



Planned Burn Guidelines

Cape York Peninsula Bioregion of Queensland



Prepared by: Queensland Parks and Wildlife Service (QPWS) Enhanced Fire Management Team, Queensland Department of National Parks, Recreation, Sport and Racing (NPRSR).

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Disclaimer

This document has been prepared with all due diligence and care based on the best available information at the time of publication. The department holds no responsibility for any errors or omissions within this document. Any decisions made by other parties based on this document are solely the responsibility of those parties. Information contained in this document is from a number of sources and as such, does not necessarily represent government or departmental policy. All Queensland Government planned burning should be done in accordance with government policies, procedures and protocols.

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Front cover photograph: 55 km north of Strathmay Station, Mark Newton, DSITIA (2008).

Bp2009

Foreword

The protected area network throughout Cape York Peninsula (the peninsula) provides the cornerstone of biodiversity conservation for this unique part of our state. Fire, I believe, provides us with the single-most valuable tool to assist in managing these natural assets. A well-planned and implemented fire program will afford managers the ability at the landscape level, to influence diversity in ecosystem age, class and structure.

As the increased resourcing of fire management has enabled the ongoing funding of successive peninsula-wide aerial ignition programs, we have successfully commenced a return to more pre-European regimes which promoted greater “patchiness” across the landscape. Throughout the peninsula, this return has effectively resulted in a shift away from the more recent patterns of destructive and large-scale late dry season wildfires. The benefit is threefold. Firstly we fulfil our obligations as custodians of nature, secondly we fulfil our commitment to be good neighbours and we reduce the greenhouse gas emissions from the protected area estate by shifting toward a generally lower-intensity fire regime.

This planned burn guideline provides comprehensive guidance that supports fire strategies and planned burning at a bioregional level. For those with little or no familiarity with the peninsula, the ability to use this guideline in the development of fire strategies and burn proposals will provide a certain confidence not available previously. The completion of the guideline represents a huge step forward and will prove a valuable addition to the fire management tool-kit for all staff, our joint management partners and other like-minded land managers.

It will be important to remember that this guideline seeks to assist in objective decision making only. It should be expected that fire behaviour and objectives will change across time and space and that skilled fire practitioners will keenly observe the natural environment to enable them to best meet the objectives of a burn. The window in which we have to meet the objectives of a burn can at times be very narrow and our ability to judge this is the key.

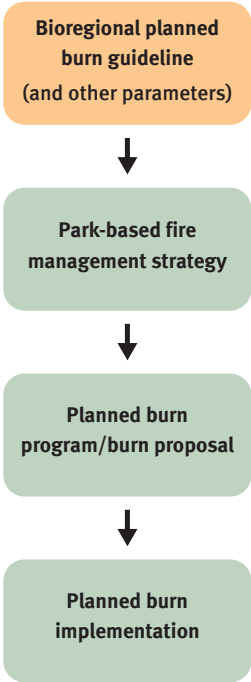
Adapt burn programs over time as confidence is gained and openly discuss and debate the observations. Suggested changes to these guidelines as time progresses are welcome, but similarly be prepared with good arguments to support them.

James Newman
Regional Director
Northern Region
Queensland Parks and Wildlife Service.

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How the planned burn guideline fits into the QPWS Fire Management System.

Purpose of this guideline

This guideline was developed as part of the Department of National Parks, Recreation, Sport and Racing’s (NPRSR) Queensland Parks and Wildlife Service (QPWS) Fire Management System to support the formation of fire strategies, burn proposals and on-ground planned burn implementation (supported by the Planned Burn Guidelines: How to Assess if Your Burn is Ready to Go). They assist rangers and other land managers to:

- protect life and property
- maintain healthy ecosystems
- promote awareness of fire management issues in the field
- identify clear fire management objectives to address those issues; and how to assess objectives to assist in adaptive management
- identify suitable fire behaviour, burn tactics and weather conditions to achieve objectives
- provide information and tools to assist in implementing planned burns.

Please note that this planned burn guideline uses ‘fire vegetation groups’ provided in ParkInfo that assist their integration into maps and fire strategies. A fire vegetation group is a group of related ecosystems that share common fire management requirements.

Scope

- This guideline applies to the Cape York Peninsula bioregion (refer to Figure 1) and covers the following fire vegetation groups: eucalypt communities, grassland communities, sedgelands, heath communities, melaleuca communities, acacia communities, dunes and coral cays, rainforests and mangroves and saltmarshes (refer to Appendix 1 for regional ecosystems contained in each fire vegetation group).
- It covers the most common fire management issues arising in the Cape York Peninsula bioregion. In some cases, there will be a need to include issues in fire strategies or burn proposals that are beyond the scope of this guideline (e.g. highly specific species management issues).
- This guideline recognises and respects Traditional Owner traditional ecological knowledge and the importance of collaborative fire management. Consultation and involvement should be sought from local Traditional Owners in the preparation and implementation of planned burns and specific guidelines incorporated into fire strategies where relevant.
- Development of the guideline has been by literature review and a knowledge-capturing exercise, using both scientific and practical sources. It will be reviewed as new information becomes available.



Peter Stanton, Environmental Consultant Pty Ltd, Heathlands (1993).

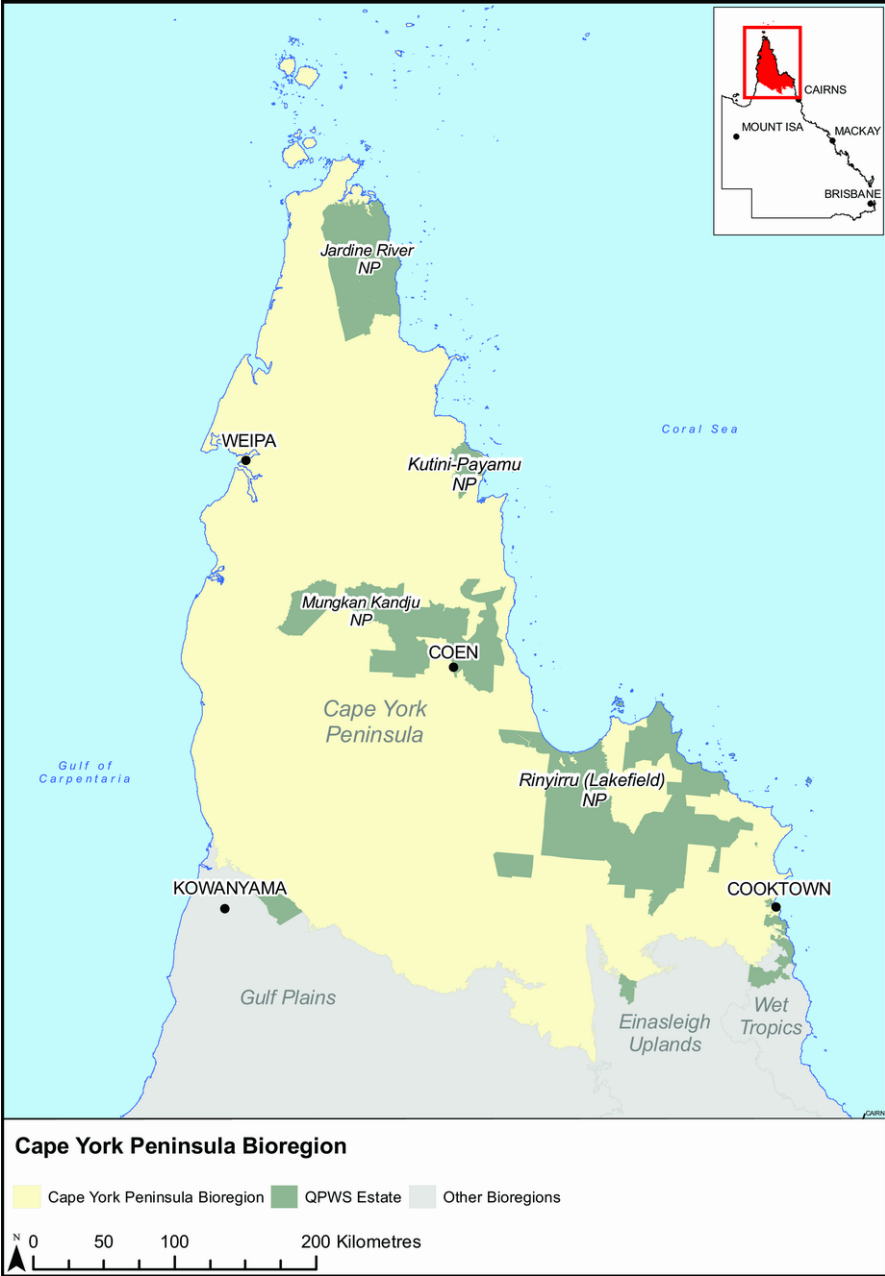


Figure 1: Map of Cape York Peninsula bioregion of Queensland.

