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Disclaimer

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Front cover photograph: Mt Greville: Moogerah Peaks National Park, QPWS (2008).
Foreword

Fire has long played an integral and essential role in the maintenance of the vegetation communities of Southeast Queensland. The considered application of fire as a tool to achieve a range of desired outcomes has been practiced for many centuries and has greatly influenced current biodiversity, vegetation type, distribution and extent.

As the most densely populated and rapidly growing region in Queensland, the interaction of urban and peri-urban development with management of fire both planned and unplanned, requires careful consideration to achieve a balance of risk management and conservation.

These guidelines grew from a recognition that the absence of appropriate fire has been and is continuing to cause structural change towards more closed forests, resulting in an increase in fuel/fire hazard, open forest decline and a loss of biodiversity.

The intent of these guidelines is to encourage land managers to critically observe their landscape to understand vegetation condition in light of appropriate fire management.

David Kington
Ranger in Charge
South East Region
Queensland Parks and Wildlife Service.
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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 Southeast Queensland (SEQ) bioregion (refer to Figure 1) and covers the following fire vegetation groups: open forests and woodlands; wet open forests; grasslands; heath communities; melaleuca communities; coastal fringing forests and headlands; riparian, foredune, coral cay island and beach ridge communities; rainforests, dry vine forests and brigalow communities; mangroves and saltmarsh (refer to Appendix 1 for regional ecosystems contained in each fire vegetation group).

• It covers the most common fire management issues arising in South East Queensland. In some cases there will be a need to include issues in fire strategies or burn proposals 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.
Figure 1: Map of the Southeast Queensland bioregion of Queensland.
Fire and climate in Southeast Queensland

The Southeast Queensland (SEQ) bioregion fire season (when more severe wildfires normally occur) is generally recognised as September to December. In the southern part of SEQ, as indicated by analysis of fire weather data from Brisbane Airport and Amberley, August is also a period of elevated fire risk, and more significant than November which has a lower risk with the commencement of storm rains. September, the peak month for wildfires is characterised by frequent westerly winds, typically low rainfall, low humidity and increasing temperatures.

Fire risk is linked to the occurrence of fire weather days or sequences of days when the fire danger rating is ‘very high’ with a forest fire or grass fire danger index 25+ (refer to Figures 2a and b). Such conditions in SEQ tend to occur when deep low-pressure systems develop over southern Australia, bringing strong dry westerly winds from the continental interior to the coast. South-east trade winds and afternoon sea breezes become a frequent occurrence December through to March bringing higher humidity and increasing the manageability of fires.

While broad fire season patterns are a good guide, it is important to consider local seasonal conditions, current rainfall and geography of each management area.

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.
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: Open forest and woodland

Open forests and woodlands dominate the landscape in the Southeast Queensland (SEQ) bioregion and fire management is critical to maintain their health. This fire vegetation group includes communities with a grassy, shrubby and mixed grassy/shrubby understorey, found on coastal lowlands, alluvial plains and inland hills and mountain ranges throughout the bioregion. They are typically dominated by one, or a mix of canopy species including eucalypts (e.g. gums, ironbarks and boxes), angophoras and bloodwoods.

Fire management issues

The main fire management issue in this vegetation group is the overabundance of saplings (e.g. wattles and rainforest pioneers) in the mid-stratum of open forest which reduces the health and diversity of shrubs and grasses in the ground layer through competition and shading. This issue is particularly significant for the maintenance of grassy tall open forests as there are very few areas remaining in SEQ. If left unmanaged, overabundant saplings as well as lantana infestations can threaten an open structure and in the southern half of the bioregion may also lead to bell miner associated dieback of eucalypts.

Issues:

1. Maintain healthy open forest and woodland
2. Reduce overabundant saplings
3. Manage invasive grasses
4. Reduce Lantana camara
5. Manage bell miner associated dieback
6. Manage sustainable production.

Extent within bioregion: 2 061 539 hectares (ha), 33 per cent; Regional ecosystems: Refer to Appendix 1.

Largest locations of this FVG: Great Sandy National Park, 89 790 ha; Wongi State Forest, 51 794 ha; Koombit Tops National Park, 33 911 ha; Bania National Park, 27 638 ha; D'Aguilar National Park, 26 953 ha; Bulburin National Park, 22 581 ha; Conondale National Park, 21 695 ha; Main Range National Park, 18 100 ha; St Mary State Forest 1, 16 986 ha; Eurimbula National Park, 15 677 ha; Wrattens National Park, 14 736 ha; Cordalba State Forest, 13 460 ha; Yabba State Forest, 12 947 ha; Curtis Island State Forest, 12 881 ha; Grongah National Park, 11 563 ha; Wondai State Forest, 11 438 ha; Mount Barney National Park, 11 046 ha; Wongi National Park, 9 653 ha; Bauple State Forest, 8 146 ha; Castle Tower National Park, 8 011 ha; Mount Walsh National Park, 7 612 ha; Littabella National Park, 7 445 ha; Monduran State Forest 1, 6 901 ha; Lockyer National Park (Recovery), 6 883 ha; Glenbar State Forest 1, 6 503 ha; Bunya Mountains National Park, 6 480 ha; Moreton Island National Park, 6 415 ha; Dawes National Park, 6 150 ha; Warro National Park, 5 986 ha; Bellthorpe National Park, 5 587 ha; Imbil State Forest, 5 459 ha.
Issue 1: Maintain healthy open forest and woodland

Mosaic burning is critical to maintaining healthy open forests and woodlands.

Awareness of the environment

Key indicators of a healthy open forest or woodland (refer to the photos below):

• Healthy open forest has a grass; sedge; or shrub-dominated understorey (or various mixtures); with a few canopy species of variable sizes (to eventually replace the canopy) and a healthy canopy.

• Lower and mid stratum trees are scattered (e.g. eucalypts, wattles and she-oaks), but are not having any noticeable shading effects on ground stratum plants.

• Fallen logs and hollow bearing trees may be present.

• In shrubby open forest, shrub layer is dominated by sclerophyllous (hard-leaved) species (e.g. grass trees, banksia, pea-flowers) with healthy foliage.

• In grassy or mixed open forest, grass clumps and/or sedges are well formed.

• Grassy open forest is easy to walk through or see through.

• Generally few weeds present.

Layers used to describe open forest/woodlands

Canopy: tallest tree layer with an open structure

Mid stratum: (not always obvious) scattered shorter trees, canopy species saplings, tall shrubs and other plants over one metre.

Lower stratum: ground layer of grasses, sedges, herbs, small shrubs and seedlings up to one metre.

QPWS.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 1 — Open forest and woodland

Page 3

Open forest with a healthy grass ground layer. The tree recruitment is significant but not so abundant that it impacts on understorey health.

Mark Burnham, QPWS, Tamborine National Park.

Although there is limited tree recruitment or variation in age of eucalypts in this open woodland, the grassy understorey is healthy and there are sufficient young trees to replace the canopy in the long term.

Mark Daly, QPWS, Glenrock.
Open forest with a mix of canopy tree ages and healthy grass clumps.

The healthy dense grass cover indicates the sparse mid-stratum of she-oaks are having no shading effects on the ground stratum.
Rowena Thomas, QPWS, Glass House Mountains National Park (2010).
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 1 —Open forest and woodland

Sydney blue gum tall open eucalypt forest with a healthy ground stratum of native tussock grass, kangaroo and blady grass.

The diversity of shrubs and grasses in the understorey will largely be determined by geology however fire regimes can alter the balance. In general, planned burning with good soil moisture at more frequent intervals will encourage grasses while longer intervals tend to favour shrubs.
David Kington, QPWS, Nerang National Park.
Open coastal woodland with a healthy mixed grassy / shrubby understorey.
Peter Leeson, QPWS, Teewah (2009).

Healthy shrubby open woodland.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 1 — Open forest and woodland

Issue 1: Maintain healthy open forest and woodland

Blackbutt open forest with mixed grass/fern/shrub understorey.

This shrubby understorey has a good diversity of species but is showing early signs of decline in health with some shrub crowns beginning to die off.
Indicators of declining health in open forest or woodland (observed across a broad area):

- Grasses overall appear sparse or clumps are poorly formed and collapsing. An accumulation of thatch (dead material) is present.
- Many shrubs have sparse crowns and/or beginning to die. There is limited or no recruitment of new shrubs (lack of juvenile shrubs).
- The diversity of mid/ground stratum species (grasses, herbs, sedges and shrubs) has declined from previous records or observations.
- In shrubby open forest, a loss or reduction of resprouters or obligate-seeders (shrub species that regenerate only from seed) has been observed and/or recorded over time.
- There is a significant build up of fine fuels such as dead grass material, leaf litter, suspended leaf litter, bark and twigs. Accumulation of elevated fuels is high or above (using the Overall fuel hazard assessment guide).
- Grass trees where present have dense brown skirts.
- There is an abundance of blady grass, bracken, dodder, one shrub species or a flush of trees or weeds all at the same age (be aware that some systems naturally have an understorey dominated by one or a few species).

Grass health is declining due to absence of fire. Note poor grass clump formation and accumulation of dead material.
A mixed grassy / shrubby understorey in decline due to absence of fire. Note drooping dead skirts on grass trees and sparse grass clumps.
Mark Burnham, QPWS, D'Aguilar National Park.

A sequence illustrating clumping grass decline in the absence of fire.
The bottom row indicates where fire has been absent too long.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 1—Open forest and woodland

A shrubby understorey in decline due to absence of fire. Note dead shrubs and shrub crowns beginning to die.
David Kington, QPWS, D’Aguilar National Park.

A sequence illustrating shrub decline.
The bottom row indicates where fire has been absent too long.
David Kington / Mark Burnham, QPWS, D’Aguilar National Park.
High severity wildfires or planned burns conducted without good soil moisture can favour regrowth and dominance of a single shrub (e.g. bush pea *Pultenaea* sp.) (above) or grass species (e.g. blady grass) (below).
Mark Daly, QPWS, Moogerah Peaks National Park (2008).

Mark Burnham, QPWS, Lamington National Park.
Discussion

- Open forest and woodland understorey is variable, (depending on rainfall, altitude, slope, aspect and geology) exhibiting a continuum from grass dominated through to shrub dominated. The mixture of grasses and shrubs is also greatly influenced by fire frequency and how fire is applied.

- It is important to recognise early signs of broad-scale mid-stratum thickening in open forest. These areas should be considered a priority for burning before thickening progresses to a point where planned fire is no longer viable.

- Retaining an ecosystem in a mosaic of different stages of response after fire promotes maximum diversity of plants and animal habitats.

- Within SEQ, many protected areas contain heavily disturbed or immature systems due to previous land use. In these systems, the canopy may be understocked, overstocked with regeneration or contain a more even-aged population. As long as the structure of the understorey appears healthy, implementing this guideline should assist a more varied and mature system to re-establish over time.

- Dominance of a single species in the ground stratum can result from fire during dry conditions, a recent high severity fire or too frequent fire.

- Some ecosystems are naturally less diverse but are nonetheless important to retain, as they increase overall diversity at a landscape level through the unique habitats they conserve.

- It is important to distinguish shrubs from small juvenile trees as a broad-scale overabundance of small trees in the understorey can be a health issue. With an absence of fire in some open forests, pioneer rainforest trees can shade out other ground layer plants, inhibit fire and create conditions favouring further rainforest recruitment, though this does not necessarily lead to a transition to rainforest.

- Rainforest species such as blueberry ash and laurels can naturally co-exist in the shrub layer of open forest with sclerophyll shrubs, grasses and sedges, however unlike eucalypts they will resprout from ground level after fire.

- Be aware that signs of poor health can also be a result of drought. Implementing fire during drought conditions is not recommended as this could compound health problems. Also consider whether the area has naturally poor soil, and therefore grasses may always appear less vigorous.

- Some open forests have a sedge dominated understorey (e.g. feather sedge), which appears grass-like but does not require fire for regeneration—seek advice if unsure.
What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Planned burn required to maintain areas of special conservation significance.</td>
</tr>
<tr>
<td>High</td>
<td>Planned burn to maintain ecosystems in areas where ecosystem health is good.</td>
</tr>
</tbody>
</table>

Assessing outcomes

Formulating objectives for burn proposals

Every proposed burn area contains natural variations in topography, understory 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 from below as appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–80 % mosaic</td>
<td>Choose one of these options:</td>
<td>Achieved: 40–80 % burnt.</td>
</tr>
<tr>
<td></td>
<td>a) Visual estimation of percentage of vegetation burnt—from one or more vantage points, or from the air.</td>
<td>Not achieved: &lt; 40% consider follow-up planned burn.</td>
</tr>
<tr>
<td></td>
<td>b) Map the boundaries of burnt areas with GPS, plot on ParkInfo and thereby determine the percentage of area burnt.</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td>&gt; 80 % burnt: need to assess results of other relevant objectives.</td>
</tr>
<tr>
<td>Objective</td>
<td>Action</td>
<td>Outcome</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>&gt; 90% of clumping grass bases remain as stubble.</td>
<td>Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity) and estimate percentage of clumping grass bases remaining after fire.</td>
<td>Achieved: &gt; 90% bases remain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: 75–90% bases remain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 75% bases remain.</td>
</tr>
<tr>
<td>Approx. 80% of grass tree skirts burnt with living shoots emerging.</td>
<td>After the fire, select one or more sites or walk one or more transects and estimate the percentage of grass skirts removed after the fire.</td>
<td>Achieved: 80%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: 40–80%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 40%.</td>
</tr>
<tr>
<td>&gt; 75% of ‘resprouter’ shrubs resprout post-fire.</td>
<td>Approximately three months after the fire, select three or more sites (taking into account the variability of landform and fire intensity) and estimate the percentage of ‘resprouter’ shrubs resprouting.</td>
<td>Achieved: &gt; 75% resprout.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 75% resprout.</td>
</tr>
</tbody>
</table>

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.

It is desirable to retain the stubble base of clumping grasses during a planned burn to enable rapid regeneration. The humus layer is also retained with good soil moisture.


Mosaic burning results in patches of unburnt vegetation providing variation in the stages of response from fire and diversity of habitat.

Peter Cavendish, QPWS, Glen Rock State Forest (2008).
## Fire parameters

### What fire characteristics will help address this issue?

#### Fire severity

- **Low** to **moderate** (small areas of **high** may occur)

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fire intensity (kWm⁻²)</td>
<td>Average flame height (m)</td>
</tr>
<tr>
<td>Low (L)</td>
<td>&lt; 150</td>
<td>&lt; 0.5</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>150–500</td>
<td>0.5–1.5</td>
</tr>
<tr>
<td>High (H)</td>
<td>500–1000</td>
<td>1.5–3.0</td>
</tr>
</tbody>
</table>

Note: Table assumes good soil moisture and optimal planned burn conditions. State-wide fire severity descriptions adjusted for SEQ conditions.
Mosaic (area burnt within an individual planned burn)

- A mosaic is achieved with generally 40–80 per cent burnt within the target communities (refer to Appendix 2, Mosaic burning).

Landscape mosaic

- Within some shrubby open forests, it may be difficult to achieve a mosaic within an individual planned burn. It is therefore important to create the mosaic at a landscape level by targeting different areas at different times. Aim to create a landscape mosaic of between 25–50 per cent of these communities burnt each year, to help create a varied age class structure that supports a diversity of habitats and species.

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 history and adjusted for wildfire risk and drought cycles.
- 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 three to six years for grassy understorey and seven to twenty-five years for shrubby understorey.
- It is a common mistake to interpret the fire frequency as a formula for applying fire to an area that has burnt only once within the suggested time frames, regardless of the internal patchiness of fire (e.g. 30 per cent burnt).

Across the landscape, burning some areas at shorter intervals and some areas at longer intervals will also add to diversity. Too frequent fire in shrubby communities can eliminate obligate seeder shrubs (species which regenerate only from seed and can take several years to reach maximum seed production). Similarly, when intervals between fires are too long, resprouters or annual species can be disadvantaged.
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:** January to August (consider varying the season of burn)

**FFDI:** < 11 (7 is optimal to promote a grassy ground stratum)

**DI (KBDI):** < 120 (good soil moisture is the critical factor)

**DI (KBDI) Sand substrates:** < 100 (generally lower as a result of quicker drying times) good soil moisture is the critical factor

**Wind speed:** < 15 km/hr

**Soil moisture:** Good soil moisture conditions are important to reduce impacts of fire on clumping grass bases, resprouters, hollow trees and fallen logs; and to promote a rapid post-fire response.

**Other considerations:**

- For sand sites, drying times may vary significantly.
- Late summer and autumn will generally provide better regenerative conditions for plants and animals. Be aware of weather conditions leading up to this period as drought conditions might lead to poor results.
- Use caution if burning in August as strong dry westerly winds are common during this period, increasing the risk of re-ignition.
- Be aware that some years will be wetter or drier than normal, influencing post-fire recovery and rates of fuel accumulation.

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). An initial test burn will help determine which tactics and ignition pattern will achieve the burn objectives on the day. 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.

- **Commence lighting on the leeward (smoky) edge** to establish the initial fireline, a safe perimeter and promote a low intensity backing fire. Depending on available fuels and the prevailing wind on the day, this may require either spot or strip lighting or a combination of both.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 1 — Open forest and woodland

Issue 1: Maintain healthy open forest and woodland

- **Progressive lighting** is a technique that can achieve good results for mosaic burning. An example is lighting over a period of time in order to safely burn fuels of varying flammability within different weather conditions. Another example is, in the early part of the year after rain, with good humidity and moisture, establish a patchy mosaic. Over the coming months repeat this exercise to establish a complex mosaic with highly variable season and flame characteristics.

