Valuable & Endangered

Working Together to Understand and Manage Threats to Monsoon Vine Thickets of the Dampier Peninsula

A Summary of Key Findings

Environs Kimberley West Kimberley Nature Project 2011 – 2013

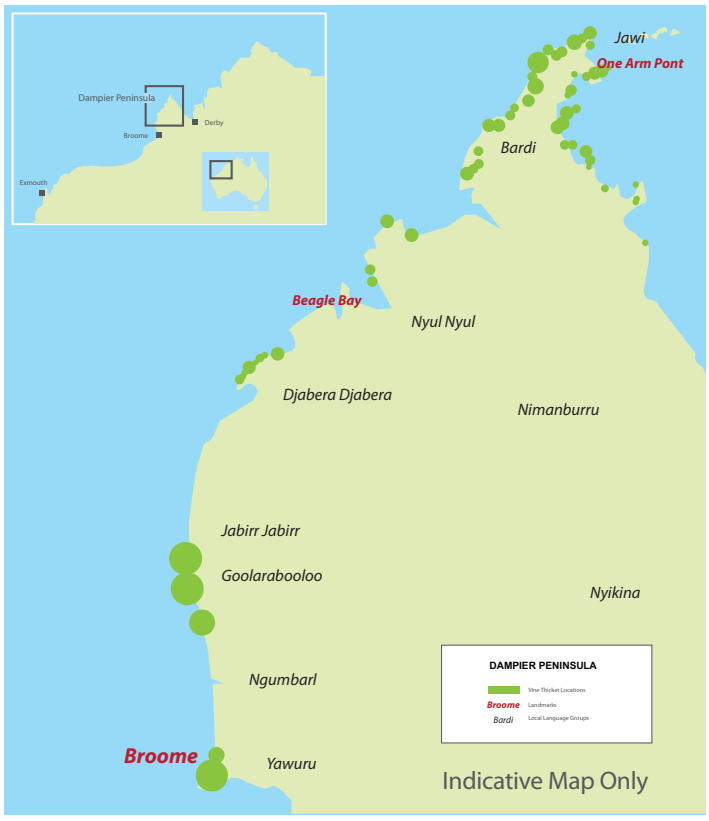
Introduction

Dampier Peninsula monsoon vine thickets span the traditional country of Yawuru, Goolaraboolo, Jabirr Jabirr, Djabera Djabera, Nyul Nyul, Nimanburru and Bardi Jawi people. They contain traditional bush foods, seasonal fruits, carving timber, medicines, tools, **Biidin** or **Jila** (freshwater wells) ceremonial areas and law grounds.

Monsoon vine thickets (MVT's) on the coastal sands dunes of the Dampier Peninsula, Kimberley region, WA, are a culturally significant Threatened Ecological Community (TEC), listed as Endangered by the Commonwealth (EPBC Act, 1999) and Vulnerable by the State of Western Australia. The Endangered listing, announced in 2013, recognises that MVT's face a "very high risk of extinction in the wild in the near future".

Bardi Jawi and Nyul Nyul Rangers, with support of Traditional Owners, have worked with Environs Kimberley and partners to use cultural knowledge, local observation and science to understand how fire and weeds are threatening Dampier Peninsula's MVT's and improve planning and cooperative management.

We have been working together since 2007, and on this project since 2011. This is a summary of the important findings. Asterisked (*) data and graphs are from the following scientific papers, available through Environs Kimberley:



"Fire history and vegetation change in threatened Monsoon Vine Thickets of northern Western Australia: applying culturally informed science."

And

"Using ant communities to monitor changes within and surrounding the Threatened Monsoon Vine Thickets of northern Western Australia."

Rainforests

Once covering Australia's north, the three broad types of rainforest, "hot and humid" and "temperate/sub-tropical humid" in North-eastern Australia, and "dry monsoon rainforest" in North-western Australia, Northern Territory and inland Queensland, are now found as smaller patches surrounded by savanna woodland.

Conservation management of small, fragmented rainforest is difficult because of the widespread damage caused by clearing, cattle, weeds, feral animals and especially fire. Because the rainforest areas are restricted, narrow and patchy, even small changes cause faster weed invasion and fire. Without natural or active protection against fire, the number, size and health of rainforest patches becomes reduced.

Rainforest edges are very sensitive to disturbance, and fire allows the invasion of weeds and grasses. Grasses on the edge and within neighbouring woodlands help fires to enter the rainforest, which is normally moist, cool, humid and fire-proof.

Goodadood - Rose-crowned Fruit-dove *(Ptilnopus regina)*, is an important fruit-eater that distributes seeds between MVT patches

Collection of MVT fruits

Today's fire regimes are very different from those once carefully managed by Aboriginal people. In earlier times, burning was guided by seasons and by cultural and hunting practices. Fire is now widespread, and intense wildfires break out late in the dry season. These hot fires are destroying some types of plants and causing extinctions. Old people with traditional knowledge have the skills to assist modern burning and prevent further species loss.

About Dampier Peninsula's Monsoon Vine Thickets

Dampier Peninsula Country is underpinned by the eco-cultural importance of MVT's, in traditional food, medicines, water sources, tools, language, law and culture.

Bardi and Goolarabooloo people call MVT **Budan**. Bardi people also call it **mayi boordan**, meaning "bush fruit country". Yawuru people call it **Mayingan manja balu**, meaning "plenty of fruit trees". In their booklet about MVT plants, Bardi Jawi Oorany rangers wrote of **Boonjaa budarjnrk goona**, meaning, "All the bush fruit trees are good for fruit and medicine." MVT are an important part of the proposed Bardi Jawi Indigenous Protected Area.