Fire in the monsoonal tropics of the Cape York Peninsula bioregion, Queensland

On Cape York Peninsula it is important to be aware of curing rates. Curing commences in the late wet season (after the last incursion of the monsoon trough from the northern hemisphere and the peninsula has begun to dry from the south). As a broad generalisation, the south central area of the peninsula dries northwards through central Cape York Peninsula with an unequal drying toward the north. This is followed by the west and finally the eastern regions (refer to Figure 2).

While occurring at different times in different locations, the seasons follow a regular pattern which varies curing rates. The wet season is a time of regular rains, high temperatures and high humidity. It begins (usually) very late in the year and is the time in which most of the grass growth and rainfall (80 per cent) occurs. This is followed by the early dry when the country commences curing and fires will usually be of a low-severity. During the mid-dry season, little rainfall occurs in the east and often no rainfall in central and western areas. Curing continues until the late dry season when fuels are completely dry and in some areas high-severity, widespread wildfires become an issue. In some north-eastern areas, fires may not carry until this time. During the storm season, irregular though increasing rains indicate a lead-up to the next wet season. Other factors such as soil type and topographic variation also affect curing at the local level (curing at this scale should be considered in planning burns and fire strategies).

Fire risk is closely linked to the occurrence of fire weather days or sequences of days (FDR very high+ / FDI 25+). In Weipa, these days have an average temperature of approximately 35°C, a low humidity of approximately 25 per cent and sustained winds of more than 22 km/hr. Palmerville (further south and inland), these days have a slightly higher average temperature of approximately 36°C, a lower humidity of approximately 18 per cent and sustained winds of approximately 12 km/hr (refer to Figure 3).

Planned burning on Cape York Peninsula must remain flexible to allow for the variation in the timing and length of wet seasons. Limited windows of opportunity to burn occur due to consistently strong moist winds along most of the east coast of the peninsula.

Staff must be vigilant in recognising opportunities to burn and capitalising on these opportunities. It is also important to be aware of conditions prior to and following burns.

Further information can be found in the QPWS Planned Burn Guidelines: How to Assess if Your Burn is Ready to Go and on the Bureau of Meteorology website at <www.bom.gov.au>.

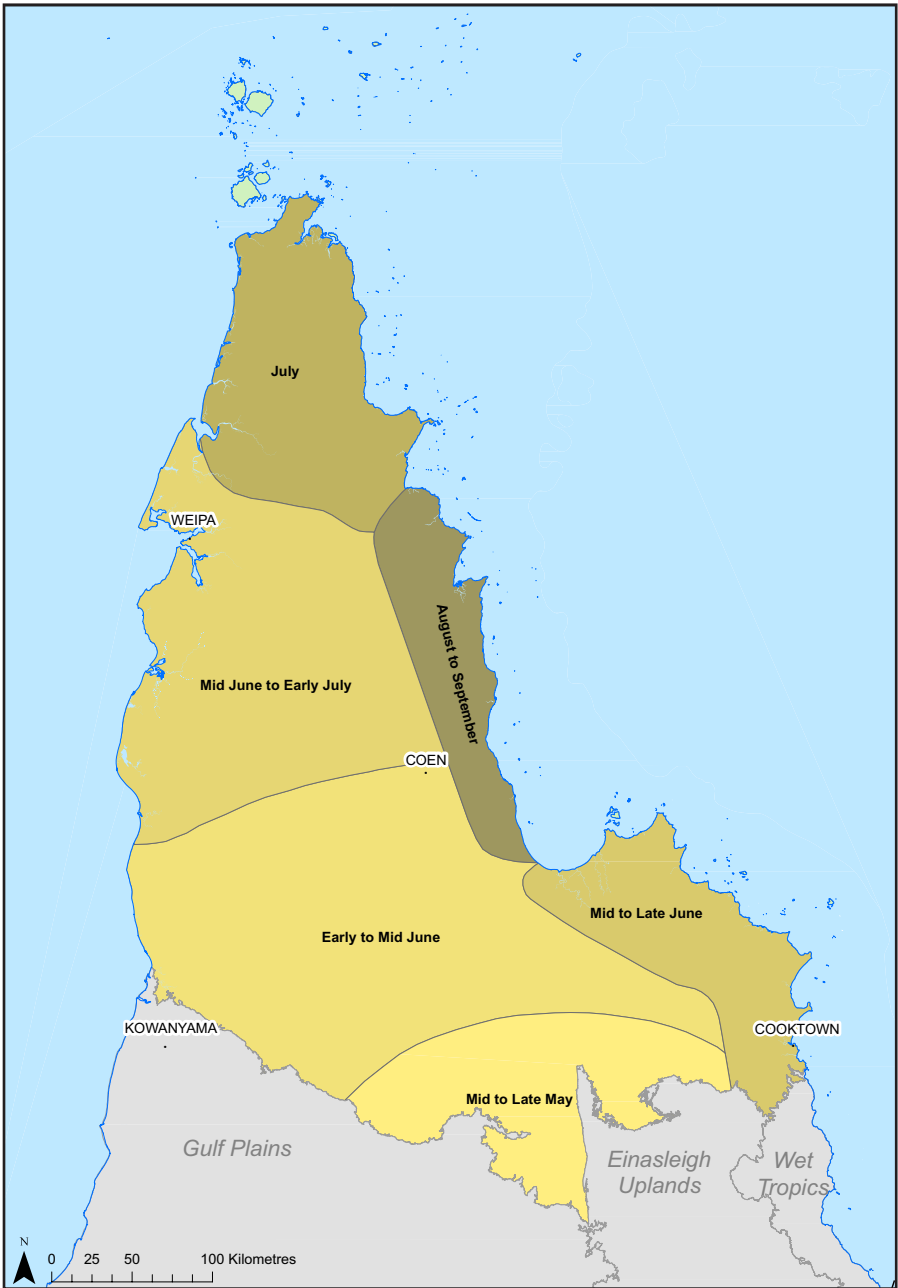
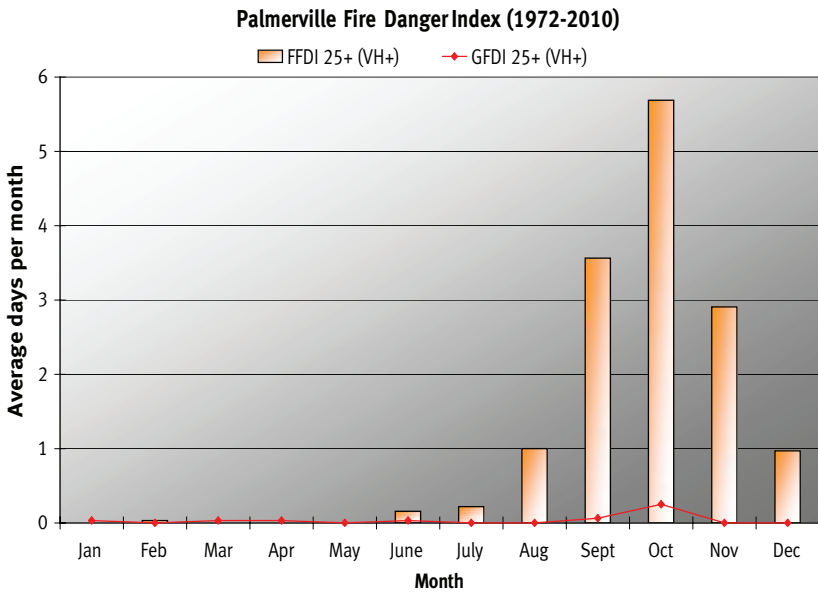
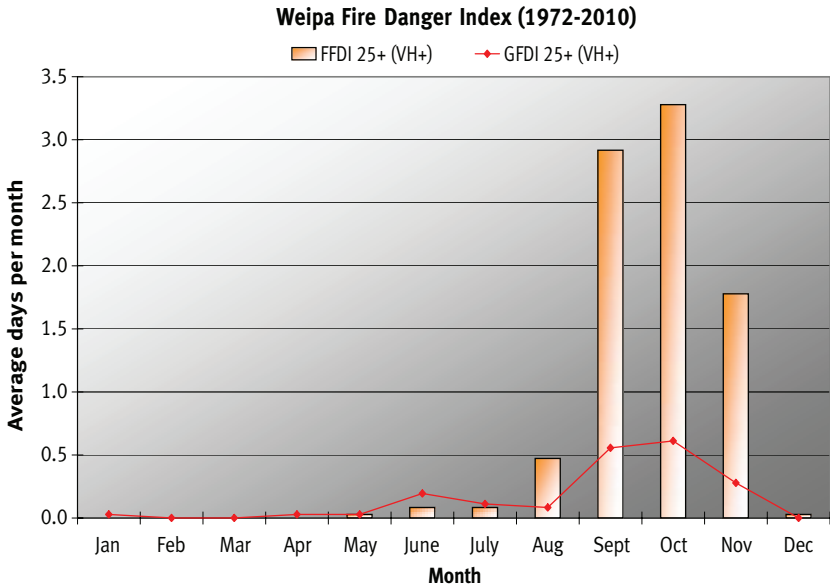


Figure 2: Map of Curing on Cape York Peninsula.

