of what is currently known of Lyngbya in Roebuck Bay, what people are doing, the knowledge gaps, and determine how to move forward. This will result in a *Roebuck Bay Lyngbya Report Card*, for all stakeholders' approval, use, and ownership. (PJ110402)

A targeted and co-ordination approach by project partners, government bodies, and traditional owners has also resulted in reduced sedimentation in Roebuck Bay and protection and rehabilitation of the dune zone from erosion and unmanaged visitor access across two high use sites on the northern shores of the Bay. (PJ111403-2)

The community awareness raising activities have been undertaken in tandem with the assessment of the nutrient levels discharging into Roebuck Bay as a result of waste water, fertiliser use and other contaminants. The results of the research have informed the communication strategy necessary to maintain community engagement. Several measures were implemented in order to assess this nutrient load:

- installation of monitoring bores at six sites on the Broome peninsular to measure groundwater level fluctuations and water quality with resultant development of conceptual hydrogeological models to identify the impact of anthropogenic activities on water quality within the Bay;
- measurement of flow rates and nutrient concentrations in stormwater sampling; and
- integration of the data collected with the WA State hydrological database. (PJ110404)

The support of traditional owners and Aboriginal Corporate bodies, such as the Kimberley Land Council, has been instrumental in ensuring success of coastal protection and conservation works. Consultative management plans have been developed to ensure targeted and co-ordinated work that meets identified needs of the communities, with fee for service arrangements put in place for Indigenous ranger teams to implement the plans.

The approach of full consultation and involvement has resulted in engagement of traditional owners in all planning processes. Ongoing support of the activities has been demonstrated through attendance at meetings, participation in on-country trips, and participation in on-ground works. The acknowledgement and recognition of ranger groups and individuals in all promotional activities and scientific papers/reports produced has contributed to the maintenance of ownership. This has been demonstrated with involvement by both Nyul Nyul and Bardi rangers in joint presentations with Environs Kimberley at two major scientific conferences – Society for Ecological Restoration Australasia Conference in Perth and the Ecological Society of Australia Conference in Melbourne. (PJ09401, PJ110401)

How effective has the support provided been in engaging community groups in protection of coastal sites?

Community engagement has involved consultation with key stakeholders to determine local priorities and regional needs. A desk top review of existing coastal NRM plans – including Pilbara Sea Country Plan (March 2010), Human Use Coastal Threats Research Project (2009), and Pilbara Investment Strategy (2009) – was also undertaken to better understand areas of significance to the community. This consultation resulted in the inclusion of local and regional coastal assets in the Rangelands NRM revised, web-based Regional NRM Plan.

Liaison with representatives from six different local government authorities – Shire of Wyndham East Kimberly, Shire of Derby West Kimberley, Shire of Broome, Town of Port Hedland, Shire of Roebourne, and Shire of Shark Bay – was undertaken to identify coastal zone management priorities. This identified that their key management priorities are:

- protection of infrastructure;
- the impact of sea level rise;
- controlling access;
- weed management; and
- community engagement.

Most existing community groups, including Indigenous communities, considered 'coastcare' a secondary activity, with their primary focus on fishing, 4WD access, Native Title, and general environmental restoration works. Ongoing conversations and engagement, however, has enabled motivated individuals and groups to become more engaged in NRM activities such as management of vehicle access on primary dunes, mangrove protection, management of marine debris, Indigenous ranger participation, protection of sites of significance, and engaging transient communities. Several workshops were held in Derby, Broome, Bidyadanga, Port Hedland, Point Sampson, Karratha, and Onslow on how to better engage coastal stakeholders and integrate into the Regional NRM framework.

The Handbook 'Caring for the Coastal and Marine Environment – A guide for active conservation and management of the WA Rangelands Coast' has been produced to assist community and land managers undertake active management and conservation of the rangelands coast. This is

available at www.rangelandswa.com.au. An abbreviated booklet for quick easy use has been distributed throughout the community. The guidebook has been distributed to Shire of Broome, Shire of Derby West Kimberley, Shire of Wyndham East Kimberley, Town of Port Hedland, Shire of Roebourne, Shire of Shark Bay, Shire of Carnarvon, and active coastal groups within those shires. (PJ110900)

How effective has community engagement been in protecting key coastal assets?

Monsoon Vine Thickets

Previous work had been undertaken on a Monsoonal Vine Thicket (MVT) at Middle Lagoon. This is the only MVT on the Dampier Peninsula where *Diospyros martim* occurs. One bollard fence has successfully protected one side of the MVT and dune from erosion. A new track across the sand dune was created by vehicles however, and was damaging the MVT. This was again opening up the thicket to erosion. In addition, a sign had been vandalised.

Further work was undertaken to install a bollard to block this new track. This has been successful in protecting the Monsoon Vine Thicket by preventing 4WD vehicles from driving through the area and down the sand dune to the beach. Two large educational 'welcome to Middle Lagoon signs' were reprinted and installed on the track. These contain information about the country, the Monsoon Vine Thickets and where people can and cannot drive. The feedback so far on the signage is very positive, but a longer time period will be required to gather more information about their success.

An unexpected outcome of the work was an idea put forward by the Nyul Nyul rangers for a Monsoon Vine Thicket walk. Its aim is to provide visitors with traditional ecological knowledge and educational information about individual plant species within the plant community point of interest. This concept was a community development model driven by the rangers. The outcomes of the implementation will be measured through use of the walk trail. This information will be used to determine its success and how the trail can be adapted and improved over time. The rangers have also identified other associated work such as development of an educational brochure that will provide information on all the plants alongside a map for visitors to refer to when walking. In addition the rangers have expressed a desire to print a 'Plant stories' booklet for Nyul Nyul country. (PJ110902-1)

Fisheries

A trial was undertaken with three fishing vessels operating from Shark Bay to identify whether electromagnetic devices would deter sharks from taking hooked fish. More than 200 replications were incorporated into the trial period. A variety of gear configurations were investigated to account for variability in fishing techniques.

The major outcome from the trial was confirmation that electronic shark deterrents deter the majority of shark species from attacking hooked fish. It is known that shark shields do not deter small species of sharks currently, however, the University of Western Australia is undertaking studies on different electromagnetic frequencies on smaller species to determine whether this can be overcome. More time and the ability to conduct additional sea trials over the peak snapper season would be beneficial, however the results have provided industry with proof of concept information to further investigate the use of electromagnetic devices to reduce shark interaction. (PJ110903-2)

Sustainable farm practices

Farmers using improved management practices and land managers/farmers with improved NRM knowledge and skills

Environmental sustainability within the WA rangelands is dependent upon practices adopted by land managers and the ability of land managers to increase their knowledge and skills in order to implement best practice. Through the funded activities (Table 9), pastoralists and land managers, including Indigenous communities, implemented property management plans; sustainable grazing practices; improved soil health; and put in place land management practices or other arrangements to improve the environment both on- and off-property. A 'showcase' – a collation of articles written about some of these activities – is available at http://webadmin.communitycreative.com.au/uploads/rangelands/publications/showcase_suspast_V1.pdf

Across BMT 1, 2, and 3 and competitive grant projects, contributions have been made to this target through activities across much of the rangelands. These contributions have come through:

- employment of the Ecologically Sustainable Rangelands Management (ESRM) 'tool' for whole property planning with pastoralists in target areas;
- revision and review of existing property management plans with new knowledge and tactics for better NRM outcomes;
- development of management plans and implementation of improved practices for control of invasive species and protection of biodiversity values;
- use of industry and community driven approaches to promote sustainable land management with a focus on maintaining ecosystem function and assist farmers within the region to increase their uptake of sustainable farm and land management practices that deliver improved ecosystem services;
- implementation of Bestprac style Action Learning Groups to support the development of skills and knowledge and provide important peer support systems;
- implementation of extension activities with pastoralists to promote best management practice, implement rehabilitation works, manage threats, improve ground cover and carbon retention, and undertake monitoring and workshops; and
- support implementation of co-ordinated mosaic burning program across target areas to reduce wind erosion, enhance production, address critical threats to biodiversity, and maintain ground cover (Table 10).

Table 9: Activities undertaken to improve knowledge and skills and management practices

Projects contributing to this target:	Project ID
ESRM at Lake MacLeod	PJ09101
ESRM in the Fortescue	PJ09201
Eighty Mile Beach Grazing Management	PJ09403
West Kimberley LCDC Small Fitzroy Catchment projects	PJ09509-1 to 3
Improving grazing management on Christmas Creek	PJ09514-1
Erosion workshop*	PJ09514-2
Community Engagement and Awareness Raising in the Fitzroy Crossing catchment *	PJ09516
Christmas Creek Rangelands Regeneration	PJ09517
Sustainable Rangelands Management through improved extension	PJ09009
Protecting the ecological and cultural values of Roebuck Plains	PJ110406
Identifying Indigenous environmental assets in the Dampierland/Central Kimberley IBRAs	PJ110407
EcoFire Stage 6 & 7	PJ110501
Managing fire for biodiversity	PJ110502
The economic benefits of EcoFire management for pastoral production	PJ110503
Indigenous Fire Management for Biodiversity, Social Development and Carbon Abatement in the North Kimberley	PJ110505
Kimberley Grazing Land Management Workshop	PJ110802-1
Reducing Gully Erosion, Argyle Downs Station	PJ110802-3
Reducing Erosion from Fence Lines, Larrawa Station	PJ110802-4
Improving Biosecurity and Grazing Management Options, Country Downs Station	PJ110802-5
Improving Biosecurity and Grazing Management Options, Dampier Downs Station	PJ110802-6
Onground works – upper Gascoyne & Pilbara	PJ110803
Gascoyne Delivery	PJ110804
Southern Rangelands Delivery	PJ110805
Yalgoo Rangeland Restoration Strategy	PJ110808
Corralling the Coral Cactus at Tarmoola	PJ110810
Feral herbivore control on Yanderra Aboriginal reserve and Mallina station	PJ110812
Protecting the Logue River	PJ110813
Recovery of biodiversity on Jundee – women's ranger group	PJ110814
Protecting the ecologically significant Nicholson Range in the Murchison from Total Grazing Pressures	PJ110815
Indigenous Sustainable Pastoralism	PJ111102
Changing pastoral practices Murchison and Gascoyne	PJ111103
Upper Gascoyne LCDC: Upper Gascoyne catchment erosion and sediment control	PJ120309
Total funding: \$3,921,155 #	
# funding for program administration, project management, communications, and MERI is external to the funding noted	
* Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Table 10: Summary of contributions to CfOC target – farmers with improved NRM knowledge and skills and using improved management practices

Approved objectives (land managers/hectares/blocks)	Actual quantity achieved			
	BMT1	BMT2	BMT3	Comp grants
Land managers participate in ESRM property planning	22 land managers			
Land managers implementing Best Practice for soil conservation (e.g. maintaining ground cover through better grazing &/or fire management)	38 land managers			
Land managers using improved property management methods	24 land managers			
Co-ordinated management of invasive species on 40 horticultural blocks adjacent to the Ramsar wetland contributes to protection of the asset through engaging land-managers in improved weed control		42 properties		
80 land managers to develop management plans and improve practices for control of invasive species and protection of biodiversity values		86 land managers		
400 hectares with management plans and improved practices for control of invasive species and protection of biodiversity values		9,639 ha		
Use industry and community driven approaches to promote sustainable land management with a focus on maintaining ecosystem function			109 land managers 1,611,215 ha	
Extension activities with 20 pastoralists over 400,000 ha to promote best management practice, implement rehabilitation works, manage threats, improve ground cover and carbon retention and undertake monitoring and workshops			79 land managers	
Improving knowledge and skills				69 land managers
Improving management practices				53 farmers, 434,000 ha
TOTAL: Contributions of 2,054,854 ha, 480 land managers, and 42 properties have been made to improving the NRM knowledge and skills of land managers within the WA rangelands and encouraging them to improve their management practices NB: Activities listed above have targeted the same land managers and this is reflected in the overall total				

A map of the works undertaken (Figure 11) reveals the large tracts of the region that have been involved in activities aimed at improving knowledge, skills, and management practices of land managers.

The ESRM program aims to improve land management practices by working with land managers to improve their knowledge of landscape function and the underpinning resources required for sustainable and viable businesses. The process involves comprehensive property visits and discussions with the land managers, backed up by software and tools including remote sensing, climate analysis, and mapping software.

The key achievement of the project is that properties implemented property plans to achieve better NRM outcomes. Two thirds of the land managers associated with the 15 Lake MacLeod properties involved actively implemented identified plans including:

- introducing rotational grazing systems to reduce extensive pressures on rangelands resources;
- seasonally turning on and off watering points to reduce grazing pressures on sensitive ecosystems in dry seasons;
- re-assessing and re-locating infrastructure (such as realigning tracks, fences and pipelines to reduce channelling of water) to promote optimal landscape function; and
- introducing monitoring systems to observe and record changes to land systems following specific management decisions.

As a result of the ESRM plans, the banks of Lake MacLeod and the Northern Ponds were protected from grazing impacts through use of selective entry devices designed to reduce goats, fencing of sensitive riparian vegetation, and alteration of watering infrastructure. These measures improved surface water flow entering the lake system, decreased grazing pressures, and promoted increased ground cover. The level of investment in weed control was also increased with control undertaken on *Cylindropuntia fulgida* cactus species adjoining the waterways entering the Lake MacLeod system (Hutton, Minilya and Cardabia Creeks) and collaborative control works to identify known locations of *Cylindropuntia* and Mesquite.

Five property management plans were completed in the Fortescue River catchment region, covering an area of over 800,000 ha. As a result of the plans, NRM projects were undertaken to:

- protect 2,500 ha of valuable Mitchell grassland on the Fortescue River from all grazing pressure for two average rainfall seasons followed by periodic, opportunistic grazing;
- implement a rotational grazing program across 30,000 ha of mixed grassland and floodplain adjacent to the Millstream Ponds; and
- protect 30 km of Fortescue River frontage adjacent to the Millstream National park from cattle grazing.

Land managers have shown a commitment to on-going management improvement with discussions and requests for further information and assistance – such as updating property maps, plans, strategies, and parameters – continuing throughout the life of the project and following completion of the program funding cycle. The planning system established over four years provided land managers with new ways of looking at their management systems and encouraged managers to have confidence to ask questions of themselves and of regional organisations and departments to ensure that they have sufficient information and skills to trial new management techniques. Overwhelmingly positive feedback was received from all participating properties and all have

Land manager engagement

On-going commitment to management improvement has been demonstrated through requests for further information and assistance

indicated that they will change their practises as a result of the exercise. A strong focus of the ESRM process is education and this has been highly successful. A quote from a land manager involved in ESRM planning in the Fortescue region is indicative of some of the feedback received.

"I have learnt more about managing my country in the last two days with the ESRM team than I have in my entire 16 years of managing this property."

There was a strong consensus that ESRM should be the vehicle through which all future NRM projects in the area should be delivered. This is evidenced by the following passage taken from a letter of support for future funding from the lead NRM group within the Fortescue catchment.

"As a catchment group that has participated in the Ecologically Sustainable Rangelands Management (ESRM) project for the past two years we feel that we are in a position to capitalise on the already positive outcomes this project has provided us. We would strongly support a continuation of the ESRM planning, development and implementation process proposed in this application."^{xviii}

A Catchment Report outlining opportunities and recommendations for sustainable management of the region's resources has been compiled as a result of this project. The *Lake MacLeod & Northern Ponds Catchment Report 2011* provided a synopsis of the overall health of the catchment nourishing the Lake and the Ponds, including its assets, threats, and issues as expressed by stakeholders and previous research; with specific emphasis on current land use and pastoral land management practices. The Report identifies strategies to manage and reduce the effects of threatening issues and provides recommendations for future management and developments required in order to improve water quality, vegetation health, and sustainable agricultural practices in the region.