MVT's are Western Australia's most southerly rainforest and are scattered from Broome, north along the west coast of the Dampier Peninsula to One Arm Point, then south along the east coast to Goodenough Bay. The patches found within and behind the swales of coastal dunes vary from a few trees over a small area to over 500 hectares. 94% are less than 100 hectares in size, and most commonly are around 10 hectares, occurring as long, narrow patches with exposed edges.

The total area of the 79 patches is less than 2660 hectares. MVT's make up less than one tenth of 1% of the Dampier Peninsula, yet contain almost a quarter of the plant species. Plant species and fruiting times vary along the coast. The reliability of foods helps fruit-eating animals such as birds, bats and wallabies to move between patches throughout the year. MVT's rely on these fruit-eaters to travel between patches and spread the seeds, keeping the patches ecologically connected. These animals need healthy woodlands to aid their movement between the patches.

The loss or degradation of one MVT patch can affect all the other patches. Damage and loss of Dampier Peninsula MVT's would have large cultural and environmental impacts.

MVT trees have a shady canopy, unlike surrounding, more open, grassy woodland. The canopy provides habitat and refuge for animals, including the important fruit-eaters, especially during widespread fire.

The Dampierland Burrowing Snake *(Simoselaps minimus)* and Dampierland Limbless Slider *(Lerista apoda)*, are only found within and next to Dampier Peninsula MVT patches, and nowhere else. The Endangered Gouldian Finch occurs on the borders of MVT and healthy, unburnt woodland, possibly nesting in large old woodland trees.

Some plants, only found in a few MVT patches, are sensitive to fire and vulnerable to local extinction. These include: **Ingirri** *(Vitex glabrata)*, a valuable bush fruit, *Pittosporum moluccanum*, a Priority IV plant, *Capparis* aff. *jacobsii, Cleodendrum floribundum* var. *ovatum*, and Kimberley endemics *Parsonsia kimberleyensis* and *Helicteres rhynchocarpa.*

Boorroo Agile Wallaby *(Macropus agilis)* move between MVT patches, eating fruits and spreading seeds

Goolmi *(Grewia breviflora)* is a popular MVT bush fruit

Bardi Jawi Ranger Phillip McCarthy holds a Dampierland Burrowing Snake found during survey of MVT at Midarlon

Fire and MVT's

MVT's are fire-sensitive and struggle to recover after fire. Fire often kills trees and stops new seedlings growing. As fires create gaps in the protective canopy, the humid micro-climate becomes hotter and dryer, changing the plants and animals living there. Canopy loss increases fire inside the MVT patches. Frequent fire causes MVT patches to shrink and be replaced by woodlands.

Early dry season (EDS) burns create mosaics of burnt and unburnt habitat, reducing the extent and damage of late dry season (LDS) fires. Animals can survive in unburnt areas, and later return to recovering habitats. Kimberley studies show that LDS fire is damaging Gouldian Finch, Brown Quail and small mammal populations by reducing unburnt habitat essential for their survival.

Fire affects animal movement within and between patches. Large, slow-growing plants, which rely on animals to spread their seeds, are replaced with pioneer plants such as wattles and grasses, that like fire and spread easily afterwards.

MVT can spread back into unburnt woodland, particularly where birds and bats are able to roost in large woodland trees and drop seeds into heavy, moist leaf litter.

Bardi Jawi and other Indigenous groups traditionally kept fire away from the MVT patches to protect cultural resources. Northern Australian Indigenous people commonly protect rainforest patches from LDS fires by burning around the edges in the EDS.

Bardi Jawi Ranger Chris Sampi monitors a cool buffer burn to protect MVT

Early dry season burns create a mosaic of burnt and unburnt habitat

Bardi Jawi Ranger, Wesley Hunter and Judy Fisher record vegetation within MVT

The Study

We wanted to understand fire seasonality and history within and on the edge of all 79 MVT patches and surrounding woodlands. We also wanted to find out how fire and weeds were affecting these areas, by measuring changes in plant and ant communities.

We believed this information would help us improve planning, management and monitoring for Dampier Peninsula MVT's.

Monitoring Protocols

With rangers, Traditional Owners and ecologists taking part, monitoring protocols developed included science, cultural knowledge and local observations. Three indicators to show change and assist management were chosen:

- Vegetation structure
- Fire impacts
- Ant community

Recording sheets were adapted for Bardi and Nyul Nyul language. Where traditional plant names were not known, common and scientific names were used.

Assessments were conducted at the end of the wet season and dry season at 5 MVT patches in three areas: the middle (M) of the MVT patch, the edge (E) and outside (O) in the pindan woodland. We measured the percentage cover of trees, shrubs, herbs, seedlings, grasses, climbers, bare ground, litter cover and depth, charcoal and fire scars. We also trapped ants and sent them off for identification.

The data allowed us to see the changes in plants and ants, in and around the MVT patches, relate them to fire history and weeds, and then quickly apply what we had learnt to planning and management.

Ants and MVT's

Ants play important roles in spreading seeds, nutrient cycling and soil health. North Kimberley surveys found that ants in MVT's are very different from those in surrounding woodlands. Not much is known about Dampier Peninsula ants. Other studies have shown ants to be a good indicator of ecosystem health. We hoped that by better understanding the ant communities we could use them to measure the health of Dampier Peninsula's MVT patches. We found them to be very good indicators, as there were differences between the ant communities in the middle, at the edge and outside the MVT patches.