Figure 3: Fire weather risk in the Cape York Peninsula bioregion.



The likelihood of a fire weather day or sequence of days (FDI 25+) increases significantly from around September and persists for a few months until the start of the wet season. Data (Lucas 2010).

How to use this guideline

Step 1: Know your local fire strategy. This planned burn guideline works with and supports your local fire strategy. While the guideline should address the majority of issues in your area, it is essential you also review your fire strategy before completing your planned burn proposal to ensure all ecological issues are considered (e.g. zoning plan, threatened species, fire histories, *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and other legislative requirements).

Step 2: Observe the country. It is essential to regularly observe the country that you manage (and the surrounding landscape). Familiarise yourself with this guideline so it becomes part of your observation of the environment as you go about your work. To assist you in observing the environment, undertake this simple exercise:

1. If a **canopy** is present (e.g. for open forests and woodlands) observe the following:
 - a) Is tree branch foliage dying? Is there epicormic regrowth on branches? Are there any dead trees?
 - b) Are there habitat trees (e.g. trees with hollows)?
 - c) Are there rainforest, scrub or riparian ecosystems nearby?
2. For fire vegetation groups with a **mid-layer** (trees above the height of shrubs and grasses but not yet in the canopy) observe the following:
 - a) What are the mid-layer trees (young canopy trees, wattles, casuarinas or rainforest species)? How open or dense is the mid-layer?
 - b) Is there evidence of fire? What is the prevalence and height of blackened bark?
3. For fire vegetation groups with a **ground-layer** of grasses, sedges or shrubs, observe where relevant:
 - a) The presence of grasses and grass clumps. Do the grasses look healthy and vigorous? Are there well-formed grass clumps?
 - b) Is there a build-up of dead and decaying matter associated with grasses, shrubs, ferns or sedges?
 - c) Are shrubs looking healthy and vigorous? Are there dying crowns on the shrubs?
 - d) Does the ground-layer have a diversity of species or is it dominated by one or a few juvenile tree species? Are weeds dominating the understorey?

Step 3: Read the relevant chapters of this guideline and decide which issues apply to the area you are observing. It is common for burn proposals to address more than one issue—do not necessarily limit yourself to one issue per burn proposal.

Step 4: Consider your fire management priorities. Each chapter offers guidance for determining fire management priorities. The statements about priorities are based on a standard QPWS planned burn proposal prioritisation framework intended to guide both land managers and approval bodies.

Step 5: Choose measurable objectives. Each chapter of this guideline provides measurable objectives to include in your burn proposals (be guided also by the objectives in your fire strategy). Choose one or more objectives whilst observing the land. Do you need to adjust the objectives so they apply to your situation? Do you need to develop objectives not already included in these guidelines? If you find it difficult to identify your objectives, contact your natural resource management ranger or equivalent.

Step 6: Write a burn proposal. The **measurable objectives, fire behaviour, tactics** and **weather conditions** sections of each chapter can be copied directly into your burn proposals. Copy (ctrl+c) statements from a PDF version of this guideline and paste them (ctrl+v) into the burn proposal. Note that you may have to adjust the wording.

Step 7: Is your burn ready to go? Refer to the QPWS Planned Burn Guidelines: How to Assess if Your Burn is Ready to Go. Becoming familiar with the tools in this guideline will enable you to predict fire behaviour and achieve your burn proposal objectives.

Step 8: Review the measurable objectives in your burn proposal. After a fire, undertake the post-fire assessment recommended by this guideline (as defined in your burn proposal). This will indicate if you have achieved your planned burn objectives. This guideline provides information on how to report the results in your fire report.

Step 9: Review your fire management issue (re-apply this guideline to the burn area starting from Step 1). Return to the burn area after one year and then a few years after the original burn—once again applying this guideline. Many issues (such as weed control) are not resolved with a single burn and it is important to keep observing the land. If the results of fire management are unexpected or difficult to understand please seek further advice. If this process identifies shortfalls in your fire strategy, consider reviewing it. Step 9 can be implemented as part of a structured photo-monitoring process at various locations within the estate. Instructions can be obtained from the QPWS Fire Management System.

Chapter 1: Eucalypt communities

This fire vegetation group contains a range of eucalypt open forest and floodplain woodland communities located across the Cape York Peninsula bioregion. The canopy ranges in height from eight to twenty-seven metres and is typically dominated by a mix of eucalypt and corymbia species. The understorey is predominantly grassy but may include shrubs, small trees and a recruiting canopy. Grass species vary with location and include kangaroo, blady, black, giant and white spear grass. On poorer soils a shrub layer tends to dominate and grasses can be sparse.

Fire management issues

This fire vegetation group occurs over extensive inaccessible areas. This necessitates a broad-scale approach to fire management, most efficiently achieved through aerial ignition. The key strategy is to commence planned burning early in the dry season to break up the continuity of fuels across the landscape. This will mitigate the extent and impact of late season wildfires. In the absence of proactive planned burning, late season wildfires are extensive, frequent and intense, resulting in ecological impacts (such as loss of age-class diversity) and producing an enormous amount of greenhouse gas emissions.

Another major issue is loss of open structure through overabundant seedlings/saplings leading to woody thickening, particularly in areas of higher rainfall. This process is attributed to a lack of planned burning and/or fires repeatedly applied too early in the season (when they are not intense enough to control emerging overabundant seedlings/saplings). 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.

Issues:

1. Maintain healthy eucalypt communities.
2. Reduce overabundant seedlings / saplings.
3. Manage high-biomass invasive grasses.



Eucalypt communities are typically dominated by a mix of eucalypt and corymbia species. Mark Newton, DSITIA, Merluna Station (2003).

Extent within bioregion: 8 525 969 hectares (ha), 69 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Mungkan Kandju National Park, 333 151 ha; Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 254 428 ha; Jack River National Park, 127 457 ha; Cape Melville National Park, 110 785 ha; Strathmay Station, 90 693 ha; Olive River Reserve, 83 069 ha; Crosbie Creek Station, 67 305 ha; Orchid Creek (Under Negotiation With Aboriginal Land And NP), 58 760 ha; KULLA (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 58 150 ha; Upper Bridge Creek (Under Negotiation With Aboriginal Land and NP), 39 850 ha; Jardine River National Park, 37 152 ha; Heathlands Resources Reserve, 35 970 ha; Alwal National Park (Cape York Peninsula Aboriginal Land), 34 729 ha; Mary Valley Station, 26 510 ha; Shelburne Bay Environmental Purposes Reserve, 26 005 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 21 309 ha; Mount Jack Station Acquisition, 15 787 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 10 742 ha; Melsonby (Gaarraay) National Park, 8269 ha; Battle Camp Station, 6198 ha; Annan River (Yuku Baja-Muliku) National Park, 5766 ha; Starcke National Park, 4850 ha; Jardine River Resources Reserve, 3566 ha; Flinders Group National Park, 2473 ha; Ngatba Bulal National Park, 1643 ha.

Issue 1: Maintain healthy eucalypt communities

Maintain healthy open eucalypt and floodplain woodland communities using broad-scale planned burning.

Indicators of healthy eucalypt communities

- Grassy eucalypt communities have a ground layer of mixed grasses with occasional legumes, lilies, *Lomandra* spp., or shrubs. Grasses are upright and vigorous, with well-formed bases. Perennial grasses are more common than annuals.
- Eucalypt communities have a canopy of eucalypt or corymbia trees. Some young canopy species are recruiting in the understorey (enough to eventually replace the canopy), but are not extensive enough to produce shading impacts.
- The community appears open and easy to walk through.
- Lower and mid-stratum small tree species are present but are not having a noticeable shading effect on ground-layerplants.
- In some areas with poorer soils, the shrub layer dominates and grasses are sparse.
- Blackened bark is present on trees indicating a history of fire.