- **Afternoon ignition:** Allowing the fire to burn into the night creates a greater mosaic than morning ignition. This is also a useful way to achieve the targeted weather conditions even when day time conditions are not ideal (but be aware of conditions on the days following).

- **Aerial ignition:** Use of aerial incendiaries is essential to cover large or inaccessible burn areas and to maximise efficiency of resources. Lighting along ridgelines will allow fire to trickle down slopes and extinguish in moister areas.

- **Timing and moisture** can be used tactically to burn adjoining vegetation with differing fire requirements (e.g. lighting grassy open forest ridgelines early in the season with good soil moisture when adjoining shrubby open forest is too moist to burn). Also, because it does not require fire as frequently.

A low intensity backing fire lit against the wind.
Peter Cavendish, QPWS, Moogerah Peaks National Park (May 2007).
Aerial ignition is essential for planned burning of inaccessible areas of open forest. 

Ignition of grassy ridgelines in cooler weather but with good soil moisture can be used to encourage grass regeneration while limiting fire encroachment into adjoining communities that require fire less frequently. 
David Kington, QPWS, Mt Barney National Park.
Issue 2: Reduce overabundant saplings

Isolated thickets of saplings can result from localised hot spots or normal variations of fire severity; however a broad-scale overabundance of saplings in the understorey of open forest or woodland can reduce the health of the ground stratum through competition and shading. To maintain an open structure, only a very small number of canopy and mid-stratum recruits are needed to provide variety in age and for eventual replacement of mature canopy species. Knowing the fire history of an area and the individual species response to fire is important in determining if overabundance is an issue.

Awareness of the environment

Key indicators of overabundant saplings:
- A broadscale mass germination of young wattles, she-oaks, eucalypts, rainforest pioneers or other saplings emerging in the ground stratum; or a broad-scale overabundance of these species in the mid-stratum.
- Presence of a monoculture of single species (e.g. brush box) in the understorey.
- Understorey or mid-stratum is difficult to see through or walk through.
- Grasses are continuous or near continuous but starting to collapse. Other ground layer plants are reduced in health and abundance.
- Shrubs where present, have dead or dying branches and are declining in diversity and abundance.

Without intervention, this mass germination of wattles will eventually shade out the ground stratum grasses making it difficult to reintroduce planned burns.

An over-abundance of she-oaks in the understorey has already led to a decline in the condition of grasses at this site.

Rainforest pioneers in the mid stratum are scattered but grasses have become sparser in the ground layer. Fire is required to restore the health of grasses.
Discussion

Why are saplings overabundant?

• An overabundance of saplings in the understorey may be triggered in response to:
  • A high severity fire event with no subsequent fire to thin the resulting mass germination of tree saplings (refer to the photo below).
  • A fire regime which has not been varied and has favoured one species.
  • Prolonged absence of fire leading to a gradual increase in woody species.
  • Removal of many overstorey trees due to a past natural disaster (drought or severe storm).

A small thicket of casuarina saplings has germinated after a planned burn. This is not considered an issue as it resulted from a localised hotspot and is not widespread.


Potential impacts of overabundant saplings

• A thickening of trees will result in a lower diversity in the ground stratum due to shading and less fine fuel to carry future fires.
• Once thickets have developed it may be difficult to re-introduce fire into that area if left too long.
• The fire intensity will often be higher and reach into the canopy when the community does burn. This may promote the regeneration of woody species rather than grasses and herbs.
Other considerations

- Small isolated flushes of saplings can result from localised hot spots or normal variations of fire severity and should not be confused with the broad-scale issue.

- Certain wattles and other tree species build up large seed banks in the absence of fire, which is likely to lead to a mass germination event after wildfire (which tends to be a higher severity fire). Post-fire observations and monitoring will help determine whether this is a broad-scale issue which requires follow-up fire.

- An abundance of some shrubs and trees can be part of a natural cycle. Fire management appropriate to the fire vegetation group in which they occur will maintain these areas—seek advice if unsure.

- Be aware that some overabundant rainforest and eucalypt species will resprout from bases and while fire will not kill them, it will keep them low in profile, so that other species can compete.

- In parts of the southeast, there is a group of rainforest pioneers that tend to colonise the ground layer and can grow into the mid stratum quickly in the absence of fire. It may be difficult to re-introduce fire into that area if left too long.

Tall open blackbutt forest with a well developed rainforest understorey. It is no longer possible or desirable to introduce fire under planned burn conditions.

Rowena Thomas, QPWS, Mapleton National Park (2012).
A thickening of trees may result in a lower diversity in the understorey due to shading and potentially less ground fuels to carry future fires.

Where grasses are scattered, poorly formed and collapsing, forest health will be more difficult to recover and becomes a lower priority for planned burning.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burns to maintain ecosystems in areas where ecosystem health is good (recoverable with one burn).</td>
</tr>
<tr>
<td>Medium</td>
<td>Planned burn in areas where ecosystem health is poor (recoverable with two or more burns).</td>
</tr>
<tr>
<td>Low</td>
<td>Planned burn in areas where ecosystem structure and function has been significantly disrupted. Ground stratum is absent or sparse and fire is no longer viable.</td>
</tr>
</tbody>
</table>

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 from below as appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
</table>
| > 75 % of overabundant saplings are scorched.                                          | 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 %. |
| > 90 % of the clumping grass bases remain as stubble.                                  | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity) and estimate clumping grass bases remaining after fire.                      | Achieved: > 90 % bases remain.                          
Partially achieved: 75–90 % bases remain.  
Not achieved: < 75 % bases remain. |

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?

Fire severity

- **Low to moderate** (small areas of **high** may occur)

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fire intensity (kWm⁻¹)</td>
<td>Average flame height (m)</td>
</tr>
<tr>
<td><strong>Low (L)</strong></td>
<td>&lt; 150</td>
<td>&lt; 0.5</td>
</tr>
<tr>
<td><strong>Moderate (M)</strong></td>
<td>150–500</td>
<td>0.5–1.5</td>
</tr>
<tr>
<td><strong>High (H)</strong></td>
<td>500–1000</td>
<td>1.5–3.0</td>
</tr>
</tbody>
</table>

Note: This table assumes good soil moisture and optimal planned burn conditions.
Scorch height:
- Scorch height required to reduce overabundant saplings will be variable depending on target species (e.g. green wattles require only lower branches scorched whereas brush box saplings should be scorched to the tip), seek advice for other species.

Other considerations:
- It is possible that more than one planned burn will be required to manage this issue. If the initial fire triggers a flush of new seedlings, follow-up planned burn as fuel allows for low to moderate severity fire.
- Try to carry out planned burns before significant seeding of overabundant saplings occurs. This may require a shorter fire frequency than normally recommended for this community.
- For medium priority planned burns, be aware that a low severity fire may do more harm than good, by reducing available ground fuel but not scorching the targeted saplings.
- Once the area has recovered, the recommended regime for healthy open forest and woodland should be resumed.

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: Depends on accumulation of fuel and sufficient moisture to favour regeneration of grasses. In general late summer burning is preferable to provide higher scorch and better conditions for grass recovery.

FFDI: < 11

Wind speed: < 15 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 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. Refer to Issue 1 for tactics.

- While a **low to moderate-severity** fire is recommended to address this issue, the scorch height required to achieve burn objectives is dependent on the target species and their height.

- A **backing fire** with good residence time. A slow moving backing fire lit against the wind on the smoky edge or fire running down-slope, will ensure the fire has a greater amount of residence time, while ensuring fire severity and rate of spread are kept to a minimum. Greater residence time is useful in reducing overabundant seedlings/saplings.

- A **running fire** of a higher severity (e.g. a fire lit along the mid-ridge running uphill), may be required initially where there is a lack of surface and near surface fuels due to shading-out or the thicket is well developed. In this instance a follow-up planned burn will be required to thin surviving saplings and any new seedlings.

Overabundant eucalypts in the understorey have been scorched however the site will need to be monitored to ensure the fire has not triggered another flush of seedlings.

QPWS (2009).
**Issue 3: Manage invasive grasses**

It is important to be aware of the presence of invasive exotic grasses during planned burn operations and the maintenance of firelines. They are generally taller and produce significantly more dry matter than native species; increasing fuel loads, fire intensity, spotting and flame height which leads to increased fire severity and spread. Some invasive grasses of concern in SEQ bioregion are guinea, thatch, signal, molasses, giant rat’s tail and whiskey grass.

**Awareness of the environment**

**Key indicators of invasive grass issue:**

- Tall, dense stands of grasses (often single-species dominated) are present.
- Invasive grasses may be located along firelines, access roads and historically cleared areas.
- There may be dead trees (within infestation) with charring high up the trunk.

A monoculture of thatch grass has replaced native pasture and begun to encroach into adjoining communities.

Dan Beard, QPWS, Gladstone (2009).
Discussion

- In many cases it is desirable to avoid burning invasive grasses, due to the likelihood of increased fire severity and further promotion of these grasses. However, planned burning of invasive grasses in good soil moisture conditions may be preferable in some situations, when there is a heightened risk of them burning with wildfire and producing an even higher-severity fire during hot, dry conditions.

- Some invasive grasses have short seed viability, and withholding fire for a period may favour native grasses and assist in control, therefore it is important to know the biology and current treatment recommendations for each species.

- Fire may be useful as part of an integrated weed control program to reduce dead biomass and promote mass germination of the seed bank in preparation for herbicide control.

- Be aware of weed hygiene issues when maintaining firelines or planned burning in areas with invasive grasses (refer to the QPWS Pest plant and pathogen spread prevention guideline).

Some species-specific information is offered in the following pages:
Guinea grass *Megathyrsus maximus*

- Fire is generally not effective in controlling Guinea grass but if the infested area must be burnt, the timing and follow-up treatment with herbicide will be critical factors. Avoid burning late in the season as this will increase the risk of high severity fire and potential damage to riparian and other sensitive areas.
- Guinea grass remains greener longer than native grasses and will burn with a higher intensity due to the increased biomass when it is sufficiently cured.
- Maintaining canopy cover (and therefore shade) will assist in the management of this grass.
Molasses grass *Melinis minutiflora*

- Molasses grass is killed by fire but regenerates rapidly post-fire from large seed banks. Observation of seedlings post-burn in North Queensland showed that seed production did not occur until the second year (Williams and Bulley 2003).

- Short fire intervals i.e. planned burning before seedlings have matured to seed production, has been trialed with success in north Queensland and has led to recovery of native clumping grasses such as giant spear grass and kangaroo grass (Williams and Bulley 2003).

- Assessment of similar trials in SEQ will determine if short fire intervals are a useful method for reducing molasses grass. Some caution is required with the use of this method over a long time-frame as it may be damaging to populations of native perennials through seedling death (Williams 2002).

Molasses grass infestation in flower. This invasive grass is particularly common along roadsides and disturbed areas of open forest in SEQ.

**Signal grass** *Urochloa decumbens*

- Signal grass is not as tall as other invasive grasses but can form a dense monoculture in disturbed areas and infestations have become more common in the southern part of the bioregion.
- This invasive grass recovers rapidly after fire from stolons and seed with the onset of rains. Little is known about how signal grass responds to different fire regimes. Monitoring and more observation is required.

Signal grass forms a dense monoculture outcompeting native grasses in open forest.
John McQueeney, QPWS (2012).

Distinctive flowers of signal grass.
Donovan Sharp, Queensland Herbarium (2012).
**Whiskey grass** *Andropogon virginicus*

- Whiskey grass is a tall tussock-grass which grows up to one metre with a distinctive erect, column-like habit, appearing orange-brown during the warmer months and fading to a straw colour during winter.
- This species invades disturbed areas along tracks and like other exotic grasses can increase the fire hazard.

Whiskey grass is very distinctive in colour and appearance during warmer months.

**What is the priority for this issue?**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burns to <strong>maintain ecosystems</strong> in areas where <strong>ecosystem health</strong> is <strong>good</strong>. It is important to be aware of the presence of invasive grasses (particularly where it is a new infestation) so that their negative effects can be managed and the potential of control can be considered.</td>
</tr>
</tbody>
</table>
Assessing outcomes

Formulating objectives

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 from below as appropriate for the site:

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<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote mass germination of invasive grass seeds in preparation for control with herbicide.</td>
<td>Assess the site after the burn (preferably after rain) for germination of invasive grass seeds.</td>
<td>Achieved: mass germination of weed seeds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: moderate germination of weed seeds (sufficient to warrant follow-up spraying).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: Insufficient germination to warrant follow-up spraying.</td>
</tr>
<tr>
<td>Reduce fuel hazard to low to limit impacts of wildfire.</td>
<td>Post fire: use the Overall Fuel Hazard 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.</td>
<td>Achieved: Fuel hazard has been reduced to low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: Fuel hazard has not been reduced to low.</td>
</tr>
</tbody>
</table>

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 management techniques for most species of invasive grasses in the SEQ bioregion are not yet established and will be subject to experimentation. Recording fire details and results will help to refine the most appropriate objectives, timing and conditions.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- This will depend on the species of invasive grass being targeted but in general aim to minimise fire severity.

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:** Late wet season to early dry season (February–April) is preferable

**FFDI:** < 7

**DI (KBDI):** < 100

**Wind speed:** < 10 km/hr

**Soil moisture:** Ensure good soil moisture to retain a duff layer and limit the opening of bare ground and further encroachment of weeds.
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.

- **As part of a control program.** The initial over-spraying of invasive grasses with herbicide, followed by a low to moderate severity planned burn about a month after herbicide treatment, has been used as an effective control method. The successful treatment of these grasses will require monitoring the site and follow up treatments either by fire or herbicide of any remaining plants and new seedlings.

- **Spot ignition.** Can be used effectively to alter the desired intensity of a fire particularly where there is an invasive grass infestation. Increased spacing between spots will result in a lower intensity. The spacing of the spots may vary throughout the burn due to changes in weather conditions, topography and fuel loads.

- **Backing fire** (lit against the wind or slope) will help to minimise the fire intensity when burning invasive grass infestations and reduce the risk of encroachment into non-target communities.

- **Running fire.** For many invasive grasses it is recommended to burn early in the season. A running fire will help carry the fire though the infestation if weather conditions are too mild or grasses are not sufficiently cured. This can be achieved by shortening the spacing of lit spots or alternatively using line or strip ignition.

- **Limit fire encroachment into non-target communities.** Use appropriate lighting patterns (e.g. spot lighting with matches) in combination with favourable weather conditions along the margin of the community to promote a lower intensity backing fire that burns away from the non-target community. Undertake burning in areas adjacent to invasive grass infestations while the grass is green and not cured, under mild conditions, early morning or late afternoon/evening will assist in creating a low severity fire that burns away from the non-target community. Where the non-target community is present in low lying areas (e.g. drainage lines utilise the surrounding topography to create a low intensity backing fire that travels down slope towards the non-target community). In both instances ensure good soil moisture is present within the non-target community.
**Issue 4: Reduce *Lantana camara***

Where *Lantana camara* occurs as a scattered understorey plant and grass fuels are still continuous, the recommended fire regime for healthy open forests should be applied.

Where *lantana camara* has become an infestation; refer to Chapter 10 (Issue 5) for fire management guidelines.

Scattered lantana in the understorey. Notice that grass fuels are still continuous and therefore the standard fire regime for open forests could be applied to control lantana.  
**Issue 5: Manage bell miner associated dieback**

Bell miner associated die-back (BMAD) of eucalypts is a significant issue in the southern half of the bioregion which appears to be associated with overabundant woody species in the mid-stratum and the consequent loss of open structure between the ground layer and canopy of open forests. A high priority should be placed on maintaining ecosystem health in fire vegetation groups adjacent to BMAD affected areas to prevent the expansion of dieback.

**Awareness of the environment**

**Key indicators of BMAD** (Look for a combination of the indicators below)

- Presence of bell miner birds (bellbirds) in the local area— calls are heard (a high pitched ‘tink’).
- Presence of a dense mid-stratum.
- Foliage of canopy tree upper branches is dying in a number of trees.
- Epicormic regrowth on branches is common within an area.
- Numerous trees are dead or dying.

Numerous dead and dying trees combined with a dense mid-stratum of mainly wattles and she-oaks can be indicators of BMAD affected open forest.

Mark Burnham, QPWS, Mt Barney National Park.
Areas such as this where dieback is well established will be difficult to recover and are therefore a very low priority for planned burning.

Mark Burnham, QPWS, Main Range National Park.

Planned burning in adjacent grassy open forest should be a high priority to prevent the expansion of dieback and reduce the impact of potential high severity wildfire.

Dave Kington, QPWS, Main Range National Park.
Epicormic regrowth on branches may be common in a BMAD area.

Dead and dying tree branches are apparent in the crown of this eucalypt.

Note upper branches beginning to die.
A dense woody understorey often accompanies BMAD.
Discussion

- Areas adjacent to BMAD which are healthy or are showing early signs of decline are the highest priority for planned burning as it also reduces the impact of potential wildfire in BMAD affected areas.
- Eucalypt dieback, strongly linked with sap feeding insects called psyllids, is sometimes associated with the native bell miner or bellbird and has become common in some parts of the bird’s range. Psyllid dieback can occur without the presence of bell miners, but management will be the same as for BMAD.
- There are various theories on the cause of bell miner associated dieback and how it can be addressed. Not all dieback is due to BMAD - drought and Phytophthora can also cause dieback and fire will not necessarily help in these cases (though there is some evidence that fire is an element in Phytophthora dieback). Seek assistance if unsure.
- Areas where dieback is well established will be difficult to recover and are therefore a very low priority for planned burning.
- A single dead tree or dead tree branch is not necessarily associated with BMAD.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burns to <strong>maintain ecosystems</strong> in areas where <strong>ecosystem health</strong> is <strong>good</strong>.</td>
</tr>
<tr>
<td>Medium</td>
<td>Planned burn in areas where <strong>ecosystem health</strong> is poor but recoverable.</td>
</tr>
<tr>
<td>Very low</td>
<td>Ecosystem is <strong>extremely difficult to recover</strong>.</td>
</tr>
</tbody>
</table>

Refer to Issue 2 ‘Reduce overabundant saplings’ or Chapter 10 (Issue 5) ‘Reduce Lantana camara’ where relevant, for fire management guidelines.
**Issue 6: Manage sustainable production**

Refer to Chapter 10 (Issue 8) for fire management guidelines.

