Chapter 5: Melaleuca communities

This fire vegetation group includes all communities dominated by melaleuca. In the Cape York Peninsula bioregion most of these communities are periodically inundated. Drier sites have a grassy understory with occasional sparse shrubs such as xanthorrhoea and grevillea. Wetter sites support sedges, ferns, palms and pandanus in the understory. They are found across the bioregion.

There are four broad sub-groupings of melaleuca communities on Cape York Peninsula with different fire requirements:

1. Melaleuca woodlands (woodlands)

Woodlands can be dominated by one or a mix of melaleuca species with other canopy species also present. The understoreys may be dominated by grasses, shrubs, sedges, ferns or a mixture of plants. The ground-layer is often sparse. Woodlands can be found in wetter areas such as drainage depressions, marine plains and swamps. These can remain boggy for weeks or months. Low hills and rises dry more quickly but accumulate fuel very slowly.

2. Melaleuca heath (heath)

Heaths have a low, dense structure dominated by a mix of species including: *Melaleuca stenostachya, Melaleuca citrolens, Thryptomene oligandra*, Cape York paperbark *Melaleuca arcana* and sometimes co-dominant broad-leaved paperbark *Melaleuca viridiflora*. There is usually no understorey or very sparse grasses. These heaths are found adjacent to wet areas such as on marine plains, stream edges or fringing fresh water lakes. They also occur on knolls and hills. Like other heaths, when melaleuca heath burns it often scorches completely with plants reshooting from the base.

3. Melaleuca gallery forest and lagoon margins (gallery forests)

Gallery forests are tall to very tall (up to 50m) and are located on the margins of swamps and lagoons on deep peat soils, on the levee banks of major streams or as part of a complex of flood channels and levee banks. Gallery forests are fire-sensitive. They sometimes have rainforest species present.

4. Melaleuca swamps (swamps)

Swamps are low areas where water usually remains near or above the surface of the peat or gley soils. They are often dominated by swamp paperbark *Melaleuca quinquenervia* or weeping paperbark *Melaleuca leucadendra*. Other species may also dominate in some areas. Swamps may have shrubs or rainforest pockets present and sedges dominate the ground layer. Swamps can cover vast areas, in some cases up to a few hundred hectares.

Fire management issues

The main issue for the drier woodlands and heaths is maintaining a Landscape Mosaic through broad-scale fire management (this limits the impacts of late season wildfires). In addition, heaths prefer a longer fire interval which is difficult to maintain if the surrounding landscape is not proactively burnt to limit extensive and regular late-season fire.

Maintaining a Landscape Mosaic within fire-adapted vegetation adjacent to gallery forests and swamps will assist in mitigating impacts of fire. Avoid peat fires by burning when standing water is present or the peat is water logged.

Issues:

1. Maintain healthy melaleuca communities.
2. Avoid peat fires.
3. Limit fire encroachment into non-target communities.

Extent within bioregion: 1 701 670 ha, 14 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 180 812 ha; Crosbie Creek Station, 42 859 ha; Cape Melville National Park, 39 843 ha; Mungkan Kandju National Park, 28 081 ha; Jack River National Park, 26 989 ha; Strathmay Station, 24 647 ha; KULLA (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 20 579 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 11 283 ha; Mary Valley Station, 11 039 ha; Olive River Reserve, 8018 ha; Alwal National Park (Cape York Peninsula Aboriginal Land), 7474 ha; Battle Camp Station, 3767 ha; Jardine River National Park, 3572 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 3119 ha; Mount Jack Station Acquisition, 2420 ha; Heathlands Resources Reserve, 2254 ha; Orchid Creek (Under Negotiation With Aboriginal Land And NP), 2077 ha; Errk Oykangand National Park (Cape York Peninsula Aboriginal Land), 830 ha; Annan River (Yuku Baja-Muliku) National Park, 204 ha.

Issue 1: Maintain healthy melaleuca communities

Indicators of healthy melaleuca communities:

Woodlands

- Healthy melaleuca woodlands have grasses, sedges, or shrubs (or any mix of these) in the understorey. A few canopy trees of varying size should be present—enough to eventually replace the canopy.
- Grasses are upright and vigorous, with well-formed bases. Perennial grasses are more common than annuals.
- Some melaleuca woodlands on low rises and hill slopes have a naturally-dense shrub layer. These can include species such as grevillea and *Jacksonia* spp. Grasses will be sparse here.

Heath

- There is a variation in age-class of heath stands across the landscape.

Gallery forests

- Plants such as the cluster fig *Ficus racemosa* var. *racemosa*, Leichhardt tree *Nauclea orientalis*, ebony *Diospyros* sp., wild plum *Terminalia platyphylla*, strychnine bush *Strychnos lucida* or wattles are present in the canopy or shrub layer.
- There is an absence of blackened trunks.

Swamps

- Sedges are upright and vigorous. Ferns are vigorous without a significant build-up of dead material.

Grasses in melaleuca woodlands should be upright and vigorous with well-formed bases.

Mark Newton, DSITIA, Main Edward River Road (2008).

Gallery forests do not require fire. Maintaining a landscape mosaic in surrounding fire-adapted communities will assist in protection from wildfire.

Daryn Storch, QPWS, Lakefield National Park (2011).

The canopy is quite sparse in scrub teatree *Melaleuca citrolens* woodlands.
Mark Newton, DSITIA, Musgrave (2008).

The following may indicate that fire is required:

Woodland

- Grasses or sedges collapsing or appearing matted with a build-up of dead material.
- *Xanthorrhoea* spp. (where present) have brown skirts.
- Shrubs (where present) are starting to decline, the crowns or branches are dying and/or lower leaves are browning.

Swamps

- Continuous fuel exists above the water level.
- Sedges are collapsing or appear matted. They have a build-up of dead material. This can form above the water level.
- Ferns are accumulating dead fronds.
- Pandanus (where present) have a build-up of dead fronds.

Heaths

- Plants are beginning to lose their lower level leaves or some crowns are dying.
- Plants have some dead or dying branches.

Melaleuca woodland on rises.

Skirts of dead material on grass trees can indicate the need to apply fire.

Mark Newton, DSITIA, Upper Archer/Wenlock River (2003).

Collapsing, matted sedges.

Kerensa McCallie, QPWS, Conway National Park (2011).

Discussion

- A key strategy to manage the vast expanse of inaccessible melaleuca communities in Cape York Peninsula is broad-scale management through aerial ignition. Ideally this would include at least three different ignition periods on each property, each year. However, the ability to achieve this will depend on resourcing. Aim to achieve as many ignition periods as feasible.
- Melaleuca communities with a peat layer are vulnerable to peat fires in the drier months. These areas should always be burnt with standing water present or when the peat layer is water logged (refer to Issue 2, for guidelines to avoid peat fire).
- Melaleuca woodlands are quite resilient and do not change quickly. In addition, fires can be frequent and long-unburnt areas rare. In some wetter areas casuarinas and acacias may become frequent.
- The number of melaleuca species and of communities containing melaleuca on Cape York Peninsula is greater than anywhere else in Australia (Stanton 1976) and their fire management requirements are variable.
- Be aware that the **papery bark** of melaleuca is volatile, highly flammable and is often described as a 'ladder fuel' as it causes fire to rapidly ascend from the base to the top of the tree. Be aware of wind conditions and ember spotting.
- Be aware that very tall (up to 50 m) gallery forests along levee banks of major streams occur (e.g. within Lakefield national Park), but are not described in the Regional Ecosystems database (Queensland Herbarium 2011a). Tall (> 30 m), melaleuca woodlands on the margins of swamps and lagoons on deep peat soils are also not described in the Regional Ecosystems database (Queensland Herbarium 2011a).
- Rubber vine occurs in gallery forest and can be managed with fire. Fire should only be applied after at least 30 mm of rain when the melaleuca bark is wet (refer to Chapter 10 [Issue 4], regarding fire management guidelines).
- Grasses are generally considered ready to burn when they reach 50–60 per cent cured. The North Australian Grassland Fuel Guide (Johnson 2001) may assist in determining when grasses are ready to burn. However, caution should be used and local knowledge sought as some grass species which still appear too green to burn, will burn severely (and vice versa).

The fire tolerance of ant plants *Myrmecodia beccarii* is unknown. Where this species is present, use a low flame height.

Paul Forster, Queensland Herbarium (2000).

What is the priority for this issue?

Priority	Priority assessment
High	Planned burns to **maintain ecosystems** in areas where **ecosystem health** is **good**.

Assessing outcomes

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Select at least two of the following as most appropriate for the site:

Measurable objectives	How to be assessed	How to be reported (in fire report)
Woodland: 30–60 % of melaleuca woodland burnt within management area.	Using fire scar remote sensing data, estimate burnt and unburnt country on an annual basis.	**Achieved:** 30–60 %. **Partially Achieved:** 20–30 % or 60–80 %. **Not Achieved:** < 20 % or > 80 %.
Woodland: > 50 % of Pandanus skirts retained.	Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire severity) and estimate number of Pandanus skirts remaining after fire.	**Achieved:** > 50 % retained. **Partially Achieved:** 25–50 % retained. **Not Achieved:** < 25 % retained.

Melaleuca swamps or gallery forests: The planned burn does not result in a peat fire.	Ongoing visual assessment during and post burn to determine if the fire has carried into peat layer and developed into a peat fire.	**Achieved:** Fire did not carry into peat layer and develop into a peat fire. **Not Achieved:** Fire carried into peat layer and developed into a peat fire.
Gallery forest: No scorch of the margin of gallery forest.	**After the burn** (immediately-very soon after): visual estimation of percentage of margins scorched – from one or more vantage points, or from the air. **Or** **After the burn** (immediately-very soon after): walk the margin of the pocket or representative sections (e.g. a 100m long section of the margin in three locations) and estimate the percentage of margin scorched.	**Achieved:** No scorch of the margin. **Partially Achieved:** < 10 % of margins scorched. **Not Achieved:** > 10 % or margins scorched.
Heath: 10–20 % of heath communities burnt within the Park in any one year.	Using fire scar remote sensing data, estimate burnt and unburnt country on an annual basis.	**Achieved:** 10–20 %. **Partially Achieved:** < 10 % or 20–30 %. **Not Achieved:** > 30 %.

If the above objectives are not suitable refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System, or consider formulating your own.

Monitoring the issue over time

Many issues are not resolved with a single planned burn and it is important to keep observing the land. To support this, it is recommended that observation points be established. Observation points are usually supported by photographs and by recording observations. Instructions for establishing observation points can be obtained from the monitoring section of the QPWS Fire Management System.

Woodland of *Melaleuca saligna* on floodplains. The naturally-sparse ground layer of this community means that fires are infrequent.