A healthy bloodwood community. Notice that canopy recruitment is extensive, but not enough to produce shading impacts.

Mark Newton, DSITIA, near Coen (2003).



Healthy grassy eucalypt communities are open and easy to walk through.
Mark Newton, DSITIA, 11km south-east of Ebagoola (2008).



Blackened bark indicates a history of fire in Eucalypt communities.

Mark Newton, DSITIA, Port Stewart (2008).

The following may indicate that fire is required to maintain eucalypt communities with a grassy, shrubby or mixed grassy/shrubby understorey:

- Grasses are collapsing or appear matted with a build-up of dead material.
- There is an abundance of eucalypt, melaleuca or rainforest seedlings/saplings becoming apparent above the grasses.
- Pandanus (where present), have well-developed skirts.
- *Xanthorrhoea* spp. (where present), have brown skirts.
- Cycads (where present), have an accumulation of dead fronds (e.g. Cape Melville and Mungkan Kandju).
- Chain fruit *Alyxia spicata* (where present) or *Dodonaea* spp. are becoming abundant and/or are beginning to smother the ground layer.



A build-up of dead grass indicates the need for fire.

Mike Ahmet, QPWS, Mungkan Kandju National Park (2009).



When grasses begin to collapse, it is a good indication of the need for fire.
Peter Stanton, Environmental Consultant Pty Ltd, Cape Melville (1993).



Rainforest pioneers are beginning to become abundant due to infrequent fire.
Mike Ahmet, QPWS, Yuku Baja-Muliku Resource Reserve (2008).



Above: An accumulation of dead fronds on cypads indicates the need for fire.
Mark Newton, DSITIA (2003).

Left: In the absence of fire brown skirts accumulate on *Xanthorrhoea* spp.
Daryn Storch, QPWS, Cape York Peninsula (2011).



Chain fruit becomes abundant when sites are long-unburnt.
Mick Ahmet, QPWS, Cape Melville (2008).

Discussion

- A key strategy to manage the vast expanse of inaccessible eucalypt 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 per year. However, the ability to achieve this will depend on resourcing. Aim to achieve as many ignition periods as feasible.
- Eucalypt communities on floodplains require particular management attention due to an accumulation of issues including grazing, weed invasion, rapid fuel accumulation, poor access and woody thickening. Fuel accumulation can reach its maximum within two years with increased wildfire risk. Rubber vine is found in floodplain woodlands on southern areas of Cape York Peninsula (refer to Chapter 10, Issue 4 for management guidelines). These communities also have episodic mass germination that occurs after floods, baring the soil (providing a good seed bed) and are often followed by persistent rains. Fire should be applied to reduce the overabundant seedlings/saplings (refer to Chapter 10, Issue 5, regarding fire management guidelines).
- Variation in burn seasons and short fire frequencies promote a healthier habitat for many species of birds in eucalypt communities. Valentine et al. (2007) found that bird abundance dramatically increased in burnt sites soon after fire (12 months), but declined in the longer term (four years), with greatest reduction in the number of nectivores and granivores.
- In healthy eucalypt communities with a history of regular fire management, overabundant seedlings/saplings leading to woody thickening is not usually a problem. Where it is becoming a problem, the application of repeated low-severity fires exacerbates it (as the fires produced are not of sufficient severity). Grazing further complicates the issue by altering fuel loads and potentially reducing the fire-severity and extent.
- In the moister areas of the east coast and along the floodplains of the Archer River, woody thickening occurs through the development of rainforest understorey in eucalypt communities. To the west of the dividing range woody thickening occurs due to melaleuca and eucalypt overabundance (refer to Chapter 10 [Issue 5], regarding fire management guidelines).
- Rainforest expansion at Iron Range occurs rapidly—within 30 years (Stanton 1992; Russel-Smith et al. 2004). Russel-Smith et al. (2004) also found that rainforest expansion can occur large distances away from rainforest edges.
- Cypress pine overabundance in eucalypt communities occurs in the Jardine River catchment and adjacent coastal areas. In many places it is so far advanced that it is no longer recoverable. Aim to use fire wherever possible in newly emerging transition areas.
- 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 they 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).



Weeds can be a problem in some floodplain woodlands; however if they are fire-killed such as this rubber vine, maintaining fire management controls the problem.

Peter Stanton, Environmental Consultant Pty Ltd, Lakefield National Park (1992).



Heavy grazing reduces grassy fuel biomass. Maintaining fuel loads is important in managing woody thickening.

Mike Ahmet, QPWS, Cape Melville (2008).

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

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)
Progressive burning demonstrated.	Using fire scar remote sensing data, estimate burnt and unburnt country by month, on an annual basis.	<p>Achieved: Remote sensing shows a series of progressive burns through the season.</p> <p>Partially Achieved: One to two burns achieved.</p> <p>Not Achieved: No burning has occurred.</p>
30–60 % of eucalypt communities within the property planned burnt.	Using fire scar remote sensing data, estimate burnt and unburnt country on an annual basis.	<p>Achieved: 30–60 %.</p> <p>Partially Achieved: 20–30 % or 60–80 %.</p> <p>Not Achieved: < 20 % or > 80 %.</p>
Within a property, the annual area burnt by planned burns is greater than that burnt by wildfires.	Using fire scar remote sensing data, estimate area of planned burns against wildfire on an annual basis.	<p>Achieved: Annual area planned burnt > wildfire.</p> <p>Not Achieved: Annual area planned burnt < wildfire.</p>
> 75 % of overabundant saplings < 2 m are reduced.	Select several sites or walk several transects, estimate the percentage of overabundant saplings (above ground components) reduced.	<p>Achieved: > 75 %.</p> <p>Partially Achieved: 25–75 %.</p> <p>Not Achieved: < 25 %.</p>

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 history mapping is an important tool in monitoring these ecosystems. Tools such as the North Australian Fire Information (NAFI) can provide good fire history maps and can be used in planned burns.



Fallen logs provide fauna habitat. Burning in conditions which result in low-severity fire will assist in maintaining these important features.

Daryn Storch, QPWS (2011).

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Low** to **moderate**; with occasional **high**-severity fire during storm 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)
Low (L)	< 100	< 0.5	< 2.0	Some patchiness, most of the surface and near surface fuels have burnt. Some scorching of elevated fuels. Little or no canopy scorch.
Moderate (M)	100–500	0.5–1.5	2.0–5.0	All surface and near surface fuels burnt. All or most of mid-storey canopy leaves scorched. Upper canopy leaves may be partly scorched.
High (H)	500–10000	1.5–4.0	Complete canopy scorch	All ground material affected by fire. All mid storey canopy leaves scorched or charred. All upper storey canopy leaves scorched.

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

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 five years (or between one and three years for eucalypt communities on flood plains).

Mosaic (area burnt within an individual planned burn)

- Under mild burning conditions fires will be patchy. Patches within individual burns can be useful as they contribute to mosaics and help retain habitat features.

Landscape mosaic

- 30–60 per cent of eucalypt communities burnt within the property.



Low-severity fire will generally produce a patchy burn and assist in retaining stags and fallen logs.

Daryn Storch, QPWS, Cape York Peninsula (2011).



Under suitable planned burn conditions, natural barriers such as dry creeks and rocky outcrops are useful barriers to fire movement.

Mick Blackman, Friendly Fire Ecological Contractor Pty Ltd, Mitchell River (2010).



Fire frequency is only a guide. Fuel accumulation tends to be the determining factor.

Peter Stanton
Environmental Consultant Pty Ltd,
Archer Bend (1993).



Fires applied too early in the season will not be of sufficient severity to reduce overabundant seedlings/saplings.

Mike Ahmet, QPWS,
Yuku Baja Muliku Lands (2008).

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 at any time of the year **after the wet season** when it is dry enough to burn **but ahead of late dry-season wildfires**.
- Use occasional **storm burns**.
- Avoid burning during **extremely dry conditions** (with humidity less than 30 per cent and high temperatures, which tend to occur just before the start of the storm season).
- Ensure successive fires are somewhat **variable in intensity, season and frequency** (e.g. **alternating** early season burns with dry season or storm 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.
- Repeated early season burns are **not recommended** where overabundant seedlings/saplings are an issue (refer to Chapter 10 [Issue 5], for fire management guidelines).