Grazing can impact on planned burning operations by reducing the fuel hazard (amount of surface and near-surface fuels available). Although grass appears similar on both sides of the fence, the right side was previously grazed by cattle and had only one year of growth, compared to the left side which had three years growth and thatch (dead grass) underneath. Under ideal planned burn conditions, this fire self-extinguished exactly on the edge of the fuel hazard change.

David Kington, QPWS, Glen Rock State Forest (2010).
Chapter 2: Wet open forest

This fire vegetation group includes open forests in wetter areas of SEQ, generally surrounding rainforests on elevated slopes, mountain ranges and gullies as well as wetter lowland areas. They are typically dominated by one or a mix of canopy species including flooded gum, tallowwood, Sydney blue gum, turpentine and brush box. These communities generally have a rainforest-dominated but mixed species understorey, though small remnants of grassy or shrubby understorey may occur, particularly within Sydney blue gum forests.

Fire management issues

In most parts of SEQ, wet open forest communities form a moving ecotone between closed rainforest communities and open forest and woodland and the composition of the understorey varies with rainfall, altitude, slope, aspect, geology and fire frequency. Most of these forests have a rainforest dominated understorey which will only burn during wildfire in prolonged dry conditions; however there may be small areas with a grassy or shrubby understorey which should be a high priority to maintain with planned burning.

Issues:

1. Maintain wet open forest with a grassy or shrubby understorey
2. Maintain wet open forest with a rainforest understorey.

<table>
<thead>
<tr>
<th>Extent within bioregion:</th>
<th>50 629 ha, 1 per cent; Regional ecosystems: 12.2.4, 12.3.2, 12.5.6a, 12.8.8, 12.8.9, 12.11.2, 12.12.15a, 12.12.15b.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largest locations of this FVG:</td>
<td>Great Sandy National Park, 9 868 ha; Conondale National Park, 4 817 ha; D'Aguilar National Park, 3 019 ha; Lamington National Park, 1 856 ha; Main Range National Park, 1 827 ha; Woondum National Park, 1 087 ha; Springbrook National Park, 853 ha; Mount Barney National Park, 683 ha; Glen Rock State Forest, 623 ha; Imbil State Forest 1, 495 ha; Deongwar State Forest, 364 ha; Ravensbourne National Park, 293 ha; Bellthorpe National Park, 250 ha; Kondalilla National Park, 240 ha; Tamborine National Park, 199 ha; Yurol State Forest, 187 ha; Lockyer National Park (Recovery), 182 ha; Tewantin National Park, 177 ha; Marys Creek State Forest, 128 ha; Neerdie State Forest 2, 123 ha; Peachester State Forest, 104 ha; Mapleton National Park, 103 ha; West Cooroy State Forest, 100 ha; Ringtail State Forest, 96 ha; Maleny National Park, 71 ha; Toolara State Forest, 67 ha; Mapleton National Park (Recovery), 55 ha; Eumundi Conservation Park, 49 ha; Ferntree Creek National Park, 48 ha; Beerwah State Forest, 38 ha.</td>
</tr>
</tbody>
</table>
Issue 1: Maintain wet open forest with a grassy or shrubby understorey

Planned burning is critical to maintain small remaining areas of wet open forest with a grassy or shrubby understorey. More frequent fire is required to maintain grasses, keeping more mesic (rainforest) species low in the profile of the understorey so that other species can compete (Campbell and Clarke 2006).

Refer to Chapter 1 (Issue 1) for fire management guidelines.
Issue 2: Maintain wet open forest with a rainforest understorey

Most wet open forest communities have a rainforest dominated ground stratum while others, in the absence of fire, develop a closed sub-canopy of mature rainforest under tall eucalypt emergent’s (e.g. Fraser Island, Lamington and Springbrook national parks). It is not possible or desirable to introduce fire into these communities under planned burn conditions and it is likely that fire will only ever penetrate under extreme or catastrophic conditions (e.g. severe wildfire following drought and / or cyclone damage).

In some areas it may be necessary or desirable to prevent fire encroachment into these communities. Refer to Chapter 10 (Issue 2), for fire management guidelines.
Chapter 3: Grasslands

In SEQ, grasslands have a very restricted distribution in the Bunya Mountains. Known locally as grassy balds, these areas are mostly dominated by tussock grasses (e.g. *Poa labillardieri* and *Sorghum leiocladum*) and are generally treeless and shrubless. In the Bunya Mountains they exist mostly as small pockets surrounded by either eucalypt forest or rainforest at both high and low altitudes. Past indigenous burning regimes are attributed to maintenance of the grassy balds prior to European influence (Fensham and Fairfax 2006a). The biodiversity status of this regional ecosystem is **endangered** (Queensland Herbarium 2011a).

**Fire management issues**

The main issue for these communities is encroachment of surrounding rainforest and eucalypt forest. Regular burning is required to maintain grassy balds surrounded entirely by rainforest; and to restrict the expansion of adjoining eucalypt forest.

**Issues:**

1. Maintain healthy grasslands and limit forest encroachment
2. Manage woody invasion.

**Extent within bioregion:** 669 ha, < 1 per cent; **Regional ecosystem:** 12.8.15

**Locations of this FVG:** Bunya Mountains National Park, 455 ha; Bunya Mountains National Park (Recovery), 1 ha.
Issue 1: Maintain healthy grasslands and limit forest encroachment

To maintain healthy grasslands and limit forest encroachment by rainforest and eucalypt forest species, it is critical to conduct planned burns with good soil moisture.

Awareness of the environment

Key indicators of healthy grasslands:
- Grass clumps are well formed.
- Trees and shrubs absent or mostly absent.
- Few weeds present.

Grasslands in good health with only a few weeds (balloon cotton) present.

QPWS, Bunya Mountains National Park.
The following may indicate that fire is required to maintain grasslands:

- Grass clumps poorly formed; an accumulation of thatch (dead material) and collapsing grass clumps.
- A flush of eucalypt or wattle saplings/seedlings emerging amongst the grass clumps.
- Rainforest pioneers emerging amongst the grass clumps.

Grass clumps are collapsing with an accumulation of thatch (dead material)

Peter Cavendish, QPWS (2007).
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 3—Grasslands

Issue 1: Maintain healthy grasslands and limit forest encroachment

Discussion

• Balloon cotton is a widespread weed on the grassy balds and is reported to increase in abundance soon after fire, however it decreases with grass regrowth (Fensham and Fairfax 1996a).

• Exotic kikuyu grass is a major threat to grasslands in the Bunya Mountains as it has the capacity to almost completely replace native species (Fensham and Fairfax 1996b).

• Burning with good soil moisture to maintain grass bases will promote faster grass regeneration and limit opportunity for balloon cotton and exotic grasses to germinate or spread.

• Be aware that signs of poor health can also be a result of drought. Implementing fire during drought conditions is not recommended as this could compound health problems.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burn required to maintain areas of special conservation significance.</td>
</tr>
</tbody>
</table>

Gradual encroachment of rainforest into grassy balds.

Peter Leeson, QPWS, Bunya Mountains National Park (2007).
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 from below as most appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
</table>
| > 90 % of the clumping grass bases remain as stubble.       | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity) and estimate grass bases remaining after fire.                                       | Achieved: > 90 % bases remain.  
Partially achieved: 75–90 % bases remain.  
Not achieved: < 75 % bases remain.                                                                 |
| > 75 % of woody saplings / seedlings < one metre in height are scorched to the tip. | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire severity); estimate the percentage of saplings/seedlings scorched. | Achieved: > 75 %.  
Partially achieved: 25–75 %.  
Not achieved: < 25 %.                                                                                      |

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.

There is a need for monitoring the extent of these grassy areas with respect to the encroachment of rainforest and eucalypt forest; however this is difficult due to the inaccessibility of many sites.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Low** with the occasional **moderate** severity fire.

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Average flame height (m)</th>
<th>Average scorch height (m)</th>
<th>Fire severity (post-fire)</th>
<th>Description (loss of biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (L)</td>
<td>50–100</td>
<td>0.3–0.5</td>
<td>≤ 2.5</td>
<td></td>
<td>Some patchiness. Most of the surface and near surface fuels have burnt. Stubble still evident.</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>100–1500</td>
<td>0.5–1.5</td>
<td></td>
<td>Complete standing biomass removed</td>
<td>All surface and near surface fuels burnt. Stubble burnt to blackened remnants.</td>
</tr>
</tbody>
</table>

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 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 three to six years.
**Mosaic** (area burnt within an individual planned burn)

The entire area is likely to burn because of mostly continuous, evenly distributed fuel, so aim for a landscape level mosaic.

**Landscape mosaic**

Generally, avoid burning more than 50 per cent of grasslands in any one year.

**Other issues**

A moderate severity fire may be required when targeting woody species that are starting to become abundant. Good soil moisture at the time of burning is vital so as not to exacerbate the issue and to favour grass regeneration.

Grasslands will dry out more quickly after rain than surrounding forest so consider this when planning and prioritising burns.

**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:**

- Concentrate efforts during years of good rainfall.
- Avoid burning following frosts.
- Be aware that grass growth and recovery post fire is slower in winter which may result in patches of bare ground for longer periods and provide the opportunity for encroachment of weeds.

**GFDI:** < 7

**DI (KBDI):** < 100

**Wind speed:** < 15 km/hr

**Soil moisture:** Good soil moisture is critical when burning grasslands to assist retention of grass bases and encourage grass regeneration. Timing burns in the days following rain (and before adjoining forests will burn) will improve regeneration and limit promotion of weeds such as balloon cotton.
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** applies to aerial and ground ignition and can be used to alter the desired intensity of a fire. Spots closer together will result in a line of a greater intensity (as spots merge and create high intensity junction zones) while increased spacing between spots or alternatively a single spot ignition will result in a lower intensity fire and more varied mosaic of unburnt and burnt patches. 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 on the leeward or smoky edge) will generally result in a more complete coverage of an area and a better consumption of fuel. This tactic creates high residence time useful to reduce overabundant seedlings, while ensuring fire intensity and rate of spread are kept to a minimum.

- **Aerial ignition** is essential for planned burning inaccessible grassy pockets and to maximise efficiency of resources. Consider burning soon after rain and/or lighting these areas later in the day to limit intensity.

Spot ignition on the smoky edge can be useful to minimise intensity which in turn helps to retain grass clump bases, and improve post-fire regeneration to out-compete weeds such as balloon cotton.

Mark Cant, QPWS, Bunya Mountains National Parks (2004).
Issue 2: Manage woody invasion

Encroachment of eucalypt, wattle or rainforest saplings from surrounding communities reduces the health of grasses and will eventually lead to forest transition.

Awareness of the environment

Key indicators of where fire can still be introduced:

- Eucalypt, wattle or rainforest species are beginning to colonise, emerging above the grass layer.
- Grasses are scattered, poorly formed and collapsing. Other ground layer plants are reduced in health and abundance.
- Grass layer is starting to become less continuous.
Discussion

Why are woody species invading?

- Prolonged absence of fire can lead to gradual colonisation of woody species from surrounding rainforest and eucalypt forest.
- Where woody species have started to colonise and fire has been absent for several years, a wildfire or high-severity fire can trigger certain wattles and other tree species to mass-germinate creating thickets.
- An altered regime of higher-intensity fires with low soil moisture can promote woody species over grasses.

Potential impacts of woody invasion:

- Shading by woody species will lead to a decline in grass health and abundance, reducing the amount of ground fuel to carry low intensity fires in the future.
- Once a thicket has developed it may be difficult to re-introduce fire into the area if left too long.
- The fire intensity will often be higher when the community does burn which promotes further regeneration of woody species rather than grasses and herbs.
- Eventually the grassland may transition into an open woodland community or rainforest.

Other considerations

- It is likely that more than one planned burn will be required to manage this issue.
- If the initial fire triggers a flush of new seedlings, follow-up planned burn when sufficient fuel allows for a low to moderate severity fire.
- Once the area has recovered, the recommended regime for healthy grassland should be resumed (refer to Issue 1).

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Planned burn required to maintain areas of special conservation significance.</td>
</tr>
</tbody>
</table>
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 from below as most appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 75% of saplings are scorched to the tip.</td>
<td>Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire severity); estimate the percentage of saplings scorched.</td>
<td>Achieved: &gt; 75%.&lt;br&gt;Partially achieved: 50-75%.&lt;br&gt;Not achieved: &lt; 50%.</td>
</tr>
<tr>
<td>&gt; 75% of grasses recover after fire.</td>
<td>Before and after fire, select three or more sites (taking into account the variability of landform and likely fire intensity) and estimate cover of grasses that recover one to three months after fire.</td>
<td>Achieved: &gt; 75% of grasses recover.&lt;br&gt;Partially achieved: 50–75% recover.&lt;br&gt;Not achieved: &lt; 50% recover.</td>
</tr>
</tbody>
</table>

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?

Fire severity

- **Moderate** severity fire.

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Average flame height (m)</th>
<th>Average scorch height (m)</th>
<th>Description (loss of biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate (M)</td>
<td>150–500</td>
<td>0.5–1.5</td>
<td>2.5–7.5</td>
<td>Limited patchiness. Some scorched litter remains. Some of humus layer and clumping grass stubble remain. Scorching of saplings.</td>
</tr>
</tbody>
</table>

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

Scorch height

- Scorch height required to reduce overabundant saplings will be variable depending on target species (e.g. green wattles requires only lower branches scorched whereas brush box saplings should be scorched to the tip), seek advice for other species.

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

- Ensure sufficient fuel has built up to carry a **moderate** severity fire depending on species.

Mosaic (area burnt within an individual planned burn)

- Burn as much of the area dominated by saplings as possible.

Other considerations:

- Be aware that a low severity fire may do more harm than good by reducing available ground fuel but not reducing the targeted saplings.
- It is probable that more than one planned burn will be required to manage this issue. If the initial fire triggers a flush of new seedlings, follow-up planned burn as fuel allows for low to **moderate** severity fire.
**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:** Depends on accumulation of fuel and sufficient moisture to favour regeneration of grasses

**GFDI:** $< 10$

**Wind speed:** $< 15$ 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 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.

- **Commence lighting on the leeward (smoky) edge** to create a safe edge to support a subsequent higher severity fire internally. Depending on available fuels and the prevailing wind on the day, either spot or strip lighting may be required or a combination of both.

- Creating a **running fire** (through closely spaced spot ignition or line ignition with the wind) may help in addressing the issue of encroachment of woody species.

- **Line ignition** is used to create a fire of higher intensity or to help fire carry through moist or inconsistent fuels. This is also useful to reduce overabundant trees (through scorching).
Chapter 4: Heath communities

In SEQ this fire vegetation group contains wet and dry coastal heaths, sedgelands and treeless vegetated swamps, wallum banksia and low mallee woodland communities on dunes and sand plains. It also includes montane heath and rock pavement, generally located on rocky mountain peaks, exposed ridges and plateaus on poorer soils.

Fire management issues

The main issue for many coastal heath communities is the recurrence of broad-scale (sometimes frequent) high intensity wildfires in dry conditions, which can reduce plant health and lead to long term loss of diversity. In more isolated areas of montane heath and some coastal, prolonged absence of fire can also lead to a decline in plant health and diversity.

Peat fires can be an issue in wet heaths and sedgelands, particularly during prolonged drought. If ignited, peat can smoulder for long periods and will take many years to re-form.

Maintaining appropriate mosaic burning in surrounding fire-adapted areas, combined with landscape mosaic burning of heath with good soil moisture, is the best strategy to mitigate the extent of unplanned fire and maintain healthy heath communities.

Issues:

1. Maintain healthy coastal heath communities
2. Maintain healthy montane heath communities
3. Avoid peat fires
4. Manage exotic pine wildings.

Extent within bioregion: 145 914 ha; 2 per cent; Regional ecosystems: Refer to Appendix 1.

Largest locations of this FVG: Great Sandy National Park, 75 291 ha; Burrum Coast National Park, 18 474 ha; Moreton Island National Park, 6 260 ha; Naree Budjong Djarra National Park, 4 193 ha; Tuan State Forest, 2 757 ha; Bribie Island National Park, 1 999 ha; Poona National Park, 1 539 ha; Deepwater National Park, 1 215 ha; Noosa National Park, 1 196 ha; Mount Walsh National Park, 1 154 ha; Bingera National Park, 986 ha; Naree Budjong Djarra National Park (Recovery), 906 ha; Toolara State Forest, 901 ha; Eurimbula National Park, 880 ha; Glass House Mountains National Park, 514 ha; Mooloolah River National Park, 447 ha; Littabella National Park, 398 ha; Land adjacent to Tuan SF, 350 ha; Mount Barney National Park, 339 ha; Lamington National Park, 333 ha; Proposed Miara National Park (Yandaran Land), 244 ha; Mount Coolum National Park, 228 ha; Eurimbula Resources Reserve, 179 ha; Moogerah Peaks National Park, 158 ha; Main Range National Park, 143 ha.
Issue 1: Maintain healthy coastal heath communities

Maintain heath communities by mosaic burning on a landscape level and burning in association with the surrounding fire-adapted communities.