Mark Newton, DSITIA, 12 Mile Yards (2004).

Low-severity fire in melaleuca woodland.

Mark Newton, DSITIA, Stewart River Crossing (2008).

Fire parameters

What fire characteristics will help address this issue?

Melaleuca woodland

Fire frequency / interval (refer to Appendix 2 for a discussion)

- Apply mosaic planned burns across the landscape at a range of intervals to create varying stages of post-fire response (i.e. recently burnt through to the maximum time frame). Consider a broad fire interval range of between **one** and **three years**.

Fire severity

- **Low** to **moderate**.

Fire severity class	Fire intensity (during the fire)		Fire severity (post-fire)	
	Fire intensity (kWm^{-1})	Average flame height (m)	Average scorch height (m)	Description (loss of biomass)
Low (L)	< 150	< 0.5	≤ 2.5 (up to 8m on melaleuca trees)	Significant patchiness. Litter retained but charred. Humus layer retained. Nearly all habitat trees, fallen logs and grass stubble retained. Some scorching of elevated fuels. Little or no canopy scorch.
Moderate (M)	150–500	0.5–1.5	2.5–7.5 (up to 20m on melaleuca trees)	Moderate patchiness. Some scorched litter remains. About half the humus layer and grass stubble remain. Most habitat trees and fallen logs retained. Some scorch of elevated fuels. Little or no canopy scorch.

Note: This table assumes good soil moisture and optimal planned burn conditions.

- Refer to Chapter 1 (Issue 1), regarding other fire management guidelines.

Melaleuca swamps

Fire frequency / interval (refer to Appendix 2 for a discussion)

- Use a frequency that is greater than **four years** to allow sufficient fuel to accumulate enabling fire to carry. These communities can be left for much longer unless they are at risk of wildfire encroachment.
- Keep fire out when peat is dry (refer to Issue 2, for guidelines to avoid peat fire).

Fire severity

- **Moderate** with occasionally **high**.

Fire severity class	Fire intensity (during the fire)		Fire severity (post-fire)	
	Fire intensity (kWm^{-1})	Average flame height (m)	Average scorch height (m)	Description (loss of biomass)
Moderate (M)	150–500	0.5–1.5	2.5–7.5	Moderate patchiness. Some scorched litter remains. About half the humus layer and grass stubble remain. Most habitat trees and fallen logs retained. Some scorch of elevated fuels. Little or no canopy scorch.
High (H)	500–1000	1.5–3.0	7.5–15.0	Some patchiness. Some humus remains. Some habitat trees and fallen logs affected. At least some canopy scorch in moderate < 20 metre height canopy, mid stratum burnt completely (or nearly so).

Note: This table assumes good soil moisture and optimal planned burn conditions.

Melaleuca gallery forests

- Refer to Chapter 10 (Issue 6), for fire management guidelines.
- Burn the surrounding areas under conditions that limit fire encroachment. Fire has a role in defining the ecotone— allow fire to carry into the edge of these communities so that the ecotone can be maintained. Occasional fire within the community will play a role in maintaining the melaleuca component.

Melaleuca heaths

- Refer to Chapter 4 (Issue 1), regarding fire management guidelines.

Melaleuca gallery forest.

Mark Newton, DSITIA, Peach Creek (2003).

What weather conditions should I consider?

It is important to be aware of conditions prior to and following burns so that undesirable conditions and weather changes can be avoided, or to help with burn planning.

Season:

- Burn any time of the year **after the wet season** when it is sufficiently dry to carry a fire. Use occasional storm burns (normally between October and January) or late dry-season burns.
- **Avoid extremely dry conditions**, high temperatures and when the humidity is less than 30 per cent. These conditions tend to occur just before the start of the storm season. Care should be exercised when undertaking planned burning in very high to extreme fire conditions.
- Ensure successive fires are somewhat variable in intensity, season and frequency (e.g. **alternating** early season burns with storm burns or late dry burns) rather than burning to a prescription of every 'x' years at the same time of year. Each fire should create a slightly different mosaic of burnt and unburnt areas.

Melaleuca woodland

- Refer to Chapter 1 (Issue 1), for fire management guidelines.

Melaleuca heaths

- Refer to Chapter 4 (Issue 1), regarding fire management guidelines.

Melaleuca swamps

Season: Burn any time of the year **after the wet season** when it is sufficiently dry to carry a fire. Avoid the very late dry season when the peat may be dry.

GFDI: < 11 and occasionally up to 18 for high-severity

DI (KBDI): 80–180

Wind speed: 15–20 km/hr

Soil moisture: Prior to the planned burn ensure standing water is present or the peat is waterlogged (water can be squeezed from the peat).

Melaleuca gallery forests

- When allowing fire to penetrate from surrounding areas, ensure moist conditions exist. Avoid peat fires by ensuring standing water is present or the peat is waterlogged (water can be squeezed from the peat).

What burn tactics should I consider?

Tactics will be site-specific and different burn tactics may need to be employed at the same site (e.g. due to topographical variation). During the burn regularly review and adjust tactics as required to achieve the burn objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

Melaleuca woodland

- **Burn in association with the surrounding landscape:** Melaleuca woodlands are burnt in association with the surrounding fire-adapted communities such as grasslands and eucalypt woodlands. Refer to Chapter 1 (Issue 1) for tactics. Note that melaleuca woodlands will tend to burn less frequently than eucalypt communities due to lower fuel accumulation rates and/or the presence of moisture.

Melaleuca heaths

- Refer to Chapter 4 (Issue 1), regarding fire management guidelines.

Melaleuca swamps

- **Secure containment:** Melaleuca swamps tend to burn with moderate to high severity. When burning swamps, it may be necessary to protect the surrounding areas from high-severity swamp fires. This can be achieved by burning the surrounding areas early in the season or at the end of the previous year.
- **Ongoing fire management in surrounding areas** will assist in preventing late-season wildfire impacts and peat fires. The best way to mitigate wildfire is to maintain mosaic burning in the surrounding landscape.

Melaleuca gallery forests

- **Limit fire encroachment.** Refer to Chapter 10 (Issue 6), regarding fire management guidelines.
- **Ongoing fire management in surrounding areas** will assist in preventing late-season wildfire impacts and peat fires. The best way to mitigate wildfire is to maintain mosaic burning in the surrounding landscape.

Issue 2: Avoid peat fires

On Cape York Peninsula most areas dry out seasonally, therefore creating an annual peat fire risk.

Low-lying communities (including wetlands and melaleuca communities) will often accumulate partially decayed, densely packed vegetation known as peat. In the absence of good soil moisture the peat is easily ignited resulting in a peat fire. Peat fires can burn for months, and can have very negative impacts on the vegetation community. Peat takes many years to re-form.

Awareness of the environment

Key indicators of suitable conditions to avoid peat fires:

- Standing water: visible water on surface or surface water that covers the bases of sedges and grasses.
- In the absence of standing water, the peat should be water logged (it is possible to squeeze water out of it).
- Regular fires in surrounding fire-adapted communities that provides adequate protection of peat communities from wildfire.

Melaleuca community with an understorey of ferns and sedges with standing water.
Sylvia Millington, QPWS, Mt Coom (2010).

Post-fire in a melaleuca community with standing water.

Mark Parsons, QPWS, Sunday Creek (2010).

Peat is extremely vulnerable when dry.

Mike Ahmet, QPWS, Cape Melville (2004).

Discussion

- Peat is highly flammable when dry due to its porous nature and high-carbon content. The resulting fire is generally of a high to very high-severity, is difficult to put out, may burn slowly and for an extended period of time and can severely damage or destroy ecosystems. Re-ignitions can occur many weeks after the main fire has passed.
- Be aware of peat issues when burning in areas adjacent to melaleuca communities or wetlands. The condition of the peat should be checked to ensure that if fire encroaches the peat will not be accidentally ignited. If it is necessary to burn adjacent areas in less than ideal conditions, manage the fire carefully to minimise the risk of fire entering the peat area (use suitable tactics such as burning away from wetland edges).

What is the priority for this issue?

Priority	Priority assessment
Very high	Where peat is present, it is important to consider the most appropriate management during burn planning and implementation.

Peat fires can burn for many weeks and have a significant impact on melaleuca. Avoid very late dry season fires.

Peter Stanton, Environmental Consultant Pty Ltd, Low Lakes, Lakefield National Park (1991).

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Measurable objectives	How to be assessed	How to be reported (in fire report)
The planned burn does not result in a peat fire.	Ongoing visual assessment during and post burn to determine if the fire has carried into peat layer and developed into a peat fire.	**Achieved:** Fire did not carry into peat layer and develop into a peat fire. **Not Achieved:** Fire carried into peat layer and developed into a peat fire.

If the above objectives are not suitable refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System, or consider formulating your own.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- Refer to relevant fire vegetation group.

Low-severity fire adjacent to a *Melaleuca viridiflora* community. Ground saturation has been used to control fire encroachment.

Mark Parsons, QPWS, Sunday Creek (2010).

What weather conditions should I consider?

It is important to be aware of weather predictions prior to and following burns so that undesirable conditions and weather changes can be avoided.

Season: Avoid late dry-season fires in the vicinity of peat

GFDI: < 11
DI (KBDI): < 80–100

Wind speed: < 20 km/hr

Soil moisture: The presence of standing water or waterlogged peat is the critical factor that will avoid peat fire.

What burn tactics should I consider?

When burning adjacent fire-adapted areas, where the conditions of standing water or waterlogged peat can not be achieved, use tactics that will limit encroachment of fire into the community (see below).

- **Aerial ignition.** Broad-scale fire management is the most common technique for fire management on Cape York Peninsula. Refer to Chapter 1 'Eucalypt communities' for techniques. Timing planned burns to avoid peat fires is particularly important as it may be the only measure by which to gauge the condition of the peat prior to the day of ignition. Targeting surrounding communities early in the dry season, or when water is visible on the surface will assist in avoiding peat fire.
- **Limit fire encroachment into non-target communities.** Where the non-target community is present in low lying areas utilise the surrounding topography to create a low-intensity backing fire that travels down slope towards the non-target community. If conditions are unsuitable (e.g. the non-target community is too dry to ensure the fire will self-extinguish on its boundary or it is upslope of a potential run of fire), use appropriate lighting patterns along the margin of the non-target community. This will promote a low-intensity backing fire that burns away from the non-target community (refer to Chapter 10 [Issue 6], regarding tactics).
- **A low-intensity backing fire.** A slow-moving, low-intensity backing fire will generally result in the more complete coverage of an area and a better consumption of fuel. This can be created using slope, wind direction or topography and ensures fire intensity and rate of spread are kept to a minimum.
- **Spot ignition** is used to alter the desired intensity of a fire and create the desired mosaic of burnt and unburnt areas. A number of patterns of lighting can be used. The spacing of the spots affects the resulting intensity and mosaic. Refer to Chapter 1 'Eucalypt communities' for techniques.