A property management report template was developed by the Fortescue project in order to benchmark current management and ecological condition of properties and identify areas to target with specific management techniques and infrastructure development for up to 15 years. These property plans are viewed as the best in the industry by many companies and groups and as such ESRM has been approached by several organisations including but not limited to:

- Rio Tinto
- Citic Pacific
- Indigenous Land Corporation
- Several Aboriginal Corporations
- Pilbara Indigenous Management Services
- Greening Australia. (PJ09201, PJ09101)

Erosion within the Upper Gascoyne region was addressed through on-ground works on six properties using various erosion control techniques. These included ponding banks, water spreading banks, sediment sieve structures, moving water points out of fragile riparian zones and self-muster yards. Skills enhancement and information sharing was also provided through a workshop discussing the causes of erosion, contributing factors, and effective control.

Monitoring sites have been installed to capture baseline data and the ongoing effects of on-ground works. Limited time has been available to fully determine the impact of the work on erosion management, however, early results indicate that:

- the experimental sieve structure work has slowed water flow and shown promise of holding silt in place;

- the removal of water points from sensitive riparian zones has lowered the stocking rate as animals have been able to spread their grazing effect over larger areas; and
- the ponding banks installed have experienced their first rain and effectively held water and increased water infiltration and vegetation growth.



Figure 12: Work undertaken as part of an erosion workshop with Upper Gascoyne LCDC

Feedback from the workshop and project has been positive. All participants indicated that their skills and knowledge of erosion control had increased and they were likely to use the new information. Key learnings taken away from the workshop included the low water use efficiency of rangelands (90 per cent of all rain running off), the large loss of production possible from continuing erosion, a greater appreciation of how water flow can be managed, and the importance of keeping water in the landscape. Additional on-ground work has already resulted from the skills enhancement gained through the workshop with Bidgemia Station commencing experimentation with ponding banks constructed with a grader. (PJ120309)

In what ways, and to what extent, has the establishment of Action Groups improved land management practices?

An end to a seven year drought in the rangelands resulted in renewed interest by pastoralists wanting to further implement existing ESRM plans. This provided an opportunity to leverage off this enthusiasm by better supporting the pastoralists to increase their uptake of planned management activities through establishment of a number of Action Learning Groups across the rangelands to facilitate learning and encourage the implementation of actions from existing plans. Where plans were not available, pastoralists were encouraged to engage in participatory action learning and research activities to address issues deemed important by the pastoralists and which addressed total grazing pressure, predation, and business planning aligned with environmental planning.

The establishment of Action Groups for the purpose of addressing NRM issues gained currency as the project progressed. Community interest in group activities was not seen as a new phenomenon as land managers regularly attend workshops or field events as a means of

gathering information – these types of events have been loosely termed by some as ‘action learning’. However, in the case of the Sustainable Pastoralism program, the notion of group activities was extended to participatory action research (PAR) and learning.

Each project funded through the sustainable pastoralism program supported activities that were appropriate for pastoralists for they were the ones that identified the activities that they would like to participate in. All participatory action research and learning activities were organised and

Land manager engagement

Effective project ownership and governance are imperative for the success of the learning activities

undertaken by pastoralists. From the onset of each proposal, the pastoralists were asked to identify the NRM or industry issues that were most important to them and how the form that they would like to address the issues (trials, study tours etc.). Effective project ownership and governance were seen as imperative for the success of the learning activities. The organic nature of PAR encourages pastoralists to own their projects and set their goals, timeframes, and evaluation questions.

A number of industry and interest groups participated in action learning. In many instances the activities were developed to trial learnings on return from workshops. For example, if a group of pastoralists were supported to undertake a workshop it was on

the proviso that on completion of the workshop they would share their learnings with their broader group and as a whole, identify what aspects of the course they would like to trial, and on whose property the trials would take place. There was also an expectation that the group(s) would identify their milestones and put project governance in place. This expectation appealed to pastoralists as it provided them with considerable autonomy over the project.

A number of trials were undertaken as a result of pastoralists attending workshops. For example, on return from a Behavioural Education for Human, Animal, Vegetation, and Ecosystem management course held in Dubbo, NSW a pastoralist shared his learning's with the Gascoyne Catchment Group. As a result three studies were then undertaken to test the theories discussed at the course:

- increased use of shrubs with primary and secondary compounds;
- preparing pastoral cattle for feedlot; and
- Scooting Study – market opportunities for value adding.

Other groups nominated on-ground trials simply out of interest and not necessarily as a follow-up to attending a workshop. For example, the Rangelands Fibre and Produce Association undertook a joint activity designed to assist sections of vulnerable and degraded landscapes to function in a healthier manner. The group utilised tools including a ‘camel pitter’ that was designed to be towed behind vehicles in areas of degraded systems. The purpose of the pitter was to break through compacted soils to allow for greater water, nutrient, and oxygen cycling. The mechanical works led to an increase in water infiltration into the soil profile and reduced water sheeting and soil erosion.

Through action learning processes pastoralists have become more informed about land management practices and the types of activities required to improve soil health. For instance, a group of pastoralists built on a previous trial by the Hedland Export Depot to determine the potential for irrigated pastures on stations in the De Grey River catchment over 1,400,000 hectares in the Pilbara. The group realised that irrigated pastures could be used as a strategic tool to improve the breeding efficiency and turn off of cattle from the stations which would result in lower total grazing pressure and the ability to reduce stock numbers/grazing pressure in droughts.



Figure 13: Camel Pitter workshop © Rangelands NRM 2013

The De Grey group trials included rotational grazing and deferred grazing, irrigated native tree trial for carbon offsets, bush tucker and seed nurseries for rehabilitation projects, along with weed management, managing land for conservation of threatened small native mammals, and conservation earth works. In addition, and following a workshop and property visits, the station managers analysed their properties and landscape function and identified critical parts of the landscape needing remedial work. The groups subsequently developed action plans to be implemented as further trials.

Are PAR groups capable of maintaining sustainability?

Groups are at different stages of independence – but still require support in terms of encouragement and this will likely affect the level of capacity to maintain sustainability. The idea of owning the project and being responsible for setting milestones, implementing governance, arrangements, and self-reporting is a new concept for many of the groups operating in the rangelands. As such, groups need to recognise the benefits of working together in terms of reaching sustainable outcomes. This can only be achieved through ongoing support by dedicated NRM facilitators who understand the principles of participatory action.

Are PAR groups confident to test innovation?

Pastoralists and groups have demonstrated a willingness to trial innovative ideas. An example has been seen in the Gascoyne Catchment Group where pastoralists undertook workshops and trials to train livestock (cattle) to eat alternative forages such as various abundant shrub species. It was thought that if cattle could change their grazing patterns to incorporate shrubs, then this would more effectively spread the grazing pressure across the landscape. The project complemented the works of CSIRO, the recipient of the Eureka Award for Sustainable Agriculture based on work undertaken by Dean Revell.

To what extent has the project been beneficial in encouraging engagement, leadership, and the transfer of knowledge and information?

The sustainable pastoralism program has been extremely beneficial in encouraging engagement, leadership, and transfer of knowledge and information. The Yalgoo Producers Group undertook an activity that was a catalyst for the engagement of 10 representatives of pastoral/industry groups across the region to visit their counterparts in Queensland for the purpose of hearing from groups undertaking similar trials in South West Queensland. The learning gained highlighted the importance of managing total grazing pressure and controlling the impact of wild dogs in the Southern Rangelands.



Figure 14: Pastoralists from WA rangelands in discussion with Charleville counterparts

A group moderator engaged group members and other groups across the Southern Rangelands in sharing knowledge and information gained from the study tour. This then resulted in the establishment of a two-day field event to be held in October 2013 which has attracted speakers from Queensland and their counterparts in NSW to talk about similar experiences as those of the rangelands pastoralists.

The study tour was a huge success and was yet a further catalyst for the development of a Southern Rangelands Leadership Group which is currently in the process of formation. It is proposed the leadership group will meet quarterly by teleconference and biannually in person. This group will liaise with their counterparts in Queensland and New South Wales and transfer information back to other groups. The outcome will be a strong leadership group that has a network of relationships vertically and horizontally across the Western Australian rangelands and burgeoning networks and relationships with interstate groups. It is proposed similar networks will be built with pastoralists in South Australia's Arid Lands. The leadership group will be a major mechanism for building holistic engagement, ensuring the development of regional leadership, and co-operative sharing of knowledge and information.

To what extent have pastoralists demonstrated an improvement in knowledge and skills?

The activities undertaken by pastoralists have been functional in terms of being readily adaptable while improving the level of awareness, knowledge and skills of pastoralists. This knowledge has been reinforced through the participatory nature of the exercises which offer participants 'hands on experiences'. A condition of funding for all action group learning projects was the transfer of knowledge and information within groups, between groups, and to the broader community. The findings of group activities, once completed, will be presented at group meetings, and reports will be provided for wider access via the Rangelands NRM website.

Improving skills

Knowledge is reinforced through participatory exercises which offer participants 'hands on experiences'

Examples of the improvement in skills can be seen in the Indigenous Environmental Management Planning projects undertaken. Two stations – Mt Wittenoom and Ullawarra – have been involved in environmental mapping and planning exercises; the first of their kind in the rangelands of Western Australia. Indigenous land managers, family members, staff, and neighbours have been involved in providing Indigenous local knowledge to assist ecologists, zoologists, and botanists in the flora and fauna mapping exercises. A cross pollination of information and knowledge took place over a period of three days. The processes exposed Indigenous pastoralists to environmental planning and provided them with interpretative maps of the existing geomorphology, flora, and fauna found on their stations. The entire mapping process was a capacity building exercise for the participants, exposing them to different ways to consider their business and the state of their natural resources. This has been extremely useful for highlighting where NRM activities need to be undertaken to address soil condition.

How successful has the project been in engaging Indigenous pastoralists/communities in NRM activities?

The project has been very successful in engaging Indigenous pastoralists/communities in NRM activities. The Indigenous environmental management plans at Mt Wittenoom and Ullawarra, and an Indigenous ESRM at Peedamulla Station have provided a strong level of Indigenous engagement. The initial Indigenous environmental planning concept envisioned that up to seven Aboriginal owned/managed pastoral properties in the southern rangelands would undertake a project, within their own boundaries, to address NRM. The Indigenous NRM Projects Facilitator at Rangelands NRM worked closely with the DAFWA Indigenous Landholders Services officer prior to the commencement of this project. Through this relationship it became clear that only 2-3 properties should be included and that others could learn from them. Any pastoralists interested could then seek similar project support. To ensure a broader outcome it was decided to include the participating station's neighbours to add value. The three currently involved stations were identified as the most prepared and likely to implement change.

Each station is operated by families who are highly regarded by peers and, more importantly, their neighbouring pastoralists. Geography and great distances meant that each family/group have differing relationships. An issue raised early in the implementation was the lack of or currency of good property plans for each of the stations. Ensuring that a sustainable, forward-looking plan was in place then became the key objective with on-ground implementation a secondary consideration. The participating Indigenous pastoralists have demonstrated their keenness and

commitment to this project, especially undertaking on-ground activities to pass on their learning. They are very keen to see their neighbours also benefit from supporting this project to ensure a broader outcome.

To what extent have land management practices changed in the Kimberley as a result of project activities?

There were four major project and workshop programs supported in the Kimberley.

Erosion Control Workshop

Soil erosion is a serious issue on many Kimberley pastoral leases and poorly constructed and/or maintained roads, tracks, firebreaks and fences (RTFF) are often a major contributing factor. Soil erosion reduces ecological function and flow-on effects can include increased sediment loads in adjacent rivers and streams, leading to a decline in river health. In addition, soil loss has serious implications for a pastoral business as the majority of nutrients are stored within the top few centimetres of soil and any loss of soil results in a decline in range condition and a decrease in production potential. As RTFF are usually devoid of vegetation and lie below the natural ground level they often intensify channelling and thus exacerbate the problem. The most effective way to combat RTFF influenced erosion is to properly plan and maintain infrastructure. A series of erosion control workshops were conducted across the Fitzroy River Catchment to inform and educate land managers representing nearly 2.5 million hectares.



Figure 15: Erosion control workshop © Rangelands NRM 2011

During the workshop, attendees learnt how to construct a diversion bank on the contour in order to reinstate the natural flow direction and prevent problems caused by channelling water. One of the findings of the process was identification that washout is the result of erosion not the cause and work needs to be done further up the hill to address the problem. Evaluation of the workshops identified that, for 87 per cent of respondents, the information was highly or very highly relevant to improve their erosion management practices. Additional feedback received during the workshop identified that although a property had installed diversion banks following a similar course in 2007,

these had not been maintained or used properly and so it is unlikely that the concept has been adopted on other parts of the property. This suggests that it takes time to introduce an idea and people may need to see the method a couple of times before routinely implementing the practice. This was consistent with comments made in the evaluation about the benefits of ensuring refresher programs are put in place. (PJ09514-2)

Water Ponding and Fencing

Pastoral land managers within the Fitzroy River catchment region have also trialled the use of techniques to reduce run-off and erosion, and encourage regeneration on land that became degraded through overgrazing in the early 1970s. The trials have included water ponding and fencing.

The results of early water ponding trials identified that the effectiveness of the installation of ponds is affected by both the slope of the land and the hardness of the ground. Whilst the initial ponding trial was of limited success in respect of the number of ponding banks created and identification of the most cost effective method of clay pan regeneration for the area, the work improved the knowledge and skills of the pastoralists involved in the trial and pastoralists who attended field day events at the sites. The visual results from the demonstration sites assisted engagement, created interest amongst other land managers, and encouraged other trials. It is too early to ascertain the extent to which the investments in ponding have increased productivity but monitoring sites have shown that increased ground cover is present and this is protecting the soil from erosion and reducing sediment load into the waterways. (PJ09516, PJ09509-3)

"The first year we got about 25 per cent vegetation coverage but this year it's up to about 50 per cent. The grasses are starting to grow now... If I see a degraded area now I want to pond it. The more I look, the more I see and want to fix."^{xxix}

Following this initial work, interstate collaborations and previous learnings were used to improve soil conservation within the Christmas Creek catchment area in the Kimberley. Pastoralists across three neighbouring properties have developed and implemented co-ordinated workplans to regenerate claypan country and surroundings areas through education, ponding, fencing, and improved grazing management. This was effectively achieved through access to equipment and expertise from the Central West Catchment Management Authority in NSW.

Evaluation of monitoring sites has shown both visual and measured improvements in ground cover and species diversity at all sites. Although results differed greatly from site to site, the treatment was assessed as successful over a variety of soil types even with lower than average rainfall. No change was observed at control sites during the same period. The results should be viewed with caution, however, as data has only been collected over one wet season. Results to date indicate that the combination of mechanical regeneration, fencing, and grazing management activities have the potential to:

- reduce wind erosion;
- enhance production levels;
- increase infiltration rates; and
- increase ground cover.

In addition to the on-ground success, the project resulted in improved understanding of clay pan country regeneration amongst both the three pastoralists and eight other land managers who took part in field day activities. The benefits of collaborative management between neighbouring

properties far exceeded the economies of scale that were obtained through sharing costs. (PJ09517-1)

Fencing trials have provided exclusion zones for key management areas around waterways. The introduction of new watering points, several kilometres from the exclusion zone has enabled grazing pressure to be spread across the area and will potentially allow for even greater control of grazing pressure through spelling. (PJ09514-1)

Grazing land Management Course

A Grazing Land Management (GLM) workshop was conducted to improve the knowledge, skills, and engagement of Kimberley pastoralists and provide strategies to assist with implementation of sustainable farm management practices that maximise beef production while delivering improved ecosystem services. The workshop was delivered to eight pastoralists who collectively manage approximately 1,200,000 ha of land and approximately 80,000 cattle. Topics covered in the workshop include understanding the grazing ecosystem, grazing management, ground cover management, fire management, weed management, pasture development, and property planning.