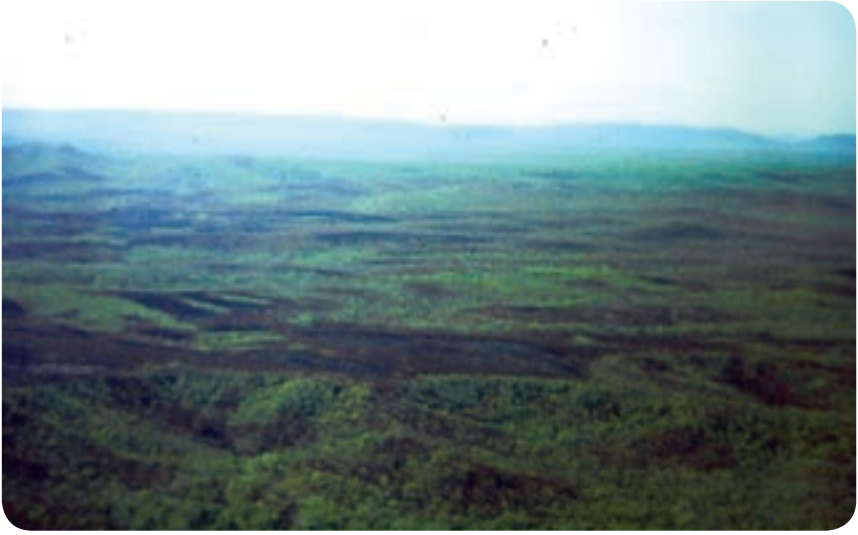
Post wet season until extremely dry	Storm burns
GFDI: < 11	GFDI: 8–16
DI (KBDI): 80–180	DI (KBDI): < 80
Wind speed: < 23 km/hr	Wind speed: < 23 km/hr

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 the tactics as required to achieve the burn objectives. What is offered below is not prescriptive, but rather a toolkit of suggested tactics.

- **Aerial ignition.** Broad-scale fire management is necessary due to the size and inaccessibility of eucalypt communities. This is mostly achieved through **aerial ignition**. Early dry-season fires can be lit in either the morning or afternoon depending on the desired outcome. Ignition timing would be determined by how far the fire is required to travel before self-extinguishing in evening conditions. A useful tool to determine the rate of spread is the CSIRO Grassland Fire Spread Meter for Northern Australia. Utilise natural features to contain fires. These can include rivers and streams (even if there is no water, there may be sufficient moisture), areas of sparse or uncured fuel, rainforest or previously burnt areas. But realise that these features may also prevent fire from carrying as far as intended. It is good practice to plot an aerial incendiary path using maps, satellite images or aerial photographs and program the path into a GPS for use in flight.
- **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.
- **Single point ignition** is used to create a fire of limited extent with a limited fire front. Often, this may mean lighting in a single location for an entire burn (a number of ignition points at the same location may be required) or very widely-spaced ignition points that create separate fires. If creating a patchy fire is the objective then it is better to use successive single-point ignitions to create separate fires.
- **Progressive burning** is an approach to planned burning where ignition is carried out throughout as much of the year as conditions allow. On Cape York Peninsula, ignition can begin soon after the wet season as soon as fuel has cured sufficiently to carry fire, with numerous small ignitions creating a fine scale mosaic. Ideally at least three periods of ignition should occur in each park in each year, but this will depend on resource constraints. These burnt areas can provide opportunistic barriers to fire to support burning later in the year. They also provide fauna refuge areas. Progressive burning helps create a rich mosaic of severities, burnt/unburnt areas, and seasonal variability.

- **Boundary ignition (see diagram over page)** is an aerial ignition strategy, often undertaken in the early dry season. It is used to reduce the risk of late-season fires entering a property or contain fires within the boundary.
- **Storm burns** are fires lit in the storm season after the first rains. A minimum of 50 mm of rainfall is recommended with consideration to the spread of rainfall. Containment of storm burns relies on earlier-season burns having already established a network of burnt areas sufficient to contain the storm burn within the planned burn area.
- Use **periods of declining fire hazard**, so that fires are more controllable. Daily patterns can be utilised. For example, after 2 pm the relative humidity tends to increase and temperature and winds decrease resulting in fires that are less severe and often self-extinguishing early in the season, but may carry through the night later in the year. Be aware that re-ignition may occur at the heel of the fire where there is increased residence time.
- **A running fire** of a higher-intensity may be required initially where the objective is to reduce weeds or overabundant rainforest seedlings/saplings or carry fire through areas of low fuel.
- **A low-intensity backing fire.** A slow-moving, low-intensity backing fire will generally result in a more complete coverage of an area and a better consumption of fuel. This can be created using slope or wind direction. This tactic creates high residence time which is useful in reducing overabundant melaleuca or eucalypt saplings, while ensures the fire intensity and rate of spread are kept to a minimum.



Broad-scale fire management should attempt to establish a landscape mosaic to break-up the country and mitigate late dry-season wildfires.

Peter Stanton, Environmental Consultant Pty Ltd, Heathlands (1989).

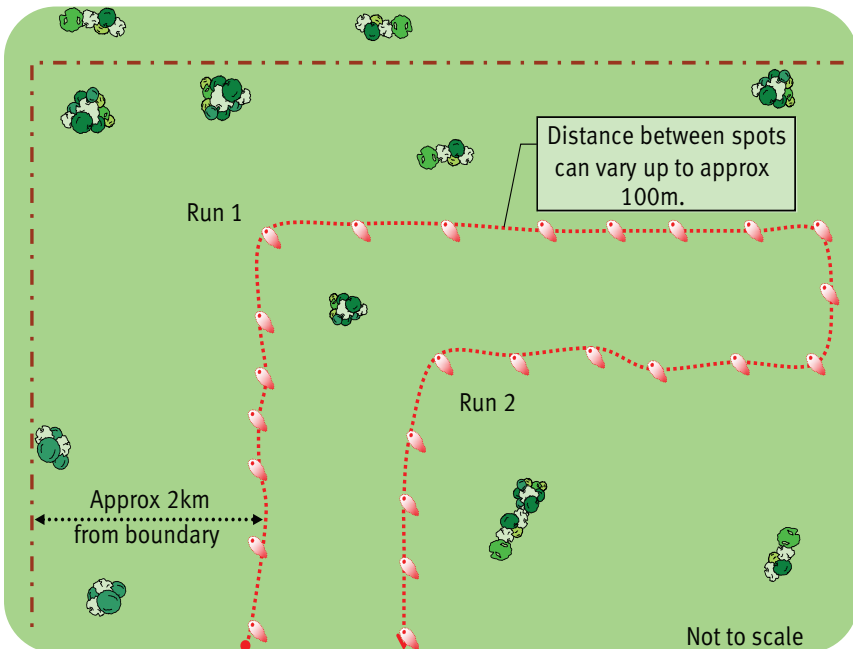


Figure 1: Boundary ignition example

Two parallel lines (within 20 m of each other), are created approximately 2 km inside the boundary edge, usually using aerial ignition. Incendiaries should be spaced relatively closely (approximately 100 m apart), but should vary somewhat in spacing. The two lines tend to draw together. This technique helps manage the spread of fire and creates an area of no or relatively low fuel. This approach can be used to control the movement of fire across property boundaries, fence lines or the edges of fire-sensitive vegetation.

Issue 2: Reduce overabundant seedlings / saplings

Refer to Chapter 10 (Issue 5), regarding fire management guidelines.

Reduce overabundant seedlings/ saplings using fire. In the moister areas of the east coast and along the floodplains of the Archer River, woody thickening can occur through the development of rainforest in eucalypt communities. To the west of the dividing range woody thickening occurs due to melaleuca and eucalypt overabundance. Other trees such as cypress pine can also become overabundant.

Issue 3: Manage high-biomass invasive grasses

Refer to Chapter 10 (Issue 3), regarding fire management guidelines.

It is important to be aware of the presence of high biomass grasses as they can dramatically increase fire severity and can be promoted by fire. Sometimes fire can be used to help in their control.



Grader grass can significantly increase the severity of fire.

Mike Ahmet, QPWS, Yuku Baja-Muliku Lands (2008).

Chapter 2: Grassland communities

Grasslands are open and treeless or contain scattered trees or shrubs. They usually contain a mix of perennial grass species including *Heteropogon*, *Themeda*, *Aristida*, *Chrysopogon*, *Cymbopogon* spp., blady *Imperata cylindrica* and cane grass *Mnesithea rottboellioides*. Significant diversity is added by forbs, sedges and annual grasses.

Fire management issues

The main fire management issue is retaining open areas of grasslands by preventing their invasion by trees and shrubs. Overabundant seedlings/saplings (leading to woody thickening) occur where fire has been long-absent, infrequent or repeatedly applied too early in the season (creating fires of insufficient severity to scorch seedlings/saplings). In moister areas (predominantly to the east of the dividing range) rainforest overabundance is the primary issue, and to the west, melaleucas and eucalypts. However other shrubs and small trees may be an issue in specific areas.