Issue 3: Limit fire encroachment into non-target communities

Refer to Chapter 10 (Issue 6), regarding fire management guidelines.

Chapter 6: Acacia communities

This fire vegetation group includes all communities where acacia dominates the canopy. Canopy species include lancewood *Acacia shirleyi*, *Acacia polystachya* or *Acacia homaloclada*, *Acacia brassii* or north coast wattle *Acacia leptostachya*. These communities exist in small pockets particularly on poorer soils. In most cases acacia communities are of such limited extent that they have not been mapped.

Fire management issues

On Cape York Peninsula, these communities are self-protecting due to a combination of low fuel loads and their position in the landscape. They are not actively managed with fire.

Discussion

- This Fire Vegetation Group is essentially self-protecting due to a combination of low fuel loads and the position of acacia communities in the landscape. Fires may trickle through at low intensity occasionally when sufficient fuel is available. Sometimes acacia communities occur in rocky areas in which fire will not carry at all.
- Lancewood communities occur on ironstone jump-ups. These appear as small isolated pockets on raised duricrusts that are surrounded by eucalypt communities. Frequent severe fire in lancewood communities can have an impact on community structure (as lancewoods only reproduce via seed). However the occasional moderate to high-severity fire may benefit the community by allowing the species' hard seeds to germinate. Russel-Smith et al. (2010) suggest that more than 10 years is required to allow lancewood to mature and set-seed prior to the next fire.

Cape York has five endemic acacia species including:

1. *Acacia* sp. (Iron Range D.G. Fell DF2327)
2. *Acacia solenota*
3. *Acacia* sp. (Harmer Creek, J.R. Clarkson, 9133)
4. *Acacia ommatosperma* (Mekunga Creek, J.R. Clarkson, 4373)
5. *Acacia* sp. (Mekunga Creek, J.R. Clarkson, 4373).

Extent within bioregion: 2496 ha, ‹ 1 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Crosbie Creek Station, 161 ha; Strathmay Station, 157 ha.

Acacia communities are usually dominated by a single species. This community has been impacted by a severe fire and will slowly recover providing further fires do not impact it for many more years.

Peter Stanton, Environmental Consultant Pty Ltd, Cape Melville (1993).

Chapter 7: Dunes and coral cays

Dune and coral cay communities are found in interrupted strips along the coastline and on the continental islands and cays of the northern Great Barrier Reef and Torres Strait. This fire vegetation group is very diverse and includes coastal she-oak woodland, microphyll and notophyll vine forest on fore dunes (beach scrub) and pisonia forest.

Fire management issues

All dune and coral cay communities are fire-sensitive and do not require fire.

In some cases dune and coral cay communities are vulnerable to wildfire during the dry season and their protection relies on proactive fire management in adjacent, fire-adapted communities. Sometimes these communities may become more susceptible to wildfire in severe fire weather, particularly as a result of disturbances such as drought, logging, cyclones or weed invasion (refer to Chapter 10 [Issue 7], regarding post-cyclone fire management guidelines).

Issue:

1. Limit fire encroachment into dunes and coral cays.

Extent within bioregion: 57 179 ha, < 1 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Shelburne Bay Environmental Purposes Reserve, 3659 ha; Jardine River Resources Reserve, 2184 ha; KULLA (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 2172 ha; Jardine River National Park, 2113 ha; Cape Melville National Park, 1748 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 1516 ha; Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 1460 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 979 ha; Bathurst Bay land adjoins Lakefield NP, 620 ha; Olive River Reserve, 416 ha; Endeavour River National Park, 263 ha; Iron Range/Portland Roads, 151 ha; Annan River (Yuku Baja-Muliku) Resources Reserve, 99 ha; Heathlands Resources Reserve, 78 ha; Possession Island National Park, 59 ha; Three Islands Group National Park, 48 ha; Lizard Island National Park, 43 ha; Denham Group National Park, 40 ha; Flinders Group National Park, 25 ha; Annan River (Yuku Baja-Muliku) National Park, 21 ha; Howick Group National Park, 14 ha; Turtle Group National Park, 13 ha; Kalpowar land adjoins Lakefield National Park, 8 ha; Saunders Islands National Park, 3 ha.

Issue 1: Limit fire encroachment into dunes and coral cays

Refer to Chapter 10 (Issue 6), regarding fire management guidelines.

Aim to conduct mosaic burns in surrounding fire-adapted communities to protect these communities from wildfire. Beach scrub edges are generally self-protecting during planned burning in appropriate conditions. Sometimes however, it may be necessary to burn back from the edges of this vegetation type.

Chapter 8: Rainforest

Rainforests occur predominantly in intermittent strips along the east coast (predominantly between Coen and Lockhart River) and as gallery forests in thin strips along rivers. On Cape York Peninsula this fire vegetation group includes mesophyll, notophyll and microphyll vine forest, gallery forests, boulder fields with vine thickets and rock pavements with very sparse herbland or shrubland. It also includes gallery forests of the Archer and Coen river systems and parts of other river systems.

Fire management issues

Typically under low to moderate-severity fire, rainforests will not burn due to moisture, microclimatic conditions and a lack of flammable grasses (Bowman 2000). Rainforest that has been repeatedly impacted by severe, late dry season fire are retracting in dryer central and western areas of the bioregion. However, in the higher rainfall areas of Cape York Peninsula (approximately greater than 1500 mm), rainforest expansion has (and continues) to occur on a large scale (Stanton 1992). A lack of fire or the practice of applying repeated, early dry-season fire (in fire-adapted communities) is the most likely cause of rainforest expansion. Refer to Chapter 10 (Issue 5), regarding fire management guidelines for reducing overabundant seedlings/saplings.

The main strategy in the protection of rainforests is to maintain surrounding fire-adapted communities with mosaic burning. This will minimise the spread and severity of wildfire during the late dry season. In certain situations, rainforests are more vulnerable to fire (e.g. dry scrubs or gallery forest adjacent to eucalypt communities or where damaged rainforest is upslope from a planned burn area). In these instances it may be necessary to employ specific tactics such as burning away from rainforest edges.

Issue:

1. Limit fire encroachment into rainforests.

Extent within bioregion: 480 819 ha, 4 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Kulla (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 76 779 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 33 385 ha; Jardine River National Park, 32 209 ha; Olive River Reserve, 15 581 ha; Mungkan Kandju National Park, 15 018 ha; Heathlands Resources Reserve, 14 504 ha; Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 5735 ha; Cape Melville National Park, 5669 ha; Shelburne Bay Environmental Purposes Reserve, 3266 ha.

Discussion

- The rainforests of Cape York Peninsula are unique in Australia due to the influences of nearby Papua New Guinea (PNG). The continent of Australia had been periodically joined to PNG many times over the last few million years for significant periods of time due to sea level fluctuations. The land bridge created at times when they merged allowed flora and fauna the ability to travel or disperse more readily. Cape York Peninsula, being the point at which the land masses joined, was at the forefront of these migrations and the rainforests were particularly influenced by these periodic merges.
- Be aware that some rainforest margins are stable in the absence of fire even if climatic conditions are suitable for rainforest expansion. Stanton and Fell (2005) attribute this to unsuitable soil conditions.

In the drier areas, severe late dry-season fires are causing rainforests to contract.
Mark Newton, DSITIA (2003).

Issue 1: Limit fire encroachment into rainforests.

Refer to Chapter 10 (Issue 6), regarding fire management guidelines.

To protect rainforest edges from wildfire it is essential to conduct mosaic burns in surrounding fire-adapted communities. Rainforests edges are generally self-protecting during planned burning under appropriate conditions. Sometimes however, it may be necessary to burn back from rainforest edges.

Chapter 9: Mangroves and saltmarshes

Mangroves and saltmarsh are found near or within estuarine or brackish water. This vegetation group is periodically inundated through tidal action and storms. Mangroves occur in stands (along tidal zones) as low trees or shrubs with very little other vegetation present. Saltmarsh is dominated by salt-adapted sedges or grasses with other plants sparse.

Fire management issues

Mangroves do not require fire and generally do not burn. Mangroves can occasionally be scorched in nearby planned burning operations or wildfire but it is rare that any lasting damage is done.

Saltmarsh is potentially flammable however it is not actively protected from fire on Cape York Peninsula. Saltmarsh can burn in association with fires in the surrounding landscape. Occasional fire here may also play a role in reducing or eliminating rubber vine infestations.

Extent within bioregion: 272 990 ha, 2 per cent; Regional ecosystems: Refer to Appendix 1 for complete list.

Examples of this FVG: Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 22 925 ha; Bathurst Bay land adjoins Lakefield National Park, 10 213 ha; Shelburne Bay Environmental Purposes Reserve, 7760 ha; Cape Melville National Park, 5466 ha; Olive River Reserve, 4318 ha; Jardine River National Park, 1486 ha; Endeavour River National Park, 1072 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 724 ha; Howick Group National Park, 660 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 625 ha; Flinders Group National Park, 440 ha; Jardine River Resources Reserve, 356 ha; Annan River (Yuku Baja-Muliku) National Park, 354 ha; Kalpowar land adjoins Lakefield National Park, 103 ha; Iron Range/Portland Roads, 102 ha; Turtle Group National Park, 84 ha; Lizard Island National Park, 55 ha; Heathlands Resources Reserve, 32 ha; Possession Island National Park, 30 ha; Saunders Islands National Park, 20 ha; Three Islands Group National Park, 17 ha; Denham Group National Park, 9 ha; Piper Islands National Park (Cape York Peninsula Aboriginal Land), 6 ha; Endeavour River Resources Reserve, 4 ha; Round Island Conservation Park, 1 ha.

Chapter 10: Common issues

In the Cape York Peninsula bioregion there are some issues where the fire management approach is similar irrespective of the fire vegetation group. Rather than repeating the issues for each fire vegetation group, they are gathered in this chapter and are cross-referenced (where relevant) in each fire vegetation group chapter.

Fire management issues:

1. Hazard reduction (fuel management) burns.
2. Planned burning near sensitive cultural heritage sites.
3. Manage high-biomass invasive grasses.
4. Reduce rubber vine.
5. Reduce overabundant seedlings / saplings.
6. Limit fire encroachment into non-target fire vegetation group.
7. Post-cyclone planned burning.

Issue 1: Hazard reduction (fuel management) burns

In many cases it is important to use fire to reduce fuels. In the QPWS Fire Management System, protection zones aim to create areas of simplified vegetation structure and reduced fuel levels around key infrastructure, property and natural and cultural resources that may be damaged by fire. Protection zones should be maintained in a relatively low fuel hazard state by planned burning as often as fuel levels allow. In wildfire mitigation zones the aim of planned burning is to simplify the structure and reduce the quantity of fuel (within the ecological regime for the community) to mitigate flame height, spread and intensity of subsequent wildfires; and therefore improve their controllability.