Grazing management plans were developed at the end of the workshop to address existing issues such as persistent over-grazing of key areas and under-utilisation of other pastures. These plans will be re-assessed at a follow-up day at the end of 2013 and the producers will be given the opportunity to share their progress with the others in the group. The sustainable farm management activities identified in these grazing management plans, for implementation by the end of 2013, included:

- spreading grazing pressure to address persistent over-grazing of key areas and under-utilisation of other pastures through the use of existing bore and water infrastructure and installation of new bore and dams;
- protection of the Logue River Catchment through reducing grazing pressure caused by feral cattle, implementation of wet season spelling, and development of an improved grazing plan;
- increasing control of grazing and spreading grazing pressure through fencing, installation of water infrastructure, changed pasture preparation over 140 ha for the following wet season, and incorporation of learnings from a current pasture improvement trial into grazing and production management plans; and
- reducing overall grazing pressure, spreading grazing pressure, and improving grazing and production management through animal husbandry, fencing, installation of water infrastructure, and use of forage budgets to improve grazing management for weaner paddocks.

Participants were also provided with a tool kit which included workshop notes, a technical manual, a number of property maps, weed identification guides, fire planning tools and forage budgeting and carrying capacity calculators. The workshop evaluation results indicated that all participants had gained new skills or knowledge in the areas of matching stock numbers to carrying capacity, the effect of GLM on financial outcomes and having tools to effectively plan GLM strategies. All but one participant also gained skills in assessment of land condition, the impact of grazing on future pasture productivity and management practices that impact on productivity. The key themes identified from responses by participants about how their grazing management would be altered as a result of the workshop centred on improving land condition through an increased understanding of effective land management, improving animal husbandry, and implementation of activities associated with better economic and business management. (PJ110802-1)

"I will now be able to look at the statistics of the carrying capacities with the numbers of cattle and determine how to manage paddocks in accordance to their land condition and in turn increase them while at the time increasing cattle's condition."xxx

Forage Budgeting

Land managers along the Eighty Mile Beach area have been provided with training on a grazing management system that incorporates a user-friendly database to allow them to manage assessment sites and maintain thorough monitoring records, including photos. This allows a comprehensive record over time to be built, that reflects the condition of their country and the impact of the management strategies. This allows producers to quickly and easily generate information that assists in management decision making and planning. For example, the forage budget calculator allows producers to enter the amount of pasture they have at the end of the growing season and the number of days until they expect the break-of- season. This then generates a report indicating how many cattle that particular paddock will sustainably carry for the dry season. This allows producers to take advantage of good seasons and plan for poor seasons. If the season has been poor and it is likely that feed will run out before the next wet, producers are able to make decisions early and adjust their management accordingly. (PJ09403)

How have the project strategies been effective in engaging land managers in NRM and biodiversity protection?

Fire management

Unplanned and extensive fires are costly. Wildfires destroy feed for cattle, reduce pasture quality, and damage fences and other infrastructure, as well as affecting biodiversity. As a result of co-ordination by Australian Wildlife Conservancy, land managers in the North Kimberley have worked closely together to develop property burn plans with 13 properties and four indigenous communities that meet their needs, whilst addressing the needs of the neighbouring properties. This facilitation and plan development process has resulted in aerial work undertaken by EcoFire and on-ground control by property owners and managers around infrastructure and other key assets. This combined effort has achieved a strategic mix of firebreaks and areas where fuel loads have been reduced. Prior to the commencement of this work unplanned fires would have caused widespread damage. The result of the activities is that now the extent of wildfires within the project area has been reduced to 22 per cent from approximately 95 per cent seen before the work was commissioned. PJ110501

Fire management

The extent of wildfires within the project area has been reduced to 22% from approximately 95%

Additional work was also undertaken to analyse data collected from surveys undertaken to identify species richness and abundance of small mammals, reptiles, and birds. These were carried out over four properties in the central Kimberley across a period of 10 years (2004 to 2013 inclusive). The surveys were designed to tease apart the single and combined effects on fauna of grazing by introduced herbivores and fire patterns. The key results from the analysis support the findings from the EcoFire project:

- reptile richness and abundance increases as fire frequency and intensity decreases;

- small mammal richness and abundance increases as fire frequency and intensity decreases, but only when the impacts of introduced herbivores are simultaneously managed; and
- bird communities are broadly resilient to changes in fire pattern, but a small number of species with specific habitat requirements are negatively impacted by increased fire frequency and extent.

These results have important implications for fire management across northern Australia, as much of this work is not concurrently undertaken with herbivore management, meaning that much of the investment in fire management may be ineffective for biodiversity conservation. (PJ110502)



Figure 16: EcoFire discussions © R Kingswood 2009

The EcoFire data set was also used for further analysis to examine the consequences of prescribed burning on pasture availability and carrying capacities of pastoral properties in northern Australia. The impact of seasonality and extent of fire induced losses in carrying capacity and the likelihood of properties experiencing catastrophic losses was modelled using theoretical carrying capacities of land systems and fire scar imagery from 2004 to 2011. This showed that over the five years the EcoFire program has been in place there has been a progressive reduction in the loss of carrying capacity caused by burning of pasture, and shifted the season that carrying capacity is lost to fire from predominantly late to early dry season. Most notably, the established program has reduced the probability of experiencing catastrophic loss (defined here as greater than 50 per cent of carrying capacity removed due to fire) from 18 incidences to three incidences within three-year periods.

These outcomes have the potential to deliver economic benefits to pastoralists via increased carrying capacity and by improvements in pasture quality, provided stocking rates are managed carefully. (PJ110503)

Invasive species management

The environmental damage caused by large feral herbivores in the rangelands is significant. When conditions are dry, these animals increase grazing pressure on country that affects the viability of pastoral enterprises, by decreasing vegetation for domestic stock. Their heavy foot traffic has also been the cause of damage to cultural landmarks and Aboriginal sites and pastoral infrastructure (fences, stock watering points). They also foul drainage lines and waterholes with impacts on the native plants and animals dependent on these sources of water. In order to address this, targeted on-ground control of large feral herbivores, mainly donkeys, across Yandeyarra Aboriginal reserve (495,000 ha) and Mallina station (293,000 ha) was undertaken in order to help prevent the spread of invasive species in the Yule River and Sherlock River catchments in the western Pilbara.

An aerial survey was undertaken across 1.26 million hectares. This process incorporated implementation of consistent data recording systems across the entire Pilbara Judas Donkey program area, including tracklogs of survey areas, waypoints of established collars and their movement across time, and the location of ad-hoc feral herbivores controlled during tracking runs. The grid surveillance and mapping activities resulted in identification of any areas likely to be infested by donkeys and gaps in the survey areas which will require follow-up surveillance in subsequent programs. The survey also allowed for monitoring of the numbers of other ferals on the Yandeyarra Aboriginal Reserve, which will allow for ongoing consultation with the community to remove these pressures from the environment in the future.

Through increasing the number of radio telemetry collars on 'Judas' donkeys the project has also provided an even distribution across the region – at the recommended saturation distance of 15 km apart. This should attract any satellite herds or individuals for removal during future tracking runs over the next five years.

One of the key outcomes of the work has been the re-engagement of the Yandeyarra community in the donkey telemetry program. The project has also offered the opportunity to engage with the Yandeyarra community more broadly in terms of feral herbivore control, namely targeted removal of feral camels and horses. This aims to improve the overall biodiversity of the reserve and protect the Indigenous heritage of the area. (PJ110812)

Community skills knowledge and engagement

Develop partnerships with Indigenous communities to increase short-term engagement in natural resource management

Activities have been undertaken to engage Indigenous communities within the WA rangelands to protect and manage the natural landscape, biodiversity, and cultural values of their country. This has been achieved through engagement of Indigenous land managers, building skills and employment of community members and ranger teams (Table 11).

Across BMT 1, 2, and 3 and competitive grant projects, contributions have been made to this target through achievements within the Kimberley, Pilbara, and Western Desert.

- Implementation of the Coastal Country Plan and Ngurrawaana reserve (water lease) plan, through engagement of Yindjibarndi traditional owners and Ngurrawaana members in partnership with Pilbara Native Title Service.
- Establishment of programs with resident and non-resident traditional owners of Martu land and the Pilbara to engage the communities in work on-country.
- NRM work plans developed for three Indigenous ranger groups (Bardi-Jawi, Nyul Nyul, and Karajarri).
- Implementation of two Indigenous NRM projects in the Fitzroy River catchment to deliver on-ground works in WoNS control.
- Establishment of a female Indigenous Fitzroy River ranger group through the participating Community Development Employment Project programs (e.g. Gooniyandi, Bunuba).
- Implementation of appropriate traditional burning regimes, WoNS management, and recording of traditional ecological knowledge (Table 12).

A 'showcase' or collation of articles written about some of these activities is available at http://webadmin.communitycreative.com.au/uploads/rangelands/publications/showcase_indigenous_V1.pdf

Table 11: Activities undertaken to develop partnerships with indigenous communities and increase short-term engagement in NRM

Projects contributing to this target:	Project ID
Ngurrawaana Rangers – Stage 2 *	PJ09203
WD – Kaluyku Ninti-Puntuku Ngurra Limited	PJ09301
WD – Central Desert	PJ09302
WD – Project Management	PJ09303
WD – Martu Lands DEC *	PJ09304
West Kimberley Nature Project Stages 1 and 2 *	PJ09401, PJ110401
Roebuck Bay community engagement and protection Ramsar values *	PJ09402, PJ110402
Dampierland Indigenous Ranger Fee for Service	PJ09404
EcoFire Stages 4 &5, 6 &7 *	PJ09501, PJ110501
Fire management at Christmas Creek sub catchment	PJ09504
Gooniyandi wetlands and river places	PJ09505
Integrating land and fire management for the Majala Wilderness Centre	PJ09508
Nyikina Mangala River Stories No. 2	PJ09515
Community Engagement and Awareness Raising in the Fitzroy Crossing catchment	PJ09516
Christmas Creek Rangelands Regeneration	PJ09517
Yindjibarndi Cultural Heritage and Conservation Co-ordination	PJ110204
Managing Parkinsonia on the Fortescue by Ngurrawaana Rangers *	PJ110205
Keeping Desert Country Healthy *	PJ110302
Western Desert – CDNTS *	PJ110303
Western Desert – KJ *	PJ110304
Western Desert – DEC*	PJ110305
Recovery of biodiversity on Jundee – women's ranger group *	PJ110814
Red Dirt *	PJ110301, PJ111201
Increasing skills for Aboriginal Rangers to protect Kimberley Rock Wallabies *	PJ110405
Rangelands Regional fire Forum *	PJ110504
CDNTS Desert Fire Project *	PJ111202
KJ Desert Fire Project *	PJ111203
DEC Desert Fire Project *	PJ111204
CSIRO Fire Project *	PJ111205
Rubber Vine eradication on the lower Fitzroy River Stage 1 *	PJ111401
Total funding: \$1,206,773 #	
# funding for program administration, project management, communications, and MERI is external to the funding noted	
* Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Table 12: Summary of contributions to develop partnerships with Indigenous communities

Approved objectives (Indigenous groups/projects)	Actual quantity achieved			
	BMT1	BMT2	BMT3	Comp grants
Partnerships with Indigenous communities to deliver activities	5 communities			
Indigenous land manager participation in short term engagement in NRM	5 land managers			
Partnership with traditional owner groups, Indigenous rangers and Indigenous community members to integrate traditional ecological knowledge with on-ground NRM works			16 projects	
Indigenous participation				5 projects
TOTAL: Contributions of 5 Indigenous communities, 5 land managers, and 21 projects have been made to increasing partnerships with indigenous groups through Rangelands NRM projects funded under CfOC since 2009				

A map of the works undertaken (Figure 17) reveals the significant extent of engagement with Indigenous communities across the WA rangelands region. Due to the presence of culturally sensitive material in relation to actual locations of endangered species and water holes within the desert, project areas are represented by Native Title Determination borders rather than actual sites worked on.

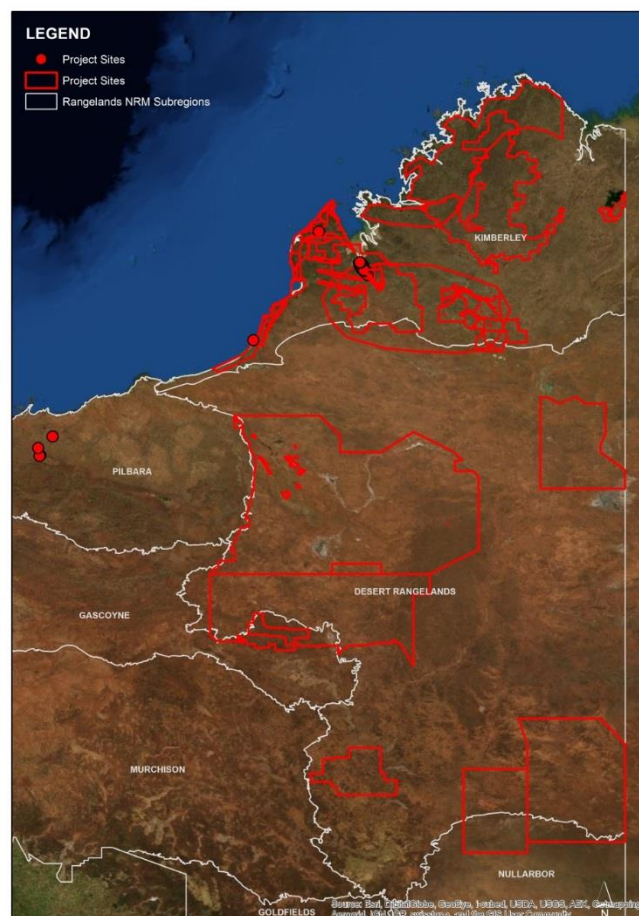


Figure 17: Map identifying the locations of activities where partnerships have been developed with Indigenous communities

An evaluation of the activities focussed on the following evaluation questions.

To what extent have the project engagement processes been successful in developing partnerships with the Indigenous groups in the Western Desert?

Engagement levels with traditional owner groups within the Western Desert regions have been very successful. Over the course of the work, the program has extended from Jigalong and Wiluna to also include Parnngurr and Punmu communities. There has also been some intermittent field work done with the Kunawarritji Community, located near well 33 on the Canning Stock Route (about 11 hours' drive from Newman). Engagement has also been possible with four additional Indigenous communities. In particular, Pila Nguru (who look after Spinifex country and the neighbouring Pilki group) have increasingly become involved in the project as they have obtained additional resources through the Biodiversity Fund. The two other groups – Ngurrupa and Yilka – are increasingly engaged however both have complex issues that make high levels of engagement and delivery of significant on-ground activities difficult. These issues include remoteness, lack of community capacity, and the absence of old people with good traditional ecological knowledge. (PJ110301)

An increasing capacity of Birriliburu people to collaborate with science-based organisations across government (DPaW), private (Bush Heritage), and volunteer (Desert Discovery) sectors has been observed. There has been a corresponding increasing sophistication of rangers' NRM skills and contributions to scientific activity, and an increased confidence of TOs and young rangers to work together to manage country. Of particular note is the declaration of Birriliburu as an Indigenous Protected Area. This has included the protection of significant habitat and taxa first identified through the Bioregional NRM in the Desert Rangelands project. These areas will be protected under the International Union for Conservation of Nature Protected Areas Category III.

Capacity building

An increasing capacity of Birriliburu people to collaborate with science based organisations has been observed.