Awareness of the environment

Key indicators of healthy coastal heath communities (refer to photos below):

- There is a diversity of shrub species that appear green and vigorous including banksias, hakeas, pea flowers, tea-trees *Leptospermum* spp. and grass trees.
- Presence of obligate seeders such as small-leaved geebung *Persoonia virgata*, *Hakea actites* and wedding bush *Ricinocarpos pinifolius*.
- Rushes, sedges, lilies and herbs are present in the ground layer of wet heath.
- Trees are absent or occasional emergents; or a low tree layer dominated by wallum banksia or stunted or mallee-form trees is present.
- Low lying areas may be seasonally waterlogged.

Healthy wet heath community

Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 4—Heath communities

Issue 1: Maintain healthy coastal heath communities

Healthy coastal open heath with emergent melaleucas

Healthy open sedgelands.
QPWS, Bribie Island National Park (2005).
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 4—Heath communities

Issue 1: Maintain healthy coastal heath communities

Healthy wet coastal heath
Adam Creed, QPWS, Toby’s Gap, Fraser Island.

Healthy high dune heath. Note the presence of dead woody material from previous fire with healthy new foliage.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 4—Heath communities

Issue 1: Maintain healthy coastal heath communities

Healthy wallum banksia heath

Healthy low mallee heath woodland
Paul Horton, QPWS, Burrum Coast National Park (2012).
Signs of where fire management is required:
- Shrubs have lost a significant amount of lower level leaves, or crowns of shrubs are dying. Dead material is accumulating on shrubs.
- There is a noticeable loss of diversity in the shrub layer.
- Dense matting of dead vegetation appears under banksias.
- Grass trees have accumulated dense brown skirts.
- Dodder is starting to smother the shrub layer.
- Substantial dead material is accumulating amongst sedges and rushes or dense matting of dry material is present in wet heath.
- Encroachment of melaleuca saplings in wet heath or increasing abundance of saplings in dry heath.

Dead branches, spindly growth and loss of diversity in the understorey indicate fire has been absent too long from this wallum banksia woodland.
Shrubs are losing lower leaves and grass trees accumulating dead skirts in this open heath.

Sedges and rushes are starting to accumulate dead material in this wet heath.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 4—Heath communities

Issue 1: Maintain healthy coastal heath communities

Dodder is smothering the shrub layer in this long unburnt heath.
Paul Horton, QPWS, Burrum Coast National Park (2012).

Hakea actites shrubs are abundant in some wet heath communities and can become structurally dominant when fully grown (2-3m). Combined with the weight of large woody seed clusters (inset) mature plants may fall over, impacting on ground layer plants.
Discussion

- Many coastal heath communities are located within the urban interface or high-use recreation areas making them more susceptible to arson and wildfire. The issue is that these areas may only experience broad-scale (sometimes frequent) high intensity wildﬁres in dry conditions, with subsequent long-term impacts on plant diversity and health.

- Conversely, some heath communities experience too infrequent fire which also results in decline in plant health and diversity. It is important to burn the landscape in a mosaic to provide a range of vegetation age classes and reduce the extent of future wildﬁres.

- Coastal heath communities feature a relatively high proportion of obligate seeder species (i.e. regenerating only from seed) which can take several years to reach reproductive maturity. It is important to allow some plants sufﬁcient time to mature and set seed over several years to build an adequate seed supply between ﬁres.

- Some obligate seeders such as hakea can become overabundant as a result of mass germination following ﬁre, particularly in low soil moisture. If this occurs across a broad area, consider reintroducing ﬁre before reseeding occurs.

- Low-lying wet heaths gradually accumulate peat (partially decayed, densely packed vegetation). Due to its porous nature and high carbon content, peat is highly flammable when dry and can continue to smoulder for weeks or months after the ﬁre has occurred. Peat takes many years to re-form.

- Peat ﬁres are extremely difﬁcult to extinguish and may travel underground beneath ﬁrelines with a high risk of re-ignition elsewhere.

- In wet heath communities with a peat layer, planned burn with standing water to help protect the peat layer.

- Implementing ﬁre during drought conditions is not recommended as in most instances plants will be drought ‘stressed’ and this will impact upon post ﬁre recovery of the plants and community generally. The resulting ﬁre can also be expected to be more damaging and extensive.
What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burns to maintain ecosystems in areas where ecosystem health is good.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create age class diversity within heath community by mosaic burning across the landscape (e.g. mosaic burn approx 30% every three years)</td>
<td>Choose one of these options: Visual estimation of percentage of vegetation burnt—from one or more vantage points, or from the air. Map the boundaries of burnt areas with GPS, plot on ParkInfo and thereby determine the percentage of area burnt. 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.</td>
<td>Achieved: 25–50 % burnt. Partially achieved: 0–25 % or 50–75 % burnt. (Adjust future planned burn objectives depending on result) Not Achieved: &gt; 75 % burnt.</td>
</tr>
</tbody>
</table>

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.
A successful mosaic burn in open heath—this can be difficult to achieve within small areas, so generally aim for a landscape level mosaic.
Rowena Thomas, QPWS, Currimundi Lake Conservation Park (2009).

Mosaic planned burning coastal heath at a landscape level using aerial incendiaries.
Galen Matthews, QPWS, Moreton Island National Park (2009).
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.

Monitoring the presence of common obligate seeders such as wedding bush may be useful as an indicator of appropriate fire regimes in some heath communities.

Fire parameters

What fire characteristics will help address this issue?

Fire severity

- Coastal heath and sedgelands: **Moderate** (small pockets of extreme can be expected).

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (L)</td>
<td>&lt; 2.0</td>
<td>Substantial unburnt vegetation (green patches) in the shrub layer. Does not remove all the surface fuels (litter) and near surface fuels. Can create distinct ‘holes’ in closed heath. Some scorching of shrubs and small trees.</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>2.0–4.0</td>
<td>Most vegetation burnt. Skeletal frames of shrubs remain. Trunks of grass trees intact. Charred duff layer remains.</td>
</tr>
<tr>
<td>Extreme (E)</td>
<td>&gt; 4.0</td>
<td>Extensive to total biomass burnt. Burnt to mineral earth.</td>
</tr>
</tbody>
</table>

Note: This table assumes good soil moisture and optimal planned burn conditions. State-wide fire severity descriptions adjusted for SEQ conditions.

Skeletal frames of shrubs remaining intact after a moderate severity fire is important to provide regeneration for many species and maintain structure of the heath community.

Jenise Blaik, QPWS, Teerk Roo Ra National Park (2002).
• Wallum banksia and low mallee woodland < 10m: **Moderate** (small pockets of **extreme** can be expected)

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average flame height (m)</td>
<td>Average scorch height (m)</td>
</tr>
<tr>
<td>Patchy (P) to Low (L)</td>
<td>&lt; 1.0</td>
<td>&lt; 5.0</td>
</tr>
<tr>
<td>Moderate (M) to Extreme (E)</td>
<td>&gt; 1.0</td>
<td>&gt; 5.0</td>
</tr>
</tbody>
</table>

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

**Landscape mosaic**

• Because most of these communities tend to burn all at once or not at all, it may be difficult to achieve a mosaic within a small individual planned burn area. It is therefore important to create the mosaic at a landscape level. Do not burn more than 30 per cent of these heath communities within a management area in the same year.
**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 history** and adjusted for wildfire risk and drought cycles.
- 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 eight and twenty years with an emphasis on eight to twelve years.

Only a small percentage of the total planned burn area was actually burnt in this coastal heath. Another mosaic burn has been planned for three years time to target some of the adjoining unburnt areas, creating variation in vegetation ages.

Galen Matthews, QPWS, Moreton Island National Park (2009).

**Other considerations**

- Generally it is not possible to planned burn coastal heath at low severity.
- It is important to ensure that individual areas are not always burnt with the same interval between fires or at the same time of year. Some hard seeded species (e.g. pea flowers require more heat to germinate).
- Consider progressive burning to treat more volatile fuel types early in the season (e.g. swamp or wet heath).
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: January to August (southern bay islands May to August)

FFDI: < 11.

DI (KBDI): < 120 (< 80 southern bay islands).

Relative Humidity: > 50 per cent (only relevant to southern bay islands)

Wind speed: < 15 km/hr

Soil moisture:

- Ensure good soil moisture is present. Be aware that although coastal heaths can receive regular moisture or rain, they are also exposed to strong winds and can dry out very quickly, particularly where they occur on sandy soils.
- Standing water or waterlogged peat is the critical factor that will help to minimise risk of re-ignition in wet heath.

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.

- **Aerial incendiary** with planned spot ignition, using topography and weather conditions on the day, is useful for mosaic burning of large areas. Pre-planning is required using GIS mapping to show previously burnt areas and determine appropriate ignition points. It may be useful to record ignition points as GPS coordinates. Post-burn aerial observation is required to accurately record percentage burnt.

- **Burning in high humidity** conditions (such as in the advent of rain, during low cloud cover or the evening) is a useful tactic to help limit spread of fire into these communities and ensure the resulting fire is of a lower severity that preferably extinguishes overnight.
Issue 2: Maintain healthy montane heath communities

Maintain healthy montane heath communities by mosaic burning on a landscape level and burning in association with the surrounding fire-adapted communities.

Awareness of the environment

Key indicators of healthy montane heath communities:

- A diversity of shrub species that appear green and vigorous including banksias, hakeas, pea flowers, tea-trees *Leptospermum* spp., she oaks and grass trees.
- Presence of obligate seeder shrubs such as Allocasuarina rigida, steelhead *Callitris monticola* and narrow-leaved boronia *Boronia anethifolia*.

Montane heath is often fragmented by rock pavement which can be used to help maintain variation in time since fire.
Justin O’Connell, QPWS, Mt Maroon (2009).
Signs of where fire management is required:

- Shrubs have lost a significant amount of lower level leaves, or crowns of shrubs are dying. Substantial dead material is accumulating on shrubs.
- Loss of diversity is observed in the shrub layer.
- Increasing abundance or dominance of a single species (e.g. hakea, she-oaks or tea-trees) is observed.
- Grass trees are accumulating dense brown skirts.
- Banksias appear spindly with a lack of leaves.

This montane heath has been unburnt for 20 years. Notice lower level leaves are dying and there is a dominance of she oaks Allocasuarina spp.

Discussion

- Montane heath communities typically require longer fire frequency than the communities that surround them and are often self protecting due to fragmentation by rock pavement.
- Plant health and diversity can be reduced by extended absence of fire as well as too frequent broad-scale high-intensity wildfires in dry conditions.
- An imbalance of hakea, she oaks or tea trees may often result from a single or series of dry, high-severity fires or where fire has been absent for an extended period.
- For obligate seeders it is important to allow some plants sufficient time to mature and set seed over several years to build an adequate seed supply between fires. In conjunction it is important to burn the landscape in a mosaic to provide a range of vegetation age classes and reduce the extent of future wildfires.
Fire parameters

What fire characteristics will help address this issue?

Fire severity

- Low to moderate

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (L)</td>
<td>2.0 – 4.0</td>
<td>Moderate unburnt vegetation (green patches) in the shrub layer. Does not remove all the surface fuels (litter) and near surface fuels. Can create distinct ‘holes’ in closed heath. Some scorching of shrubs and small trees.</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>2.0 – 4.0</td>
<td>Most vegetation burnt. Skeletal frames of shrubs remain. Trunks of grass trees intact. Charred duff layer remains.</td>
</tr>
</tbody>
</table>

Notes: a) This table assumes good soil moisture and optimal planned burn conditions.
   b) State-wide fire severity descriptions adjusted for SEQ 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 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 fifteen to fifty years.
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:** Late wet season to early dry season (e.g. February to August)

**FFDI:** $< 11$

**DI (KBDI):** $< 120$

**Wind speed:** $< 15 \text{ km/hr}$

**Soil moisture:** The presence of good soil moisture is crucial for good regeneration. These communities are heavily influenced by local weather conditions, drying and exposure due to topography and shallow soils.

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.

- **Burn in association with surrounding landscape.** Allow fire to penetrate naturally into heath when burning surrounding areas but do not attempt to re-ignite unburnt areas.

- **Aerial or manual spot ignition of heath** along spurs and ridgelines may be useful to encourage variability or to introduce fire into long unburnt areas when burning in association with the surrounding landscape.

Spot lighting montane heath in the late afternoon will help reduce the fire severity and promote mosaics. QPWS, Moogerah Peaks National Park (2008).
**Issue 3: Avoid peat fires**

Planned burn with standing water in wet coastal heath and sedgelands to avoid peat fires.

Refer to Chapter 10 (Issue 4), for fire management guidelines.
Issue 4: Manage exotic pine wildings

Germination of exotic pine wildings is an issue in areas of heath adjacent to pine plantations.

Refer to Chapter 10 (Issue 7), for fire management guidelines.

Exotic pine wildings in regenerating heath community.
Graeme Bulley, QPWS, Bribie Island National Park (2011).
Chapter 5: Melaleuca communities

This fire vegetation group includes melaleuca swamps, melaleuca woodlands and open forests commonly dominated by *Melaleuca quinquenervia* (swamp paperbark). The understorey is variable with wetter sites supporting sedges, ferns and other wet heath species, while drier sites may have a grassy and/or shrubby understorey. The endangered swamp tea-tree *Melaleuca irbyana* forests restricted to SEQ are also included in this group.

Fire management issues

There are considerable differences in how melaleuca communities occur in the landscape which present different fire management issues. Where they occur as isolated stands within a broader fire-adapted community, the focus is on mosaic burning in surrounding areas, allowing fire to penetrate into melaleuca communities on some occasions. Where they occur as an extensive forest, a more direct approach to fire management may be required.

Issues:

1. Maintain healthy melaleuca communities
2. Avoid peat fires
3. Manage exotic pine wildings.

**Extent within bioregion:** 80,673 ha; 1 per cent; **Regional ecosystems:** Refer to Appendix 1.

**Largest locations of this FVG:** Great Sandy National Park, 12,338 ha; Bribie Island National Park, 4,725 ha; Tuan State Forest, 3,237 ha; Poona National Park, 2,919 ha; Deepwater National Park, 2,043 ha; Eurimubula National Park, 1,916 ha; Toolara State Forest, 1,667 ha; Burrum Coast National Park, 1,274 ha; Beerburrum East State Forest, 988 ha; Curtis Island National Park, 704 ha; Naree Budjung Djara National Park, 657 ha; Noosa National Park, 552 ha; Wongi State Forest, 547 ha; Littabella National Park, 505 ha; Southern Moreton Bay Islands National Park, 501 ha; Moreton Island National Park, 371 ha; Mooloolah River National Park, 323 ha; Beerwah State Forest, 297 ha; Wongi Forest Reserve, 296 ha; Eurimubula Resources Reserve, 295 ha; Curtis Island Conservation Park, 278 ha; Proposed Miara National Park (Yandaran Land), 261 ha; Coolum Creek Conservation Park, 260 ha; Great Sandy Conservation Park, 150 ha; Naree Budjung Djara National Park (Recovery), 124 ha; Bingera National Park, 122 ha; Maroochy River Conservation Park, 118 ha; Carbrook Wetlands Conservation Park 1, 117 ha; Elliott River State Forest, 116 ha; Land adjacent to Poona NP, 112 ha; Pumicestone National Park, 110 ha; Vernon Conservation Park, 108 ha; Mount Coolum National Park, 105 ha; USL Central Great Sandy Strait, 100 ha; Ext to Poona National Park, 94 ha; South Stradbroke Island Conservation Park, 90 ha; Beerburrum West State Forest, 79 ha; Neerdie State Forest 2, 78 ha; Ext to Bribie Island National Park, 71 ha; Venman Bushland National Park, 68 ha; Glass House Mountains National Park, 67 ha; Teerk Roo Ra National Park, 60 ha.
Issue 1: Maintain healthy melaleuca communities

Maintain healthy melaleuca communities with planned burning.

Awareness of the environment

Key indicators of a healthy melaleuca community

- Understorey may contain a sparse to dense ground layer of grasses, sedges, forbs, ferns, orchids, shrubs, or any mix of these in the understorey, with melaleuca species of variable sizes and a healthy canopy.
- Cabbage tree palms may be present in the mid stratum or sub-canopy of some coastal communities.
- Permanent or seasonal standing water may be present.

Melaleuca community with a healthy grass/sedge understorey.
Rowena Thomas, QPWS, Caloundra Conservation Park (2011).
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 5—Melaleuca communities

Issue 1: Maintain healthy melaleuca communities

Melaleuca swamp with wet heath understorey
Rowena Thomas, QPWS (2011).

Melaleuca forest with fern/sedge understorey, subject to seasonal inundation.
Melaleuca communities can occur in narrow strips along drainage channels. Burning adjacent fire adapted communities when standing water is present will limit impacts on melaleuca from more frequent regimes.

Jenise Blaik, QPWS Teerk Roo Ra National Park (2011).
Some of the following may indicate that fire is required to maintain a melaleuca community:

- There is a dense accumulation of dead material (grasses/sedges/ferns) and grasses are beginning to collapse (no longer erect).
- Increasing density of monkey vine *Parsonsia* spp., in the mid stratum
- Surface and near-surface fine fuels such as leaf litter, bark and twigs have accumulated to High hazard (using the Overall Fuel Hazard Assessment Guide).
- There has been a mass germination of melaleuca in amongst or just above the ground layer.
- There has been a flush of pine wildlings or groundsel which have grown up and begun to shade out ground layer. Sometimes these form a whipstick stand of many closely spaced narrow trees.

Dead material is accumulating in the fern / sedge ground stratum. Note the presence of monkey vine in the mid stratum which can also become dense in the absence of fire.

Rowena Thomas, QPWS, Glass House Mountains National Park (2009).
Discussion

- The thick papery bark of some melaleucas promotes ladder fires which will quickly run from the base of the tree to the top. Often these fires will self extinguish without causing any damage particularly to mature trees (depending upon weather conditions at the time and fire severity). Younger melaleuca trees will often respond post fire with a flush of regrowth from epicormic buds.