Frequent, intense late season fires occur within drier areas of the bioregion and often cover vast areas. They threaten life and property and have been shown to have significant impact on conservation values and native species. The main strategy for managing these fires is through broad-scale mosaic burning within the fire-adapted landscape (e.g. refer to Chapter 1: Eucalypt Communities). This hazard reduction guideline (this issue) is for the management of protection and wildfire mitigation zones, and does not cover broad-scale fire management within the broader landscape.

Awareness of the environment

Main indicators of where fire management is required

- The combined accumulation of all fuels (surface fuels, near-surface fuels, elevated fuels and bark hazard) exceeds a low to moderate overall fuel hazard as per the Overall Fuel Hazard Assessment Guide (Hines et al. 2010b). Note that this is the preferred assessment method.

Or

- The combined accumulation of all fuels (surface fuels, near-surface fuels, elevated fuels and bark hazard) exceeds five tonnes per hectare (see Step 5 of the supporting guideline: How to assess if your burn is ready to go, for a fuel load estimation technique).

Descriptive indicators of where fire management is required
(Not all of these indicators will apply to every fire vegetation group)

- Containment hazards (e.g. stumps, logs and stags) are present along firelines within protection zones.
- A high bark hazard is present.
- Dead material has accumulated around the base of grasses, sedges and ferns.
- There is an accumulation of continuous surface fuels that will carry a fire.
- Ground layer plants or shrubs are smothered by leaf litter in some areas.
- Shrub branches have significant dead material.
- Ribbon bark, leaf litter and fine branch material is perched in shrub and sapling foliage.
- An accumulation of coarse fuels with a diameter greater than six millimetres is present on the ground or perched in shrubs and trees.
- The mid or lower stratum is difficult to see through or walk through.

Discussion

- To estimate fuel hazard (recommended for use in open forests and woodlands) use the Overall Fuel Hazard Assessment Guide (Hines et al. 2010b).
- To estimate fuel load, refer to Step 5 of the QPWS Planned Burn Guidelines: How to Assess if Your Burn is Ready to Go.
- The terms fuel load and fuel hazard are widely used to describe fuels, often interchangeably. While they are related, they do differ significantly (refer to Photos 1a and 1b) and can be defined as:

Fuel hazard—'the 'condition of the fuel taking into consideration such factors as quantity, arrangement, current or potential flammability and the difficulty of suppression if fuel should be ignited' (Wilson 1992).

Fuel load— 'the dry weight of combustible materials per area, usually expressed as tonnes per hectare. A quantification of fuel load does not describe how the fuel is arranged nor its state or structure' (Hines et al. 2010a).

- It is important to maintain a simplified vegetation fuel structure in protection zones and wildfire mitigation zones, which means addressing issues such as suspended and elevated fuel and overabundant saplings and seedlings.
- Fire management that favours grasses will assist in achieving an open structure suitable for wildfire management and mitigation. Moist conditions and low-severity burns that retain the bases of grasses will give them a competitive advantage over woody species.

Demonstration of the difference between **fuel load** and **fuel hazard.**

Photo 1a: The two samples above have the **same fuel load** (eighteen pages of newspaper) but a different fuel arrangement.

Troy Spinks, QPWS (2010).

Photo 1b: The fuel arrangement contributes to the difference in **fuel hazard.**

Troy Spinks, QPWS (2010).

- In wildfire mitigation zones it is essential to maintain ecosystem health. Ensure the use of appropriate conservation objectives for the fire vegetation group in addition to a fuel reduction objective (refer to fuel reduction objectives below).
- When establishing protection zones or wildfire mitigation zones favour fire vegetation groups that support a simplified vegetation fuel structure. Where possible avoid fire vegetation groups containing species that naturally produce high-severity fire during wildfire conditions (e.g. heath).
- It is not always possible to contain planned burns within the protected area due to the location of park boundaries (firelines may not exist along park boundaries as they are often in inaccessible areas and have continuous fuel levels. Cooperative fuel reduction burns with neighbours are often the only way to achieve the objectives of protection and wildfire mitigation zones. Refer to the QPWS Good neighbour policy and Notifying external parties of planned burn operations procedural guide.
- Planned burning often creates a smoke management issue particularly where burns are undertaken close to residential areas or commercial operations (e.g. agriculture, airports, major roads and high voltage power lines). Planning needs to consider factors such as fuel type, fuel hazard, temperature inversion and wind speed and direction all of which can have significant effects on the quantity of smoke generated and how it is distributed.

What is the priority for this issue?

Priority	Priority assessment
Highest	Planned burn required to **protect life** and/or **property**, usually within **protection zones**.
Very high	Planned burn required to **mitigate hazard** or **simplify vegetation structure**, usually within **wildfire mitigation zones**.

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Measurable objectives	How to be assessed	How to be reported (in fire report)
Reduce overall fuel hazard to low or moderate. **Or** Reduce fuel load to <5 tonnes/ha.	**Post fire:** use the Overall Fuel Hazard Assessment Guide (Hines et al. 2010b) **Or** Step 5 of the QPWS Planned Burn Guidelines: How to Assess if Your Burn is Ready to Go, to visually assess the remaining fuel in at least three locations.	**Achieved:** Fuel hazard has been reduced to low or moderate. **Or** Fuel load has been reduced to <5 tonnes/ha. **Not Achieved:** Fuel hazard has not been reduced to low or moderate. **Or** Fuel load is > 5 tonnes/ha.

Burn 90–100% (for protection zone) 60–80 % (for wildfire mitigation zone).	Choose one of these options: a. Visual estimation of percentage of vegetation burnt – from one or more vantage points, or from the air. b. Map the boundaries of burnt areas with GPS, plot on ParkInfo and thereby determine the percentage of area burnt. c. In three locations (that take account of the variability of landform and ecosystems within burn area), walk 300 or more metres through planned burn area estimating the percentage of ground burnt within visual field.	**Protection zone** **Achieved:** > 90 % burnt. **Partially Achieved:** 80–90 % burnt, the extent and rate of spread of any subsequent wildfire would still be limited. **Not Achieved:** < 80 % burnt. High proportion of unburnt corridors extend across the area (the extent and rate of spread of any subsequent wildfire would not be sufficiently limited). **Wildfire mitigation zone** **Achieved:** 60–80 % burnt. **Partially Achieved:** 50–60 % burnt. **Not Achieved:** < 50 % burnt. High proportion of unburnt corridors extend across the area (the extent and rate of spread of any subsequent wildfire would not be sufficiently limited).

If the above objectives are not suitable refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System or consider formulating your own.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Low** and occasionally **moderate**. Where there is a high fuel load or elevated fuels (e.g. when first establishing a protection zone) the initial fire may result in a **moderate** to **high** severity. Following this initial burn, aim to reinstate a regime that will promote **low** severity planned burns. Severity should be sufficient to reduce elevated fuels and bark hazard (i.e. allow fire to run up trunks).

Fire frequency / interval (refer to Appendix 2 for a discussion)

- **Protection zones:** Fuel management planned burns within protection zones are carried out as soon as possible after they can carry a fire in order to maintain a relatively low fuel hazard.
- **Wildfire mitigation zones:** Planned burns within wildfire mitigation zones are undertaken within the fire frequency recommended for the fire vegetation group but generally towards the lower end of that range.

Mosaic (area burnt within an individual planned burn)

- **Protection Zones:** 90 per cent burnt.

What weather conditions should I consider?

It is important to be aware of conditions prior to and following burns so that undesirable conditions and weather changes can be avoided, or to help with burn planning.

Western (drier) areas	Eastern (moister) areas
Season: Burn in the early dry seasons where overnight conditions will extinguish the fire. Day-time conditions will allow a good coverage of fire. **GFDI:** < 11 **DI (KBDI):** 80–100 **Wind speed:** < 15 km/hr	**Season:** Burn when conditions are dry enough to ensure a good coverage of fire. Avoid periods of increasing fire hazard in the very late dry season. **GFDI:** < 11 **DI (KBDI):** 80–180 **Wind speed:** < 23 km/hr

Relative humidity (RH): Burn during high relative humidity to achieve a low to moderate-severity burn. This will reduce the potential impact on infrastructure during hazard reduction burns. Cloud cover may also be of use.

Soil moisture: While the aim of hazard reduction burning is to reduce the amount of fuel, good soil moisture is desirable to:

- reduce scorch height and limit leaf-drop post-fire
- minimise the impact on habitat trees, soils and other environmental values
- reduce the likelihood of a woody thicket developing post-fire
- favour grasses over woody species (woody species create undesirable fuel conditions).

What burn tactics should I consider?

Tactics will be site-specific and different burn tactics may need to be employed at the same location (e.g. due to topographical variation). Also, during the burn tactics should be reviewed and adjusted as required to achieve the burn objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

- **Spot ignition** can be used effectively to alter the desired intensity of a fire particularly where there is a high accumulation of available and volatile fuels. Spots closer together will result in a line of a greater intensity (as spots merge and create hot junction zones) while increased spacing between spots will result in a lower intensity fire. The spacing of the spots will regularly vary throughout the burn due to changes in weather conditions, topography, fuel loads etc.
- **Commence lighting on the leeward (smoky) edge** to contain the fire and promote a low intensity backing fire. Depending on available fuels and the prevailing wind on the day, use either spot or strip lighting or a combination of both.
- **A low intensity backing fire** is usually slow moving, and will generally result in a more complete coverage of an area and a better consumption in continuous fuel. This tactic ensures the fire has a greater amount of residence time and reduction of available fuels, particularly fine fuels (grasses, leaf litter, twigs etc), while minimising fire severity and rate of spread.
- While a low intensity backing fire is recommended, a **running fire** of a higher intensity may be required in discontinuous or elevated fuel. Use with caution and be aware of environmental impacts that may result. To create higher intensity, contain the smoky side first, then **spot light the windward (clear) edge**. If the planned burn area is narrow, use caution when lighting the windward edge as the fire intensity may increase when the fire converges with the previously lit backing fire creating higher- intensity junction zones and the potential of fire escaping through a spot-over.

Issue 2: Planned burning near sensitive cultural heritage sites

It is important to have knowledge of the location of significant cultural heritage sites, items and places of Indigenous or European heritage when planning fire management. The local fire strategy should identify these locations (it is important to note that some locations will be culturally sensitive and therefore their location will not be specifically identified in text or on maps). Consulting Traditional Owners, the Department of Aboriginal and Torres Strait Islander and Multicultural Affairs (DATSIMA) Indigenous cultural heritage branch and the Department of Environment and Heritage Protection (EHP) European cultural heritage branch during fire strategy preparation will help to identify these places, items and issues.