A key achievement of the project has been the ability to incorporate groups with different levels of engagement and experience in land management in order to initiate tailored work programs with each of them. This has resulted in facilitated consultation with the groups about their hopes for their country and identified the levels of knowledge and enthusiasm among the communities for such work. (PJ110301 to PJ110305)

Until 2012 the Wiluna Martu ranger team had engaged men only and increasingly, Martu women based in Wiluna had requested an opportunity to be employed on land management projects. A project was put in place to facilitate the development of a women's ranger team, making it the first Wiluna land management project to directly engage Martu women. Having a dedicated women's project allowed work activities to be tailored to suit the practical and cultural responsibilities of women. This included being able to take their children on work trips as well as doing work more culturally appropriate to women rather than simply replicating the work undertaken by the men's team. The project was successful with the appointment of a female ranger co-ordinator having an immediate effect on the engagement of women in planning the work program and undertaking activities on the pastoral lease.

An unexpected outcome was that the monitoring data collected by the women's ranger team informed the work of the male ranger team working concurrently at Jundee. The Martu women have surveyed biodiversity hot spots and forwarded data about the health of certain threatened species populations and the presence of feral animals to the male team. This has resulted in an ability for the male ranger team to better target their interventions. For instance, fire management zones have been created to specially protect the survey reference and biodiversity hotspots on the lease. Baseline data from the women's fauna monitoring is also being used to inform a targeted pest management strategy to be put in place by the male team.

The project has also been effective in intergenerational transfer of knowledge. Much of the information sharing has been facilitated through camping on country and speaking about country in language. Martu words for the environment contain a complexity of information and the younger generation have benefitted from learning about the environment through the use of language. (PJ110814)

Evidence of the level of engagement of the traditional owners in contemporary NRM activities is seen in almost 1,600 days effort on on-ground activities by Martu. The high level of engagement is also demonstrated through the opportunities taken by Prescribed Body Corporate, and other related organisations, to leverage other funds to undertake additional works. This also reflects the high levels of interest of the TOs in looking after country and obtaining culturally appropriate employment opportunities.



Figure 18: Western Desert Rangers © Central Desert Native Title Service 2012

To what extent have the Indigenous Rangers contributed to alleviating the fire/weed threat to assets (TEC, wetlands, eucalypt woodland habitat) on the Dampier Peninsular/Fitzroy Catchment?

Traditional owners and ranger groups have been involved in activities to protect country and support culturally appropriate natural resource management across many of the targets already discussed in this report. Activities were developed and delivered utilising a fully participatory process, whereby draft project proposals for all on-ground works were developed after a series of

site visits and planning workshops with the relevant rangers. These drafts were circulated amongst communities for feedback and then formally presented to the TOs through Prescribed Body Corporates, Native Title working groups, and Traditional Lands Associations. Following endorsement of the proposals, fee-for-service contracts were developed for the rangers to implement the plans.

The success of this approach has resulted in Bardi Jawi, Bardi Jawi Oorany and Nyul Nyul rangers working to identify the most vulnerable Monsoon Vine Thickets on the Dampier Peninsula and developing work plans to integrate proactive early season 'cool' burns and weed control in order to help conserve them. Monitoring of both vegetation and invertebrates – mainly ants – has also been completed through development of a science-based monitoring tool. This, together with analysis of the fire scar history between 1989 and 2010 and its relationship to vegetation change, has led to rangers assimilating scientific understanding about the changes occurring with their traditional and practical on-ground knowledge.

Karajarri rangers and traditional owners developed a project plan and delivered on-ground activities for weed control, feral animal control (cat, foxes, and dogs), and monitoring and management of natural and cultural heritage. The Karajarri Coastal Country Management Plan (2010) identified cultural values and ecological values that need to be protected including:

- cultural and heritage sites;
- old law grounds;
- Pukarikarra (dreamtime) and Pulany sites;
- bush tucker;
- massacre and burial sites;
- middens;
- riji (pearl shell) collection and pearl shell breeding sites;
- fishing sites and marine species; and
- water sites, natural springs, and the wildlife they support.

As a result seven interpretive signs were installed in the Eighty Mile Beach region (Figure 19). These signs focus on 'Nganyjurrukura ngurra tukujana' – everybody looking after country properly – with directions for tourists and local users on how to protect these special places. (PJ110401, PJ09401)



Figure 19: One of the interpretive signs installed in the Eighty-Mile Beach region

Protection of important sites has also been completed in the Nyikina Mangala Claim Area in the Kimberley. Planning for environmental management work was prioritised across seven sites by rangers, cultural advisors, and children. This identified a diverse range of cultural heritage including sites containing rock art, threatened species, and those rich with cultural knowledge and stories. (PJ09515)

Work has also been undertaken with:

- Yawuru, the Native Title holders of Broome to undertake monitoring and management activities on Roebuck Bay;
- the Djarindjin Bardi Jawi Women's ranger group;
- the Goolarabooloo people at Mojal, who undertook work on an isolated outbreak of Lantana in the area;
- the Yawuru people to implement ground water monitoring and planning;
- Wunggurr rangers to control WoNS within the JoonJoo botanical reserve;
- Bardi Jawi rangers to develop the Chile Creek and Kooljamon management plans;
- Yimadoowarra rangers (Nyikina Mangala) for weed identify and reporting; and
- Nyul Nyul rangers at Middle Lagoon and Gubin on Beagle Bay.

Close liaison between on-ground working teams and Indigenous ranger teams in weed eradication activities has resulted in communication about important cultural issues. This led to increased awareness of law sites within search zones that could only be cleared by those within the ranger group who had the right to enter and cultural events that required rescheduling of aerial searches in order to avoid specific areas at particular times. (PJ111401)

The work undertaken to control Rubber Vine in the west Kimberley region has resulted in the Indigenous rangers gaining sufficient skills, knowledge, confidence, and capacity to investigate setting up a weed control business that will be available for contract work. This concept is in its infancy stages but has provided the traditional owners with opportunities not previously understood. (PJ110700)

"Yeh, it's a hard job, at the moment, but the encouragement is there. Kelvin is going to start his own business, hoping to employ a lot more local fellas, and will give them a real incentive. ...It's just us three at the moment, and we're hoping to expand from there... It was just a job to start off with, now it's going to be a career opportunity..." xxxi

What other ways has the engagement process with Traditional Owners been strengthened?

Engagement processes across the rangelands have been further fostered through identification and management of gaps in knowledge for both TOs and non-Indigenous team members. Across all activities information and training has been provided to traditional owners in:

- weed identification and eradication techniques including chemical certificate training with TAFE;
- the impact of feral animals, particularly cats and foxes, on small and medium fauna;
- feral animal control, including trapping techniques and 1080 pest animal bait training;
- MapInfo, Cybertracker, and GPS use;
- basic wildfire awareness, and fire management including aerial burn practices;
- Aerial Observers Training for targeted rangers;
- Fire Fighter Level 2 for ranger co-ordinators; and

- attendance at program planning meetings, regional planning meetings, and attendance at key events such as representation by Martu and Biriliburu traditional owners at the National Indigenous Land and Sea Management Conference in Broken Hill in November 2010 and Ngurrawaana rangers attending the Kimberley Rangers Forum and Kimberley ranger groups co-presenting at conferences in Perth and Melbourne.

The work undertaken identified that NRM outcomes are more successful in the Western Desert when activities with these communities acknowledge traditional management methods. This is due to the reliance on Martu knowledge, participation, support, access to country, political legitimacy, and knowledge of certain habitat preferences and their location.

Engagement

NRM outcomes are more successful in the Western Desert when activities acknowledge traditional management methods

What lessons have been learnt from the engagement process with traditional owners?

Interviews were held with stakeholders involved in Rangelands NRM projects to identify key issues that need to be understood and managed in order for successful outcomes when working with TOs and Indigenous communities on NRM projects. Knowledge and understanding gained by each of the interviewees, over the course of their project work, was reviewed and consolidated in an effort to identify learnings that can be used to inform all new Rangelands NRM activities that seek to engage Indigenous communities.

Community engagement

It is very important to create programs based on what communities want by effectively matching funder targets and community needs. To be successful projects should be collaborative in spirit from the outset with all activities operating under a culture of 'doing it together'. This needs to be manifested in consistent and continued acknowledgement of partnerships, individuals, and common goals.

Successful engagement of a new Indigenous group requires initial concept discussions with key stakeholders in the Indigenous Prescribed Body Corporate in order to gain early understanding and acceptance. Endorsement of the community should be sought and results of the discussion consistently taken back to the community. Clarity of purpose and values, and common goals and agendas, are vital if successful, positive outcomes are to be achieved. These consultation and engagement processes can, however, take considerable time. Finding and involving a community based 'champion' can be beneficial so that partners can learn and work together, with awareness and motivation continually increased. Each community has different ways of working and it is vital to understand and respect the differing cultural components between groups and to know the language nuances of each group, particularly in relation to community values. Wherever possible, ensure information is gathered in the group's first language; however care should be taken with interpretation and use of an interpreting service may be necessary.

Ensure that individual and personal relationships are put in place and maintained. These relationships can be enhanced through regular information sharing and consistency in both communication and interaction. On-ground decision making by co-ordinators may need to be confirmed by senior personnel in the partnership particularly if communication is not good.

Key connections between people such as which country they are from and who are their relationships with other community members should be acknowledged. Gatekeepers, however, may limit access to key relationships. The ability to maintain contact between the project team and the community will impact on the success of planned community engagement activities. This is exacerbated when large distances exist between the locations of the project team and communities involved. This affects planning processes and impacts on the success of visits to the community, particularly when cultural events take priority.

Project Planning

Planning for NRM projects needs to take into account that land management activities on Aboriginal land must focus equally on social engagement, well-being, and land management. It is necessary to recognise the need for both land management targets and engagement/social outcomes, and the differing processes needed to achieve these. It is also important to understand previous activities, the effectiveness of the processes implemented and ways to link in to the previous work. Business timeframes won't necessarily match those of the community and patience is required to ensure effectiveness. It can take a significant amount of time for planning to be put into effect.

Negotiations about working in partnership need to be undertaken during the initial phase of the project and then updated on an ongoing basis. This includes ensuring that contractual agreements are in place that acknowledge 'good faith' relationships and that ownership is shared. The partnership must be endorsed and valued. Consistency in key personnel is important. Consideration should also be given to how involvement with Native Title litigation issues can affect access and engagement of partners.

The partners and partnership need to develop together and this requires commitment and continuity. Processes should be implemented to guarantee joint development of plans and ensure intellectual property is vested with the group or partnership (other than TEK, which always remains with the community).

The program and ultimate outcomes should be built in a stepped approach. Trust built in earlier projects is consolidated when continuing in the spirit of working together. It is necessary to obtain sign off by all relevant stakeholders if trust is to be maintained. This can mean that progress can be delayed but full and accepted agreement is vital in order to maintain engagements.

Cultural values can impact on work readiness and this will result in delays to the execution of activities. This is exacerbated when engagement levels are variable. This needs to be factored into allocated time frames and budgets, particularly when distance is involved. Including an Indigenous member on the project team can assist the team to have a good understanding of cultural respect. A lack of cultural understanding and traditional knowledge can impact on the ability to engage successfully with community members. Cultural awareness training should also be provided to all members of a new project team. Mentoring for key personnel can also be of benefit. Implementation of connections to other Indigenous work can offset mentoring, if this is not available or appropriate.

Cultural considerations

Cultural protocols need to be fully understood in order for a project to succeed. For example, it is not appropriate to access the community without first determining who speaks for the country and respecting boundaries such as cultural law areas. Care should be taken to identify the potential for gratuitous concurrence – a widely recognised cultural tendency whereby Aboriginal English

speakers often agree to a question even if they do not understand it, in order to be obliging and socially amenable.^{xxxii}

Working with on-ground teams

Different approaches are needed with different genders especially if the project manager is of a different gender to the on-ground team. The ability of the project manager to discuss important issues with members of community can be hindered when opposite genders are involved. If a project manager is working with a ranger group of the opposite gender it is necessary to have a good relationship with the marital/relational partners within the community in order to negate any potential jealousies. Care should also be taken in such situations to ensure that the project manager is not placed in situations of being alone with one member of the team.

The levels of motivation and desire to manage the environment through a traditional approach can differ between male and female teams. Appropriate remuneration for a team is critical. Where appropriate, fee for service arrangements should be utilised in order to place value on the services provided. A key consideration of men's and women's 'work' is to maintain awareness and accommodation of where different genders can't go and ensure that such information is sought from appropriate community members with the relevant authority (the 'right' people).

An effective ranger team can be built through ensuring the following foundations are in place.

- A good governance structure from the steering committee, land council, or other arrangement.
- Teams understand their processes and who manages the different functions.
- A team mix of older people with cultural knowledge and respect and younger people who have motivation and enthusiasm and contemporary skills (IT, GPS etc.).
- A co-ordinator with appropriate skills is employed.
- Team members know how to work with partners but have confidence to be assertive enough to stand up for themselves – this necessitates having clarity of purpose and effective, equitable, contractual agreements.
- Pastoral care of team members is implemented through acknowledgements that life in communities is difficult. Issues should be worked through but team members need to remain accountable.
- Good representation of family groups is present within the team and members have good relationships with each other external to the team.
- Skills to operate in a professional environment are provided and expectations are matched to the team's capability.

Using/recording Indigenous traditional knowledge (TEK)

Aboriginal people have survived in the Australian landscape for thousands of years relying on their knowledge of the land and its plants and animals. In order to safeguard this knowledge it is important to learn and document these practices and insights. Integration of traditional ecological knowledge (TEK) with contemporary NRM practices, scientific understanding of best practice land management, and biodiversity conservation has been a key component of working with Indigenous communities (Table 13). This has allowed Indigenous people to protect and manage both the natural and cultural values of the landscape whilst offering important understanding to the way we manage the environment now and in the future.

Table 13: Activities undertaken to utilise or record Indigenous traditional knowledge

Projects contributing to this target:	Project ID
WD – Kalyuku Ninti-Puntuku Ngurra Limited *	PJ09301
WD – Central Desert *	PJ09302
WD – Project Management *	PJ09303
WD – Martu Lands DEC	PJ09304
West Kimberley Nature Project Stages 1 and 2 *	PJ09401, PJ110401
EcoFire Stages 4 &5, 6 &7 *	PJ09501, PJ110501
Fire management at Christmas Creek sub catchment *	PJ09504
Keeping Desert Country Healthy *	PJ110302
Western Desert – CDNTS *	PJ110303
Western Desert – KJ *	PJ110304
Western Desert – DEC *	PJ110305
Red Dirt *	PJ110301, PJ111201
CDNTS Desert Fire Project *	PJ111202
KJ Desert Fire Project *	PJ111203
DEC Desert Fire Project *	PJ111204
CSIRO Fire Project	PJ111205
Rangelands Regional fire Forum *	PJ110504
Total funding: \$295,727# # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Contributions have been made to this target through the collection, recording, and use of TEK, across BMT 1, 2, and 3 and competitive grants (Table 14).

Table 14: Summary of contributions to CfOC target – using and recording TEK

Approved objectives (partnerships)	Actual quantity achieved			
	BMT1	BMT2	BMT3	Comp grants
Partnerships and projects to support TEK and integrate scientific and traditional management	14 projects			
Partnership with six Aboriginal ranger groups to integrate traditional ecological knowledge with on-ground NRM works		13 projects	See previous section	
TOTAL: Contributions of 27 projects have been made to the use and recording of TEK through Rangelands NRM projects funded under CfOC since 2009				

A map of the works undertaken (Figure 20) reveals the extent of activities that have incorporated TEK into their work. Due to the presence of culturally sensitive material in relation to locations of endangered species and water holes within the desert, project areas are represented by Native Title Determination borders rather than actual sites worked on.