- Where a thicket of young melaleucas has developed, the resulting fire can be of a much greater severity due to the closeness of saplings and fuel arrangement which can result in a much greater mortality of melaleuca.

- The endangered swamp tea-tree communities occur as low forests with an open eucalypt overstorey. Regeneration of these melaleucas may be disrupted by too frequent high severity fires in dry conditions or too infrequent fires.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Planned burn required to maintain areas of <strong>special conservation significance</strong>.</td>
</tr>
<tr>
<td>High</td>
<td>Planned burn to <strong>maintain ecosystems</strong> in areas where <strong>ecosystem health</strong> is <strong>good</strong>.</td>
</tr>
</tbody>
</table>

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 from below as appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
</table>
| Combined surface and near-surface fine fuel reduced to moderate. | **Post fire:** use the Overall Fuel Hazard Guide, to visually assess the remaining fuel in at least three locations. | **Achieved:** fine fuel reduced to Moderate.  
**Not achieved:** fine fuel still High. |
| < 5 % mortality of mature melaleuca. | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire severity); estimate the percentage of mature dead trees (approximately six months after the fire). | **Achieved:** < 5 %.  
**Not achieved:** > 5 %. |
| > 90 % of clumping grass or sedge bases remain as stubble. | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity) and estimate percentage of clumping grass bases remaining after fire. | **Achieved:** > 90 % bases remain.  
**Partially achieved:** 75–90 % bases remain.  
**Not achieved:** < 75 % bases remain. |
| The planned burn does not result in a peat fire. | Ongoing visual assessment during and post burn to ensure the fire has not 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.
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.

Monitoring the presence and condition of specific species such as the endangered swamp orchid *Phaius australis* can be used as an indicator of appropriate fire.

Sylvia Millington, QPWS (2005).
# Fire parameters

## What fire characteristics will help address this issue?

### Fire severity

- **Low** to **moderate** (Melaleuca open grassy/ferny woodland).
- **Moderate** with small areas of **high** (other melaleuca communities)

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Average flame height (m)</th>
<th>Average scorch height (m)</th>
<th>Description (loss of biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low (L)</strong></td>
<td>&lt; 150</td>
<td>&lt; 0.5</td>
<td>&lt; 2.5</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Moderate (M)</strong></td>
<td>150–500</td>
<td>0.5–1.5</td>
<td>2.5–7.5</td>
<td>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.</td>
</tr>
<tr>
<td><strong>High (H)</strong></td>
<td>500–1000</td>
<td>1.5–3.0</td>
<td>7.5–15.0</td>
<td>Some patchiness. Some humus remains. Some habitat trees and fallen logs affected. At least some canopy scorch in moderate &lt; 20 m height canopy, mid stratum burnt completely (or nearly so).</td>
</tr>
</tbody>
</table>

Note: This table assumes good soil moisture and optimal planned burn conditions.
Specific guidelines for melaleuca communities

Where they are not directly targeted as part of fuel management burns, the main fire management approach for melaleuca communities is burning surrounding fire-adapted areas with a good awareness of moisture conditions within the melaleuca community. Fire penetration into melaleuca (from surrounding areas) can be planned to achieve the recommended fire frequency. Direct targeting of melaleuca areas with fire management may be required depending on on-ground assessment.

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 frequencies to create varying stages of post-fire response (i.e. recently burnt through to the maximum time frame).
- Consider the needs of melaleuca communities based on understorey and moisture with a broad fire interval range for mixed grass/shrub understorey of six to twenty years; heath understorey eight to twelve years; and sedge/fern understorey twelve to twenty years.

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: January to July (consider varying the season of burn)

FFDI: < 11

DI (KBDI): Ideally 60–80, but < 100

Wind speed: < 15 km/hr

Soil moisture: Burn with good soil moisture in melaleuca woodlands. Melaleuca communities seasonally inundated or where a peat layer has formed are vulnerable to peat fire in the drier months and should always be burnt with standing water or when the peat layer is water logged (refer to Chapter 10 Issue 4, for guidelines).
Other considerations

Be aware that the **papery bark and leaves** of melaleuca are volatile and highly flammable. Planned burns following rain will help protect melaleuca trees and reduce ember spotting (due to moisture being retained in bark).

The papery bark of Melaleuca draws fire up the tree trunk. Planned burning soon after rain will help the fire to self-extinguish and improve post-fire regrowth.

Jenise Blaik, QPWS, South Stradbroke Island Conservation Park (2011).

• For melaleuca and pine wilding overabundance, it is particularly important to observe post fire germination and kill rates to ascertain the need for subsequent fires. It is likely that more than one planned burn will be required to manage this issue. Although **moderate** severity fires may be necessary to control sapling overabundance, it may also have an impact on canopy species recruitment. Therefore once mid stratum overabundance is controlled, it is important to return to a predominantly **low** severity fire regime.
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**. Useful to alter the desired severity of a fire. Well spaced spot lighting adjacent to melaleuca stands is preferred to limit the chance of hot damaging junction zones forming within this community.

- **A backing fire with good residence time** - A slow moving backing fire (lit against the wind on the smoky edge or down-slope) will generally result in a more complete coverage of an area and ensures the fire has a greater amount of residence time, while ensuring fire intensity and rate of spread are kept to a minimum. Greater residence time is useful in reducing overabundant trees.

- **Commence lighting on the leeward (smoky) edge** to establish the initial fire-line, a safe perimeter and promote a low severity backing fire. Depending on available fuels and the prevailing wind on the day this may require either spot or strip lighting or a combination of both.

- **Areas with standing water** can be used to protect peat and create fires with a greater mosaic and variability of time since fire.

- **Line or strip ignition** is used to create a fire of higher intensity or to help fire carry through moist or inconsistent fuels. This is also useful to reduce overabundant trees (through scorching).

- **Limit fire encroachment into non-target communities**. When burning in surrounding fire-adapted areas where you do not want fire to penetrate into melaleuca, appropriate lighting patterns along the margin of the melaleuca community may assist in creating a low intensity backing fire that burns away from the non-target area. Or, where the melaleuca is low-lying (e.g. drainage lines), utilise the surrounding topography to create a low intensity backing fire that travels down slope towards the melaleuca community. In both instances ensure good soil moisture is present within the melaleuca community.
Issue 2: Avoid peat fires

Refer to Chapter 10 (Issue 4), for fire management guidelines.

Standing water will prevent peat fires and reduce likelihood of ignition during planned burning in adjacent communities.

Troy Spinks, QPWS, South Stradbroke Island Conservation Park (2005).
Issue 3: Manage exotic pine wildings

Refer to Chapter 10 (Issue 7), for fire management guidelines.

A flush of pine wildings has formed a dense thicket in the understorey of this melaleuca community.

Graeme Bulley, QPWS, Bribie Island National Park (2008).
Chapter 6: Coastal fringing forests and headlands

This fire vegetation group includes coastal fringing forests of swamp she-oak and exposed rocky headlands (grassy or wind-sheared shrub).

Fire management issues

Issues:
1. Maintain health of fringing swamp she-oak forests

Extent within bioregion 4 259 ha; < 1 per cent; Regional ecosystems: Refer to Appendix 1.

Largest locations of this FVG: Eurimbula National Park, 406 ha; Southern Moreton Bay Islands National Park, 215 ha; Curtis Island National Park, 203 ha; Great Sandy National Park, 148 ha; Great Sandy Conservation Park, 115 ha; Bribie Island National Park, 110 ha; Burrum Coast National Park, 68 ha; Pumicestone National Park, 45 ha; Beerburrum East State Forest, 42 ha; Noosa National Park, 37 ha; Eurimbula Resources Reserve, 30 ha; Southend Conservation Park, 21 ha; Eudlo Creek Conservation Park, 21 ha; Ext to Poona National Park, 18 ha; Barubbra Island - Proposed Addition To Conservation Park, 18 ha; Coombabah Lake Conservation Park, 17 ha; + Naree Budjong Djara National Park, 16 ha.
Issue 1: Maintain health of fringing swamp she-oak forests

Fringing swamp she-oak forests are fire-adapted communities which should be burnt in association with surrounding fire-adapted communities. These communities have an endangered biodiversity status (Queensland Herbarium 2011a).

Awareness of the environment

Key indicators of health in fringing swamp she-oak forest:

• Open to dense canopy of swamp she-oaks.
• Melaleuca and/or mangroves may be intermingled on the margins.
• The ground stratum may be present as a sparse cover of salt-tolerant plants (e.g. marine couch); a cover of fallen she oak ‘leaves’ (cladodes) and devoid of ground plants or with reeds, sedges and/or ferns.
• Few or no weeds e.g. groundsel are present.
• These areas may be subject to tidal inundation.

Signs of where fire management is required in fringing swamp she-oak forest:

• It is difficult to see through or walk into the forest.
• Increasing infestation of weeds, particularly groundsel.
• Accumulation of dead material in sedge/fern understorey where present.
• Build up of fine fuels such as dead grass material, leaf litter, suspended leaf litter, bark and twigs. Accumulation of elevated fuels is high or above.
What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>High</td>
<td>Planned burn to <strong>maintain ecosystems</strong> in areas where ecosystem health is good.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic burn in association with surrounding fire-adapted communities</td>
<td>Choose one of these options: Visual estimation of percentage of vegetation burnt—from one or more vantage points, or from the air. Map the boundaries of burnt areas with GPS, plot on ParkInfo and thereby determine the percentage of area burnt. 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.</td>
<td><strong>Achieved:</strong> 40–70 % burnt. <strong>Partially achieved:</strong> between 15–40 % Or 70–85 % burnt. <strong>Not achieved:</strong> &lt; 15 % or &gt; 85 % burnt.</td>
</tr>
</tbody>
</table>

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.

Discussion

- The fire ecology of these communities is poorly known. Monitoring this ecosystem’s response to fire is highly desirable.
- Swamp she-oak forest can accumulate a significant fine fuel layer and requires fire to maintain an open structure.
Fire parameters

What fire characteristics will help address this issue?

Fire severity

- **Low** and occasionally **moderate**

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
<th>Description (loss of biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low (L)</strong></td>
<td>Fire intensity (kWm⁻²)</td>
<td>Average flame height (m)</td>
<td>Average scorch height (m)</td>
</tr>
<tr>
<td></td>
<td>&lt; 150</td>
<td>&lt; 0.5</td>
<td>&lt; 2.5</td>
</tr>
<tr>
<td><strong>Moderate (M)</strong></td>
<td>150–500</td>
<td>0.5–1.5</td>
<td>2.5–7.5</td>
</tr>
</tbody>
</table>

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

- Aim to burn no more than 50 per cent of swamp she-oak in any year.

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 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 six to seven years.

Other considerations

Moisture: good soil moisture is important for the regeneration of grasses

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.

- Coinciding more frequent planned burns in surrounding areas with high tides or seasonal inundation will limit fire encroachment into this community when not required.
**Issue 2: Maintain health of rocky headlands**

Rocky headlands are fire-adapted communities which are generally burnt in association with surrounding fire-adapted communities but may also be targeted for individual planned burns. These communities have a biodiversity status of concern (Queensland Herbarium 2011a).

**Awareness of the environment**

**Key indicators of health in rocky headlands**

Grassy:
Ground stratum dominated by kangaroo grass in well-formed clumps, shrubs and trees mostly absent.

Or

Shrubby:
Ground stratum dominated by sparse wind-sheared shrubs (e.g. *Banksia* spp.), taller shrubs and low trees may be present in the mid-stratum.

Rocky headland dominated by kangaroo grass with occasional low shrubs. Good soil moisture is important for planned burns in these communities to favour regrowth of native grasses and minimise opportunity for weed invasion.

Signs of where fire management is required in rocky headlands

Grassy:
- Invasion or monoculture of casuarina species.
- Change of grass species from kangaroo grass to blady grass and couch

Some grassy headlands have been invaded by stands of casuarina and grass species are changing.

Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 6—Coastal fringing forests and headlands

**Issue 2: Maintain health of rocky headlands**

**Shrubby:**
- Shrubs are beginning to lose lower level leaves, or some crowns of shrubs are dying. Dead material accumulating on shrubs.
- Noticeable loss of diversity in the shrub layer.

Trees are only scattered on this grassy headland but kangaroo grass is being replaced by other grasses.
### 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 from below as appropriate for the site:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
</table>
| > 90 % of the clumping grass bases remain as stubble. | Select one or more sites or walk one or more transects (taking into account the variability of landform and likely fire intensity) and estimate grass bases remaining after fire. | Achieved: > 90 % bases remain.  
Partially achieved: 75–90 % bases remain.  
Not achieved: < 75 % bases remain. |
| > 75 % of casuarinas are scorched. | 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 casuarinas (above ground components) scorched. | Achieved: > 75 %.  
Partially achieved: 25–75 %.  
Not achieved: < 25 %. |
Create age class diversity within shrubby headland communities by burning in association with surrounding fire-adapted vegetation.

<table>
<thead>
<tr>
<th>Choose one of these options:</th>
<th>Achieved:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Visual estimation of percentage of vegetation burnt – from one or more vantage points, or from the air.</td>
<td>25–50 % burnt.</td>
</tr>
<tr>
<td>2. Map the boundaries of burnt areas with GPS, plot onto ParkInfo (GIS) and thereby determine the percentage of area burnt.</td>
<td>Partially achieved: 50–75 % burnt (adjust future planned burn objectives depending on result).</td>
</tr>
<tr>
<td>3. 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.</td>
<td>Not achieved: &lt; 25% or &gt; 75 % burnt.</td>
</tr>
</tbody>
</table>

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.

- The fire ecology of these communities is poorly known. Monitoring this ecosystem’s response to fire is highly desirable.
**Fire parameters**

**What fire characteristics will help address this issue?**

**Fire severity** (grassy headlands): **Low**

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fire intensity (kWm⁻¹)</td>
<td>Average flame height (m)</td>
</tr>
<tr>
<td>Low (L)</td>
<td>50–100</td>
<td>0.3–0.5</td>
</tr>
</tbody>
</table>

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

**Fire severity** (shrubby headlands): **Low to moderate**

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Fire severity (post-fire)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average flame height (m)</td>
<td>Description (loss of biomass)</td>
</tr>
<tr>
<td>Low (L)</td>
<td>&lt; 2.0</td>
<td>Substantial unburnt vegetation (green patches) in the shrub layer. Does not remove all the surface fuels (litter) and near surface fuels. Some scorching of shrubs and small trees.</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>2.0–4.0</td>
<td>Most vegetation burnt. Skeletal frames of shrubs remain. Charred duff layer remains.</td>
</tr>
</tbody>
</table>

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

- Because most of these communities tend to burn ‘all or nothing’ it may be difficult to achieve a mosaic within a small individual planned burn area. It is therefore important to create the mosaic at a landscape level.

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 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 ten to thirty-five years.

Grassy headlands will require more frequent fire than shrubby headlands and should be planned to be burnt according to an assessment of health issues discussed above.

**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:** Jan to Aug

**FFDI:** < 11

**DI (KBDI):** < 120

**Wind speed:** < 15 km/hr

**Soil moisture:** Good soil moisture is important. These communities are heavily influenced by local weather conditions, exposure to strong winds and can dry out very quickly, particularly where they occur on shallow or sandy soils.

**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.

- **Burn in association with surrounding landscape.** Wind-sheared shrubby headlands typically require less frequent fire than the communities that surround them. Therefore burning of adjacent fire-adapted communities needs to consider tactics to minimise fire encroachment. Refer to Chapter 10 (Issue 2), for further tactics.
Chapter 7: Riparian, foredune, coral cay island and beach ridge communities

This fire vegetation group includes riparian communities (blue gum/river oak/weeping bottlebrush); foredune communities (coastal she-oak/spinifex); coral cay island vegetation (pandanus/coastal she-oak and various grass/herb/shrublands) and beach ridge communities (bloodwood/moreton bay ash/wattle/cypress).

Fire management issues

These communities are mostly fire sensitive. Riparian and beach ridge communities are often subject to weed invasion following disturbance from high-severity fire which poses a significant threat by increasing the fuel loads and fire risk to these communities. Proactive fire management in surrounding fire-adapted areas will help mitigate impacts of unplanned fire.

Issue:

1. Limit fire encroachment into healthy riparian, foredune, coral cay island and beach ridge communities.

Extent within bioregion: 102 548 ha; 2 per cent; Regional ecosystems: Refer to Appendix 1.

Largest locations of this FVG: Great Sandy National Park, 18 874 ha; Wongi State Forest, 3 638 ha; Moreton Island National Park, 2 749 ha; Eurimbula National Park, 2 501 ha; Curtis Island National Park, 2 454 ha; Burrum Coast National Park, 2 204 ha; Eurimbula Resources Reserve, 2 012 ha; Cordalba State Forest, 933 ha; Curtis Island State Forest, 910 ha; South Stradbroke Island Conservation Park, 746 ha; Lockyer National Park (Recovery), 696 ha; Noosa National Park, 676 ha; Deepwater National Park, 664 ha; Curtis Island Conservation Park, 642 ha; Wongi National Park, 523 ha; Tuan State Forest, 451 ha; Naree Budjong Djara National Park, 406 ha; Bribie Island National Park, 261 ha; Cordalba National Park, 255 ha; Broadwater Conservation Park, 221 ha; Mouth of Kolan River Conservation Park, 199 ha; Crows Nest National Park, 199 ha; Naree Budjong Djara National Park (Recovery), 188 ha; Poona National Park, 186 ha; Elliott River State Forest, 181 ha; Lockyer National Park, 178 ha; Bulburin National Park, 154 ha; Deer Reserve State Forest, 153 ha.
Issue 1: Limit fire encroachment into healthy riparian, foredune, coral cay island and beach ridge communities

Riparian communities

Many riparian communities contain a high proportion of fire-sensitive species. High severity fire will simplify the structure and increase the risk of soil erosion and weed invasion, which in turn may increase the fire hazard.