Awareness of the environment

Key indicators of Indigenous cultural heritage sites:

- Raised mounds (especially with visible shell debris), or the presence of shell debris scattered on the ground can indicate the presence of shell middens.
- The presence of rock shelters, especially if they have rock paintings, stone tools, artefact bundles, wrapped material or bones inside.
- Engravings exist on trees or rock faces.
- There are arrangements of stones or raised earth patterns on the ground, or artefacts scattered on the ground.
- The presence of trees that have been scarred or carved (e.g. a scar in the shape of a canoe).

Scars in trees may indicate past use by indigenous people. More recent tenants may include opportunistic micro bats. Low to moderate-severity fire presents little threat to these trees.

Daryn Storch, QPWS, Mary Valley Station (2011).

This rock art site is potentially vulnerable to radiant heat and smoke impacts.

QPWS, Carnarvon Gorge.

Caves such as this may contain cultural material vulnerable to smoke impacts.

David Cameron, DNRM, Unspecified location.

Rocks on the ground that appear to have been purposefully arranged are likely to have cultural heritage significance.

David Cameron, DNRM, Atherton (2002).

Shell material strewn across the ground or visible in a mound structure usually indicates the presence of a midden. Middens are potentially vulnerable from radiant heat, fire line construction or vehicle or machinery operations.

David Cameron, DNRM, Bribie Island (2005).

Key indicators of European cultural heritage sites:

- Ruined buildings, corrugated iron shacks, wooden house stumps, old fence posts, old stockyards, tombstones, wells, graves, bottle dumps, old machinery and iron debris may all indicate the presence of a significant site.
- The presence of quarries and old mines sites (often seen as deep holes covered with corrugated iron or wood).
- The existence of plane wreckage.

Early European explorers sometimes left marks, plaques, and paint on trees. These may be vulnerable to fire especially if fuel has built up around the base of the tree.

David Cameron, DNRM, Dogwood Creek (2005).

Discussion

- **Do not** disturb any cultural heritage site or artefact. Leave all materials in place and treat the location with respect. If you are not sure whether the location or artefacts have been reported, consult the cultural heritage coordination units of DATSIMA (for Indigenous sites) or EHP (for European sites). Also refer to the Duty of Care Guidelines provided in the *Aboriginal Cultural Heritage Act 2003* (Queensland Government 2004).
- When planning burns in and adjacent to sensitive cultural heritage places there is a duty of care to ensure appropriate people are involved. Appropriate people may include Traditional Owners, indigenous rangers, historical societies and cultural heritage experts. If you are unsure who the appropriate people are, refer to the DATSIMA and/or EHP cultural heritage coordination units.
- Be aware of QPWS policy and procedures Management of cultural heritage places on NPRSR estate (DERM 2010a, 2010b) which recommends fire management of a heritage place involve burning only the area surrounding the place that does not contain objects or areas related to the cultural heritage place (e.g. fences or gravestones).
- Large-scale wildfires are known to damage cultural heritage values. A landscape proactively managed with mosaic burning will limit the spread and severity of wildfires giving better protection to cultural heritage artefacts and sites.
- The key risks to cultural heritage sites and artefacts from fire are direct contact with flames, radiant heat and smoke (e.g. radiant heat can exfoliate the surface of rock art sites, flame can crack or burn items and smoke can damage paintings).
- To manage impacts from flame and radiant heat, consider reducing fuel levels though manual, mechanical, or herbicide means or a combination of these. If it is not necessary to reduce fuel it is preferable to leave the site completely undisturbed.
- For larger culturally significant sites it may be necessary to create a secure burnt edge by backing fire away from these locations. Use this tactic prior to broader-scale planned burns.
- For sites that may be impacted by smoke (e.g. rock paintings and rock shelters) use wind to direct smoke away from the site.

What is the priority for this issue?

Priority	Priority assessment
Highest	Planned burn required to **protect** life and/or **property**, usually within protection zones.
Very high	Planned burn required to maintain areas of **special conservation significance**.

Assessing outcomes

Formulating objectives for burn proposals

As required choose three or more locations that will be good indicators for the whole burn area. Return to the same locations before and after fire.

Measurable objectives	How to be assessed	How to be reported (in fire report)
No impact on item or site of cultural heritage significance.	Visual inspection of site or items taking photographs before and after fire.	**Achieved:** No impact on site or item. **Not Achieved:** There was some impact on site or item

If the above objectives are not suitable, refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System or consider formulating your own.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- Burn within the parameters recommended for the fire vegetation group. **Low**-severity fires will be less likely to impact on cultural heritage sites.

Fire frequency / interval (refer to Appendix 2 for a discussion)

- Be guided by the fire zoning plan and the recommendations within it for the fire vegetation group within the planned burn area.

Mosaic (area burnt within an individual planned burn)

- If possible to achieve, use a patchy fire to give greater overall protection to cultural heritage sites and items (unless burning in adjacent areas where the object is to reduce fuel, in which case a good coverage of fire is recommended).

Landscape mosaic

- A landscape proactively managed with mosaic burning will help reduce fuel hazards and thereby limit the spread and severity of wildfires. This will give better protection to cultural heritage artefacts and sites.

What weather conditions should I consider?

It is important to be aware of conditions prior to and following burns so that undesirable conditions and weather changes can be avoided, or to help with burn planning.

Season: Favour early season burning and moist conditions

GFDI: < 11

DI (KBDI): 80–180

Wind speed: < 15 km/hr

Wind direction: Closely monitor the wind direction to avoid smoke, flame and/or radiant heat coming into contact with sensitive cultural heritage sites

Soil moisture: Ensure good soil moisture is present.

Smoke is directed away from a rock art site during a planned burn.
Mark Parsons, QPWS, Fishers Creek (2010).

What burn tactics should I consider?

Tactics will be site-specific and a range of burn tactics may be required at the same location (e.g. due to changes in topography, weather and vegetation). Tactics should be reviewed and adjusted as required to achieve the objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

- **Manual fuel management.** Prior to undertaking planned burns near sites of cultural significance (e.g. scar trees and rock art sites), the manual reduction of fuel may be required. This may include raking, clearing (e.g. rake-hoe line), trimming or leaf blowing the surface fuels away from the site to limit the potential impacts. If it is not necessary to manually reduce the fuel level, it is preferable to leave the site completely undisturbed.
- **Spot ignition** can be used to effectively alter the desired intensity of a fire particularly where there is an accumulation of available and volatile fuels next to a site of interest. Widely-spaced spot ignition is preferred around cultural heritage sites. This tactic will promote a slow-moving and manageable low-severity fire and limit the chance of a high-severity junction zones developing.
- **A low-severity backing fire.** A slow-moving, low-severity backing fire can help ensure fire severity and rate of spread are kept to a minimum.
- Depending on the conditions, **spot light the windward (clear) edge** to direct the active fireline and smoke away from the cultural heritage site. Use a chipped or wet line around the site so the resulting backing fire can be extinguished or will self-extinguish at the chipped or wet line.

Manual removal and burning of flood debris from around the posts of a historical railroad bridge.

Mark Cant, QPWS (2002).

Issue 3: Manage high-biomass invasive grasses

High-biomass exotic grasses are capable of outcompeting native species to form dominant stands. High-biomass grasses of concern on Cape York Peninsula include (but are not limited to) grader, gamba, Parramatta, Guinea, aleman, olive hymenachne, para, thatch and annual and perennial mission grasses. These grasses are generally much taller and produce significantly more dry matter than native species. These traits increase fuel load, fire intensity, spotting ability and flame height all of which lead to an increased fire severity and spread. This then results in greater tree death and loss of habitat features with flow-on effects to flora and fauna species and the community as a whole. Fire can be used as part of control for some high-biomass exotic grasses. At the same time, high-biomass grasses both promote fire and many are promoted by fire. These grasses tend to occur as a result of disturbance and spread along roadsides, firelines and utility easements. It is important to be aware of the presence of high-biomass grasses during planned burn operations.

Awareness of the environment

Key indicators of high-biomass grass species:

Note: be on the lookout for newly-forming stands as **control is much easier if their presence is detected early**.

- Dense stands of grasses (often single-species dominated) are present.
- High-biomass grasses are generally taller than the native species.
- There is a lot of mass and/or dead material present.

Guinea grass infestation.

John Clarkson, QPWS, Mereeba (2007).

Close up of Guinea grass.

Paul Williams, Vegetation Management Science Pty Ltd, near Patterson's Gorge (2005).

The height, mass and structure of guinea grass infestations increases flame height and severity, contributing to tree death.

Mark Parsons, QPWS, Mullers Creek (2010).

In this photo, increased fire severity caused by gamba grass has resulted in tree death.
Paul Williams, Vegetation Management Science Pty Ltd, Bachelor Northern Territory (2007).

A Gamba grass infestation.
John Clarkson, QPWS, Batchelor, Northern Territory (2004).

Grader grass infestation.
John Clarkson, QPWS, Mareeba (2007).

Thatch grass infestation.
John Clarkson, QPWS, Mareeba (2007).

Para grass infestation.
John Clarkson, QPWS, Julatten (2007).

Discussion

- During planned burn operations, where these grasses are present, the potential to either promote them or control them and their effect on fire severity must be considered. Be aware that fire will usually promote these grasses unless used in very specific ways mentioned below.
- Exotic grasses are highly-invasive and thrive on disturbance. They can establish where the cover of native grasses has been reduced, however some species such as gamba grass can outcompete even a dense cover of native grasses.
- There is a relationship between fire timing, frequency and severity and the ability of these grasses to invade which is still poorly understood. You are encouraged to record observations regarding these species' response to fire.
- Be aware of weed hygiene issues when conducting planned burns in areas with high-biomass grasses. Fire vehicles and machinery can aid seed spread along firelines and should be washed down after exposure.
- In many cases it is desirable to avoid burning high-biomass invasive grasses, due to the likely increase in fire severity and the potential to promote them. However, the risk of wildfire later producing an even higher-severity fire must be considered. In some situations, burning high-biomass grasses under mild conditions with planned fire is more desirable then allowing them to burn with wildfire.

- For some species, application or exclusion of fire is known to be an important aspect of control. Specific information is offered below:

Gamba grass and mission grass

- These grasses dramatically increase fuel loads. In gamba grass this can be as high as 11–15 tonnes/ha and possibly as high as 30 tonnes/ha. This can carry fire into the canopy, killing mature trees. As such, **fire is generally not recommended as a control method for these species.**
- If fires are applied they should be conducted prior to seeding. Updrafts during burning can carry the light seeds great distances away and create new infestations.
- Fire removes the bulk of the grass biomass and encourages active growth making herbicide application (following fire) more effective.
- Gamba grass has a short lived seed bank with only one per cent of seeds viable within a year. Thus control is possible over a couple of years.
- An effective method of control for mission grass is to burn before it flowers in the early dry season. A follow-up application of herbicide is required in the next wet season.