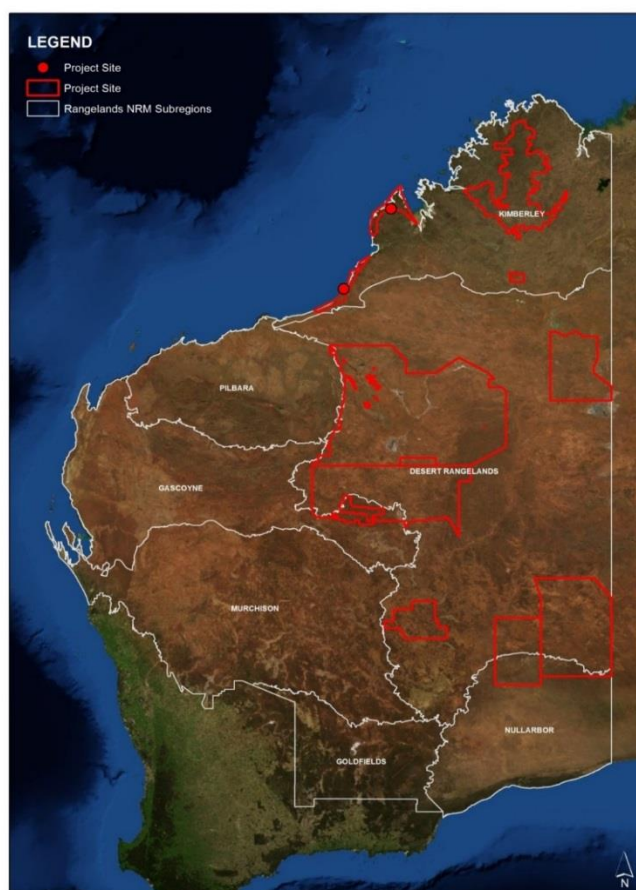


Figure 20: Map identifying the locations of activities using/recording TEK

An evaluation of the activities focussed on the following evaluation questions.

Western Desert

A regional fire management strategy has been developed to co-ordinate and support effective fire management in the Martu and Biriliburu native title determinations. Martu strongly associate fire with water and bush food production. Fire is not generally perceived by Martu as a destructive event, rather a part of a process of landscape renewal and maintenance. Martu hunting and foraging and its associated burning is an important cultural activity, and one of the prime sources of enjoyment for many desert community members. The ability to consistently hunt and forage in close and accessible proximity to these communities is important in maintaining and transferring traditional knowledge. The Regional Fire Management Strategy for the Western Desert region has recognised this and integrated both traditional and contemporary burning practices through the support of traditional hunting and foraging.

The continuation and extension of traditional hunting practices by Martu across the region is seen as a key component in this fire strategy. The strategy recognises that fire ideals in the Western Desert are based on Martu traditional practices and this gives landscape scale management a purpose in the minds of local people. Through this, the importance of the traditional hunting regime in fire management activities is reinforced and this encourages Martu to go hunting and foraging in zones around communities or main access tracks that they identify as traditional burning zones.

The planning processes aimed to use aerial and ground based burn programs to replicate traditional burn patterns, where possible. The plan recognises the need for older Martu to teach younger Martu traditional ways to create fire such as use of fire sticks; natural fire breaks; and knowledge of how fire interacts with different plants, and the benefits from dedicating certain burning operations to the use of TEK only. (PJ111203)

The Martu content for the regional fire plan includes a commissioned drawing series about fire practice illustrated by Edwina Booth; a Martu targeted 'Fire DVD'. This was developed from archival materials, some ethnography, Martu quotes, and researcher interpretations of practice and incorporated:

- Dreaming origins of fire;
- production of fire;
- domestic role of fire;
- uses and purposes of burning; and
- who can light fires to country, where, and when.

Martu hold a deep and sophisticated knowledge of fire and burning and only some of this will be reflected in the planning. Their concepts about fire are very different to science-based and European derived concepts about fire. Their experience is founded in practice-based planning and text-based planning for fire management is very new to Martu people. Yet fire is a subject of profound interest and relevance to their lives. In order to recognise this, the regional fire management strategy has placed a substantial emphasis on proper and equitable participation processes by Martu. (PJ111205)

Kimberley

Work to manage fire threats within the northern part of the Kimberley identified the impacts of unplanned, extensive fire on the Aboriginal communities and their values, including biodiversity. Their concern about the effects of the wildfires on livestock, pasture, infrastructure, cultural sites,

and country, particularly the native flora and fauna, was incorporated into the EcoFire management planning. (PJ110501)

"There is more fire now, right across the plains, hill, ranges, you know, we lose a lot of bush medicine, bush plants, some of the wildlife gets caught, you know like the mammals and all the trees that we know from before we don't see now because they all burnt down, our grass we don't get the grass medicine like the lemon grass anymore because of wildfire, bushfire, when someone light it at the wrong time of year – that fire can travel, travel all the way."^{xxxiii}

Traditional knowledge and practice was also used in the strategic development and implementation of a fire management plan for the Majala Wilderness Centre in the Kimberley. This integration resulted in research, development, and production of brochure and a film to capture and transfer the traditional knowledge of land and fire management practices from cultural elders and to share this knowledge with the wider community. (PJ09508)

To what extent have engagement processes with Traditional Owners led to successful collection and recording of Traditional Ecological Knowledge (TEK)?

Western Desert

As a result of the integration of both traditional and contemporary knowledge, engagement levels in the Western Desert sites have been high with Prescribed Body Corporate and other relevant organisations encouraged to leverage other funds to assist in exceeding targeted outputs. This also reflects the high levels of interest of the TOs in looking after country and obtaining culturally appropriate employment opportunities that these activities have provided.

Collection and use of TEK has been tailored to the level of engagement and period of involvement in order to increase effectiveness. On country trips for newly engaged groups focussed on demonstration activities where NRM activities were shown and discussed in context with traditional activities. Trips involving established groups focussed on explicitly integrating TEK and NRM in monitoring and environmental assessments. The implementation of fire management work around specific habitats also enabled focused discussions that combined TEK and contemporary NRM. Planning and training days were well attended and always incorporated discussion of TEK and contemporary NRM practices. Barriers to full engagement and delivery of significant on-ground activities using TEK were found to include remoteness, lack of community capacity, and the absence of old people with good traditional ecological knowledge. (PJ 09300, PJ110301, PJ111201)

Work with traditional owners in the desert rangelands has also identified that:

- implementation of methodologies to capture and record are important if the transfer of TEK is to be effective;
- planning to complete management/monitoring works at sites where TOs have the most experience/knowledge informs the quality and quantity of knowledge passed on;
- scheduling longer trips where more time is possible enables greater transfer of TEK;
- understanding the cross cultural meaning of different land systems is of particular value for transfer of knowledge. For example, paleo-drainage lines and laterite formations are sites of significant biodiversity but they are also associated with particular Tjukurrpa stories. Thus engaging TOs in the Tjukurrpa story also engages the TO in the biodiversity 'story'. (PJ110303)

Work has been undertaken to document Martu fire-related traditional knowledge and practice and support intergenerational transfer of this knowledge. This has resulted in increased Martu engagement in activities and affirmation and expansion of Martu burning practice. This process has also increased Martu confidence and capacity to engage with external people about burning and developed Martu inter-cultural skills including interpretation of remote-sensing imagery, public speaking, translating, and documentation. The work has facilitated intergenerational knowledge transfer related to burning but this has been limited compared to the level of need.

The use of this information to inform the Regional Fire Management Strategy has ensured that the strategy addressed:

- the Martu conceptual framework and world view fire and burning sits within;
- the knowledge and practices Martu elders want to transfer to younger Martu;
- what younger Martu want to learn;
- identification of methods of intergenerational knowledge transfer about fire;
- identification of burn knowledge and practices that are effective;
- ways in which Martu share/transfer/learn about fire now and in the past;
- ways to facilitate learning cycles from knowledge to practice; and
- what knowledge can be public, what needs to remain private and what is knowledge specific to men or women.

Indigenous capacity

Increases have been seen in Martu confidence and developed Martu inter-cultural skills including interpretation of remote-sensing imagery, public speaking, translating, and documentation

The key findings of this process have been outlined in a video produced for Martu titled *Waru, Kuka and Everything! Burning, Bushfoods and Biodiversity*. The key take away messages from this film (<http://www.rangelandswa.com.au/740/videos>) for non-Indigenous people are:

- Martu see fire as a living being that comes from the Jukurrpa¹ and their fire-related knowledge still deeply integrates Jukurrpa, People, Country and species production;
- fire ignition is by people for purposes of people but there is strong evidence that Martu see no direct human-agency to suppress, extinguish, or stop fires. Fire suppression by people can only be achieved from Jukurrpa-derived power through song and gesture;
- Martu residence on their country is vital to the maintenance of burn knowledge, practice and localised fine-scale burns;
- Martu families burn to hunt for immediate and short-term returns. Martu are aware of patch bush resource diversity benefits from burning but there is little and dubious ethnographic evidence that the creation of beta-diversity through patch mosaics is a deliberate strategy applied by Martu. This diversity was likely to be an inadvertent consequence of multiple human ignitions over space and time
- there have been extremely rapid changes in burn practice and knowledge over just three generations and this has led to fragmented, dislocated integration of both traditional and modern knowledge and practice; and

¹ The spelling of Jukurrpa and Tjukurrpa is different for different language groups

- Martu people view the current extensive hot wildfires as the largest fires they have seen in their lifetimes – “volcano” fires and something that has never before been experienced on country in Martu history. (PJ111205)

Kimberley

A fire management plan in the Fitzroy River catchment incorporated TEK in the identification of the ‘best time to burn’ and the use of fire for food gathering purposes. The findings identified that coastal and north Kimberley people burn throughout the dry but there were two key times. These related closely to wind direction – when south-east winds blew in the early dry and in the late dry when northerly winds were expected to bring rain. A comparison between scientific knowledge and TEK was also undertaken to measure the Indigenous women’s knowledge of flammability for different species of plants. Results indicated that the knowledge of the women was very refined with their ranking of plants according to how ‘strongly’ they burn and species vulnerability to intense burning regimes closely aligned. (PJ09504)

How successful has the project been in engaging younger TOs in learning about contemporary NRM, TEK and threatened species?

All on-country activities undertaken in the WA rangelands desert regions are informed by traditional ecological knowledge. The opportunities for transmission of knowledge between generations of traditional owners have been maximised with all trips on country and workshops including both elders and younger traditional owners. This has been achieved with three quarters of the days on country including both old and young people (Figure 21). The ability to effectively transfer TEK between generations is increased in longer trips where more time is available to pass on knowledge. The use of planning to ensure that management/monitoring works are completed at sites and times where TOs have the most experience/knowledge also increases the effectiveness and ensures the quality and quantity of knowledge passed on. (PJ110301)

The installation of traditional burning practices is effective conduit for the transfer of TEK between generations. Fire is a very active management tool and enables one of the strongest opportunities for transfer of TEK and collaboration between TEK and contemporary NRM. Fire is also an active management intervention which creates the opportunity for sharing knowledge and experience. The opportunities for transmission of knowledge between generations of traditional owners have been maximised with between 75 per cent and 100 per cent of trips and workshops conducted to date including elders and younger traditional owners. There is a limited window, however, for old people, with first-hand knowledge of traditional life, to continue to be involved in on-ground activities. (PJ111201 to PJ111205)

The days spent on country were generally demonstration activities where the NRM activities were shown and put in context with traditional activities. Monitoring work enabled direct management as well as focused discussions that brought together TEK and NRM practices. Planning and training days focussed on both TEK and contemporary NRM practices with discussion about how these can be explicitly combined in monitoring and environmental assessments. Fire management work around specific habitats also enabled focussed discussions that combine TEK and contemporary NRM. (PJ110301 to PJ110305)

Interviews with TOs highlighted the importance to them of the transfer of traditional knowledge.

"Sometime we take the old people for camping out, out in the bush. They learning us. Make them feel strong, keep the culture strong. ...'cause we listen them old people"^{xxxiv}

"So that when they grow up, when they have their own kids they can show their kids and other kids how to do the same thing and look after the country and all that and ...pass the knowledge."^{xxxv}



Figure 21: Martu women of varying ages undertaking assessments after traditional mosaic burning

Work has been completed to animate an illustrated book, originally written by Jimmy Pike, an Indigenous artist. Jimmy Pike, a Walmajarri man, grew up in the traditional way in the Great Sandy Desert of Western Australia. Although Jimmy left the desert when he was a boy, he never forgot his home country and how to live there, including how to use fire. Later in his life, Jimmy Pike went back to the desert and started burning the country again, the way he had learnt as a boy. His wife, Pat Lowe, asked him to tell stories and make drawings to show how his people used fire. She wrote down what Pike told her and the stories and drawings were published by Backroom Press in a small book, *The Art of Fire*. The book aimed to provide cross cultural communication for young rangers and school aged children about the benefits of traditional/mosaic burning regimes in desert country.

In order to help inter-generational transmission of traditional knowledge to Martu rangers and other Martu land managers about fire practices, *The Art of Fire* has been animated and a 26 minute DVD has been produced. The DVD is narrated in Manyjilyjarra language and will be distributed to Martu. The video is also available at <http://www.rangelandswa.com.au/740/videos>.

Additional film footage has been produced to chart continuity and change and challenges over 20 years of Martu caring for their country. The film uses old photographs and interviews to explain change in the social and ecological environments. The film can be viewed at <http://www.rangelandswa.com.au/740/videos>.

Interviews held with stakeholders involved in Rangelands NRM projects have also identified key issues that need to be understood and managed in order for successful outcomes when recording TEK.

- Some of the younger traditional owners (TOs) have a significant gap in knowledge. The community may have been away from country for a generation and the younger members do not have the traditional knowledge. Many elders also have a lower than expected level of knowledge.
- It should neither be assumed that communities hold traditional knowledge nor that traditional knowledge will automatically lead to an understanding of NRM concepts. It should also not be assumed that knowledge is passed between different groups. In some cases inter-group transfer is not appropriate.
- Communication documentation, such as media releases and publications, must always be undertaken jointly and cover what is of value to traditional owners. Where possible, direct quotes taken from the TOs should be included. It is also necessary to ensure all spellings and names are correct and obtain sign off by all relevant stakeholders if trust is to be maintained. This can mean that the deliverable may be late but accuracy is important in order to maintain relationships.
- Communities seek cultural based activities in order to maximise the transfer of knowledge and prefer interaction that involves demonstrations more than meetings.
- Care should be taken to find ways to encourage non-resident TOs to become involved when communities are no longer 'on country'.

Increase volunteer involvement in managing NRM

Within the WA rangelands the activities involving formalised volunteer participation have been limited to the protection of Roebuck Bay Ramsar site, Dampierland monsoon vine thicket communities, and coastal zone projects (Table 15). Informal participation, such as involvement in advisory committees, has not been identified.

Table 15: Activities undertaken to increase volunteer involvement in managing NRM

Projects contributing to this target:	Project ID
Roebuck Bay community engagement and protection of Ramsar values *	PJ09402, PJ110402
West Kimberley Nature Project *	PJ110401
Coastcare *	PJ110901
Kimberley Coastal Devolved grants *	PJ110902-1 to -3
Pilbara and Gascoyne Coastal Devolved Grants *	PJ110903-1 to -3
Pilbara Change Pastoral Practices	PJ111101
Total funding: \$0 # # funding for program administration, project management, communications, and MERI is external to the funding noted * Projects that sit across several targets have had the funding assigned to the target that the majority of activities align to or that the funding that the project was approved under	

Across BMT 1, 2, and 3 contributions have been made to this target through involvement of community volunteers – such as visitors, residents, Indigenous groups, and land managers – in the planning and implementation of projects (Table 16).

Table 16: Summary of contributions to CfOC target – increasing volunteer involvement in NRM

Approved objectives (volunteers)	Actual quantity achieved		
	BMT1	BMT2	BMT3
Support for community groups to assist with activities in a voluntary capacity	55 volunteers		417 volunteers
Engagement and capacity building of broader community		109 volunteers	
TOTAL: Contributions of 581 volunteers have been made to increasing volunteer involvement through Rangelands NRM projects funded under CfOC since 2009			

A map of the works undertaken around Broome is shown below (Figure 22).