Avoid fire into most healthy riparian communities. Implementing planned burns in surrounding fire adapted communities with good soil moisture, using appropriate tactics will limit potential impacts on this community.

Paul Lawless-Pyne, QPWS, Kroombit Tops National Park (2011).

Foredune and coral cay island communities

These communities also contain many fire-sensitive species such as coastal she-oak *Casuarina equisetifolia* which are killed by fire. Fire can open up sites sensitive to erosion in high recreation areas.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 7—Riparian, foredune, coral cay island and beach ridge communities

Issue 1: Limit fire encroachment into healthy riparian, foredune, coral cay island and beach ridge communities

Foredune communities including coastal she-oak and spinifex are easily killed by fire. When burning adjacent fire-adapted communities, care should be taken to avoid any fire penetration.

Peter Leeson, QPWS, Great Sandy National Park (2008).

Littoral open scrub restricted to coral cay islands is fire sensitive.

G.C. Naylor, DERM, Capricornia Cays National Park.

Herblands restricted to coral cay islands do not require fire for regeneration.

D.A. Halford, Queensland Herbarium, Capricornia Cays National Park.
Beach ridge communities

Beach ridge communities contain many fire-adapted species in the canopy such as bloodwoods, moreton bay ash, banksia and wattle but may have a ground stratum or midstratum of fire-sensitive vine forest species. These are sometimes interspersed with swales (hollows between beach ridges) containing stands of melaleuca and occasionally livistona palms. Due to the harsh growing conditions and rapidly drying sandy soils, these communities are more sensitive to high-severity fire or dry-season fire, with subsequent slow recovery which will favour invasion of weed species. When burning adjacent fire-adapted communities, care should be taken to avoid fire encroachment unless there is high soil moisture, particularly for swale communities.

Planned burns with good soil moisture in surrounding fire-adapted areas that on some occasions penetrate into more open or grassy beach ridge communities may be required to reduce fuel loads and help mitigate impacts of potential wildfire.

Refer to Chapter 10 (Issue 2), for fire management guidelines.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 7—Riparian, foredune, coral cay island and beach ridge communities

Issue 1: Limit fire encroachment into healthy riparian, foredune, coral cay island and beach ridge communities

Beach ridge communities with vine forest understorey are vulnerable to fire during dry conditions. Ensure good soil moisture when planned burning surrounding fire-adapted vegetation.

Paul Horton, QPWS, Woodgate, Burrum Coast National Park (2012).

Sections of beach ridge communities may be more open with a mainly blady grass understorey, requiring low intensity burns with high soil moisture to reduce the risk of impacts from potential wildfire during dry conditions.

Paul Horton, QPWS, Woodgate, Burrum Coast National Park (2012).
Chapter 8: Rainforest, dry vine forest and brigalow

This fire vegetation group includes extensive areas of subtropical rainforest, warm and cool temperate rainforest and Antarctic beech forest in the southeast corner; and isolated remnants of rainforest at Kroombit Tops in the far north of the bioregion. Vine thickets, dry scrub and brigalow/softwood scrub commonly with vine thicket species are located in drier and western parts of the bioregion. The coastal lowlands and sand islands support a variety of rainforest, feather palm and fan palm communities and this group also includes Pisonia low closed forest restricted to coral cay islands. Brigalow has mostly been cleared for agriculture in SEQ and has a biodiversity status of endangered.

Fire management issues

Dry rainforests, vine thickets and brigalow/softwood scrubs are generally more vulnerable to fire as they are often small areas located adjacent to or upslope from fire-adapted communities and are more susceptible to fire during drought periods. Scorching of rainforest margins may also occur where there has been disturbance (e.g. storm damage or previous logging) or where fire promoting invasive grasses and/or lantana has established.

The main strategy is to maintain surrounding fire-adapted communities with mosaic burning to minimise the spread and severity of wildfire during severe weather events. When planned burning adjacent areas, it may also be necessary to employ specific tactics such as burning away from rainforest edges.

Issue:

1. Limit fire encroachment into dry vine forest, brigalow and rainforest margins.

| Extent within bioregion: 254 207 ha; 4 per cent; Regional ecosystems: Refer to Appendix 1. |
| Largest locations of this FVG: Lamington National Park, 14 219 ha; Grongah National Park, 10 260 ha; Main Range National Park, 9 796 ha; Bulburin National Park, 9 473 ha; Bunya Mountains National Park, 9 029 ha; Conondale National Park, 8 654 ha; Wrattons National Park, 6 825 ha; Great Sandy National Park, 6 226 ha; D'Aguilar National Park, 5 473 ha; Mount Barney National Park, 5 434 ha; Good Night Scrub National Park, 4 889 ha; Bania National Park, 4 460 ha; Imbil State Forest 1, 4 402 ha; Benarkin State Forest, 4 322 ha; Elgin Vale State Forest, 2 705 ha; Yabba State Forest, 2 616 ha; Yarraman State Forest, 2 468 ha; Jimna State Forest, 2 462 ha; Kroombit Tops National Park, 2 169 ha; Glenbar National Park, 2 163 ha; Oakview National Park 2 083 ha; Squirrel Creek State Forest 1 948 ha; Springbrook National Park, 1 836 ha; Mount Walsh National Park, 1 703 ha; Elgin Vale Forest Reserve, 1 588 ha; Bellthorpe National Park, 1 580 ha; Amamoor State Forest, 1 451 ha; Mudlo National Park, 1 448 ha.
Rainforests in SEQ bioregion are typically located within areas that will not burn due to topography, internal moist microclimate and a lack of available fuels (Williams et al. 2006; QPWS 2007).

Issue 1: Limit fire encroachment into dry vine forest, brigalow and rainforest margins

The mosaic burning of surrounding fire-adapted vegetation communities will assist in limiting potential impacts of unplanned fires on non-target communities such as dry rainforests, vine thicket and brigalow. The edges of these communities are generally self protecting during planned burning with good soil moisture. Sometimes however, it may be necessary to burn back from rainforest edges.

Refer to Chapter 10 (Issue 2), for fire management guidelines.

Repeated wildfires in dry conditions in combination with the slow rate of regeneration in vine thicket vegetation have been attributed to the loss of vine thicket remnants in Queensland particularly on hill slopes and fragments adjacent to roadsides.

Mark Daly, QPWS, Cressbrook Conservation Park (2006).
Issue 1: Limit fire encroachment into dry vine forest, brigalow and rainforest margins

*Pisonia grandis* open to closed forests are restricted to established coral cay islands and do not require fire. They are generally self-protecting due to the absence of understorey plants.

G.N. Batianoff, DERM, Capricornia Cays National Park.

Open forest and rainforest interface. Burning back away from rainforest edges may be necessary in some situations to avoid fire encroachment.

Wayne Kington, QPWS, Lamington National Park.
Chapter 9: Mangroves and saltmarsh

Mangroves and saltmarsh are found near or within estuarine or brackish water. They are 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. Sometimes mangroves can be scorched in nearby planned burning operations or wildfire, but it is rare that any lasting damage is done.

Care needs to be taken when burning around saltmarsh however, as it is potentially flammable. The main strategy is to burn with high tides or recent rain with groundwater seepage protecting saltmarsh vegetation. Although saltmarsh may occasionally burn, do not intentionally introduce fire.

In most instances fire management should aim to limit fire encroachment into mangroves and saltmarsh areas maintaining mosaic burning in surrounding fire-adapted vegetation communities.

Issue:

1. Limit fire encroachment into mangroves and saltmarsh.

<table>
<thead>
<tr>
<th>Extent within bioregion:</th>
<th>83 182 ha; 1 per cent; Regional ecosystems: Refer to Appendix 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largest locations of this FVG:</td>
<td>Great Sandy National Park, 3 242 ha; Curtis Island Conservation Park, 2 373 ha; USL Central Great Sandy Strait, 1 307 ha; Burrum Coast National Park, 883 ha; Southern Moreton Bay Islands National Park, 870 ha; Barubbra Island - Proposed Addition To Conservation Park, 695 ha; Curtis Island National Park, 669 ha; Naree Budjong Djara National Park, 607 ha; Eurimbula National Park, 593 ha; Tuan State Forest, 557 ha; Mouth of Kolan River Conservation Park, 519 ha; Bribie Island National Park, 516 ha; Mud Island Conservation Park, 407 ha; Ext to Poona National Park, 360 ha; Mouth of Baffle Creek Conservation Park 2, 256 ha; Maroom (Fish Habitat) Reserve, 256 ha; Poona National Park, 239 ha; Barubbra Island Conservation Park, 208 ha; Deception Bay Conservation Park, 177 ha; Pumicestone National Park, 171 ha; USL Northern Great Sandy Strait, 154 ha; Great Sandy Conservation Park, 146 ha; Hays Inlet Conservation Park 1, 143 ha; Teerk Roo Ra National Park, 142 ha; Hays Inlet Conservation Park 2, 132 ha.</td>
</tr>
</tbody>
</table>
Issue 1: Limit fire encroachment into mangroves and saltmarsh

The mosaic burning of surrounding fire adapted vegetation communities will assist in limiting potential impacts of unplanned fires on non-target communities such as mangroves and saltmarsh. Due to their location, these communities are generally self-protecting during planned burning in appropriate conditions. Coinciding planned burns in surrounding areas with high tides and the inundation of saltmarsh will further limit the chance of fire encroaching into this community.

Depending upon conditions at the time of burning, if a planned burn does carry into a saltmarsh area it is unlikely to cause any lasting impacts as this community has demonstrated good post-fire recovery in the past.

Refer to Chapter 10 (Issue 2), for fire management guidelines.

Tidal inundation can be used to limit fire encroachment into saltmarsh communities.
Sylvia Millington, QPWS, Coombabah Conservation Park (2005).
Chapter 10: Common issues

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

Fire management issues

1. Hazard reduction (fuel management) burns
2. Limit fire encroachment into non-target fire vegetation groups
3. Planned burning near sensitive cultural heritage sites
4. Avoid peat fires
5. Reduce *Lantana camara*
6. Manage severe storm or flood disturbance
7. Manage exotic pine wildings
8. Manage sustainable production.
**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.

**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.
Issue 1: Hazard reduction (fuel management) burns

Accumulation of dead grass material provides continuous surface fuel while overabundant saplings provide elevated fuels which in combination increase the fuel hazard. Jenise Blaik, QPWS (2009).

Dead material accumulated around the base of ferns and sedges and fine branch material perched on top. Dave Kington, QPWS (2011).

**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).
### Issue 1: Hazard reduction (fuel management) burns

- 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.
- 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).

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**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).

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

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>Planned burn required to protect life and/or property, usually within protection zones.</td>
</tr>
<tr>
<td>Very high</td>
<td>Planned burn required to mitigate hazard or simplify vegetation structure, usually within wildfire mitigation zones.</td>
</tr>
</tbody>
</table>

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 from below as most appropriate for the site:

<table>
<thead>
<tr>
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<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
</table>
| 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

- **Wildfire mitigation zones**: 60–80 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.

**Season:** January–August
Later burning can occur in protection zones if they are well established and have no containment hazards. For wildfire mitigation zones, avoid periods of increasing fire danger when relights are more likely.

**FFDI:** < 12

**DI (KBDI):** < 120

**Wind speed:** < 15 km/hr

**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
- reduce the likelihood of a thicket of woody species developing post fire
- favour grasses over woody species as woody species will 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). 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 generally vary throughout the burn due to changes in weather conditions, topography and fuel loads.

- **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: Limit fire encroachment into non-target fire vegetation groups

Non-target fire vegetation groups include riparian and foredune communities, rainforest, brigalow and saltmarsh. These communities are often self protecting if fire is used under appropriately mild conditions. If suitable conditions are not available, tactics such as burning away from these communities should be used to protect them. Other areas where you may wish to limit fire encroachment include melaleuca and wet coastal heath communities when the peat is dry (refer to Issue 4) or other fire vegetation groups which are not ready to burn.

Awareness of the environment

Indicators of fire encroachment risk

• Melaleuca swamp, wet heath or saltmarsh without standing water or water logged conditions.
• Invasive grasses or lantana invading rainforest or riparian edges.
• Severe storm or logging damage with dry fuel lying upon the ground inside of rainforest areas.
• Non-target community is upslope of potentially running fire or completely surrounded by fire-adapted vegetation.

There are additional photos in relevant fire vegetation group chapters.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 10—Common issues

Issue 2: Limit fire encroachment into non-target fire vegetation groups

Discussion

- Because wildfire often occurs during hot, dry or otherwise unsuitable conditions (e.g. when melaleuca swamps are dry) there is the potential for fire encroachment into non-target fire vegetation groups. Proactive broad-scale management of surrounding fire-adapted areas with mosaic burning is one of the best ways to reduce impacts of unplanned fire.

- Under appropriate planned burn conditions with good soil moisture, non-target communities tend to self protect and additional protective tactics may not be required. Sometimes where a non-target community occurs at the top of a slope, it is necessary to avoid running fires upslope even in ideal conditions.

- If suitable conditions cannot be achieved specific tactics may be required to protect the non-target fire vegetation group. See the tactics at the end of this chapter.

- For melaleuca and wet heath communities, ensure standing water is present to avoid peat fires when burning surrounding areas.

- Sometimes lantana forms a thicket that can draw fire into rainforest or riparian areas. Reduction of lantana may be advisable prior to burning to reduce biomass and avoid scorching rainforest or riparian edges.

- The presence of dense stands of invasive grasses increases the severity of fire and may contribute to impacts on non-target communities. Where stands are present, use fire with caution.

- Many riparian communities contain a high proportion of fire-sensitive species and/or habitat trees. Too frequent and/or severe fire removes, or inhibits the development of structurally complex ground and mid-strata and may open-up the canopy. This in turn may increase the risk of weed invasion and soil erosion, and lead to greater production of fine fuel (mainly grass) and hence an increase in the fire hazard.

- The main strategy to protect saltmarsh is to burn with high tides or recent rain with groundwater seepage protecting saltmarsh vegetation. Saltmarsh is most vulnerable to scorching if fire-promoting plants (especially flammable grasses) occur within or adjacent to them.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Planned burn required to maintain areas of special conservation significance.</td>
</tr>
<tr>
<td>High</td>
<td>Planned burns to maintain ecosystems in areas where ecosystem health is good.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No scorch* of margin of non-target fire vegetation group.</td>
<td>After the burn (immediately or 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 or very soon after): walk the margin of the non-target community or representative sections (e.g. a 100m long section of the margin in three locations) and estimate the percentage of margin scorched.</td>
<td>Achieved: no scorch. Partially achieved: &lt; 5% scorched. Not achieved: &gt; 5% scorched.</td>
</tr>
</tbody>
</table>

*Note—scorch includes penetration by mild surface fire.

If the above objective is unsuitable 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?

The below characteristics apply to fires in areas adjacent to the non-target fire vegetation group.

Fire severity

- A Low-severity fire in adjacent fire-adapted communities will help achieve the objective of limited fire encroachment. A backing fire will help ensure good coverage (refer to the mosaic section below). If there are overabundant saplings in the area being burnt a higher-severity fire may be required (in which case, appropriate tactics and moisture conditions will help limit scorch of the non-target areas).

Mosaic (area burnt within an individual planned burn)

- Consult the recommended mosaic for the fire vegetation group being burnt. Aim for the higher end of the recommended mosaic as this will help mitigate the movement of wildfire into fire-sensitive communities.

Landscape mosaic

- Proactive broad-scale management of surrounding fire-adapted areas using mosaic burning is one of the best ways to reduce impacts of unplanned fire on non-target fire vegetation groups and fire-sensitive communities.

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.

FDI: Refer to relevant fire vegetation group

DI (KBDI): Refer to relevant fire vegetation group

Wind speed: < 15 km/hr

Soil moisture: If fuel moisture within a fire-sensitive community is insufficient, or the fire-sensitive community is upslope from the planned burn, consider using tactics outlined below.
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.

- **Test burn** the site to ensure non-target communities will not be affected.
- **Do not create a running-fire.** When burning in adjacent sclerophyll forest during dry conditions use a low-intensity perimeter burn from the edge of low lying communities if necessary to protect its margins.
- **Commence lighting on the leeward (smoky) edge** to establish the fire and promote a low-intensity backing fire. Depending on available fuels and the prevailing wind on the day, this may require either spot or strip lighting or a combination of both.
- **Afternoon ignition.** Planned burning in areas adjacent to non-target communities can be undertaken late in the afternoon. The milder conditions during this period will assist in promoting low-severity fires that trickle along the edge and generally self-extinguish, particularly during winter.
- **Limit fire encroachment into non-target communities.** Where the non-target community is present in low lying areas (e.g. sedgelands), utilise the surrounding topography to create a low-intensity backing fire that travels down the slope towards the non-target community. If conditions are unsuitable (e.g. the non-target community is too dry to ensure 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.
- **Use strip ignition to draw** fire away from the non-target community’s edge. When more than one line of ignition is used it can create micro wind conditions that can draw fire away from non-target areas. It is important to have safe refuges when undertaking this type of burning.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 10—Common issues

Issue 2: Limit fire encroachment into non-target fire vegetation group.

Secure the edge of the non-target community (e.g. acacia stand) by spot lighting the margin to create a buffer.

Once the buffer around the non-target community has been created further lighting (e.g. targeting spurs as shown) can commence if necessary.

It was not necessary to burn back from the non-target community at the bottom of the slope, as the backing fire naturally extinguished against its edge due to greater moisture in the low lying area.