Bardi Jawi Ranger, Trevor Sampi and coordinator, Todd Quartermaine measure litter and grass cover with Gemma Chaquebor, outside MVT

Nyul Nyul Rangers Brendon Smith and Ninjana Walsham record vegetation structure on the edge of MVT with Louise Beames (Environs Kimberley)

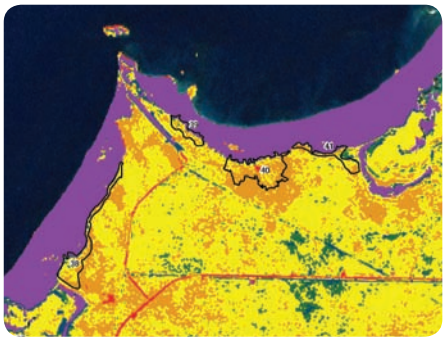
Remote Sensing

With Fisher Research, DEC and SERCUL we used remote sensing to determine fire history and map changes to vegetation cover across all MVT patches from 1989 to 2010. We produced three types of maps for each of the MVT patches:

- Fire scars including year and season
- Numbers of fires
- Vegetation cover change across time

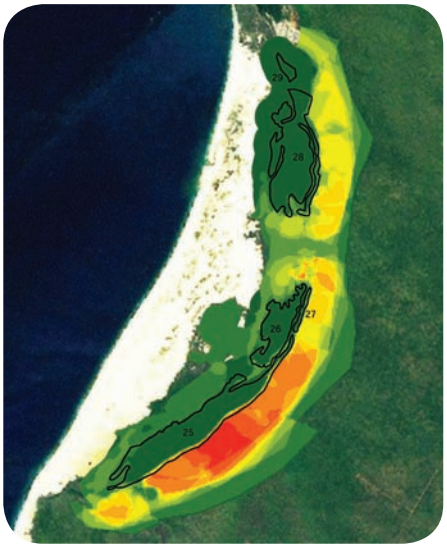
To check the remote sensing we walked through and "ground-truthed" areas to calculate where canopy had been lost due to fire or for other reasons, such as roads or infrastructure.

We found that remote sensing satellites only showed where the canopy had been burnt, but not when fires had burnt the understorey only. Also, some seasonal data between 1989-1999 were unavailable. This means that the fire damage is greater than we have calculated.

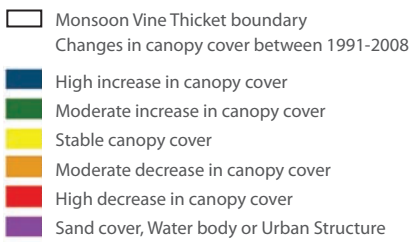


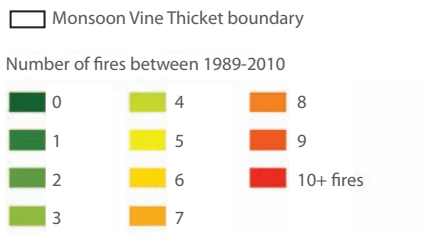
Map 1: Vegetation cover change (1991-2008) at Kooljaman-Midarlon MVT patches and surrounding area

Map 2: Fire scars from 1989 to 2010 at Millagoon MVT patches and surrounding area



Map 3: Numbers of fires (1989 -2010) within and next to Cape Borda MVT patches





Seasons and fire mapping

Dampier Peninsula seasons vary along the coast and are best understood from Aboriginal seasonal calendars.

August/September is a short warming-up season known by Bardi Jawi people as **Jalalay**. Goolarabooloo and Yawuru people identify this season, in September, as **Wilburu** or **Wirlburu**. The hot, humid build-up to the wet in the Bardi Jawi seasonal calendar is **Lalin** (October to mid-December). Goolarabooloo and Yawuru call this season in Oct/Nov **Larja** and **Laja**. In Bardi Jawi country, **Mankal**, the wet, follows **Lalin** from mid-December, and in Goolarabooloo/Yawuru country, the wet, **Mankala/Mangala**, starts in December.

For the study, early dry season (EDS) was recorded as June and July, and late dry season (LDS) as August to December (mostly **Jalalay** to **Lalin**). December was included in LDS as, though the rains may have started, the vegetation is still dry and so the fires are still hot.

Results

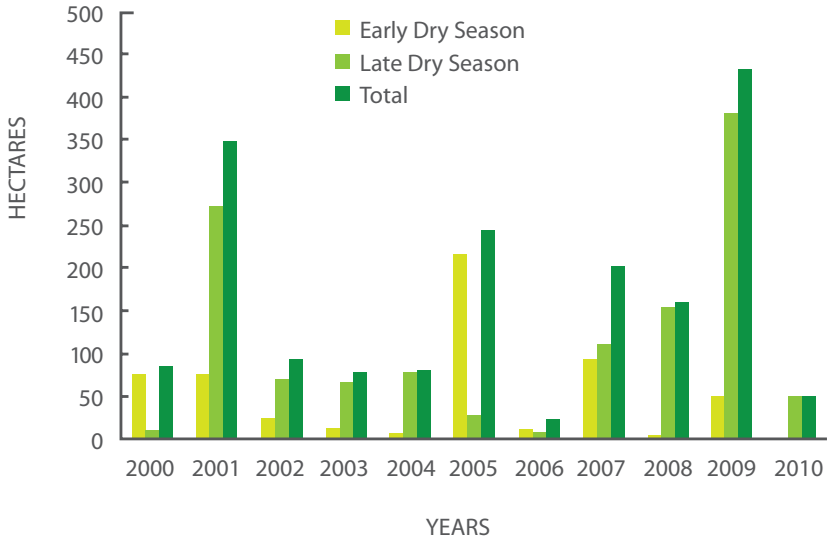
Fire History

We found that fires have become more frequent and much larger and hotter, severely damaging MVT patches. Over 2100 hectares of MVT have been burnt since 1989.