Figure 23: Volunteers conducting seagrass monitoring © Max Lawton 2009

The working group has instigated a friendship drive through Facebook with practical tips on how to reduce land-based pollution such as fertilisers, sewage, treated wastewater, garden waste, swimming pool water, and other pollutants entering stormwater drains and feeding Lyngbya. This has resulted in a regular following of information posted on the social media site. Involvement in *Celebrate the Bay Day* and *NorthWest Expo* events has resulted in an increasing number of the community signing up to be a “Friend of Roebuck Bay”. (PJ09402, PJ110402, PJ110401)

Assistance has been provided to Conservation Volunteers Australia to lodge a CfOC Target Area Grants proposal for Cleaning WA Coastlines and Waterways. This will allow the volunteer group to assist the Shire with drain clean-ups during the dry season. A newly formed group, Keep Broome Clean, who undertake regular rubbish clean-ups, are also keen to help with removing rubbish from Broome's drains and Roebuck Bay's foreshore. (PJ110402)

Work has also been undertaken with Conservation Volunteers Australia to identify methods of increasing community volunteer numbers, engage the group for project activities, and commence initial stages of project development leading to grant applications with Coastwest and other funding opportunities. (PJ110901)

Local residents and visitors interested in helping look after the local environment have taken part in WA Clean Beach Day (Figure 24). This involved cleaning rubbish from Cable Beach in Broome. (PJ110901)



Figure 24: Children volunteering at Clean Beach Day © K Curran 2011

Volunteers within the Society for Kimberley Indigenous Plants and Animals participated in the trial survey for Gouldian Finches at Barred Creek. This resulted in further engagement of the wider community and involvement in the development of a booklet. Further involvement has been seen through Monsoon vine thicket survey and weeding activities undertaken by this group. (PJ110401)

Of the significant number of volunteers involved in coastcare activities, more than a third (37 per cent) were Indigenous. (PJ110900)

Rangelands NRM assisted the 'Care for Hedland' community volunteers to run a weeding weekend on Yarrie Station in the De Grey catchment. Also involved in the weekend work were some teenagers from Hedland involved in a 'Prevention and Diversion' programme of the Pilbara Regional Youth Services, Department of Corrective Services. Twenty volunteers targeted *Parkinsonia* along 4 km of the De Grey river bank near the station homestead. There were also some *Ricinus communis* (Castor oil plants) and *Calotropis procera* (Rubber bush) found during the weekend and destroyed.

The *Parkinsonia* was controlled by pruning plants back to the stump and then spraying the stump with Roundup. The pruned limbs were then used to pack erosion gullies using an approach based on Peter Andrews' system of Natural Sequence Farming. The *Parkinsonia* branches were used to control erosion through slowing the water, trapping sediment, and recreating the natural chain of pods in the landscape. This approach to using weeds is an example of turning a problem into a solution. The weekend exercise by the volunteers was the first example of Peter Andrews' approach put in to action in the Pilbara. Feedback indicated that the volunteers saw benefit in their involvement and want to be involved again next year. The young people involved were also enthusiastic workers and their program managers would like to make this sort field trip a regular event. (PJ111101)

Regional bodies supporting community groups in local projects and supporting access to knowledge and skills

Support for community group involvement in local projects is a key principle underpinning the operations of Rangelands NRM. This basic tenet is clearly outlined in the Strategic Plan 2012-2015 and has been communicated to all stakeholders within the region. Many of the previous sections of this report have outlined the key role skills enhancement activities have played in order to achieve sustainable on-ground outcomes. Educational workshops and skills based training activities have been conducted across all regions in an effort to maintain and improve landscape scale conservation (Table 17).

Table 17: Access to knowledge and skills provided

Approved objectives (workshops, groups, materials and participants)	Actual quantity achieved			
	BMT1	BMT2	BMT3	Comp Grants
Targeted NRM communications to partners and key stakeholders	267 individuals			
Priority projects funded through devolved grants	15 Devolved grants			
Stakeholder/community workshops			52 meetings, 1,676 participants	3 meetings, 26 participants
Educational workshops/ activities/trials/field days			26 meetings, 682 participants	3 meetings, 21 participants
Public / volunteer events			8 meetings, 1,100 participants	
Educational materials developed			3 materials, 625 recipients	
Community groups engaged (not counted elsewhere)		15 groups	23 groups	2 groups
TOTAL: Contributions of 92 events, 4,397 participants, 3 educational materials, 15 devolved grants, and 40 community groups have made up the activities undertaken to increase access to knowledge and skills via Rangelands NRM projects funded under CfOC since 2009				

To what extent has the community's knowledge and skills improved and resulted in better on ground outcomes?

Evaluation of the workshops and field days has identified that generally the workshops were successful and respondents felt that their attendance had been worthwhile and they were motivated to implement some of the techniques on their own properties. For many events the key benefits reported were the increased level of confidence and an enhanced desire to question the 'status quo', although there was occasionally a level of concern that the techniques presented should more fully take specific rangelands conditions into account.

Amongst the workshops evaluated there was general agreement that:

- the information provided was relevant to the work landowners were doing, or expect to do;
- they had learnt something that they could apply to their land management activities;

- their land management knowledge and skills had improved as a result of the information provided; and
- they were likely to implement the techniques presented on their properties.

Strategies that landowners reported that they were motivated to put into action following an educational session included:

- managing water flow, dispersion, and run-off and undertaking key repairs;
- reconsidering the overuse of fire;
- undertaking or continuing with planning for activities;
- comparing and sharing information with others in order to be more effective; and
- passing the information received onto other land holders.

The key barriers to implementation of the techniques demonstrated were noted as time, resources, and limited availability of markets. Respondents identified enablers as the introduction of small scale trials rather than bigger ones, with support to put the trials into place, and the availability of follow up education to reinforce the concepts.

Evaluation processes also identified that attendees learnt different things depending on their previous experiences and knowledge. In some instances the younger attendees, many of whom were staff members of the stations, seemed to get the most from an understanding of the basics e.g. stock handling methods affect animal behaviour, animal behaviour affects diet selection and performance. The most experienced pastoralists often gave the highest ratings on questionnaires. This would appear to indicate that a high level of previous understanding is required in order to gain the most from an event when complex concepts are presented.

The use of a field day format with demonstrations and participant involvement was deemed very beneficial to the level of learning achieved. Attendees noted that they benefitted from reinforcement of information received previously and reported that practical examples assist in deeper understanding, provide sufficient confidence to take the next step, and foster uptake of the 'call for action'. Frequently reported were the benefits gained from opportunities to come together with peers and learn from each other. Pastoralists are keen to continue to have field day based information and education sessions made available with a key focus given to land and animal management techniques and commercial up-skilling.

How effective have communication strategies been in engaging stakeholders?

A significant amount of work has been undertaken to engage with rangelands communities and stakeholders. A wide range of communication devices have been employed to raise awareness and understanding of NRM and the outcomes achieved and to maintain engagement. Both traditional and social media have been utilised to reach the widest possible audience.

The Rangelands NRM website (<http://www.rangelandswa.com.au>) was re-developed and re-launched in September 2012 in order to improve access to information about the WA rangelands and the work undertaken. To date, the website has had 9,520 unique visitors (Figure 25), 338,567 hits, and 79,710 pages viewed (October 2012 to June 2013 inclusive).

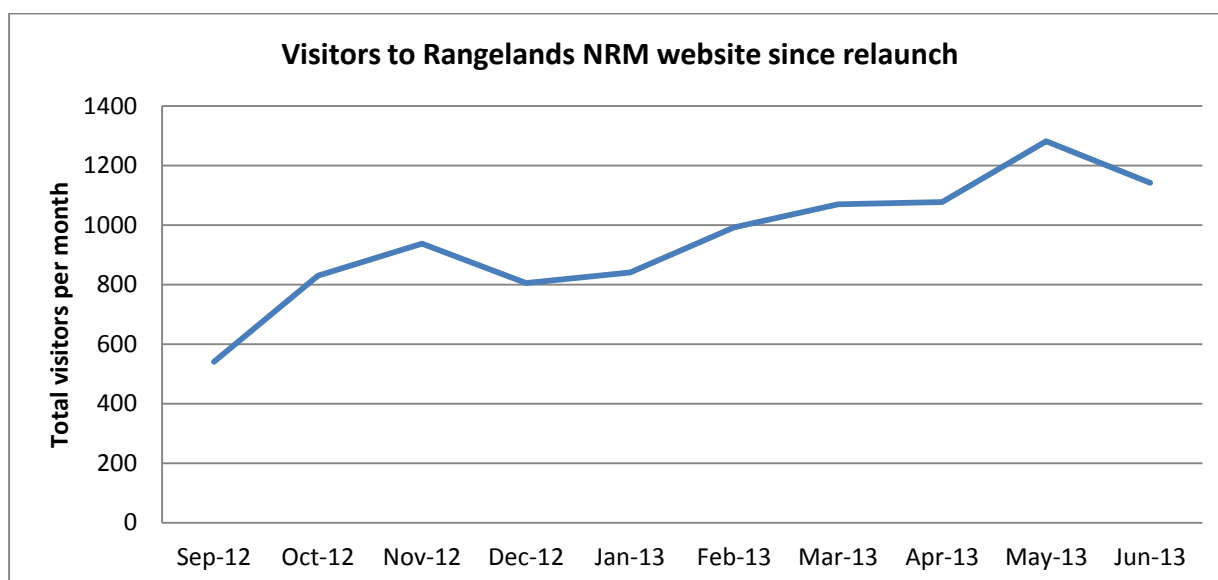


Figure 25: Number of unique visitors to Rangelands NRM website since relaunch in September 2012

Social media has also been introduced as a communication tool to enhance accessibility. Rangelands NRM has a Facebook page (www.rangelandswa.com.au/rangelandsnrm) that is used to share information and news with community members and groups, as well as the wider community and the media. Since commencement on 3 October 2012, the page has now been 'liked' by 86 individuals and 13 organisations. Facebook allows news to be shared in a social setting and encourages sharing of news, images, and feedback through comments. For example, the winning photographs from the School of the Air Photo Competition were posted on the Rangelands NRM Facebook site and encouraged more page 'likes' as parents were keen to view and share their child's photos amongst friends. A Twitter account is also used to reach stakeholders and maintain engagement (www.twitter.com/rangelandsnrm). Since commencement on 6th August, 2012 the account now has 179 followers and 138 tweets have been written. Generally, tweets relate to news from the eNews or event notifications as well as relevant NRM information and news. Tweets are automatically fed in the 'Twitter Feed' on the Rangelands NRM website, enabling regular updating of content on the homepage.

As a result of results of a survey about communication needs, a monthly eNews is produced and distributed electronically to over 1,000 subscribers – ranging from pastoralists, Aboriginal groups, environmental organisations, industry representatives, the media, politicians, and individuals from State and Commonwealth Government departments. The eNews features articles about projects, outcomes and events in the WA rangelands, under a series of regular subheadings:

- Latest News;
- Carbon and Climate Change;
- Pastoralism; Coastal;
- Indigenous;
- Desert Rangelands;
- Biodiversity;
- Other News;
- Staff Profile;
- Events; and
- Grants and Funding.

The eNews is received by a significant number of news outlets within the region (such as newspapers and Regional ABC radio) and stories are often 'picked up' by the media from this publication. Feedback received from recipients of the eNews distribution is encouraging.



The amalgamation of themed eNews stories has resulted in distribution of 'showcases'. To date these have been produced on indigenous and sustainable pastoralism projects. Other showcases are planned in the near future. The showcases were sent to key stakeholders in the State and Commonwealth Governments and are handed out at meetings, where relevant.

In May 2013, the Rangelands NRM magazine was launched – named 'The Rangelands Roundup'. This publication was produced to further showcase the projects that have been supported through Rangelands NRM. The publication is aimed at a general non-scientific audience. Five features appeared in the first edition together with one profile. The features covered the topics of

- RAMSAR wetlands;
- the Martu people;
- the envirorolls project;
- carbon farming; and
- EcoFire.

The magazine has been distributed to members of Rangelands NRM, Board members, key stakeholders in the State and Commonwealth Governments and distribution through satellite offices. Feedback so far has included:

"Have just received your complimentary newsletter – congratulations on a great publication."

**Susanne Dennings,
Project Co-ordinator,
Malleefowl Preservation Group Inc.**

Rangelands Roundup

Between July 2012 and June 2013, 13 media releases were distributed to media. Less news has been distributed in this manner more recently because the majority of media pickup is through the eNews articles. This is an unexpected outcome that has resulted in significant efficiencies whilst maintaining consistency of message. To date, 12 radio interviews and 25 newspaper articles are known to have mentioned Rangelands NRM.

In June 2013, a YouTube channel was created (www.youtube.com/rangelandsnrm). To date two videos have been uploaded that were produced to showcase outcomes of work funded through Rangelands NRM. The first, 'On Country in the desert rangelands' had 36 views in its first month of upload. The second, 'The Art of Fire – Animation', was uploaded in July. It had 41 views in its first month of upload. More videos are in planning or production; these range from short films on carbon sampling, weed control, sustainable pastoralism, and the ESRM process.

School of the Air Photo competition

A School of the Air Photo Competition was started in 2011 and invited children living in the bush to submit photos of their 'country'. The competition was run again in 2012 with children from all five Schools of the Air (Kalgoorlie, Meekatharra, Carnarvon, Port Hedland and Kimberley) taking part. One hundred and thirty photos were submitted from 46 individual students. Prizes were awarded for the age groups of:

- lower primary (Kindergarten, Pre-Primary, Years 1, and 2);
- middle primary (Years 3, 4, and 5); and
- upper primary (Years 6 and 7).

Prizes - including a digital camera, a telescope and various environmental and science kits and books – were donated by sponsors Scitech, Crea Direct Learning, and Australian Geographic.

The photographs were used in the Rangelands NRM 2011-12 Annual Report and posted on the Rangelands NRM website and on Facebook. A calendar was also produced featuring the winning entries. These were sent to the five Schools of the Air for distribution to all families, teachers and staff, plus key stakeholders in each region. This annual competition will continue as the 'Kaz Collins School of the Air Photo Competition' to recognise the contribution made by Kaz, a valued staff member, before her death.

How have engagement and partnerships been encouraged?

A comprehensive Engagement and Partnership Management Strategy has been drafted. This provides a series of guiding principles, guidelines, and processes for the development and progression of community engagement, partnerships, and indigenous collaboration. The engagement and partnerships framework (Figure 26) outlines the goal of moving from consultative funder/manager relationships to equal partnerships with full engagement in order to better facilitate NRM outcomes. This strategy has also been produced as brochures for distribution to:

- potential partners
(http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_PartnershipsBrochure.pdf); and
- the rangelands community
(http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_CommunityBrochure.pdf).