Figure 1: Example of initial lighting pattern to limit fire encroachment into non-target fire vegetation group.

Figure 2: Example of strategic ignition adjacent to non-target community and along spurs.

Figure 3: It was not necessary to burn back from the non-target community at the bottom of the slope, as the backing fire naturally extinguished against its edge due to greater moisture in the low lying area.
Issue 3: 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.
• Rock shelters, especially if they have rock paintings, stone tools, artefact bundles, wrapped material or bones inside.
• Engravings on trees or rock faces.
• 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).
• Presence of culturally significant landscapes or species (e.g. mature cypress along ridgelines).
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, fireline construction or vehicle or machinery operations.
David Cameron, Bribie Island, DNRM (2005).

Indigenous people scarred trees in order to make canoes, containers or temporary shelters. These trees are potentially vulnerable to fire if fuel builds up around their bases and the central pipe ignites.
Southeast Queensland Bioregion Planned Burn Guidelines: Chapter 10—Common issues

Issue 3: Planned burning near sensitive cultural heritage sites

Raised earth or stone patterns in cleared or previously cleared areas can be indicators of culturally significant sites. Ceremonial sites such as this earth ring are potentially vulnerable to damage from vehicles and machinery during fire operations if not identified.

David Cameron, DNRM, Kipper Creek (2004).

Cypress ridges are often associated with Traditional Owner campsites and may be a potential indicator of midden sites and water points.

Graeme Bulley, QPWS, Bribie Island National Park (2012).
Key indicators of European cultural heritage sites:

- Ruined buildings, corrugated iron shacks, wooden house stumps, old fence posts, old stock yards, tomb stones, wells, graves, bottle dumps, old machinery and iron debris may all indicate the presence of a significant site.
- Quarries and old mines sites, deep holes sometimes covered with corrugated iron or wood.
- Plane wreckage.
- Forestry artefacts including marked trees (shield trees), springboard trees (stumps or trees with axe notches cut into it to support boards) and old machinery such as winders (timber tramways) and timber jinkers (timber lifting wagon).

When located in forested areas, historic sites such as these are often vulnerable to fire, and need to be protected from severe wildfire through appropriate planned burning or mechanical fuel reduction.

When planning burns, consider if particular mild weather conditions, tactics, chipped lines or mechanical fuel reduction (e.g. brush cutting) is required prior to implementing the burn.
Issue 3: Planned burning near sensitive cultural heritage sites

Military plane wreckage.
David Cameron, DNRM, Kroombit Tops National Park (2004).

Harry’s Hut.
David Cameron, DNRM, Cooloola National Park (2004).
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 help 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?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>Fuel management through the implementation of planned burns within Protection Zones to protect life, property, and conservation values.</td>
</tr>
<tr>
<td>Very high</td>
<td>Burns protecting significant cultural heritage sites.</td>
</tr>
</tbody>
</table>

### Assessing outcomes

#### Formulating objectives for burn proposals

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No impact on item or site of cultural heritage significance.</td>
<td>Visual inspection of site or items taking photographs before and after fire.</td>
<td>Achieved: no impact on site or item. Not achieved: there was some impact on site or item</td>
</tr>
</tbody>
</table>

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 with good soil moisture 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 recommendations for the specific fire vegetation group within the planned burn area.

**Landscape mosaic**
- A landscape proactively managed with mosaic burning will help reduce fuel hazard and thereby limit the spread and severity of wildfires, giving overall 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 soil conditions

**FFDI:** < 11

**DI (KBDI):** < 100 for areas where there are combustible historic sites.

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

**Wind speed:** < 15 km/hr

**Soil moisture:** Burn with good soil moisture to help prevent impacts on cultural sites or artefacts.

Mature cypress trees are vulnerable to fire damage at their bases as fine fuels can continue to smoulder after the fire has passed through. Ensure good soil moisture before planned burning in areas of cultural significance.

Steve Samuels, QPWS, Bribie Island National Park (2012).
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.

- **Manual fuel management** may be required prior to undertaking planned burns near sites of cultural significance (e.g. scar trees and rock art sites). This may include raking, clearing (e.g. creating a 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 as it will promote a slower-moving and more manageable fire.

- **A low-severity backing fire** (usually slow moving) 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 self-extinguishes at the chipped or wet line.
Issue 4: Avoid peat fires

Some low lying communities (including wet heath and melaleuca) accumulate peat (partially decayed, densely packed vegetation) over many years or decades. In the absence of good soil moisture the peat is easily ignited resulting in a peat fire. Peat fires can burn for weeks or months with major impacts on the vegetation community and can take 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).

Water covering the base of sedges and other plants will prevent ignition of the peat layer during planned burns.

Roland Dowling, QPWS, Moreton Island National Park (2012).
Discussion

- Due to its porous nature and high carbon content peat is easily ignited when dry and can burn / smoulder for an extended period of time, causing re-ignitions and long-term damage to ecosystems.
- Be aware of peat issues when burning in areas adjacent to melaleuca communities or wet heath. The condition of the peat should be checked to ensure that if fire encroaches, a peat fire will not be unintentionally ignited.

![Image of a melaleuca swamp]

This melaleuca swamp ignited unintentionally during a planned burn of an adjacent community. Although conditions were mild, the peat was dry and resulted in a peat fire which burnt deep into the peat layer.

Jenise Blaik, QPWS, Teerk Roo Ra National Park (2002).

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>Where peat is present, it is important to consider the most appropriate management during burn planning and implementation.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The planned burn does not result in a peat fire.</td>
<td>Ongoing visual assessment during and post burn to ensure the fire has not carried into peat layer and developed into a peat fire.</td>
<td>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.</td>
</tr>
</tbody>
</table>

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.
**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:** Avoid dry season fires in the vicinity of peat.

**Soil moisture:** Standing water, or water logged peat, is the critical factor that will avoid peat fire.

This wet heath burnt when the peat was water logged preventing ignition and damage to the peat layer.

Peter Leeson, QPWS, Moreton Island National Park (2012).

**What burn tactics should I consider?**

When burning adjacent fire-adapted areas, where the conditions of standing water or water logged peat can not be achieved, treat the peat area as non-target vegetation. However be aware that the site is flammable and may not self-protect. Use tactics that will limit encroachment of fire (refer to Issue 2).
**Issue 5: Reduce *Lantana camara***

*Lantana camara* is found in a range of fire vegetation groups favouring disturbed areas, rich soils, clearings, drainage lines, gullies, road verges and wet riparian pockets. The growing habit of lantana shades out regeneration of native species, particularly grass, which in turn inhibits low severity planned burns but also carries wildfire (Tran et al. 2008). Where it occurs along rainforest edges, it increases the severity of fire, impacting on fire-sensitive ecosystems.

**Awareness of the environment**

**Key indicators of *Lantana camara***

- *Lantana camara* occurs as a dense infestation
- Grass or fine fuels are absent

Where lantana occurs as a dense infestation, grass or fine fuels are generally absent requiring a different approach to fire management.

**Discussion**

- Whilst fire is useful to control lantana, consider whether the resources required to restore heavily infested areas may be better utilised in maintaining healthier areas.

- Where dense lantana is widespread, a series of fires (with increased fire frequency) may be the only practical method of control. This can be effective to reduce the abundance and density of lantana, or to reduce the size of individual plants so that native ground covers can compete.

- In areas where lantana has become a dense infestation of a limited size, an approach combining planned burning and herbicide usage (particularly splatter gun technique [Somerville et al. 2011]) would assist in better control of lantana.

- In areas where lantana density is high but where some native grasses remain beneath it, the introduction of a low to moderate severity fire on its own may be sufficient to control lantana and favour the native grasses.

- Implementing the recommended regime for the fire vegetation group is effective in the management of lantana where it occurs as a scattered understorey plant.

- Although high intensity fires may kill lantana, it favours regrowth of woody species such as wattle or more lantana and disadvantages grasses and herbs.

**What is the priority for this issue?**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Planned burn in areas where <strong>ecosystem health</strong> is poor but recoverable.</td>
</tr>
<tr>
<td>Low</td>
<td>Planned burn in areas where <strong>ecosystem</strong> structure and function has been <strong>significantly disrupted</strong>.</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce lantana abundance by 75 %.</td>
<td>Approx. 3 months after fire, in three locations, count living and dead lantana plants within a 10 m radius.</td>
<td>Achieved: 75 % or more of lantana killed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: 25–75 % of lantana killed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 25 % killed.</td>
</tr>
<tr>
<td>Majority of lantana clumps reduced by fire to promote basal resprouting (and enable more efficient and effective follow-up spraying).</td>
<td><strong>After the burn</strong> (preferably after rain): Walk through the burn area and visually estimate the percentage of clumps that are reduced to basal resprouting.</td>
<td>Achieved: &gt; 75 % of clumps reduced to basal resprouting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: 25–75 % of clumps reduced to basal resprouting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 25 % of clumps reduced to basal resprouting.</td>
</tr>
</tbody>
</table>

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 repetitive fire.

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

- Repeat planned burn (within three years) until the issue is under control, and then re-instate the recommended fire regime for the fire vegetation group. Continue monitoring the issue over time.

- Where lantana is a scattered understorey plant, applying the standard recommended frequency for the fire vegetation group in which it occurs may be sufficient. In any case, increasing fire frequency for a while will assist control. Monitor the situation.

**Mosaic** (area burnt within an individual planned burn)

- 75–100 per cent where lantana has become a dense infestation; or

- Within the fire vegetation group, increase coverage of fire to 50–75 per cent where lantana is a scattered understorey plant.

**Fire severity**

- **Low to moderate** (generally within the recommendations for the fire vegetation group in which the lantana occurs).

**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:** Late summer to autumn

**FDI:** < 11

**DI (KBDI):** < 120 (< 80 is optimal for good soil moisture)

**Wind speed:** < 15 km/hr (10–15 km/hr is optimal)
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.

- **Line or strip ignition of leeward (smoky) edge** is used to contain the fire. Also required if there are minimal surface fuels (e.g. lantana has shaded out grasses).
- **Running fire** may be useful to carry fire through the infestation if fuel load is low or discontinuous.
- **Low to moderate severity backing fire** with good soil moisture (and presence of sufficient surface fuels) is effective where lantana is scattered in the understorey as it ensures a greater residence time at ground level and has proven to be successful in killing both seedlings and mature lantana plants.

![Image of a fire being controlled by a line or strip ignition of leeward edge.](image)

Low to moderate backing fire allows good residence time to maximise the lantana kill rate without impacting on the regeneration of native species.

Dave Kington, QPWS, D'Aguilar National Park (2005).

- **Subdividing lantana infestations** using mechanical methods can improve access for chemical control, and allow the infestation to be burnt in sections in order to manage fire severity and behaviour.
- **As part of a control program.** The initial over-spraying of lantana with herbicide (e.g. splatter gun), knocking down the lantana frames a month or so post herbicide treatment and then implementing a low to moderate severity burn into the remaining material has been shown to be very effective as a control method and is particularly useful along rainforest margins. Alternatively, it is possible to knock down the lantana first, prior to herbicide control. The successful treatment of lantana will require monitoring the site and follow up treatments either by fire or herbicide treatment of any remaining plants and new seedlings.
**Issue 6: Manage severe storm or flood disturbance**

In the event of a severe storm, the canopy of trees and shrubs may be stripped, with the debris accumulating on the ground or left suspended. Snapped limbs can be left hanging in the canopy increasing elevated fuels, and high numbers of fallen trees can greatly increase fuel loads and impede fireline access.

Major flood events can have a significant impact on riparian communities, by removing ground and mid-stratum vegetation and in some cases canopy trees. Invasion of exotic grasses and other weeds may often follow, increasing fuel loads and creating a fire-prone community which can inhibit the recovery of riparian vegetation.

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Severe storm events can dramatically alter forest structure. Reassessment of zoning plans may be required in response to greatly increased fuel loads.  
Peter Cavendish, QPWS, D’Aguilar National Park (2008).

Riparian vegetation has been completely removed during a severe flood event and replaced by flammable exotic grasses. Although previously used as a strategic fireline, flood impacts have instead created a potential fire corridor.  
Changed fuel conditions from severe storm or flood disturbance may lead to:

- the potential for high severity wildfires
- an increased fuel hazard close to assets and infrastructure
- altered fire behaviour during planned burning operations in the months and years following a severe storm or flood event
- fire-sensitive communities (e.g. riparian) becoming vulnerable to fire encroachment during drought periods
- an opportunity to re-introduce fire into areas with overabundant saplings at an advanced stage.

An initial assessment and review of strategic fire control lines and the fire management zoning plan will usually be required. Possible strategies to manage changed fuel conditions include: strategic planned burning with high soil moisture and avoiding dry conditions; encouraging neighbouring landholders to mechanically reduce fuel; avoiding ignition sources during risk periods; and reviewing scheduled planned burns to make use of moister seasonal conditions.

Flood events can create concentrated areas of high fuel hazard. Large debris deposits adjacent to or within fire sensitive communities can increase the risk of fire encroachment. Dave Kington, QPWS, Lockyer National Park (2011).
Issue 7: Manage exotic pine wildings

Pine wildings *Pinus* spp. often invade protected areas adjacent to forestry pine plantations. If they are not managed, pine wildings can displace native species and pine needles can smother lower layer plants. Recently gazetted protected areas that were historically cleared for pine plantations will require a more intensive rehabilitation plan.

**Awareness of the environment**

**Key indicators:**

- Adjacent to a pine plantation.
- Young pine wildings are beginning to emerge above the ground layer plants.
- Ground layer plants reduced in abundance and health. Grasses where present are scattered, poorly formed and collapsing.

Moderate to high severity fire will be required to char these pine wildings (one–three metres) to the tip.

Graeme Bulley, QPWS, Bribie Island National Park.
Discussion

- Pine wildings less than 1m in height are relatively easy to manage and most fire will kill the saplings. Wildings of one to three metres are more difficult to manage and specific tactics may be required such as a high-severity or running fire which chars the tip of the wildling. More advanced wildlings will require other control methods.

- Repeated low severity fire will promote pine wildings. The initial fire promotes a flush of seedlings and following fires are not hot enough to kill the growing seedlings as the fire does not char the tip of the plant.

- Care should be taken burning areas adjacent to pine plantations as high severity fires increase the risk of spot-over which can reduce the quality and value of plantation trees.

- Pine seeds are primarily wind dispersed (species dependent) and isolated wildings can be found up to five kilometres from the parent plant. However the majority of seeds will fall within 500 m of the plantation and regular reinfestation means ongoing management is crucial.

Why are wildings overabundant?

- Pine wildings in the understorey may be triggered in response to:
  - A fire event with no subsequent fire to thin the resulting flush of wildings. If a fire triggers a flush of wildings, it will be necessary to plan a subsequent burn.
  - Repeated low severity, early season fires.
  - Prolonged absence of fire.

Potential impacts of overabundant wildings

- Overabundant wildings may result in a lower diversity of plants within the understorey due to suppression from pine needles and displacement of native species.

What is the priority for this issue?

<table>
<thead>
<tr>
<th>Priority</th>
<th>Priority assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Planned burns to maintain ecosystems in areas where ecosystem health is good.</td>
</tr>
<tr>
<td>Medium</td>
<td>Planned burn in areas where ecosystem health is poor but recoverable.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Measurable objectives</th>
<th>How to be assessed</th>
<th>How to be reported (in fire report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 75 % of pine wildings &lt; 2 m are charred to the tip.</td>
<td>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) charred.</td>
<td>Achieved: &gt; 75 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially achieved: 50–75 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not achieved: &lt; 50 %</td>
</tr>
</tbody>
</table>

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?

Fire severity

- **Moderate** to **high**. Aim for flame height sufficient to char to the tip of the pine wildings.

<table>
<thead>
<tr>
<th>Fire severity class</th>
<th>Fire intensity (during the fire)</th>
<th>Average flame height (m)</th>
<th>Average scorch height (m)</th>
<th>Description (loss of biomass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate (M)</td>
<td>150–500</td>
<td>0.5–1.5</td>
<td>2.5–7.5</td>
<td>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.</td>
</tr>
<tr>
<td>High (H)</td>
<td>500–1000</td>
<td>1.5–3.0</td>
<td>7.5–15.0</td>
<td>Some patchiness. Some humus remains. Some habitat trees and fallen logs affected. At least some canopy scorch in moderate &lt; 20 m height canopy, mid stratum burnt completely (or nearly so).</td>
</tr>
</tbody>
</table>

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

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

- See frequency recommended for the fire vegetation group.
- Avoid repeated low intensity fires as this allows the persistence of pine wildings.

Mosaic (area burnt within an individual planned burn)

- 80 per cent of area dominated by understorey pine trees burnt
Other considerations:

- It is likely that more than one planned burn will be required to manage this issue. If the initial fire results in a flush of wildings, follow-up planned burn within two years with moderate to high severity fire.
- Prior to implementing a high severity fire for pine wildings, consider planned burning adjacent fire-adapted communities as recommended for the fire vegetation group to reduce risk of non-target impacts.
- An initial high intensity fire may replace pine with wattles, requiring continuing fire management to rehabilitate to a healthy condition.