Grader grass

- Grader grass is an annual (its life cycle occurs within a year) and the viability of seed in the soil has been observed to drop off after four or five years. Fire should be excluded for four or five years (if fire is applied while the seed is still viable the grader grass will be promoted).
- If using fire, attempt to time it prior to setting-seed (typically in March-May). Timing of fires to control grader grass may be difficult on Cape York Peninsula due to the length of the wet season (fuels may not be sufficiently cured to carry fire before they set seed).
- When fire is reapplied in these infestations ensure good soil moisture exists to aid the re-establishment of native grasses.
- Too-frequent or severe fire promotes the spread of grader grass.
- New infestations of grader grass can be controlled by hand removal, before they set seed (March-May).

Olive hymenachne

- Fire has been shown to be an effective tool in the control of this grass when used in combination with other methods such as grazing or herbicide.
- Fire should be applied just prior to the wet season when plants have dried out enough to provide suitable fuel. Fire should be followed by grazing or herbicide control.
- Fire will destroy seeds on the surface of the soil, but not seed that is buried — a follow-up fire will be required.

Guinea and thatch grass

- Fire is not known to be an effective tool in the control of Guinea grass. However, frequent fire (every one to two years) can promote it's spread through disturbance mechanisms and possibly also through the reduction of canopy cover.
- Post-fire herbicide control is effective but needs to be ongoing.
- If Guinea and thatch grass must be burnt, timing is a critical factor. Avoid burning late in the season to avoid creating a high-severity fire and encroachment into riparian zones.

Para grass

- Fire can be used with partial success for the management of para grass where it occurs in swamps and drainage lines. Fire is more effective where the para grass is within ephemeral swales which have dried out. Burning has been found to be more effective if used later in the year or in combination with chemical control.

Other high-biomass grasses

- Successful fire management techniques for other species of high-biomass grasses in Cape York Peninsula are not yet established and will require experimentation. The examples above may be a useful starting point.

Fruiting para grass.

Paul Williams, Vegetation Management Science Pty Ltd (2007).

Fire has been found to be effective in burning para grass where it exists in ephemeral wetland depressions. This can open channels of water flow previously clogged by grass invasion.

Paul Williams, Vegetation Management Science Pty Ltd, Townsville Town Common (2007).

What is the priority for this issue?

Priority	Priority assessment
High	It is important to be **aware of the presence** of high biomass grasses so that their negative effects can be managed and the potential of control can be considered.

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Choose from below as appropriate:

Measurable objectives	How to be assessed	How to be reported (in fire report)
Protect high-biomass grass infestation from unplanned fire, by burning adjacent areas.	Inspection of infestation at the end of the fire year.	**Achieved:** At the end of the fire year, infestation remains unburnt. **Partially Achieved:** At the end of the fire year, infestation partially burnt. **Not Achieved:** At the end of the fire year, infestation burnt.

*Significant reduction in density of invasive grasses.	Seek advice from resource staff and/or publications such as the Parks Victoria Pest Plant Mapping and Monitoring Protocol (Parks Victoria 1995). One option is given here. **Before and after the burn** (after suitable germination/establishment conditions and growing season): define the density of the infestation using the following criteria (from Parks Victoria Protocol [Parks Victoria 1995]): • Rare (0–4 % cover) = target weed plants very rare. • Light (5–24 % cover) = native species have much greater abundance than target weed. • Medium (25–75 % cover) = roughly equal proportions of target weed and native species. • Dense (> 75 %) = monoculture (or nearly so) of target weed.	**Achieved:** Weed infestation 'drops' two 'density categories' (e.g. goes from dense before the fire to light after the fire). **Partially Achieved:** Weed infestation 'drops' one 'density category' (e.g. goes from dense before the fire to medium after the fire). **Not Achieved:** No change in density category or weed density gets worse. *note that some of these species quickly recover even after they have been reduced. Ongoing monitoring is recommended.

If the above objectives are not suitable, refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System or consider formulating your own.

Monitoring the issue over time

Many issues are not resolved with a single planned burn and it is important to keep observing the land. To support this, it is recommended that observation points be established. Observation points are usually supported by photographs and by recording observations. Instructions for establishing observation points can be obtained from the monitoring section of the QPWS Fire Management System.

When using fire to reduce the density of high biomass grasses, it is important to monitor the potential for these grasses to re-establish.

As highly invasive weeds, high-biomass grasses such as this single guinea grass plant can quickly establish and spread. The maintenance of a healthy native grass cover is vital to exclude high biomass exotic grasses. Fire has an important role in maintaining healthy grass cover.

Mark Parsons, QPWS, Princess Hill, Girringun National Park (2007).

Fire parameters

The fire parameters vary depending on the species (see discussion above).

What burn tactics should I consider?

Tactics will be site-specific and different burn tactics may need to be employed at the same location (e.g. due to topographical variation). During the burn tactics should be reviewed and adjusted as required to achieve the burn objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

- **Burn as part of a control program.** The initial spraying of high-biomass grasses (e.g. Guinea grass) with herbicide, followed a month later by a low to moderate-severity planned burn is an effective control method. The successful treatment of these grasses will require continued monitoring and follow-up (either by fire or herbicide) of any remaining plants and new seedlings.
- **Spot ignition** can be used to effectively alter the desired intensity of a fire particularly where there is a high-biomass grass infestation. Increased spacing between spots will result in a fire of lower-intensity. The spacing of the spots may vary throughout the burn due to changes in weather conditions, topography and fuel loads.
- **A low-intensity backing fire.** A slow-moving, low-intensity backing fire (lit against the wind or up slope), will generally result in the more complete coverage of an area and a better consumption of available fuels. This tactic ensures the fire has a greater amount of residence time, reduces available fuels (particularly fine fuels) and ensures the fire intensity and rate of spread are kept to a minimum.

Issue 4: Reduce rubber vine

Rubber vine *Cryptostegia grandiflora* is found in scattered infestations in southern Cape York Peninsula. It is not restricted to disturbed vegetation and prefers a good layer of organic material in the soil. It is also restricted to areas where fires are absent or infrequent (Mackey et al. 1996). While known rubber vine infestations are primarily south of the Rubber Vine Strategic Control Line (which bisects Cape York Peninsula at approximately 15° South) it has the potential to continue it's spread north throughout the peninsula.

Rubber vine has the ability to smother trees and shrubs and shade-out grasses and marine forbs, making fire difficult to apply. It is usually found in riverine areas, floodplain woodland, saltmarshes and creeks, including dry creek beds. It spreads from these areas onto alluvial flats, plains and beach scrubs. It is also found in higher areas and in isolated pockets where seeds have been dispersed by wind, water or birds.

Awareness of the environment

Key indicators of where rubber vine can be managed with fire:

- Use fire where rubber vine occurs in fire-adapted vegetation, or the fire extent can be limited where it occurs in fire-sensitive vegetation.
- Fire can be used where grass or forbland fuels are still continuous enough to carry a fire despite the occurrence of rubber vine.
- When grass fuel crumbles in the hand, meaning it is sufficiently cured.

Rubber vine occurring in marine samphire forbland. These forblands are adapted to occasional fires. A series of fires may assist in reducing rubber vine.

Barry Nolan, QPWS Cape Upstart (2007).

This sequence of images shows the successful use of fire to control young rubber vine plants.

The image on the left was taken in October 2005. A Moderate-severity fire was used to scorch smaller plants to their tips and brown the leaves of the taller plants.

The image below, taken in March 2006, shows the results.

Eleanor Collins, QPWS, Bowling Green Bay (2006).

Fire might be a useful tool near watercourses in which herbicide use poses an environmental risk.

John Clarkson, QPWS, Undara (2009).

Fire-killed rubber vine. Fire can be a useful technique to kill rubber vine in inaccessible or remote locations.

Barry Nolan, QPWS, Cape Upstart (2009).

Key indicators of rubber vine in situations where care should be taken when using fire or fire alone would be insufficient:

- Where rubber vine occurs in areas that have insufficient fuel to sustain a fire.
- Where rubber vine occurs in fire-sensitive vegetation.

Rubber vine smothering native trees. Fire has been applied to kill rubber vine in the foreground but due to low fuel, has not reached some plants.

Above: Rubber vine flower, Col Dollery.

Barry Nolan, QPWS, Cape Upstart National Park (2008).

Emergent seedlings. If fire were to trickle between the boulders the low fuel load may provide insufficient residence time to cause the sap to boil and kill the plants.
Kerensa McCallie, QPWS, Gloucester Island (2005).

Rubber vine on beach dunes. Fire should not be applied where rubber vine occurs in fire-sensitive vegetation such as beach scrubs unless the impact of fire is limited or other control options are not available.
Kerensa McCallie, QPWS, Gloucester Island (2005).

Rubber vine control by 'heli-torch'. One technique used with success in areas where fire is not desired is aerial ignition using flammable gel. The gel produces fires of limited extent in the right conditions.

Barry Nolan, QPWS, Cape Upstart (2008).

Discussion

- Where sufficient fuel is available, a single fire can be used to reduce or eliminate rubber vine seeds, seedlings and young plants. Follow-up fires may be required if some seeds survive or plants resprout.
- Rubber vine should always be burnt when the soil is moist to allow native grasses the best chance of re-establishing.
- Using fire to control rubber vine is more successful in areas where rubber vine rust occurs. Leaf-drop caused by the rust means the fuel density is greater below infected plants and if this fuel occurs adjacent to the stems, it can increase residence time. Rubber vine rust tends to reduce the density of the plants latex (possibly lowering the boiling point) leading to a more effective burn.
- More mature rubber vine plants require increased residence time to allow the latex to boil, which will kill the plant. Simply scorching mature rubber vine is not sufficient to kill them.
- In areas where rubber vine has shaded-out native grasses, mechanical or chemical control may be necessary. A combination of fire and chemical control could also be useful where grasses abut an infestation. A backing fire into the rubber vine infestation may reduce the area requiring chemical treatment or increase accessibility.
- A heli torch can be used to control rubber vine in fire-sensitive communities, inaccessible areas or where chemical use is not viable. The flammable petroleum-based gel is applied directly to the plant then ignited. The success of this method is generally reliant upon the moisture content of the rubber vine which needs to be high to effectively cause the sap to boil and kill the plant. In some areas this method has been very successful but mixed results in other areas have been reported. See tactics below.
- Take care using fire where fire-adapted communities abut fire-sensitive communities (e.g. rainforest). Dead plant material or high-severity fire can draw fire in to these communities.
- Be aware of weed hygiene issues when planned burning in areas with rubber vine. Fire vehicles and machinery can aid seed spread along firelines, roads and tracks and should be washed down after exposure. Infestations of rubber vine north of the Rubber Vine Strategic Control Line presently occur in the Holroyd Basin and Lama Lama National Park (Cape York Peninsular Aboriginal Land [CYPAL]).