Broad-scale fire management is the key to preventing late season wildfires which can be extensive, frequent and intense. They can also result in ecological impacts and produce an enormous amount of greenhouse gas. The key strategy is to commence planned burning early in the dry season as this will break-up the continuity of fuels across the landscape. Be aware of the presence of invasive and high-biomass grasses as they can be promoted by fire and have the potential to increase fire severity.

Issues:

1. Maintain grasslands.
2. Reduce overabundant seedlings/saplings.
3. Manage high-biomass grasses.

Extent within bioregion: 439 270 ha, 4 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 70 483 ha; Olive River Reserve, 6895 ha; Strathmay Station, 6257 ha; Bathurst Bay land adjoins Lakefield NP, 3048 ha; Mount Jack Station Acquisition, 2619 ha; Mungkan Kandju National Park, 2315 ha; Cape Melville National Park, 1405 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 1169 ha; Crosbie Creek Station, 919 ha; KULLA (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 704 ha; Lizard Island National Park, 585 ha; Alwal National Park (Cape York Peninsula Aboriginal Land), 148 ha; Shelburne Bay Environmental Purposes Reserve, 144 ha; Sir Charles Hardy Group National Park, 123 ha; Jardine River Resources Reserve, 121 ha.

Issue 1: Maintain grasslands

Maintain grasslands with broad-scale fire management.

Awareness of the environment

Key indicators of health:

- Grasslands are treeless and shrubless or contain only scattered trees or shrubs.
- There is more or less a continuous layer of grasses with a diversity of forbs, sedges and other ground-layer plants scattered.
- Grasses should appear upright and vigorous.



Grasslands should be treeless or contain only very scattered trees and shrubs such as this grassland on a marine plain.

Peter Stanton, Environmental Consultant Pty Ltd, Nifold Plain (1993).



Grasses should appear upright and vigorous.

Mick Blackman, Friendly Fire Ecological Contractor Pty Ltd, Silver Plains (2010).



Late in the dry season, as grasses cure, they may begin to collapse, however they are still healthy.

Mike Ahmet, QPWS, Lakefield National Park (2008).



A more-or-less continuous layer of grasses characterise grasslands.

Mike Ahmet, QPWS, Lizard Island (2005).

The following may indicate that a fire is required to maintain grassland

- There is an accumulation of thatch (dead material), collapsing grass and/or the grass clumps are poorly-formed.
- Overabundant seedlings/saplings are beginning to emerge above the grasses.
- Shrubs are becoming more than scattered.



Melaleuca saplings are emerging above the grassy understorey.

Mike Ahmet, QPWS, Lakefield National Park (2008).



Grasslands on coastal headlands are under threat from shrub invasion. However, this one still appears quite open.

Peter Stanton, Environmental Consultant Pty Ltd, Bolt Head (1994).

Discussion

- Rare grasslands are quickly being lost and so their retention and maintenance using fire is a conservation priority (e.g. at Iron Range National Park grasslands surrounded by rainforests are being lost due to tree invasion and grasslands on coastal headlands are being lost to shrub invasion). Be aware that irruptions of rainforest plants can appear in grasslands even if they are well away from rainforest edges.
- Grasslands found on deep soil are susceptible to rainforest invasion, grasslands on poorly-drained soils are susceptible to melaleuca thickening and grasslands on cracking clay soils of central Cape York Peninsula are susceptible to thickening by *Ptilostigma malabaricum*.
- Melaleuca thickening, subsequent broad-scale loss of grassland and the need for a concerted fire management effort has been identified for many years (Crowley and Garnett 1998) and is an ongoing issue. The crimson finch, star finch and golden-shouldered parrot utilise grasslands and may be threatened by overabundant saplings/seedlings that shade-out the grasses.
- 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.
- 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).
- Grazing reduces grass cover and thus the fire severity (through reduced fuel loads). Continuous grazing can lead to an increase in saplings/seedlings which can dominate where the grassy ground-cover has been reduced.
- Variation in burn season and short fire frequency promotes better habitat for many species of birds in grassland communities. Valentine et al. (2007) found that bird abundance dramatically increased in burnt sites soon after fire (12 months) but declined in the longer term (4 years) with the greatest reduction in the number of nectarivores and granivores. The season is important with dry season burns being beneficial to some species and the wet season beneficial for others—variability is the key.
- The endangered crimson finch utilises cane grass and pandanus habitat for shelter. Fires late in the dry season can destroy the cane grass and pandanus skirts that are animal refuges (Dorricot and Garnett 2007). Also, melaleuca invasion into grasslands is thought to threaten their habitat. Refer to Chapter 10 (Issue 5), regarding fire management guidelines for overabundant trees.



Ptilostigma malabaricum overabundance occurs on the cracking clay soils of central Cape York Peninsula.

Peter Stanton, Environmental Consultant Pty Ltd, Archer Bend (1993).



The open nature of this community has been impacted by overabundant trees.

Mike Ahmet, QPWS, Lakefield National Park (2008).

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

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)
Progressive burning demonstrated.	Using fire scar remote sensing data, estimate burnt and unburnt country by month, on an annual basis.	<p>Achieved: Remote sensing shows a series of progressive burns through the season.</p> <p>Partially Achieved: One to two burns achieved.</p> <p>Not Achieved: No burning has occurred.</p>
30–60 % of grassland communities within the property planned burnt.	Using fire scar remote sensing data, estimate burnt and unburnt country on an annual basis.	<p>Achieved: 30–60 %.</p> <p>Partially Achieved: 20–30 %.</p> <p>Not Achieved: < 20 % or > 60 %.</p>

Within a property, the annual area burnt by planned burns is greater than that burnt by wildfires.	Using fire scar remote sensing data, estimate planned burns as against wildfire on an annual basis.	<p>Achieved: Annual area planned burnt > wildfire.</p> <p>Not Achieved: Annual area planned burnt < wildfire.</p>
> 75 % of overabundant saplings < 2 m are reduced.	Select several sites or walk several transects (taking into account the variability of landform and likely fire intensity), estimate the percentage of overabundant saplings (above ground components) reduced.	<p>Achieved: > 75 %.</p> <p>Partially Achieved: 25–75 %.</p> <p>Not Achieved: < 25 %.</p>

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.



Very late in the dry season fuels are fully cured and grasses have collapsed. The potential for intense and extensive fires is high. Avoid burning at this time.

Mike Ahmet, QPWS, Iron Range National Park (2008).

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Low** to **moderate** with the occasional **high**-severity fire, particularly where overabundant seedlings/saplings are an issue.

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)	50–100	0.3–0.5	< 2.0	Some patchiness, most of the surface and near surface fuels have burnt. Some scorching of elevated fuels. Little or no canopy scorch.
Moderate (M)	100–1500	0.5–1.5	Complete standing biomass removed	All surface and near surface fuels burnt. Stubble burnt to blackened remnants.
High (H)	1500–5300	> 4.0	Complete biomass removed	Ground burnt completely stubble burnt to ash.

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

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

- Apply mosaic planned burns across the landscape at a range of frequencies 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.

Landscape mosaic

- 30–60 per cent of grasslands burnt within Cape York Peninsula annually.

Mosaic (area burnt within an individual planned burn)

- Under mild burning conditions, fires will be patchy. Patches within individual burns can be useful as they contribute to mosaics and help to retain habitat features.

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.

Post wet season until extreme dry season	Storm burns
GFDI: < 11	GFDI: 8–16
DI (KBDI): 80–180	DI (KBDI): < 80
Wind speed: < 23 km/hr	Wind speed: < 23 km/hr

Season:

- Any time of the year **after the wet season** when it is sufficiently dry to burn. Occasional storm burns (normally between October and January), or late dry season burns. Avoid burning during **extremely dry conditions** with humidity less than 30 per cent and high temperatures, which tend to occur just before the start of the storm season.
- Early season burns are **not recommended** where overabundant seedlings/saplings are an issue, nor should they be applied regularly in the same location.
- **Variability:** 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.



Vary the severity of fire in grasslands with most burns low to moderate, with occasionally high-severity fires.

Melissa Spry, DNRM, south-west of the Dixie Homestead (2007).

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.