Between 2000 and 2010, nearly 70% or almost 1800 hectares of MVT was burnt frequently.

The worst fire years were 2001, 2005, 2007, 2009, with 200 hectares burnt, and fires affecting half of all MVT patches.

There were more burns in the late dry season than the early dry season in 8 of the years between 2000 and 2010.



*** Figure 1:** Extent of fire for the Dampier Peninsula monsoon vine thickets, 2000-2010, for early dry season, late dry season and total per year.

Fire Frequency and Fire Return Intervals between 1989–2010

- Nearly three quarters of MVT patches were burnt every 1-3 years.
- 13% of patches were burnt every 4-5 years.
- No patches had escaped burning.
- Nearly 90% of the patches were burnt 5 or more times.

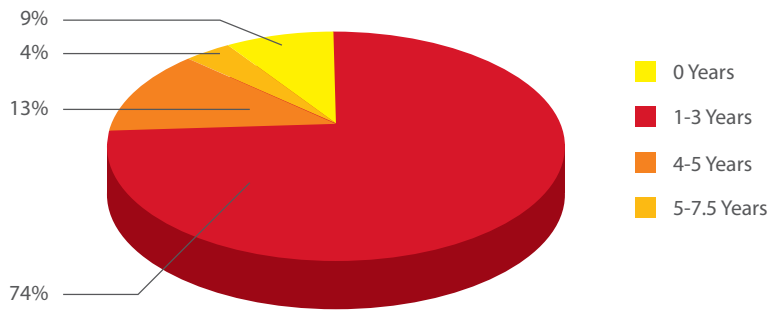


***Figure 2:** Fire return intervals for Dampier Peninsula monsoon vine thicket patches (1989 -2010)

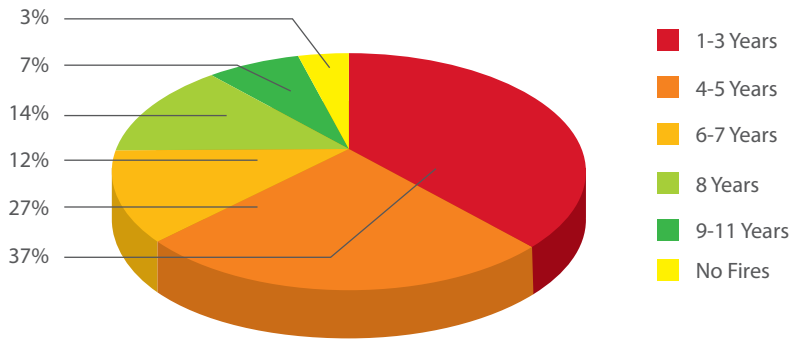
Frequent and hot fires cause a loss in structure and canopy cover

Fire can affect the movement of important fruit-eaters between patches, including Niimanboorr (Pteropus alecto) Black Flying Fox

Cool, early dry season fires, and fires after rain, are less intense and can leave the canopy unburnt

Fire Frequency and Fire Return Intervals between 2000 and 2010

- Nearly 40% of MVT patches were burnt every 1-3 years.
- Nearly 30% of patches were burnt every 4-5 years.
- Only 2 patches were not burnt at all.
- Half of the patches were burnt 5 or more times.
- The median area of canopy burnt per patch was equal to the most common patch size of c. 10ha.
- Nearly 70% of fires were late dry season fires, which are larger and hotter than early dry season fires.
- A few patches were burnt every or almost every year.



* **Figure 3:** Fire return interval for Dampier Peninsula monsoon vine thicket patches (2000-2010)

Habitat Types

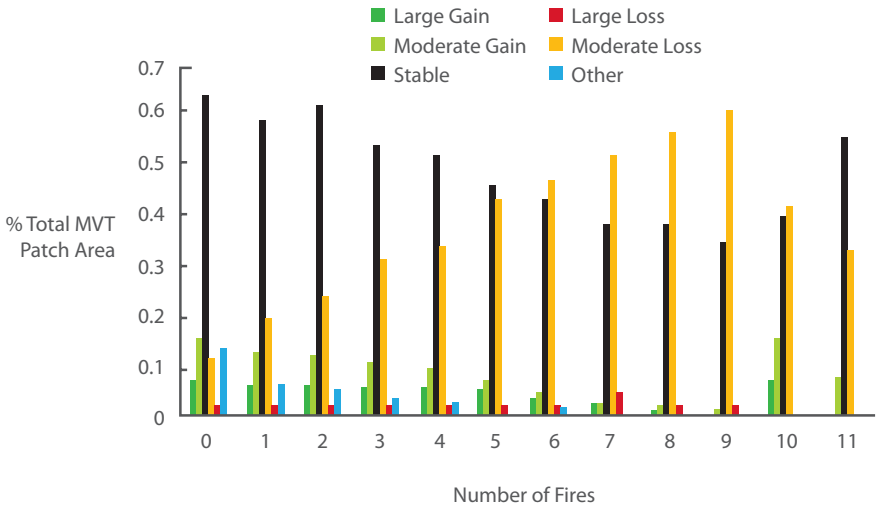
The total vegetation cover at the middle (M) of the MVT patches, the edge (E) and outside (O) in the pindan woodland were very different from each other.