What is the priority for this issue?

Priority	Priority assessment
High	Planned burns to **maintain ecosystems** in areas where **ecosystem health** is **good**.
Medium	Planned burn in areas where **ecosystem health** is **poor** but recoverable.

Using fire in areas where dense rubber vine almost completely dominates the canopy may not be possible due to low fuel loads at the base of the plants.

Paul Williams, Vegetation Management Science Pty Ltd, Finucane Island National Park (2010).

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Measurable objectives	How to be assessed	How to be reported (in fire report)
> 90 % reduction in number of rubber vine seedlings, saplings and young or mature plants.	**Before and after the burn** (after suitable germination/ establishment conditions, or a growing season): In three locations (that take account of the variability of landform and weed density within burn area), one year after fire estimate what percentage saplings have been killed. **Or** If using the 'heli-torch' method, retrace the flight path in three locations and estimate the percentage of mature rubber vine plants killed.	**Achieved:** > 90 % plants killed* **Partially Achieved:** 75–90 % plants killed* **Not Achieved:** < 75 % plants killed* *It is not necessarily a good outcome if you have killed most of the rubber vine plants and yet the fire was too severe.

If the above objectives are not suitable, refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System or consider formulating your own.

Monitoring the issue over time

Many issues are not resolved with a single planned burn and it is important to keep observing the land. To support this, it is recommended that observation points be established. Observation points are usually supported by photographs and by recording observations. Instructions for establishing observation points can be obtained from the monitoring section of the QPWS Fire Management System.

Fire Parameters

What fire characteristics will help address this issue?

Key factors

- The principal factor in successful control is residence time. Slow-moving fire is required to kill mature rubber vine.
- A second fire may be required where mature plants have re-sprouted or seedlings are emerging from the seed bank.

Fire frequency / interval (refer to Appendix 2 for a discussion)

- Apply a follow-up burn the following year if the observations indicate that the issue is not under control. In some cases a third fire may be required to completely remove the infestation. Once resolved, re-instate the recommended fire regime for the fire vegetation group. Continue Monitoring the issue over time.
- In some cases applying the standard recommended fire frequency for the fire vegetation group in which rubber vine occurs may be sufficient to control the issue. Increasing fire frequency for a period of time may further assist in its control.

Fire severity

- **Low** to **moderate**. Best results have been achieved using a slow-moving backing fire with good residence time at the base of the plant in combination with high soil moisture. Fire severity should generally remain within the recommendations for the fire vegetation group in which the rubber vine occurs.

What weather conditions should I consider?

It is important to be aware of weather predictions prior to and following burns so that undesirable conditions and weather changes can be avoided, or to help with burn planning.

Season: Different approaches are possible including burning early in the year with good moisture or alternatively, progressive burning to secure a late season burn under dry conditions or storm burning.

GFDI: < 11

DI (KBDI): 80–160

Wind speed: < 23 km/hr. Variable depending on objective and density of rubber vine infestation (denser infestation may require some fanning by wind so that the fire will carry).

Other considerations: In some western areas, greater rubber vine control has been achieved using low humidity and high temperatures for example 20 per cent humidity and 30°C.

What burn tactics should I consider?

Tactics will be site-specific and different burn tactics may need to be employed at the same location (e.g. due to topographical variation). During the burn tactics should be reviewed and adjusted as required to achieve the burn objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

- **Storm burning** is undertaken in the storm season after the first rains. A minimum of 50 mm is recommended with consideration to the spread of the rainfall. The containment of storm burns relies on earlier-season burning having established defendable boundaries with lower fuel.
- A **running fire** of a higher severity may be required to carry fire through areas of low fuel.
- **A low to moderate severity backing fire.** Where rubber vine is scattered in the understorey, a slow-moving, low to moderate-severity backing fire with good soil moisture (and presence of sufficient surface fuels), ensures a greater residence time at ground level and has proven to be successful in killing seeds, seedlings, young and some mature rubber vine plants.
- **As part of a control program.** In areas where dense rubber vine shades-out grasses and limits the fuel available to the fire, an initial herbicide treatment could be used. Care should be taken when applying fire to dead rubber vine plants which remain hanging in the canopy as they may act as elevated fuels.
- **Aerial incendiary using a heli-torch.** In areas where rubber vine has invaded communities where fire is either not required or desired (e.g. fire-sensitive communities), apply fire using a heli-torch (an aerial incendiary that uses gelled gasoline to ignite the rubber vine directly). The surrounding vegetation needs to be moist to wet to ensure the fire doesn't spread.

Issue 5: Reduce overabundant seedlings / saplings

In the Cape York Peninsula bioregion overabundance of rainforest, melaleuca or eucalypt seedlings/saplings (and occasionally other species) may reduce the health and diversity of the ground-layer through competition and shading. If left unmanaged, the structure of woodlands and forests can become more closed and grasslands can become woodlands, a process known as woody thickening. As woody thickening progresses fires become more difficult to reintroduce.

Melaleuca and eucalypt overabundance occurs predominantly on the drier western and southern areas of the bioregion, west of the dividing range. Rainforest pioneers are more common in the moister eastern area where rainfall is generally > 1500mm (Stanton 1992). Cypress pine, *Callitris intratropica* overabundance in eucalypt communities occurs in the Jardine River catchment and adjacent coastal areas. Rose butternut, *Blepharocarya involucrigera* is invading eucalypt communities in the Iron and McIlwraith Range and to a lesser extent in the Jardine River area. On the cracking clay soils of central Cape York Peninsula the transition is to *Piliostigma malabaricum*.

Awareness of the environment

Key indicators:

- Young trees including rainforest species, melaleuca, eucalypt or cypress pines are beginning to rise above the ground layer plants.
- The understorey or mid-stratum is becoming difficult to see through or walk through.
- Ground-layer plants are declining in health, diversity and abundance due to shading.
- Grasses are thinning.
- Vines are making walking difficult.
- *Alyxia spicata* is climbing into the mid stratum.

Young melaleuca trees are beginning to rise above the grassy ground layer.
Mark Newton, DSITIA, near Silver Planes house (2003).

Young eucalypt trees are abundant in the mid-stratum. It is becoming difficult to see through.
Mike Ahmet, QPWS, Mungkan Kandju (2009).

Grasses are beginning to thin-out due to overabundant trees.
Mike Ahmet, QPWS, Annan River (2008).

Rainforest trees are invading this grassland.
Mike Ahmet, QPWS, Iron Range National Park (2008).

Discussion

- East of The Great Dividing Range in the moister areas of Cape York Peninsula (where rainfall is above 1500 mm per year), the speed of rainforest encroachment into surrounding ecosystems is rapid. This is mainly due to more regular, continual rainfall, warmer temperatures and less frequent fires. In the drier western area of the bioregion, the area impacted by the expansion of melaleuca and eucalypts is less due to frequent, late dry season fires which impact a large proportion of the bioregion. However where it does occur it can have a significant impact on species and communities and emphasis should be placed on minimising further losses of open woodland and grasslands.
- Rainforest expansion at Iron Range National Park occurs rapidly, within 30 years (Stanton 1992; Russel-Smith et al. 2004). Russel-Smith et al. (2004) also found that rainforest expansion can occur even at large distances away from rainforest edges. In grassy pockets within rainforest, fire frequency is likely a more important factor than fire severity in overabundant rainforest seedlings/sapling control.
- Soil type varies the species that are likely to become overabundant. For example, in some areas grasslands are found on deep soil which is suitable for the development of rainforest. Melaleuca overabundance usually occurs on shallow, poorly drained soils. On cracking clay soils of central Cape York Peninsula the transition is to *Piliostigma malabaricum*.
- Cypress pine overabundance is extensive and very far advanced in eucalypt communities that occur in the Jardine River catchment and adjacent coastal areas. Cypress is limited to deeper soil types on broad ridges in an undulating landscape. This overabundance (which has occurred over a long period of time) is now far beyond recovery through planned burn operations. However, nearby emerging problems should be considered a priority.
- In eucalypt communities that exist on floodplains, be aware of episodic mass germination that can occur after flooding. The bare soil provides an ideal seed bed for eucalypt germination, and is usually followed by persistent rains that nurture the regrowth.
- Application of fire in rare grassland communities is a very high priority. These areas include grasslands surrounded by rainforests at Iron Range National Park and coastal headland grasslands invaded by shrubs. Remaining examples of these communities should be retained.

- The endangered golden-shouldered parrots *Psephotus chrysopterygius* nest in termite mounds in grasslands. Their habitat is declining due to melaleuca woodland invading grassland and reducing nesting habitat, food sources and potentially increasing the threat of predation. Melaleuca seedlings and saplings shade-out and eventually replace open grassland communities when high-severity fires are restricted or absent. These parrots are now confined to two populations in central Cape York Peninsula which continue to retreat and become isolated. They are found on protected estate at Staaten River National Park (Garnett and Crowley 2002), Alwal National Park (CYPAL) and Mary Valley Station.
- Palm cockatoos *Probosciger aterrimus* are threatened by overabundant rainforest seedling/saplings in their preferred nesting habitat—open woodlands adjacent to rainforest (Murphy et al. 2003). Palm cockatoos have a lower nesting success rate in rainforest possibly due to higher humidity, greater rates of predation and higher tree turn over. As such, their preference is for nest sites in open woodland areas. However, distance from the rainforest margin is also important as they utilise food sources in both ecosystems— their habitat range is limited to the ecotone. Rainforest expansion threatens suitable nest sites in areas of open woodlands which are burned too infrequently or with low-severity— fire plays a key role in the survival of this species.
- Seed-eating species such as the crimson finch (white bellied) *Neochmia phaeton evangelinae*, and the star finch (northern) *Neochmia ruficauda clarescens* have declined significantly across the tropical north of Australia to such an extent that their survival is threatened. While not completely understood, it is thought that this (in part) is attributed to grasslands being invaded by melaleuca woodland (altering habitat and reducing food sources). Cattle grazing, introduced flora and fauna, illegal trapping and trampling most likely also play a role (Dorricott and Garnet 2007). The finches are found on protected estate at Lakefield National Park and Battle Camp Station in the Laura Basin.
- Woody thickening becomes much more severe where stock grazing is combined with repeated early season burns. Stock grazing reduces fuel loads preventing fires of a sufficient severity to manage overabundant seedlings/saplings. This is further compounded by concentrated feeding on regrowth grasses in the recently burnt areas which allows woody species the competitive advantage.