- **Aerial ignition.** Broad-scale fire management is necessary due to the size and inaccessibility of most grassland communities. This is mostly achieved through **aerial ignition**. Early dry season fires can be lit in either morning or afternoon, depending on the desired outcome. Ignition timing will be determined by how far the fire is required to travel before self-extinguishing in evening conditions. A useful tool to determine the rate of spread is the CSIRO Grassland Fire Spread Meter for Northern Australia. Utilise natural features to contain fires. These can be rivers and streams (even if there is no water, there may be sufficient moisture), areas of sparse or uncured fuel, rainforest or previously burnt areas. Note that these may also prevent fire from carrying as far as intended. It is good practice to plot an aerial incendiary path using maps, satellite images, or aerial photographs and program these into a GPS for use in flight (refer to Chapter 1, for further tactics).

Issue 2: Reduce overabundant seedlings/saplings

Refer to Chapter 10 (Issue 5), regarding fire management guidelines.

Overabundant seedlings and saplings of rainforests or melaleuca species can reduce the health and abundance of grasses and eventually lead to a transition from grassland to forest.

Issue 3: Manage high-biomass grasses

Refer to Chapter 10 (Issue 3), regarding fire management guidelines.

It is important to be aware of the presence of high-biomass grasses as they can dramatically increase fire severity and can be promoted by fire. Sometimes fire can be used to help in their control.

Chapter 3: Sedgeland

Sedgeland are treeless (or contain only scattered trees) with a ground-layer dominated by one or two sedges, rushes, or similar species with other ground-layer plants scattered. They may be permanently or seasonally inundated and are generally found in low areas of the landscape throughout Cape York Peninsula. They are dominated by saw sedge *Gahnia sieberiana*, bulkaru *Eleocharis* spp. and other species of sedges or ferns. Wetter sites may have water lilies *Nymphaea* spp., wild rice *Oryza rufipogon*, marshworts and occasionally *Nymphoides* spp. Often these wetter sites are fringed by woodlands of broad-leaved tea tree *Melaleuca viridiflora*, weeping paperbark *Melaleuca leucadendra* or sedgeland.

Fire management issues

Sedgeland on Cape York Peninsula are not actively targeted with fire. They are allowed to burn in association with the surrounding landscape but tend to burn far less often due to the presence of water. Saw sedge communities that are very extensive, may require active fire management. Saw sedge communities mostly occur with *Melaleuca quinquenervia* swamp forest (refer to Chapter 5 for fire management guidelines). Permanent lakes and lagoons with fringing woodland/sedgeland rarely burn and active fire management is not required.

Sometimes there is a risk of a peat fire occurring in some sedgeland communities. These can include saw sedge communities and permanent lakes and lagoons. Be aware of this issue when planning fires.

Extent within bioregion: 100 674 ha, 1 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Jardine River National Park, 16 910 ha; Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 4517 ha; Olive River Reserve, 2150 ha; Shelburne Bay Environmental Purposes Reserve, 2003 ha; Mungkan Kandju National Park, 1877 ha; Jardine River Resources Reserve, 1692 ha; Mount Jack Station Acquisition, 550 ha; Cape Melville National Park, 470 ha; Jack River National Park, 417 ha; Endeavour River National Park, 265 ha; Heathlands Resources Reserve, 203 ha; Annan River (Yuku Baja-Muliku) National Park, 174 ha; Lama Lama National Park (Cape York Peninsula Aboriginal Land), 168 ha; Strathmay Station, 157 ha; Mary Valley Station, 63 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 45 ha.



Bulkaru sedgeland in the dry season.

Mike Ahmet, QPWS, Red Lily Lagoon Lakefield National Park (2009).



Permanent lakes and lagoons. These communities will generally not burn. However, be aware of peat existing in adjacent communities.

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

Discussion

- Peat fires should be avoided. Perennial sedges in ecosystems with a significant peat layer are vulnerable to severe fires. When peat catches fire it tends to burn slowly, with high severity and is very difficult to put out. Sedge roots burn when peat burns, often resulting in the death of all or part of the sedge colony. A peat fire or high-severity fire which removes most of the dominant sedge layer can cause a significant species change with colonies of perennial sedges taking many years to re-appear. The sedge roots, along with the peat layer can take decades or more to reform and affect other plant species which are adapted to the peat substrate. This process of species change may have flow-on effects to fauna species that have specific requirements.
- Refer to Chapter 5 (Issue 2), regarding fire management guidelines for avoiding peat fires.

Chapter 4: Heath communities

Heaths are shrubby communities that are treeless or contain only scattered trees (Keith et al. 2002). The main centres of distribution are within the Jardine and Olive river catchments and at Iron Range National Park. On Cape York Peninsula the heathlands are less diverse than the other heathlands of Australia. In many areas one or two species dominate, others are more diverse. Usually this community consists of extensive areas of closed shrublands in undulating terrain, on hills, mountains and on sand dunes. This fire vegetation group also includes open-heaths and dwarf open-heaths on dune fields, sand plains and headlands. On the Jardine River extensive areas of seasonally-inundated heath swamps occur. These are characterised by sedges and occasional shrubs. For melaleuca dominated heaths see Chapter 5.

Fire management issues

This fire vegetation group occurs over extensive inaccessible areas necessitating a broad-scale approach, most efficiently achieved through aerial ignition. Because heaths have a longer fire interval than the surrounding fire-adapted vegetation, it is important to apply fire in and around the heath so that too-frequent unplanned fire is avoided. A lack of fire will allow an accumulation of fuel. After many years this accumulation can create the risk of a large-scale single-event fire that reduces ecosystem diversity and promotes a cycle of repeated large-scale fire events.

The key approach is to maintain a Landscape Mosaic using broad-scale fire management. Aerial ignition is the most efficient way to achieve this and will assist in breaking up the continuity of fuels across the landscape. This will mitigate the extent and impact of late-season wildfires. In the absence of proactive planned burning, late season wildfires are extensive, frequent and intense, resulting in negative ecological impacts and producing an enormous amount of greenhouse gas emissions. In some areas a loss of diversity has occurred due to a lack of fire and has allowed longer-lived species to dominate.

Issue:

1. Maintaining healthy heath communities.

Extent within bioregion: 587 299 ha, 5 per cent; **Regional ecosystems:** Refer to Appendix 1 for complete list.

Examples of this FVG: Jardine River National Park, 140 838 ha; Shelburne Bay Environmental Purposes Reserve, 74 839 ha; Heathlands Resources Reserve, 73 110 ha; Olive River Reserve, 42 997 ha; Jardine River Resources Reserve, 10 541 ha; Jack River National Park, 9301 ha; Cape Melville National Park, 5612 ha; Kutini-Payamu (Iron Range) National Park (Cape York Peninsula Aboriginal Land), 3850 ha; Orchid Creek (Under Negotiation With Aboriginal Land And NP), 2633 ha; Mount Jack Station Acquisition, 2078 ha; Starcke National Park, 1884 ha; Battle Camp Station, 1743 ha; Upper Bridge Creek (Under Negotiation With Aboriginal Land and NP), 1048 ha; KULLA (McIlwraith Range) National Park (Cape York Peninsula Aboriginal Land), 385 ha; Rinyirru (Lakefield) National Park (Cape York Peninsula Aboriginal Land), 242 ha; Melsonby (Gaarraay) National Park, 130 ha; Annan River (Yuku Baja-Muliku) Resources Reserve, 115 ha; Flinders Group National Park, 90 ha; Possession Island National Park, 30 ha; Lizard Island National Park, 17 ha; Iron Range/Portland Roads, 13 ha; Archer Point Conservation Park, 5 ha; Hann State Forest, 2 ha.

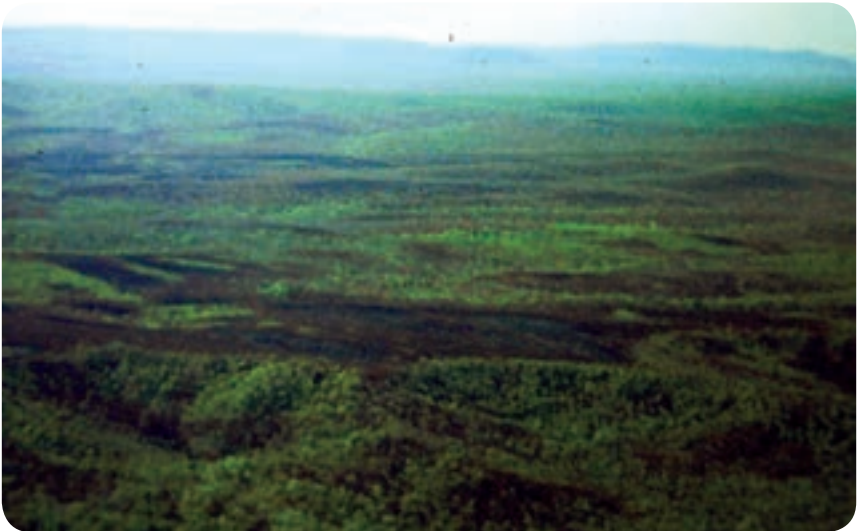
Issue 1: Maintaining healthy heath communities

Implementation of mosaic burning in and around heath (usually with aerial ignition) helps achieve longer fire intervals by creating a Landscape Mosaic that mitigates against too much heath burning at once.