The middle and edge had more canopy cover than the pindan woodland, but the edges were very degraded. The coverage of all plants (trees, shrubs, vines etc.) at the edge was much less than in the middle of the MVT and outside in the pindan woodland.

Fire degrades MVT edges, reducing canopy cover and increasing weeds. Bardi Jawi and Oorany rangers and Environs Kimberley at the Kooljaman MVT weed control and restoration site

Fire and Vegetation Change Over Time

Though mostly stable, there was a 20% loss in canopy cover across all MVT patches. Where there were more fires, larger areas of MVT were burnt and more canopy cover was lost.



* **Figure 4:** Number of fires and changes in vegetation (1990-2010)

Fire and Pindan Woodland

Since 1990 up to 93% of the 300 metres of pindan woodland surrounding each MVT patch was burnt by 4 or more fires.

34% of the canopy was lost in the 10km of pindan woodland surrounding the MVT patches.

As with the MVT, more canopy was lost from pindan woodland experiencing more frequent and larger fires.

Nyul Nyul Rangers and Louise (Environs Kimberley) record vegetation structure outside MVT in burnt woodland

Ants and Invertebrates

A surprising number (81) of ant species were identified. Different communities of ants were found in each of the three areas across the 5 patches; the middle contained 37 ant species, the edges 48 species and 62 species were found outside. Ant surveys can now show how healthy an MVT is by what types of ants are present.

Of the 7,350 ants identified across the wet and dry seasons, 43% of all ants were the aggressive invasive Black Crazy Ant *(Paratrechina longicornis)*. We also found the invasive Singapore Ant (*Monomorium destructor)* in small numbers at one site. Invasive ants have not been found in these areas before. Where there was weed damage or there had been more fires, there were more invasive ants.

There was a great variety of invertebrates: spiders, beetles and bugs. We found 836 spiders from 28 families. Pindan woodland had far more invertebrates than MVT. Those at the edges of MVT were more like those in pindan woodland, than those in the middle of the MVT. The fires are changing MVT edges and allowing woodland invertebrates to invade.

Black Crazy Ant cultivate mealybugs to collect their sugars

Field Sites

Field studies were conducted within and surrounding the 5 MVT patches where Bardi Jarwi and Nyul Nyul ranger groups are implementing management plans; they have developed the plans (with endorsement of Traditional Owners) in collaboration with the Environs Kimberley West Kimberley Nature Project.

Bardi Jawi Country

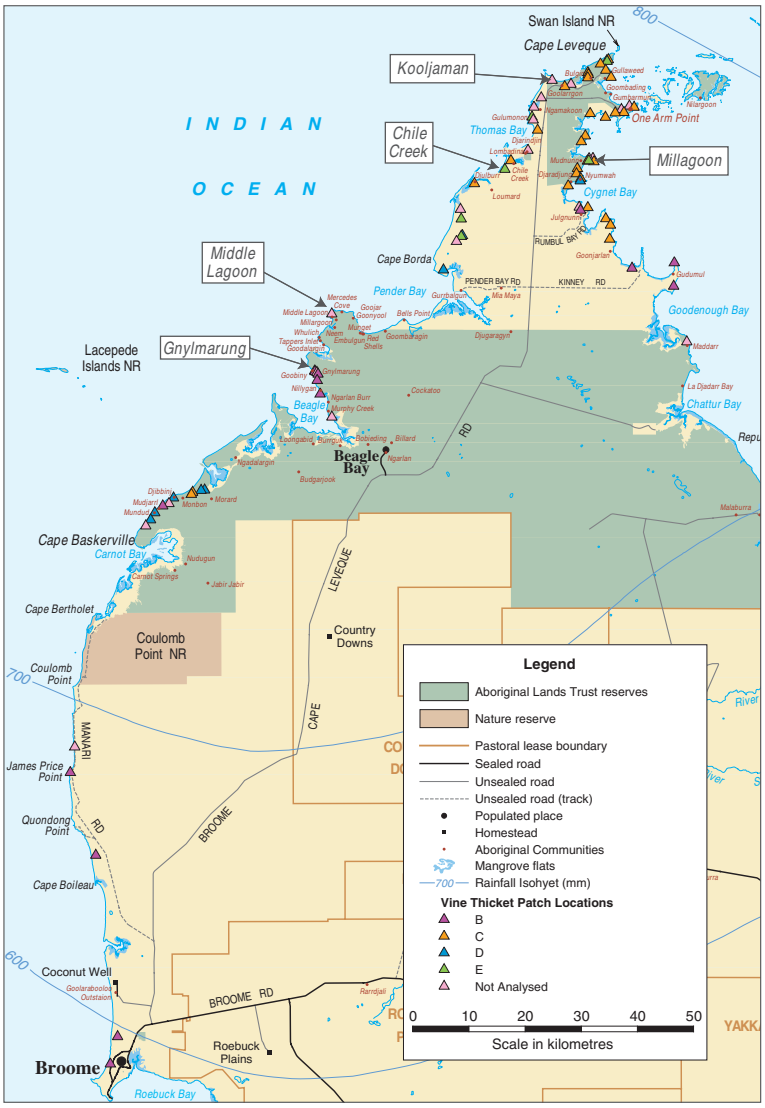
- Kooljaman/Midarlon
- Millagoon,
- Chile Creek

Broome Botanical Society recommended that all three sites be conserved.