The grassland habitat of the golden-shouldered parrot continues to decline due to inappropriate fire.

Above: nest in a termite mound.

Daryn Storch, Cape York Peninsular.

Appropriate fire management is vital to the survival of palm cockatoos.

Daryn Storch, QPWS, Wenlock River, Batavia Downs (2010).

A female crimson finch. Inappropriate or altered fire regimes may play a role in their decline.

Daryn Storch, QPWS, Kennedy Bend

Lakefield National Park (2010).

What is the priority for this issue?

Priority	Priority assessment
High	Planned burns to **maintain ecosystems** in areas where ecosystem **health** is **good**.
Medium	Planned burn in areas where **ecosystem health** is **poor** but recoverable.
Low	Planned burn in areas where **ecosystem** structure and function has been **significantly disrupted**.

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understorey or vegetation type. It is recommended that you select at least three locations that will be good indicators for the whole burn area. At these locations walk around and if visibility is good look about and average the results. Estimations can be improved by returning to the same locations before and after fire, and by using counts where relevant.

Select at least two of the following as most appropriate for the site:

Measurable objectives	How to be assessed	How to be reported (in fire report)
> 75 % of mid stratum saplings are reduced.	Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity), estimate the percentage of overabundant saplings (above ground components) scorched.	**Achieved:** > 75 %. **Partially Achieved:** 25–75 %. **Not Achieved:** < 25 %.
Increase the size of grassland.	At a number of locations on the boundary of grasslands and woodlands or rainforests, establish photo monitoring points. Return to these locations within a year of each burn to check the grassland is expanding/woodland or rainforest retreating.	**Achieved:** Grassland expanding/woodland or rainforest retreating. **Partially Achieved:** Grassland not expanding/woodland or rainforest not retreating. **Not Achieved:** Grassland continues to retreat/woodland or rainforest expand.

If the above objectives are not suitable, refer to the compendium of planned burn objectives found in the monitoring section of the QPWS Fire Management System, or consider formulating your own.

Monitoring the issue over time

Many issues are not resolved with a single planned burn and it is important to keep observing the land. To support this, it is recommended that observation points be established. Observation points are usually supported by photographs and by recording observations. Instructions for establishing observation points can be obtained from the monitoring section of the QPWS Fire Management System.

Fire parameters

What fire characteristics will help address this issue?

Residence time or scorching

- **For overabundant cypress, melaleuca and eucalypts** use a slow-moving backing fire that creates high residence time around the base of the saplings/seedlings. For **rainforest saplings/seedlings**, scorching to the tip of the plant is more important, therefore ensure fire is of sufficient severity —see below).

Mosaic (area burnt within an individual planned burn)

- Mosaic burn as much of the area dominated by mid-stratum saplings as possible.

Fire frequency / interval (refer to Appendix 2 for a discussion)

- It is likely that more than one planned burn will be required to manage this issue. Monitor the outcomes until the overabundant saplings/seedlings are controlled.

Fire severity

- **Use moderate** for most situations where young trees are less than one metre tall. Where young trees are taller than one metre, a **high**-severity fire might be necessary. Use high-severity fire with caution, as there will be an impact on habitat trees and fallen logs and the fire will be much harder to contain. Avoid lower-severity burns as this will exhaust fuel and reduce opportunities for subsequent higher-severity burns.

Fire severity class	Fire intensity (during the fire)		Fire severity (post-fire)	
	Fire intensity (kWm^{-1})	Average flame height (m)	Average scorch height (m)	Description (loss of biomass)
Moderate (M)	150–500	0.5–1.5	2.5–7.5	Moderate patchiness. Some scorched litter remains. About half the humus layer and grass stubble remain. Most habitat trees and fallen logs retained. Some scorch of elevated fuels. Little or no canopy scorch.
High (H)	500–1000	1.5–3.0	7.5–15.0	Some patchiness. Some humus remains. Some habitat trees and fallen logs affected. At least some canopy scorch in moderate < 20 m height canopy, mid stratum burnt completely (or nearly so).

Note: This table assumes good soil moisture and optimal planned burn conditions.

Other considerations

- It is important to observe post-fire germination, regeneration and kill rates to ascertain the need for subsequent fires. If the initial fire triggers a flush of new seedlings, a follow-up planned burn within two years, using a **moderate**-severity fire may be required.
- If a fire has triggered a flush of eucalypt seedlings do not burn the following year but allow the fuels to accumulate so that fire in the second year kills the seedlings.
- Once the area has recovered, the recommended regime for the fire vegetation group can be resumed (see relevant chapter).

To manage rainforest sapling and seedlings, fire of sufficient severity should be applied to scorch the tip of the plant (see scorch heights in the table on page 136).
Mike Ahmet, QPWS, Iron Range National Park (2008).

When grasses have thinned as significantly as this, it can be difficult to burn.
Peter Stanton, Environmental Consultant Pty Ltd (1996).

What weather conditions should I consider?

Season: Progressive burning through the year (as conditions allow) in surrounding healthy areas will make it easier to achieve burns **later in the season** that help address overabundant saplings.

Late season burns	Storm burns
GFDI: 2–18	**GFDI:** 12–24
DI (KBDI): 80–180	**DI (KBDI):** < 80
Wind speed: 15–20 km/hr	**Wind speed:** < 23 km/hr

Fires applied too early in the season will result in fire severity that is too low to kill saplings/ seedlings. Note the eucalypts resprouting.

Mike Ahmet, QPWS, Mungkan Kandju (2009).

What burn tactics should I consider?

Tactics will be site-specific and different burn tactics may need to be employed at the same location (e.g. due to topographical variation). During the burn tactics should be reviewed and adjusted as required to achieve the burn objectives. What is offered below is not prescriptive, rather a toolkit of suggested tactics.

- While a moderate-severity fire is recommended to address overabundant rainforest seedlings/saplings, this issue is largely dependent upon the height of the saplings. A **running fire** of a higher-intensity may be required initially where there is a lack of surface and near surface fuels (due to shading-out or if the thicket is well developed). **Line or strip ignition** is used to create a fire of higher-intensity or to help carry fire through moist or inconsistent fuels. In this instance a follow-up planned burn will be required in the one to three years post-fire to kill the surviving and new seedlings/saplings. Poorer soils will take a longer time to accumulate fuel.
- **A backing fire with good residence time.** For melaleuca, cypress and eucalypt overabundance, a slow moving backing fire (lit against the wind on the smoky edge), will allow a greater residence time, while ensuring fire intensity and rate of spread are kept to a minimum. Greater residence time is useful in reducing these overabundant seedlings/saplings.
- **Storm burning** is undertaken in the storm season after the first rains. A minimum of 50 mm is recommended with consideration to the spread of the rainfall.
- **Aerial ignition** is a tactic used when access is difficult and limited. Grid ignition can be used to increase the fire severity (see below). The established route of any flight should take into consideration the property boundaries and any fire-sensitive vegetation. Flight routes should be programmed into a GPS.
- **Grid ignition:** Incendiaries are dropped well-within the park boundary (as illustrated below) in sweeping 180^{o} turns with considerable variation in spacing between ignition points and runs. In areas of overabundant seedlings/saplings, the spacing between incendiaries is reduced to increase the severity and lessen patchiness.

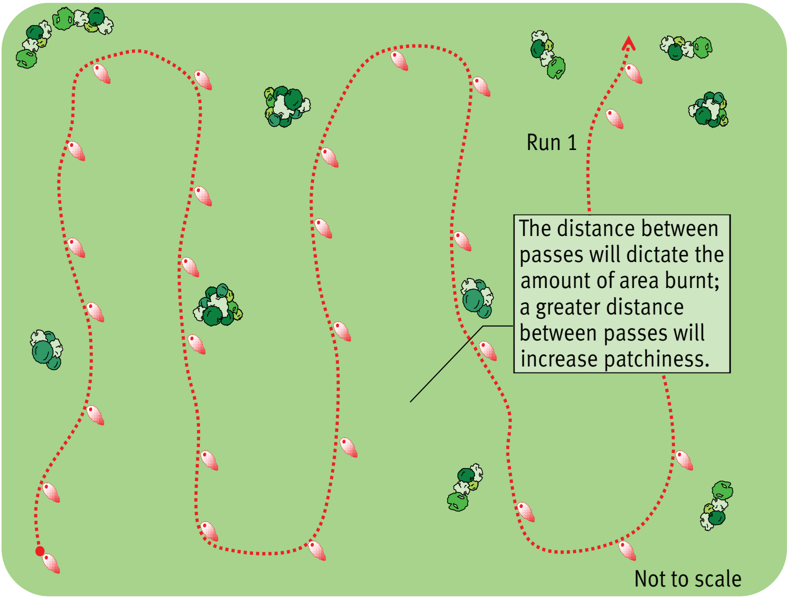

Figure 1: Aerial ignition tactics

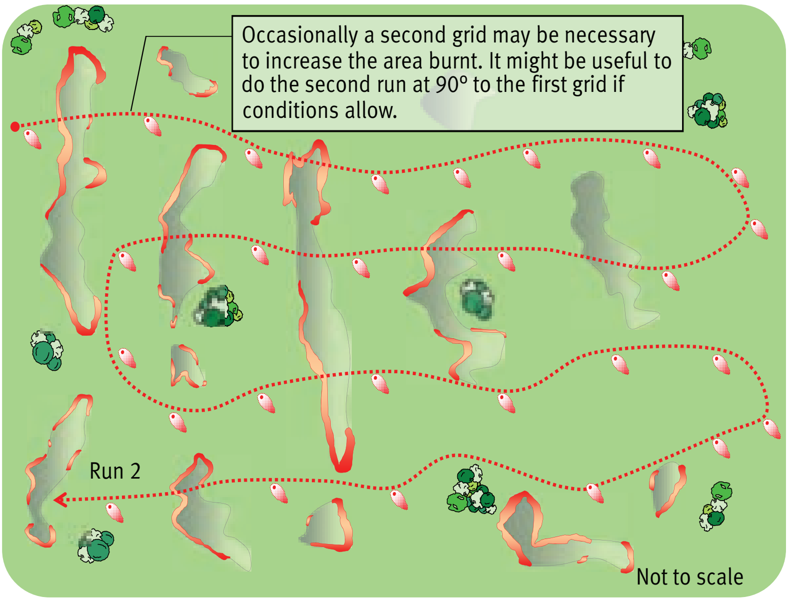

Figure 2: The second run of aerial ignition at 90° will further increase the area burnt and the severity of the fire.