Awareness of the environment

Indicators of health:

- There is a variation in time-since-fire for heath across the landscape.
- A continuous cover of shrubs exists (except in areas that are naturally sparse). On headlands, shrubs are wind-sheared, sparse and interspersed by grasses. In heath swamps shrubs are sparse and are interspersed by sedges.
- There are few or no trees.



Heaths should vary in time-since-fire across the landscape. A mosaic of burnt and unburnt areas will mitigate the impacts of too-frequent and widespread wildfire.

Peter Stanton, Environmental Consultant Pty Ltd, Heathlands Resource Reserve (1989).



Healthy closed heath. A continuous cover of shrubs appears green and dense.
Mike Ahmet, QPWS, Tozers Gap, Iron Range National Park (2008).



In healthy heath Swamps, shrubs are naturally sparse and interspersed by sedges.
Peter Stanton, Environmental Consultant Pty Ltd, Jacky Jacky Creek (1988).



Shrubs within headland communities are often wind-sheared and do not emerge far above the grasses.

Peter Stanton, Environmental Consultant Pty Ltd, Captain Billy Landing (1985).

Indicators of where fire is required:

- Heath plants are beginning to lose their lower-level leaves and some crowns or lower branches of the heath plants are dying.
- There is a build-up of dead and dying material.
- Heath community is becoming dominated by *Allocasuarina* trees (e.g. black she-oak *Allocasuarina littoralis*).
- Mature toothbrush grevillea *Grevillea pteridifolia* (where present) are more than two metres high.
- Heaths which are long unburnt have become entangled with dodder vine (a leafless, parasitic vine).
- Cypress pine *Callitris intratropica* (where present) are beginning to become abundant.



Notice the crowns of many shrubs have begun to die. This is an indicator of the need to apply fire to maintain a healthy heath. Occasional she-oak trees are not a problem. Where they are beginning to dominate, planned burning should be considered.

Mark Newton, DSITIA, Iron Range National Park (2009).



Plants are beginning to lose lower-level leaves.

Mike Ahmet, QPWS, Olive River Resource Reserve (2009).



Lower branches of heaths begin to die when they remain long-unburnt.

Peter Stanton,
Environmental Consultant
Pty Ltd, Iron Range
National Park (1996).



Some species are no longer present in this community—it has begun to simplify due to a long absence of fire. However, be aware that many heaths on Cape York Peninsula are naturally less-diverse.

Mike Ahmet, QPWS,
Olive River Resource
Reserve (2009).



Long fire intervals tend to lead to a domination of some species such as this toothbrush grevillea.

Peter Stanton,
Environmental Consultant
Pty Ltd, Heathlands
Resource Reserve (1991).

Discussion

- The key approach is to maintain a Landscape Mosaic using broad-scale fire management. Aerial ignition is the most efficient way to achieve this.
- Long fire intervals tend to lead to a domination of tree species. In heaths these often include black she-oak, cypress pine and grevillea. As a result, diversity in heath gradually decreases. Black she-oak has the ability to establish in dense litter allowing them a competitive advantage over other heath species in the absence of fire (Stanton 1999).
- A lack of fire will allow an accumulation of fuel. After many years this accumulation can create the risk of a large-scale, single-event fire that reduces ecosystem diversity and promotes a cycle of repeated large-scale fire.
- Planned burns in adjacent fire-adapted communities have two roles: The first is to help maintain longer fire intervals in heaths by mitigating too frequent unplanned fires. The second is to mitigate the impact of severe heath fires impacting the surrounding areas.
- Some heaths contain many endemic, rare and endangered species such as the rare *Xanthostemon arenarius*, the rare *Xanthostemon xerophilus* and the endangered *Eremochloa muricata*. While these species' fire response is poorly understood, fire maintains healthy heathlands which increases their chance of persistence.
- Stanton (1992) observed that even high-severity fires in heath can create a varied mosaic of burnt and unburnt patches, and attributed this to wind speed variation.
- A long absence of fire leads to a loss of some species from the community. Cool fires can be detrimental as they do not promote the regeneration of heath species. A hot fire is required to germinate the seed bank (Stanton 1992).
- On Cape York Peninsula the structure of heaths can vary considerably from dense, closed heath on sand dunes to dwarf heath on plains.
- Fires in heaths tend to burn in a linear (long narrow fire) pattern when under the influence of a strong wind. In the evening the flank fires will tend to self-extinguish, while the head fire will continue to burn. This can assist in breaking up areas of long-unburnt heath and establishing a mosaic pattern.



Fires lit with the wind (running fires) tend to burn heath in a linear pattern.

Peter Stanton, Environmental Consultant Pty Ltd, Jardine River catchment (1989).



Heaths occur on a variety of landforms including sand dunes.

Peter Stanton, Environmental Consultant Pty Ltd, Iron Range National Park (1996).



This dwarf heath is long unburnt.

Peter Stanton, Environmental Consultant Pty Ltd, Heathlands (1993).

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

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)
10–20 % of heath communities within the property planned burnt annually.	Using fire scar remote sensing data (e.g. NAFI), estimate burnt and unburnt country on an annual basis.	Achieved: 10–20 %. Partially Achieved: 5–10 % or 20–30 %. Not Achieved: Less than 5 % more than 30 %.
Within a property, the annual area burnt by planned burns is greater than that burnt by wildfires.	Using fire scar remote sensing data (e.g. NAFI), estimate planned burns as against wildfire on an annual basis.	Achieved: Annual area planned burnt > wildfire. Not Achieved: Annual area planned burnt < wildfire.

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.

Consider monitoring the height of toothbrush grevillea to indicate the need for fire. Planned burns should be implemented when they reach about two metres and a well-developed shrub layer has formed.

Consider monitoring the presence of black she-oak. Fire has been absent for too long where black she-oak trees begin to dominate above the shrub layer.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Patchy/low** or **moderate/extreme**. Fires will either burn severely or at very low-severity.

Fire severity class	Fire intensity (during the fire)	Fire severity (post-fire)
	Average flame height (m)	Description (loss of biomass)
Patchy (P) to Low (L)	< 1	40–60 % vegetation burnt. Unburnt vegetation (green patches) in the ground and shrub layer. Does not remove all the surface fuels (litter) and near surface fuels. Can create distinct ‘holes’ in closed heath. Overall little canopy scorch. Some scorching of shrubs and small trees.
Moderate (M) to Extreme (E)	> 1	Greater than 60 % vegetation burnt. Understorey burnt to mineral earth. Extensive to total foliage burnt. Minimal evidence of green vegetation remaining. Skeletal frames of shrubs.

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

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

- Fire frequency should primarily be determined through **on-ground assessment of vegetation health, fuel accumulation** and **previous fire patchiness** and adjusted for wildfire risk and drought cycles.
- 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 five and ten years.

Mosaic (area burnt within an individual planned burn)

- Patchiness will occur in some areas due to the presence of creeks, drainage lines and other landscape features such as rocky outcrops. Overnight conditions will lead to decreased fire severity and add to patchiness.

Landscape Mosaic

- 10–20 per cent.

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: August–September or even November depending on the season. Heath will not burn prior to this period as it is too wet. Be aware of containment issues in the very late dry season.

FFDI: < 24

DI (KBDI): 160–190



Don't be concerned if heath burns completely. Heaths recover well from stored seed banks or resprouts from the base.

Peter Stanton, Environmental Consultant Pty Ltd, Jardine River (1991).



Four years after fire these *Melaleuca arcana* are recovering by resprouting. They will eventually regain their original height.

Peter Stanton, Environmental Consultant Pty Ltd, Lakefield National Park (1998).

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.

- **Aerial ignition.** Broad-scale fire management is necessary due to the size and inaccessibility of heath communities. This is mostly achieved through **aerial ignition**. Incendiaries should be placed so that fire spread will be limited. This can be achieved by placing incendiaries so that fires will only burn to the edge of areas previously burnt. Refer to Chapter 1 for further information.
- **Single point ignition.** It may be necessary to light only a single location for the entire burn (a number of ignition points at the same location is sometimes required). If creating a mosaic is the objective of the burn then use successive single-point ignitions, allowing one fire to extinguish before lighting another (this provides a better chance of breaking the area into a mosaic). When combined with a strong wind, a single-point ignition will create a long narrow fire.