At Kooljaman, rangers have been managing the invasive Buffel Grass and weedy vines, and revegetating with native plants. Frequent fire has affected the edges and rangers have worked to create protective fire buffers in the EDS.

Milagoon has been moderately protected from fire, and rangers have extended this protection, by burning protective buffers in adjoining woodland in the EDS. Rangers have been controlling Neem, Buffel Grass and weedy vines, planting and encouraging natural restoration.

Chile Creek has a rich variety of plant species (41) and is the only Peninsula location for *Secamone timoriensis.* Natural protection and fire exclusion has kept it in good condition. Rangers have removed small numbers of grass weeds and monitored localised fires.



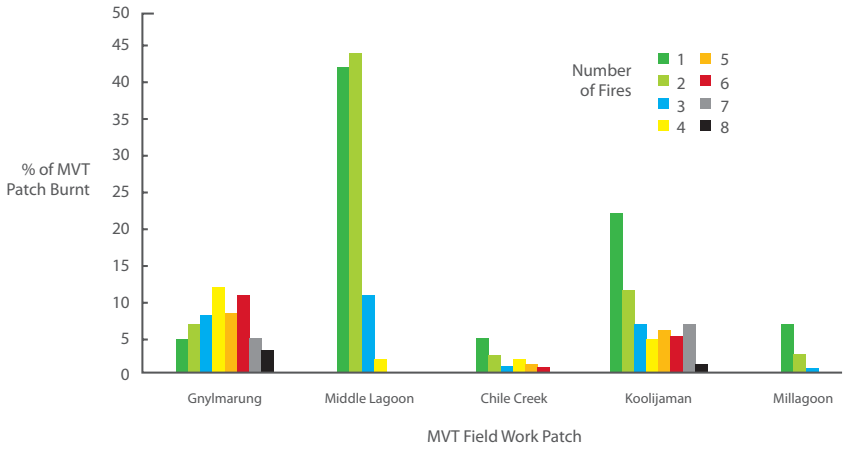
Source: Adapted from the Department of Environment and Conservation.

Nyul Nyul Country

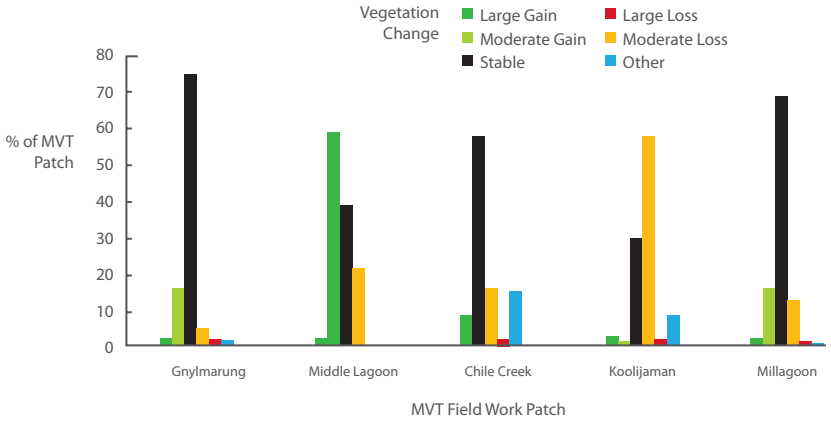
- Middle Lagoon
- Gnylmarung

Middle lagoon is the only Peninsula location for the plant *Diospyros maritima*. Excessive driving through the sand dunes has opened up the patch, destroying vegetation and causing erosion. Rangers have used fencing and signage to encourage restoration, and controlled Buffel grass weeds. They have also burnt surrounding woodland in the EDS to reduce local wildfire.

Gnylmarung was recommended for conservation by the Broome Botanical Society. Nyul Nyul Rangers and Gnylmarung community have undertaken protective fire management in the EDS and controlled small patches of grass weeds.



* **Figure 5:** Number of fires (1989-2010) and the % of MVT patch affected over time



* **Figure 6:** % Vegetation canopy change (1989-2010) per MVT field work patch

From our data we know that since 2000:

- Middle Lagoon had the smallest area affected by frequent fires and the greatest vegetation gain.
- The greatest vegetation loss was at Kooljaman/Midarlon due to frequent fires over a large % of the patch.
- Though similar numbers of fires passed by Gnylmarung, the dunes provided some natural protection.
- Other losses not related to fire were highest at the Chile Creek and Kooljaman/Midarlon sites, where there has been more tourism development.

Nyul Nyul Rangers have reduced 4WD access and helped MVT dunes at Middle Lagoon to slowly recover

Early season buffer burns outside Millagoon site – Bardi Jawi Rangers, Philip McCarthy and Dwayne George

Beetles on **Goorralgar** *(Flueggea virosa)*. We found 101 beetles and 394 bugs from 18 different families. Fires are changing where invertebrates occur and how many there are

Fire and Dampier Peninsula MVT's

Before 2002, Broome Botanical Society recorded fire damage in 32% of (62) MVT patches surveyed. The survey identified fire and weeds as serious threats and recommended that priority patches and plants be protected and managed. The summary "Valuable and Threatened" is available at the ranger bases or www.environskimberley.org.au

This is the first comprehensive study of fire damage to Dampier Peninsula MVT patches. Observations by rangers and Traditional Owners, that fire frequency and intensity had increased, were confirmed.