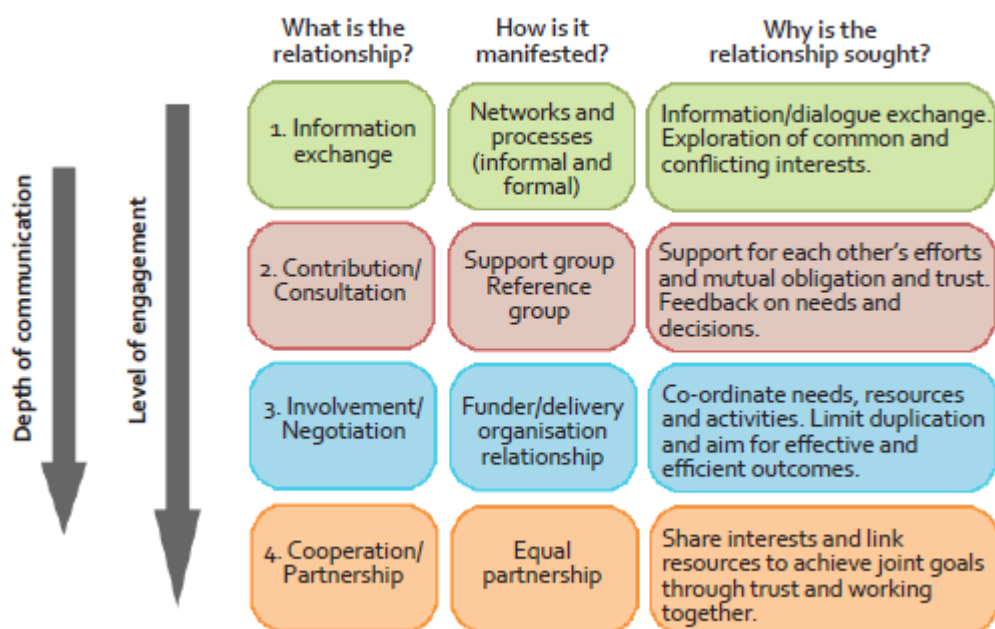


Figure 26: Rangelands NRM Engagement and Partnerships Framework

In 2012 this strategic approach to partnerships resulted in 18 new relationships with key community, corporate, mining, and government bodies. An important formal partnership was also developed with Greening Australia for implementation and management of the new Pilbara Corridors Project.

To what extent did project funding facilitate community engagement?

Wok funded to manage weeds in the Pilbara has resulted in the Pilbara Mesquite Management Committee (PMMC) recognised as the primary contact organisation for information regarding the management of Mesquite and Parkinsonia. The group have consulted widely and built solid partnerships with industry to ensure that weed management is prioritised and resourced. Strong links have been developed with multiple resource companies and contractors.

This has resulted in increased membership of the PMMC, with the majority of resources companies and owners of Parkinsonia infested pastoral stations attending and becoming involved in committee activities. At these meetings, project updates are presented and members have opportunities to learn about activities on a regional basis, and to discuss their specific successes and failures within their own programs. As a part of one meeting, members took the opportunity to experience, first hand, the mechanical removal of large Mesquite plants at a local field demonstration.
(PJ110201)

"...without the Pilbara Mesquite Management Committee and Linda and the Department of Ag getting behind us, I don't think this would have got anywhere near where it is. I also add, BHP has been fantastic there with the amount of money they've thrown at this job because this place would have been out of control with the Mesquite. So it's a whole junction of things and people that are working together and if we all get together, there's a good chance that we just might get to control this thing. I don't say I'm going to beat it, but we can control it."^{xxxvii}

"...they've helped us achieve the clean areas and work to some goals that we've set and we've got to now, and we're getting to – each time we have set new goals and we get to them. They help us set new goals up in the meetings with all the different parties and different government agencies all tied together to set us goals to get to, and that's where we've got to keep resetting goals..."^{xxxviii}

Additional sources of funding

An unexpected outcome of the funding provided to several projects has been the capacity for project teams to secure funding from other sources to undertake similar work.

Long-term financial commitments have been secured in the Pilbara from several pastoral land managers and mining tenement holders, to ensure Mesquite and Parkinsonia control programs are well resourced in the longer term. To date, \$730,000 per annum has been leveraged from resource companies – Citic Pacific Mining, Rio Tinto Iron Ore, BHP Billiton Petroleum, Chevron Australia, Onslow Salt, Hancock Resources, and Fortescue Metals Group – to fund ongoing weed control programs. All of these funds are directed towards the on-ground control of Mesquite and Parkinsonia. (PJ09202, PJ110201)

Ongoing commitment

\$730,000 pa has been leveraged from resource companies to fund ongoing weed control programs in the Pilbara

The EcoFire project has been so successful that the CfoC funding provided via Rangelands NRM has been decreasing over the last 2 years and replaced by funding from WA government through the Kimberley Science and Conservation Strategy. (PJ110501)

A number of the Indigenous communities within the Western Desert have also secured additional funding to increase the level of on-ground work undertaken.

Regional bodies have best-practice governance in place

An independent evaluation of Rangelands NRM's performance and capability against the 'Performance Excellence Guide for Regional Natural Resource Management Organisations', Second Edition' 2008 was undertaken in January 2012 to:

- identify key strengths and opportunities for improvement;
- prioritise strategies for improving organisational capability and performance; and
- provide a base line for monitoring progress over time.

The Guide utilised a framework of seven components that served as the basis of the organisational evaluation. These were:

- leadership – governance, organisational leadership, and social responsibility;
- corporate strategy and planning – strategy development and strategy implementation;
- client and community focus – client and community knowledge, and relationships and satisfaction;
- information and knowledge – information and knowledge management, and measurement and analysis of organisational performance;
- People Focus – work systems, capability, learning and motivation, and well-being and satisfaction;
- process management – management of processes, improvement and innovation, and supplier and partner processes;
- business results – NRM outcomes, client focus, financial, people, organisational effectiveness, and governance and social responsibility.

The review was undertaken through an initial working session with members of the Board and senior management team, a document review, and Interviews with a cross section of staff, Board members and external stakeholders. A planning workshop was held to discuss the findings once analysis had been completed. A report was provided that identified the way in which the Excellence Criteria were being addressed within the organisation and identified and prioritised a manageable number of improvement strategies (Table 19 to Table 25). Where relevant and appropriate, comments that drew upon experience gained through organisational evaluations of similar regional NRM organisations were offered to provide additional context and comparisons.

The results of the review and work undertaken to address the findings and recommendations, across each of the seven components, are tabulated below. Each finding has been prioritised by urgency and importance and colour coded as per Table 18.

<u>Prioritisation Matrix</u>			
		Importance	
Urgency	High		
	Med		
	Low		
		Low	Med
		High	

Table 18: Prioritisation matrix for implementation of work to address organisational review recommendations

Leadership

Framework component	Results of the organisational review	Progress towards improvement
Governance	Take steps to strengthen the strategic focus of the Board and examine ways in which the skills and experience that exist on the Board can be better utilised to deliver value to the organisation	The 2012-2015 Strategic Plan has been completed, using the Argenti System of Strategic Planning™ and the Constitution, Committee Charter, Standing Orders, and Code of Conduct have been reviewed. A survey of the Board members was undertaken in early 2013 with focus given to effective functioning of the Board, involvement in strategic development and support needs. The results indicated that the Board should continue to focus on working through strategic issues as this is felt to be a vital component of the Board's role – however full involvement of all Members is required for this to be successful; and there is a need to provide more opportunities for professional development in areas that would provide direct benefit to full involvement by all Members. A review of the Board calendar and processes to ensure the Board can have sufficient input in key operational decisions has been completed.
	Establish a more structured process for the identification, treatment and monitoring of organisational risks	A risk management plan has been developed for the organisation to recognise, analyse, and report on key strategic, operational, and financial risks. It provides a mechanism for ongoing monitoring, treating, and reporting the risk position of the organisation. The plan sets out the key risk categories, risk events, their rated risk factor, the proposed risk treatment(s), the responsible officer(s). An organisational wide risk management workshop has been conducted to ensure that all staff are informed of processes for identification, treatment, and monitoring of organisational risks. A risk management workshop will be conducted with the Board in August 2013. This will focus on risk identification and risk management planning. In addition, each project management plan must incorporate a detailed risk management plan prior to initiation of the project.
	Establish clear guidelines to ensure there is an appropriate balance of focus between operational and strategic considerations at Board level	Development of a structured reporting process for the Board is underway. This will seek to assist the Board members to identify strategic issues within their regions and link these to the Strategic Plan.
	Strengthen the process for the Board to undertake regular reviews of its own performance and that of its members	A survey of the Board members has been conducted and a report of the findings circulated. Plans are in place to further update the Board Charter to include ongoing evaluation requirements.
Organisational leadership	Review and clarify the role of the senior management team to optimise its functionality and decision making processes	The organisational chart has been revised following a restructure of the senior management team to provide better separation of corporate and operational functions. Guidelines for the functioning of the senior management team have also been developed.
	Clarify staff reporting responsibilities and authority for decision making throughout the organisation	The updated organisational chart provides clear lines of responsibility and authority. All position descriptions have been updated to include authorities and responsibilities. Internal communication processes have been improved through fortnightly staff updates and monthly staff meetings.
	Strengthen the focus on succession planning to minimize business continuity risks	The senior management team has been reviewed and a framework put in place that outlines both the structure of roles and guidelines for functional management.
Social responsibility	Strengthen the organisation's environmental policy and actions to set an example for reducing its environmental footprint in the way it operates	This has not yet been considered.

Table 19: Results and progress towards addressing the findings of the 2012 organisational review – Leadership component

Corporate Strategy and Planning

Framework component	Results of the organisational review	Progress towards improvement
Corporate Strategy Development	Complete the Corporate Strategic Plan in a way that will ensure a high level of 'ownership' by staff and Board members and be able to be used as the central reference to direct all organisational activities with a focus on NRM outcomes	The 2012-2015 Strategic Plan has been completed and distributed widely. The plan provides a clear three-year strategic direction that ensures that Rangelands NRM WA effectively responds to National, State and regional NRM needs and fosters productive relationships with the wider community, with a focus on land and coastal resource managers, to support and progress its strategic objectives. The plan is used as the basis for all planning and decision making. http://webadmin.communitycreative.com.au/uploads/rangelands/publications/rangelands_strategic_plan_a3.pdf
	Clearly define the relative positioning of various plans and strategies within an overall planning framework that can be understood by staff and board members	A project development process has been outlined that clearly defines steps from project concept or identified need to project activation. This incorporates a requirement for proposed work to clearly align with the Strategic Plan.
	Consider the development of simple scenario plans to identify strategic options for likely funding scenarios in the future	Each program delivery region has developed a program logic model that clearly identifies the visions for each program, how these feed into the organisational outcomes (derived from the 2012-2015 Strategic Plan), and the actions necessary to meet the outcomes. This has provided direction for work planning and will allow for easy identification of how well proposed work will contribute to outcomes and how applicable funding can be sought.
Corporate Strategy Implementation	Ensure plans, support plans and strategies contain clear actions, responsibilities and performance indicators to enable reporting and monitoring of performance against plans	A logic model and logframe has been developed in order to allow effective monitoring of the Strategic Plan. These identify how achievement of the desired strategic outcomes for each of the seven Strategic Objectives can be measured against key evaluation questions. Project management plans are required to identify how they contribute to the Strategic Plan and incorporate an appropriate evaluation plan, including a logic model, prior to initiation of the project.
	Take steps to ensure that the cascading structure of plan implementation achieves a high degree of alignment of work throughout the organisation and a common understanding of how individual efforts are contributing to overall organisational goals	The Strategic Plan is used as the basis for all planning and decision making. This cascades through all levels such as operational planning, risk management, and project planning, to staff performance planning and review. A review of success against the Strategic Plan was undertaken in 2012. This resulted in a scorecard document that was widely distributed – http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_AnnualReport_Card_2012.pdf
	Closely align Board meeting agendas with the Corporate Strategic Plan, when completed	Not yet considered.

Table 20: Results and progress towards addressing the findings of the 2012 organisational review – Corporate strategy and planning component

Client and Community Focus

Framework component	Results of the organisational review	Progress towards improvement
Client and Community Knowledge	Articulate more clearly an overall community engagement and communications strategy that also defines segmentation of targeted groups	A comprehensive Engagement and Partnership Management Strategy has been drafted. This provides a series of guiding principles, guidelines, and processes for the development and progression of community engagement, partnerships, and indigenous collaboration. The engagement and partnerships framework outlines the goal of moving from consultative funder/manager relationships to equal partnerships with full engagement in order to better facilitate NRM outcomes. This detailed strategy has also been produced as a brochure for distribution throughout the rangelands community – http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_PartnershipsBrochure.pdf
	Consider the development of a strategic framework for building upon programs delivered through working with indigenous communities and more effectively promote the successes that have been achieved	The Engagement and Partnership Management Strategy includes a dedicated section with information about issues to consider and principles to employ when seeking Indigenous engagement and partnerships. A review of 'on the job learnings' of project managers involved in key RNRM Indigenous projects has been undertaken in order to understand how these can inform the way business is managed in the future – http://webadmin.communitycreative.com.au/uploads/rangelands/evaluation%20reports/PjMInterviewsreWorkwTOs_20130415.pdf . A 'showcase' of Indigenous projects completed is available at http://webadmin.communitycreative.com.au/uploads/rangelands/publications/showcase_indigenous_V1.pdf .
	Clearly define the positioning of a stated objective to increase membership of Rangelands NRM within the broader context of community engagement and promotion of the organisation's role amongst community groups	Draft Membership Management Guidelines have been developed. These draft guidelines set out principles; benefits, rights, and responsibilities of membership; membership management processes; evaluation; and communication tools. A membership application form is on the Rangelands NRM website – http://www.rangelandswa.com.au/405/membership – and a membership drive was undertaken in June 2013 via the e-newsletter. A client relationship management system is now in place to better manage community engagement.
Relationships and Satisfaction	Engage specific expertise to develop value propositions to support business opportunities in the mining sector in ways that will ensure related projects will have an NRM outcome	Work in this regard has focussed on developing relationships with mining companies as and where it is appropriate. Rather than developing general 'value propositions' the approach has been more targeted in terms of responding to the needs of individual mining companies to demonstrate that Rangelands NRM is useful. The focus of this approach has been to encourage mining companies to co-ordinate activities to ensure best use of resources and a landscape scale approach. A number of mining companies attended our asset prioritisation workshops and discussions have been held to discuss the integration of offsets projects with broader programs in the Pilbara.
	Develop and communicate a clear pathway for Reference Groups while not jeopardising the on-going support of such groups	The Constitution and Policies have been reviewed. Work is being undertaken to encourage engagement of Reference Groups and improve their representation at Board level.
	Strengthen ways of capturing 'value' delivered to key community groups as perceived by them to inform future strategy development	Innovative ways of capturing perceived 'value' are being introduced into project and program evaluation processes. Electronic surveys and the use of social media are being introduced to applicable projects. Films about outcomes of work undertaken in the western desert, from the perspective of the traditional owners, have been produced. Similar work is underway to identify the land manager's perceived value of weed control projects within the Pilbara. Events and workshops funded as part of on-ground works are evaluated where possible. Findings from all evaluation activities are communicated via the website – http://www.rangelandswa.com.au/714/evaluation or communications activities.