The fire regime has changed so that cooler burns in the EDS, which leave more unburnt refuge for species, have been replaced with more frequent, hotter and more widespread wildfires occurring in the LDS. Fires are opening up normally closed canopies of MVT and causing patches to shrink.

Frequent fire is killing sensitive plants. Large trees and shrubs are being lost from the edges, reducing canopy cover and the deep, moist leaf litter that inhibits fire, so reducing the germination of fire-sensitive plants, changing and degrading the vegetation.

Siratro, a high priority weed, invades MVT and promotes fire

Goolay trees *(Planchonia careya)* struggle to recover after fire and can die after being burnt.

Joongoon, Mamajen (*Mimusops elengi)* is sensitive to fire. Hot fires can kill them.

Fire threatens the Dampierland Limbless Slider *(Lerista apoda)*, which is only found on the Dampier Peninsula near and within MVT's

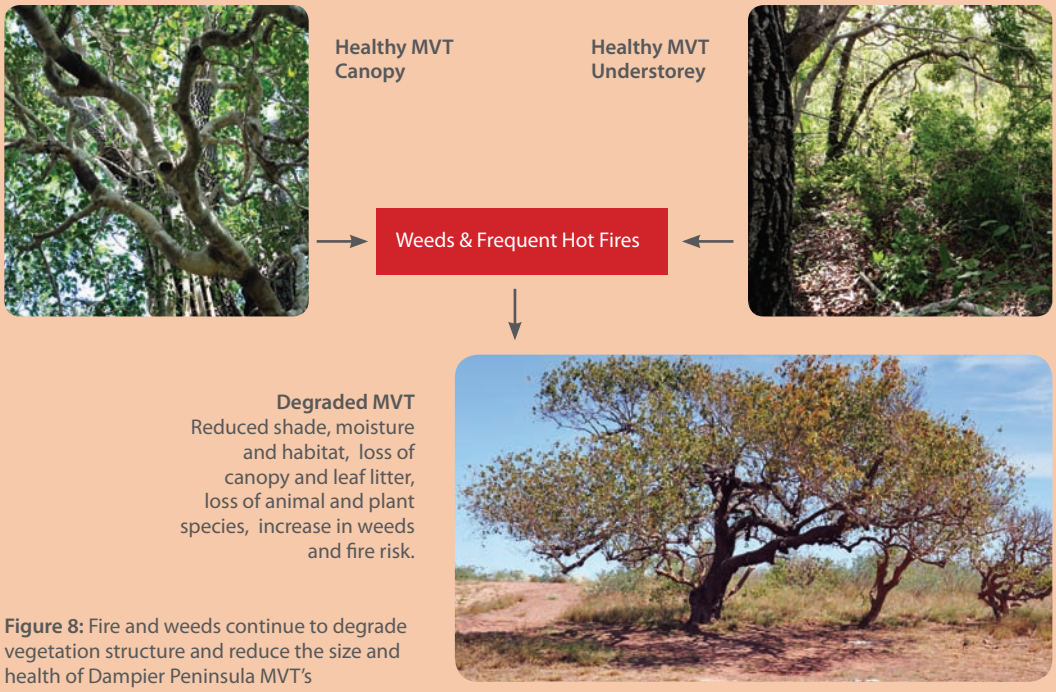


Figure 8: Fire and weeds continue to degrade vegetation structure and reduce the size and health of Dampier Peninsula MVT's

How Fire is Affecting Different Species.

Produced with Environs Kimberley in 2011, the "Plant Stories" booklet by Bardi Jawi Oorany rangers recognised that many important MVT plants die or struggle to recover after **Noorroo** (fire), particularly hot fires, including: **Albay** *(Ficus virens)*, **Birimbiri** *(Diospyros humilis)*, **Goolay** *(Planchonia careya)*, **Joongoon** *(Mimusops elengi)*, **Mangarr** *(Sersalisia sericea)*, **Marool** *(Terminalia petiolaris),* **Iidool** (*Pandanus spiralis)* and **Goolmi** (*Grewia breviflora)*.

MVT canopy species are slow growing. The rate of fire returning to areas isn't allowing enough time for trees to recover from fire or germinate and become established. Fire also changes the timing of flowering and the numbers of flowers and seeds produced by plants.

MVT plants, culturally valuable bush-tucker, and restricted and endangered species, risk extinction locally if Dampier Peninsula wildfire is not contained and MVT patches are not protected. Endemics like *Lerista apoda*, and other reptiles and small mammals that don't move far or fast are very vulnerable.

The cycle of weed invasion and increasing LDS fires is degrading MVT patches. Grasses are creeping in at the edges, increasing fuel loads and helping fire and then more weeds to enter patches. As the grasses, mostly the native annual spear grass and the weedy Buffel Grass *(Cenchrus ciliaris)* like and promote frequent fire, areas are changing from MVT and woodlands into more grass-dominated areas.

Other fire-promoting plants include the high priority weed Siratro *(Macroptilium atropurpureum)*, and *Merremia* spieces. These weeds are growing over trees and shrubs, strangling other plants. When they die off in the dry season they help fires burn the MVT canopy.

Rangers have found that if they restore the vegetation structure, "trees will provide more shade, get rid of buffel grass and help to close it back up again" (Chris Sampi[1])

To restore MVT patches we have to control fire-promoting weeds and protect MVT patches and surrounding woodland from fire. By assessing changes in vegetation structure and ant communities we can gauge the health and vulnerability of MVT patches and guide management.