Table 21: Results and progress towards addressing the findings of the 2012 organisational review – Client and community focus component

Information and Knowledge

Framework component	Results of the organisational review	Progress towards improvement
Information and Knowledge Management	Develop an organisation-wide approach to the management of records and information	<p>Shared electronic information storage facilities have been reviewed and upgraded with all staff now contributing to a shared library of organisational information and ensuring that all data is safely stored off site. Arrangements have also been made for 'future proofing' with inclusion of a data management system in the upgraded structure. Guidelines for information storage, electronic file naming conventions, and electronic folder structures have been developed.</p> <p>A system has been implemented (enQuire™) that supports the end-to-end project life-cycle from initiation through to closure through storing, tracking, managing, and reporting. All projects are managed through this centralised system. The project management system is closely integrated with the client relationship management system thereby ensuring that outcomes from project based relationships are fully integrated with the on-ground work outcomes of the project.</p>
	Clearly define the organisation's future role related to the capture and dissemination of knowledge and establish policies and processes to support such a direction	<p>The website has been reviewed and updated in order to ensure that relevant organisational information is transparent and available. Communications policies and guidelines have been developed to ensure consistency in approach and maintenance of the corporate image.</p> <p>The review of the Regional Plan and subsequent placement on the website will provide a facility for users to view assets on regional maps and bring in overlays for key aspects such as sub-IBRA and LGA boundaries as well as interrogating climate change and potential carbon sequestration opportunities.</p>
Measurement and Analysis of Organisational Performance	As part of the development of a revised Corporate Strategic Plan, define a set of organisational performance measures that will provide a more balanced view of overall organisational performance	<p>A review of success against the Strategic Plan was undertaken in 2012. This resulted in a scorecard document that was widely distributed – http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_AnnualReport_Card_2012.pdf</p> <p>A logic model and logframe has been developed in order to allow effective monitoring of the Strategic Plan. These identify how achievement of the desired strategic outcomes for each of the seven Strategic Objectives can be measured against key evaluation questions.</p> <p>Evaluation of activities is made public and available via the e-newsletter and/or the website – http://www.rangelandswa.com.au/714/evaluation</p>

Table 22: Results and progress towards addressing the findings of the 2012 organisational review – Information and knowledge component

People Focus

Framework component	Results of the organisational review	Progress towards improvement
Work Systems	Take steps to clarify roles, responsibilities and reporting relationships and ensure boundaries and decision making authority are clear to all staff	The updated organisational chart provides clear lines of responsibility and authority. All position descriptions have been updated to include authorities, relationships, and responsibilities. Changes to the performance review systems has resulted in staff taking responsibility for planning their annual performance objectives – in line with Strategic Objectives – and identifying measures of success.
	Strengthen job-specific induction to streamline the introduction of staff into new roles	An employee induction policy has been developed. A formal staff induction process has also been implemented with an induction package that identifies strategic directions, key policies, and procedures. This culminates in a probation review.
	Bring to completion work already started to review and up-date the suite of HR policies to ensure currency and relevance	In 2011 a review of HR issues was conducted to identify gaps in policies and procedures and to develop a 'system' of HR for Rangelands. As a result of this review all Human Resource policies and procedures have been reviewed and updated, recruitment and employment contracting has been streamlined and a documented salary and allowance structure developed. Rangelands NRM now employs an external HR consultant to provide ongoing support and advice on all HR needs.
Capability, Learning and Motivation	Clearly articulate the skills and in-house capabilities that need to be developed to support the strategic direction of the organisation	This is yet to be addressed in a more strategic fashion however the skills of the organisation as a whole have been mapped and are being addressed.
	Strengthen the focus on professional development based on individual needs of staff members	During the mid-term 2013 performance review process staff were asked to complete a skills/training matrix which aligned with their job description to identify areas that they wished to enhance through training. A training schedule for the 2013/14 period is now being finalised.
Well-being and Satisfaction	Strengthen and broaden the focus on OH&S beyond driver safety and elevate safety consciousness throughout the organisation	An OH&S audit was conducted in 2012 which identified a number of non-compliant issues. Work has been undertaken since that time to address these including remote travel policy and procedures and developing up the regional approach to OH&S. Impacts of the new 'Harmonisation' legislation have necessitated further work and current development of a Health and Safety Management System. Initial training for this was undertaken in July 2013.

Table 23: Results and progress towards addressing the findings of the 2012 organisational review – People focus component

Process Management

Framework component	Results of the organisational review	Progress towards improvement
Management of Processes	Develop a structured and consistent approach to management and improvement of critical business and support processes	<p>A system has been implemented (enQuire™) that supports the end-to-end project life-cycle from initiation through to closure through storing, tracking, managing, and reporting. All projects are managed through this centralised system. The project management system is closely integrated with the client relationship management system thereby ensuring that outcomes from project based relationships are fully integrated with the on-ground work outcomes of the project.</p> <p>A review of contractual arrangements between RNRM and organisations implementing activities is underway.</p>
Improvement and Innovation	Adopt a more proactive approach to systematically streamline and improve business processes through reduction of cycle time and elimination of non value-adding activities and ensure actions and targets are reflected in corporate plans	<p>A project development process has been outlined that clearly defines steps from project concept or identified need to project activation. This, combined with regional program logic modelling, ensures the quality and value of funded work.</p> <p>Work is being undertaken to improve use of enQuire™ project management system in order to ensure more timely management of budgeting at the project and program manager levels. Processes are also in place to improve identification and management of overheads.</p> <p>Use of online, off-site technology (cloud technology) has improved efficiency.</p>
Supplier and Partner Processes	Incorporate the work completed in developing an outline and definitions of partnerships into the Corporate Strategic Plan	<p>Identification of key engagement targets has been completed at both an organisational and regional level. This process has identified key contact points, outcomes sought, and communication methods required to maintain engagement.</p> <p>A draft Engagement and Partnerships Management Strategy has been developed and a brochure produced – http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_PartnershipsBrochure.pdf</p>
	Strengthen relationships with research and scientific organisations at a more strategic level	The Engagement and Partnerships Management Strategy includes the need for planning and implementation efforts to be underpinned by scientific knowledge as a key principle.

Table 24: Results and progress towards addressing the findings of the 2012 organisational review – Process management component

Business Results

Framework component	Results of the organisational review	Progress towards improvement
Business Result	Develop a small suite of KPIs that will enable regular monitoring of performance against key strategic objectives	<p>A logic model and logframe has been developed in order to allow effective monitoring of the Strategic Plan. These identify how achievement of the desired strategic outcomes for each of the seven Strategic Objectives can be measured against key evaluation questions.</p> <p>A review of success against the Strategic Plan was undertaken in 2012. This resulted in a 'scorecard' that was widely distributed – http://webadmin.communitycreative.com.au/uploads/rangelands/publications/Rangelands_AnnualReport_Card_2012.pdf</p>
	Strengthen ways of assessing perceived relevance of Rangelands NRM to critical stakeholder groups and provide regular trend reports to the Board	<p>A review and update of the Regional Plan was conducted in 2012. This involved stakeholders through 11 workshops in key locations across the rangelands. The updated plan and newly-developed register of assets will be 'live' online and will consist of maps detailing special environmental areas or 'assets' within the region, as well as climate change and potential carbon sequestration opportunities. Information will be able to be updated and assets filtered in response to changes in threat levels, new information, and new opportunities. An evaluation of the workshops identified that whilst the majority of respondents felt that the workshops were an effective method of identifying assets, the process could be improved. Many of the suggestions centred on strengthening the engagement and involvement of all groups, so that a wider range of assets, opinions, and priorities can be identified. This was seen as important both in the lead up to the workshops and during them.</p> <p>Ongoing work is required to continue to measure perceived value of Rangelands NRM.</p>

Table 25: Results and progress towards addressing the findings of the 2012 organisational review – Business results component

Conclusion

In conclusion, significant achievements have been made under CfOC funding administered by Rangelands NRM. The impact of this work has been seen in:

- enhanced body of knowledge of the locations and ongoing management or control of WoNS;
- survey, map, and control of WoNS in key sites
- reductions in core infestations of WoNs and creation of containment lines;
- a co-ordinated landscape scale approach to fire management;
- protection of threatened ecological communities and EPBC listed species;
- targeted control of feral species;
- employment of the Ecologically Sustainable Rangelands Management 'tool' (ESRM) for whole property planning with pastoralists in target areas and the development of ESRM plans;
- revision and review of existing property management plans with new knowledge and tactics for better NRM outcomes;
- development of management plans and implementation of improved practices for control of invasive species and protection of biodiversity values;
- use of industry and community driven approaches to promote sustainable land management with a focus on maintaining ecosystem function and assist farmers within the region to increase their uptake of sustainable farm and land management practices that deliver improved ecosystem services;
- implementation of Bestprac style Action Learning Groups to support the development of skills and knowledge and provide important peer support systems;
- implementation of extension activities with pastoralists to promote best management practice, implement rehabilitation works, manage threats, improve ground cover and carbon retention, and undertake monitoring and workshops;
- support for implementation of co-ordinated mosaic burning program across target areas to reduce wind erosion, enhance production, address critical threats to biodiversity, and maintain ground cover;
- support for on-ground activities by Martu people in Western Desert to monitor threatened species and complete environmental assessments;
- implementation of devolved grants to facilitate management, planning, and co-ordination of restoration and rehabilitation;
- a greater understanding of the threats to Roebuck Bay and management strategies implemented to protect it;
- control of public access and disturbance of roosting shore birds;
- engagement of Indigenous communities within the WA rangelands to protect and manage the natural landscape, biodiversity, and cultural values of their country;

- implementation of the Coastal Country Plan and Ngurrawaana reserve (water lease) plan, through engagement of Yindjibarndi traditional owners and Ngurrawaana members in partnership with Pilbara Native Title Service;
- establishment of programs with resident and non-resident traditional owners of Martu land and the Pilbara to engage the communities in work on-country;
- NRM work plans developed for Indigenous ranger groups;
- implementation of Indigenous NRM projects in the Fitzroy River catchment to deliver on-ground works in WoNS control;
- establishment of a female Indigenous Fitzroy River ranger group through the participating Community Development Employment Project programs;
- implementation of appropriate traditional burning regimes, WoNS management, and recording of traditional ecological knowledge
- a better understanding of the strengths and weaknesses of the organisation;
- improvements in organisation leadership, structures, and governance; and
- greater strategic direction.

Through projects funded under CfOC since 2009 contributions have been made to national targets (it should be noted that several activities have targeted the same land managers and rangelands communities and this is reflected in the overall totals):

- **189 land managers across 799,480 ha**, have contributed to reducing the impact of WoNS;
- **5,952,142 ha** have been contributed to protecting native habitat;
- **10 land managers, 16 community groups, and 34 ESRM plans** have contributed to addressing the threat of invasive species in high value aquatic ecosystems across **429,550 ha**;
- **11 organisations and 20 community groups** have been engaged in rangelands coastal conservation;
- the NRM knowledge and skills of **480 land managers** within the WA rangelands has improved, and encouraged improvement of management practices on **42 pastoral properties and 2,054,854 ha**;
- indigenous group partnerships have been established with **5 communities, 5 land managers, and 21 projects**;
- **27 projects** have incorporated the use and recording of TEK;
- volunteer involvement has increased by **581 volunteers**; and
- knowledge and skills of **4,397 participants** has been increased by their access to **92 events**, provision of **3** sets of **educational materials**, **15 devolved grants**, and engagement of **40 community groups**.

References

- ⁱ Quote from a transcript of an interview with Richard Climas, Station Manager Mardie Station on 2/8/2013.
- ⁱⁱ Quote from a transcript of an interview with Joe Armstrong, Station Manager Urala Station on 1/8/2013.
- ⁱⁱⁱ Quote from a transcript of an interview with Linda Anderson, Co-ordinator Pilbara Mesquite Management Committee on 1/8/2013.
- ^{iv} Quote from a transcript of an interview with Richard Climas, Station Manager Mardie Station on 2/8/2013.
- ^v Quote from a transcript of an interview with Richard Climas, Station Manager Mardie Station on 2/8/2013.
- ^{vi} Quote from a transcript of an interview with Linda Anderson, Co-ordinator Pilbara Mesquite Management Committee on 2/8/2013.
- ^{vii} Quote from a transcript of an interview with Marc McDonald, Conservation, Environment and Heritage Unit Manager on 31/7/2013.
- ^{viii} Quote from a transcript of an interview with Ngurrawaana ranger group on 31/7/2013.
- ^{ix} Quote from a transcript of an interview with Ngurrawaana ranger group on 31/7/2013.
- ^x Quote from a transcript of an interview with Kelvin Mitchison, Indigenous member of Team Rubber Vine, on 16/9/2013.
- ^{xi} Quote from a transcript of an interview with Douglas McCasker, Indigenous member of Team Rubber Vine, on 16/9/2013.
- ^{xii} Quote from PJ09514-3 Fitzroy Mesquite Final Report (November 2011).
- ^{xiii} Quote from PJ09514-3 Fitzroy Mesquite Final Report (November 2011).
- ^{xiv} Email correspondence between project co-ordinator John Szysmanski and Rangelands NRM Operations Manager on 28/11/2011.
- ^{xv} Rubber vine report – operation “Hit the road Jack” (June 2012). Prepared by Wayne Baddock and submitted to Rangelands NRM WA.
- ^{xvi} Quote from Louise Beames, Environs Kimberley Projects Co-ordinator in a Media Release: Kimberley ‘rainforest’ listed as endangered by Australian Government (1/3/2013).
- ^{xvii} Legge S, Webb T, Swan D, Maher B, Lawler P, Smith J, Tuft K (2012). EcoFire 2000-2012 fire pattern analysis, central and north Kimberley. Australian Wildlife Conservancy, Perth WA.
- ^{xviii} Quote from a transcript of a filmed interview with Ivan Wongawol, a Traditional Owner on 20/11/2012.
- ^{xix} Quote from a transcript of a filmed interview with Zareth Long, a Traditional Owner on 20/11/2012.
- ^{xx} Quote from a transcript of a filmed interview with Pamela Jeffries, a Traditional Owner on 20/11/2012.
- ^{xxi} Quote from a transcript of a filmed interview with Ivan Wongawol, a Traditional Owner on 20/11/2012.
- ^{xxii} Quote from a transcript of a filmed interview with Pamela Jeffries, a Traditional Owner on 20/11/2012.
- ^{xxiii} Carwardine J et al (2011). Priority threat management to protect Kimberley wildlife. CSIRO Ecosystem Sciences, Brisbane. Taken from Karajarri Jurarr weed and feral animals 2012 Final Report.
- ^{xxiv} Vivian G. (2013). *Food web tracked in Roebuck Bay algal bloom*. Downloaded from Science Network Western Australia (Environment & Conservation) on 9/5/2013.

^{xxv} Fourqurean J. et al (2012). Seagrass ecosystems as a globally significant carbon stock. *Nature Geoscience* 5, 505-509.

^{xxvi} Sora M. Estrella (2013). Effects of nutrient enrichment and toxic *Lyngbya* blooms on benthic invertebrates-and migratory shorebird communities of Roebuck Bay Ramsar site. Final report to the NRM Office, WA. May 2013

^{xxvii} Excerpt from the Draft Terms of Reference for Roebuck Bay Research Steering Group

^{xxviii} Excerpt taken from a letter of support provided by Roebourne – Port Hedland Land Conservation District Committee

^{xxix} Quote by Kevin Brockhurst, about results of work funded. Quote taken from interview reported in *Feedback*, a magazine published by Meat and Livestock Australia.

^{xxx} Quote from a participant of the Grazing land Management workshop held in March 2013.

Quote taken from the evaluation form completed at the end of the session.

^{xxxi} Quote from a transcript of an interview with Douglas McCasker, Indigenous member of Team Rubber Vine, on 16/9/2013.

^{xxxii} Australian Human Right Commission (2007). Cultural issues affecting communication. Submissions of the Aboriginal and Torres Strait Islander Social Justice Commissioner on common difficulties facing Aboriginal witnesses. No QUD300/2005. Downloaded from <http://www.humanrights.gov.au/commission-submission-1> on 15/4/2013.

^{xxxiii} Quote from Betty Walker, Tirralintji Community taken directly from Legge S, Webb T, Swan D, Maher B, Lawler P, Smith J, Tuft K (2012). *EcoFire 2000-2012 fire pattern analysis, central and north Kimberley*. Australian Wildlife Conservancy, Perth WA.

^{xxxiv} Quote from a transcript of a filmed interview with Pamela Jeffries, a Traditional Owner on 20/11/2012.

^{xxxv} Quote from a transcript of a filmed interview with Ivan Wongawol, a Traditional Owner on 20/11/2012.

^{xxxvi} Quote taken from feedback reported in the PJ110402 Project Evaluation report July-Dec 12.

^{xxxvii} Quote from a transcript of an interview with Joe Armstrong, Station Manager Urala Station on 1/8/2013.

^{xxxviii} Quote from a transcript of an interview with Richard Climas, Station Manager Mardie Station on 2/8/2013.