Fire and weeds are also increasing the threat of invasive ants in MVT. Invasive ants compete with and prey on native ants, reducing populations, causing species loss. More complex changes include the cultivation of sap-sucking insects and the facilitation of pest outbreaks that weaken plants and compromise seed distribution or pollination processes.

[1] Bardi Jawi Ranger and Traditional Owner

What is Happening in the Pindan Woodland

Pindan woodland, neighbouring MVT, supports the movement and seasonal habitats of fruit-eaters that keep MVT patches connected. Fire damage within pindan woodland and MVT prevents these species from moving easily between patches, reducing the ecological connection and viability of the Dampier Peninsula MVT patches.

Recurring hot fires in pindan woodland are degrading MVT edges, allowing more weeds and fire to enter patches. This reduces the opportunity for MVT to re-emerge and recover. MVT plants like **Birimbiri** *(Diospyros humilis)* or **Goorralgar** *(Flueggea virosa)* will grow in pindan woodland, but only where large bird/bat roosting trees have a long unburnt understorey, and the soil , litter and shade conditions allow germination and survival.

The study confirms that old pindan woodland trees are being lost to fire, helping to further shrink MVT. These losses could also affect the Endangered Gouldian Finch, which may use these trees as nesting sites.

Bardi Jawi Ranger Philip McCarthy observes Birimbiri seedlings growing on the edge of healthy unburnt woodland

Endangered Gouldian Finch populations persist in healthy woodland on the Dampier Peninsula and are being surveyed for by rangers with the Environs Kimberley West Kimberley Nature Project

Partnerships

Research that includes Indigenous and scientific knowledge helps "everyone better understand what is happening on country" (Kimberley Aboriginal Caring for Country Plan — KACCP) and provides traditional and modern tools for managing new threats like weeds and wildfire.

Australia's most successful conservation efforts are community-based ones, with good partnerships. The partnership between ranger groups, Kimberley Land Council and Environs Kimberley has worked well because of "good communication and the need for rangers to access the best available science" (Kevin George[2]), ongoing commitment, mutual respect, trust, capacity and strong governance.

Cultural protocols — "right people, right country, right way" (KACCP) — have guided consultation, engagement and communication in "two way" planning, management and research. This collaboration between Indigenous rangers and Traditional Owners with strong traditional, local knowledge and practical skills, ecologists, government, naturalists and partners has been an effective way of working.

The fee-for-service paid to ranger groups to deliver cooperatively developed management plans has enabled them to direct conservation management on their country. Projects like this should be encouraged as the way to do conservation business; they add to the employment, training and resourcing opportunities and wellbeing of local people.

[2] Bardi Jawi Senior Cultural Ranger and Traditional Owner in "Managing weeds on native title lands", Native Title Research Report, AIATSIS, Duff 2012

Management

The partnerships, support and knowledge sharing have resulted in a better understanding of weeds, fire and MVT's, and support improved management planning across the Dampier Peninsula.

Using ant communities and plant structure, we can now assess the health of MVT patches and guide weed and fire management for individual patches.

The fire history maps, showing vegetation cover change, fire scar and fire incidence since 1989, give great insight into the fire history of Dampier Peninsula's MVT patches, and can be used to plan for, prioritise and manage fire. Maps are available on request from the Bardi Jawi or Nyul Nyul Ranger office, or from Environs Kimberley.

Bardi Jawi and Nyul Nyul rangers are using this information to adapt fire management, returning to more traditional protective and mosaic, early-season burning. Previously we used early-season buffer burns, informed by the Bardi Jawi seasonal calendar and cultural advisers, to prevent fire from entering the MVT patches and leave an unburnt area of at least 50m around patches. The findings confirm the value of using this fire protection model.

We now recommend that at least 200 metres from the MVT patch be left unburnt.

Rangers can use this information to lead cooperative fire management planning, with stakeholders, on their country, and get the best outcomes for communities, outstations and infrastructure, while also protecting cultural sites and environmentally significant areas.

We have assessed the vulnerability of MVT patches, overlaid cultural and conservation priorities and developed 2012/13 management plans for Bardi Jawi and Nyul Nyul country. Areas of high conservation significance are often the most vulnerable to fire. 2012/13 fire Planning has included protecting vulnerable MVT areas, significant cultural sites, and Gouldian Finch habitat.

Recommendations for fire management include:

- reducing the number of fires,
- ensuring large unburnt buffers surround MVT,
- restricting fires to the early dry season,
- preventing fires in the late dry season,
- controlling fire-promoting grasses and weeds such as Buffel Grass *(Cenchrus ciliaris)*

Langgoorr *(Trichosurus arnhemensis)* Northern Brushtail Possum. The movement of important fruit-eaters between patches is affected by fire

Bardi Jawi Rangers work to control weedy buffel grass on the edge of MVT and restore vegetation structure through planting

Bardi Jawi Ranger Chris Sampi ignites an early season buffer burn to protect MVT

Cover Images: Aerial photo of MVT within and behind the swales of coastal dunes, on the Dampier Peninsula (main image). **Iidool/Manbang** (Pandanus spriralis) provides bushtucker, medicine and materials and can die after a hot fire. **Mangarr** *(Sersalisia sericea)* is a nutritious fruit found within MVT and is sensitive to fire. Channel-billed Cuckoo *(Scythrops novaehollandiae)* migrate each year from New Guinea and Indonesia, feeding on MVT fruits and spreading seeds between the patches.

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BARDI JAWI RANGERS

NYUL NYUL RANGERS

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