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: As recommended for the fire vegetation group

Soil moisture: Burn with good soil moisture

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.
- While a moderate severity fire is often sufficient to address this issue, it is dependant upon the height of the wildings. A running fire of a higher severity may be required to increase flame height to ensure the tips of the wildings are charred.
- Line or strip ignition is used to create a fire of higher intensity or to help fire carry through moist or inconsistent fuels. A second line of fire in parallel with the initial strip can increase fire severity between the two lines as the fires draw together.
- A backing fire with good residence time. A slow moving backing fire (lit against the wind on the smoky edge or lit from upslope) will generally provide a greater amount of residence time, while ensuring fire intensity and rate of spread are kept to a minimum. Greater residence time is useful for killing wildings one to two metres in height.
**Issue 8: Manage sustainable production**

Within QPWS managed areas of SEQ, leases and permits are issued for cattle grazing, beekeeping and foliage harvesting. Where the primary focus of fire management in an area is on maintaining the production or use of a forest product (e.g. promoting pasture for grazing), the area should be zoned as a sustainable production zone and details contained within the local fire strategy. The lease or permit holder may plan and undertake the burning and this should be integrated into the QPWS planned burn program. Where the primary focus of fire management is conservation, even though sustainable production occurs, refer to fire management guidelines for the relevant fire vegetation group but be aware of the lease or permit conditions.

**Awareness of the environment**

**Key indicators where fire management for sustainable production may be required:**

- Current permits or leases are in place for foliage collection, cattle grazing or beekeeping within fire-adapted communities.
- The presence of beehives or cattle within designated areas which require planned burning.
- The protection and/or promotion of specific plant species for sustainable collection of plant parts (e.g. flowers/ fruits) or other plant products (e.g. honey) is required.
- The maintenance of pasture for sustainable grazing is required.

Foliage harvesting for specific species such as this umbrella fern, may require consideration during fire planning to either minimise impact on or promote regeneration of the target species. Jenise Blaik, QPWS, D’Aguilar National Park (2012).
Other considerations

- Establishing and maintaining good communications with lessees or permit holders on timing of planned burns can minimise impacts on both production and ecological values.
- Where possible, avoid planned burning prior to peak flowering periods for key honey production species or peak harvesting times for foliage collection.
- Consultation with lessees or permit holders during development of the planned burn program will allow any special conditions to be considered during the planning and approval process, including the option for relocation of cattle/hives, negotiation on timing of planned burns where possible and incorporation of lessee planned burns into the annual program.
- In some cases beehives may be transported to coastal areas to take advantage of seasonal flowering (e.g. winter flowering heath shrubs) or the higher altitude eucalypts can provide sustenance and rejuvenation for bees over the winter.
- Mosaic burning will help to minimise impacts on production values by promoting a range of plant ages and stages of reproduction and minimising the risk of severe and extensive wildfire which can have longer term economic impacts for the lease or permit holder.
- Fire management regimes in sustainable production zones will vary according to the product or sustainable use that is being protected or promoted in the zone. If possible the regimes should be compatible with or compliment those of the relevant fire vegetation group.
Beehives may need to be placed in a protection zone to minimise the risk of hives being burnt, particularly if the primary focus of fire management in surrounding areas is conservation or mitigation.

Mark Daly, QPWS, D’Aguilar National Park (2009).
## Glossary of fire terminology

*(Primary source: Australasian Fire Authorities Council 2012)*

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial ignition</td>
<td>The lighting of fine fuels for planned burning by dropping incendiary devices or materials from aircraft.</td>
</tr>
<tr>
<td>Available fuel</td>
<td>The portion of the total fuel that would actually burn under current or specified conditions.</td>
</tr>
<tr>
<td>Age-class distribution</td>
<td>The distribution of groups of similar aged vegetation (age-class) of a particular vegetation community after fire. In fire ecology this is used to indicate the success of mosaic burning in achieving varied habitat conditions. This is usually represented as a plot of areas (y-axis) versus age-class (x-axis) (e.g. 25 per cent of a fire vegetation group burnt between one and five years ago) (refer to Figure 1).</td>
</tr>
<tr>
<td>Burn severity</td>
<td>Relates to the amount of time necessary to return to pre-fire levels of biomass or ecological function.</td>
</tr>
<tr>
<td>Backing-fire</td>
<td>The part of a fire which is burning back against the wind or down slope, where the flame height and rate of spread is minimal.</td>
</tr>
</tbody>
</table>

**Figure 1: Idealised age-class distribution (concept only)**

![Age-class distribution graph](image)

- Vegetation community
<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Beaufort scale           | A system of estimating and reporting wind speeds, invented in the early nineteenth century by Admiral Beaufort of the Royal Navy. It is useful in fire management to indicate wind speed and relies on visual indicators rather than instruments. It equates to:  
  • Beaufort force (or Beaufort number)  
  • wind speed  
  • visible effects upon land objects or seas surface. |
<p>| BOM                      | Bureau of Meteorology.                                                                                                                                                                                                                                                                                                                                       |
| Crown scorch             | Browning of the needles or leaves in the crown of a tree or shrub caused by heat from a fire.                                                                                                                                                                                                       |
| Char height              | The height to which former green leaves still suspended on plants that are turned black by the flame of the fire. NB: This cannot be measured on the stems of plants as fire ‘climbs’ the bark.                                                                                                                                    |
| Dew point temperature    | This is a measure of the moisture content of the air and is the temperature to which air must be cooled in order for dew to form. The dew-point is generally derived theoretically from dry and wet-bulb temperatures, with a correction for the site’s elevation (BOM).                        |
| Drought                  | A drought is defined by the Bureau of Meteorology (BOM) as an ‘acute rainfall deficiency’. For the purpose of quantifying the severity of a drought, the BOM describe rainfall deficiency in two categories: ‘Serious rainfall deficiency—rainfall lies above the lowest five per cent of recorded rainfall but below the lowest 10 per cent (decile 1 value) for the period in question, Severe rainfall deficiency—rainfall is among the lowest five per cent for the period in question.’ For more information, refer to &lt;www.bom.gov.au/climate/glossary/drought.shtml&gt; |
| Drought index (DI)       | A numerical value (e.g. the Byram-Keetch Drought Index), reflecting the dryness of soils, deep forest litter, logs and living vegetation.                                                                                                                                                                                                                         |
| Duff layer               | Refer to ‘humus layer’.                                                                                                                                                                                                                                                                                                                                       |</p>
<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire behaviour</td>
<td>The manner in which a fire reacts to variables of fuel, weather and topography.</td>
</tr>
<tr>
<td>Fire Danger Index (FDI)/Fire Danger Rating (FDR)</td>
<td>A relative number and rating denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of fuel moisture and wind speed.</td>
</tr>
<tr>
<td>FFDI/FFDR</td>
<td>Forest Fire Danger Index/Danger Rating.</td>
</tr>
<tr>
<td>Fire frequency</td>
<td>The frequency of successive fires for a vegetation community in the same point of the landscape (refer to fire interval).</td>
</tr>
<tr>
<td>Fire extent</td>
<td>Refer to patchiness.</td>
</tr>
<tr>
<td>Fire intensity</td>
<td>The amount of energy released per unit length of fire front, in units of kilowatts per metre of the fireline (also known as the Byram fire-line intensity).</td>
</tr>
<tr>
<td>Fire interval</td>
<td>The interval between successive fires for a vegetation community in the same point of the landscape. Often expressed as a range indicating a minimum and maximum number of years that an area should be left between fire events (refer to Appendix 2).</td>
</tr>
<tr>
<td>Fireline</td>
<td>Constructed or treated lines/trails (sometimes referred to as fire trails or control lines) or environmental features that can be used in the management of a fire. Permanent firelines should (usually) have a primary purpose other than that of a control line (e.g. access track to a campground). Firelines are <strong>NOT</strong> fire breaks. Although the term ‘fireline’ is not without its shortcomings it should be used in preference to ‘firebreak’ to avoid the perception that a fire will stop at a break.</td>
</tr>
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<td>Terminology</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
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<td><strong>Fire Danger Index (FDI)/Fire Danger Rating (FDR)</strong></td>
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</tr>
</tbody>
</table>

### Clarification over the terms ‘fire vegetation group’ and ‘fire management zone’.

The fire management requirements within a **conservation fire management zone** are based on the **fire vegetation groups** (FVGs)—groups of related ecosystems that share common fire management requirements. Fire regimes for FVGs are identified in the Bioregional Planned Burn Guidelines and are reflected in fire strategies. Other fire management zones (e.g. protection, wildfire mitigation, special conservation, sustainable production, rehabilitation, exclusion, and reference) will have specific management objectives that override the FVG fire regime requirements. Further, if there are a number of these other zones within a strategy they are identified as **fire management subzones** (FMSz) (e.g. P1, P2, P3, WM1, WM2, etc) each with specific fire management requirements.

<table>
<thead>
<tr>
<th>Fire management zone</th>
<th>Fire management sub-zone or Fire vegetation group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation</td>
<td>FVG1</td>
</tr>
<tr>
<td></td>
<td>FVG2</td>
</tr>
<tr>
<td>Protection</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>P2</td>
</tr>
<tr>
<td>Wildfire mitigation, etc</td>
<td>W1</td>
</tr>
<tr>
<td></td>
<td>W2</td>
</tr>
</tbody>
</table>

**Fire perimeter**
The outer containment boundary in which fire is being applied.

**Fire regime**
The recommended use of fire for a particular vegetation type or area including the frequency, intensity, extent, severity, type and season of burning.

**Fire regime group (FRG)**
A group of related ecosystems that share a common fire management regime including season, severity, recommended mosaic etc. These are a sub-grouping of the fire vegetation groups to provide more detail about specific fire management requirements. Fire regime groups are provided as a more detailed alternative for use with fire strategies or in mapping.
<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fire season</strong></td>
<td>The period(s) of the year during which fires are likely to occur, spread and cause sufficient damage to warrant organised fire control.</td>
</tr>
<tr>
<td><strong>Fire severity</strong></td>
<td>A measure of the effect of fire on vegetation and soil immediately after the fire (e.g. vegetation consumption, vegetation mortality, soil alteration). Can be used to indicate fire intensity.</td>
</tr>
<tr>
<td><strong>Fire vegetation group (FVG)</strong></td>
<td>A group of related ecosystems that share common fire management requirements. For the purpose of practical fire management, these ecosystems are treated as a group.</td>
</tr>
<tr>
<td><strong>Flame height</strong></td>
<td>The vertical distance between the average tip of the flame and ground level, excluding higher flares.</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td>Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.</td>
</tr>
<tr>
<td><strong>Fuel hazard</strong></td>
<td>The condition of the fuel and takes into consideration such factors as quantity, arrangement, current or potential flammability and the difficulty of suppression if fuel should be ignited.</td>
</tr>
<tr>
<td><strong>Fuel load</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Fuel moisture content</strong></td>
<td>The water content of a fuel particle expressed as a percentage of the oven dry weight of the fuel particle (% ODW).</td>
</tr>
<tr>
<td><strong>Grid ignition</strong></td>
<td>A method of lighting prescribed fires where ignition points are set at a predetermined grid-like spacing through an area.</td>
</tr>
<tr>
<td><strong>GFDI/GFDR</strong></td>
<td>Grassland Fire Danger Index/Danger Rating.</td>
</tr>
<tr>
<td>Terminology</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>High biomass grasses</td>
<td>Tend to be exotic species of grasses which can out-compete native species to form dense mono-specific stands. They:</td>
</tr>
<tr>
<td></td>
<td>• are generally taller than native species</td>
</tr>
<tr>
<td></td>
<td>• can lead to decreased biodiversity</td>
</tr>
<tr>
<td></td>
<td>• increase biomass</td>
</tr>
<tr>
<td></td>
<td>• increase fire severity</td>
</tr>
<tr>
<td></td>
<td>• increase threat to life and property.</td>
</tr>
<tr>
<td>Humus (or duff layer)</td>
<td>The mat of partly decomposed vegetation matter on the forest floor, the original vegetative structures still being recognisable.</td>
</tr>
<tr>
<td>Junction zone</td>
<td>An area of greatly increased fire intensity caused by two fire fronts (or flanks) burning towards one another.</td>
</tr>
<tr>
<td>Keetch-Byram Drought Index (KBDI)</td>
<td>A numerical value reflecting the dryness of soils, deep forest litter, and heavy fuels and expressed as a scale from 0–203.</td>
</tr>
<tr>
<td>Landscape mosaic</td>
<td>A mosaic burn at a landscape level, usually achieved by planning a series of fires across a reserve, a bioregion or broader area.</td>
</tr>
<tr>
<td>Lighting pattern</td>
<td>The lighting pattern adopted by fire fighters during planned burning operations, or indirect attack.</td>
</tr>
<tr>
<td>Litter</td>
<td>The top layer of the forest floor composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves and needles, little altered in structure by decomposition. (The litter layer of the forest floor).</td>
</tr>
<tr>
<td>Mesophyll pioneers</td>
<td>Large-leaved (12.5–20 cm long) rainforest tree species able to establish in neighbouring communities.</td>
</tr>
<tr>
<td>Mineral earth</td>
<td>Being completely free of any vegetation or other combustible material.</td>
</tr>
<tr>
<td>Terminology</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mosaic burn</td>
<td>An approach which aims to create spatial and temporal variation in fire regimes. This can occur within an individual burn and at a landscape level (refer to Appendix 2).</td>
</tr>
<tr>
<td>Obligate seeders (obligate seed regenerating species)</td>
<td>Shrubs that are killed by fire and rely on soil-stored seed bank to regenerate. In fire ecology, the time it takes obligate seeders to mature and establish a seed bank often indicates the minimum frequency with which a vegetation community should be burnt in order to avoid the local extinction of these species.</td>
</tr>
<tr>
<td>Patchiness</td>
<td>A percentage or proportion of the ground layer vegetation (grasses, herbs and trees/shrubs less than one metre) not affected by fire (i.e. 20 per cent patchiness = 80 per cent burnt).</td>
</tr>
<tr>
<td>Perennial plants</td>
<td>Plants that last for more than two growing seasons, either dying back after each season as some herbaceous plants do, or growing continuously like many shrubs.</td>
</tr>
<tr>
<td>Planned burn</td>
<td>The controlled application of fire under specified environmental conditions to a pre-determined area and at the time, intensity, and rate of spread required to attain planned resource management objectives. In the context of QPWS operations: a fire that is deliberately and legally lit for the purposes of managing the natural and/or cultural and/or production resources of the area (e.g. reducing fire hazard, ecological manipulation), and protecting life and property.</td>
</tr>
<tr>
<td>Progressive burning</td>
<td>Progressive burning is an approach to planned burning where ignition is carried out throughout much of the year as conditions allow. In northern Queensland, ignition can begin early in the year after heavy seasonal rain, with numerous small ignitions creating a fine scale mosaic. These burnt areas can provide opportunistic barriers to fire for burning later in the year. They also provide fauna refuge areas. Progressive burning helps create a rich mosaic of intensities, burnt/unburnt areas, and seasonal variability. Be aware of how fire behaves differently in different seasons.</td>
</tr>
<tr>
<td>Rate of spread (ROS)</td>
<td>The forward progress per unit time of the head fire or another specified part of the fire perimeter, defined as metres per hour.</td>
</tr>
<tr>
<td>Terminology</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Relative humidity (RH)</td>
<td>The amount of water vapour in a given volume of air, expressed as a percentage of the maximum amount of water vapour the air can hold at that temperature.</td>
</tr>
<tr>
<td>Scorch height</td>
<td>Is the height to which former green leaves still suspended on plants are turned brown by the heat of a fire.</td>
</tr>
<tr>
<td>Strip burning</td>
<td>Setting fire to a narrow strip of fuel adjacent to a fire-line and then burning successively wider adjacent strips as the preceding strip burns out.</td>
</tr>
<tr>
<td>Test fire</td>
<td>A controlled fire of limited extent ignited to evaluate fire behaviour.</td>
</tr>
</tbody>
</table>


References


Southeast Queensland Bioregion Planned Burn Guidelines: References


Williams P and Bulley G 2003, ‘Short fire intervals can reduce molasses grass cover’, *Ecological Management and Restoration*, vol. 4, part 1, p. 74.

Appendix 1: List of regional ecosystems

A fire vegetation group is a group of related regional ecosystems that share common fire management intent for the purpose of practical fire management.

<table>
<thead>
<tr>
<th>Fire vegetation group</th>
<th>Hectares within the Southeast Queensland bioregion</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open forest and woodland</td>
<td>2 061 539</td>
<td>33</td>
</tr>
<tr>
<td>Wet open forest</td>
<td>50 629</td>
<td>1</td>
</tr>
<tr>
<td>Grassland</td>
<td>669</td>
<td>0.2</td>
</tr>
<tr>
<td>Heath communities</td>
<td>145 914</td>
<td>2</td>
</tr>
<tr>
<td>Melaleuca communities</td>
<td>80 672</td>
<td>1</td>
</tr>
<tr>
<td>Coastal fringing forest and headlands</td>
<td>4 259</td>
<td>0.8</td>
</tr>
<tr>
<td>Riparian, foredune, coral cay island and beach ridge communities</td>
<td>102 548</td>
<td>2</td>
</tr>
<tr>
<td>Rainforest, dry vine forest and brigalow</td>
<td>254 207</td>
<td>4</td>
</tr>
<tr>
<td>Mangroves and saltmarsh</td>
<td>83 182</td>
<td>1</td>
</tr>
<tr>
<td>Plantations</td>
<td>184 782</td>
<td>3</td>
</tr>
<tr>
<td>Non-remnant and other</td>
<td>3 301 536</td>
<td>53</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6 282 450</td>
<td>100</td>
</tr>
</tbody>
</table>
## Southeast Queensland Bioregion Planned Burn Guidelines: Appendix 1–List of regional ecosystems

(Sattler and Williams 1999; Queensland Herbarium 2011a; 2011b).

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Issues</th>
<th>Fire vegetation group</th>
<th>Fire regime group</th>
<th>Map label (if required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Open forest and woodland</td>
<td>Mixed grassy/shrubby</td>
<td>OFgs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.3.15, 12.5.1, 12.5.1a, 12.5.1b, 12.5.4, 12.5.7, 12.5.8, 12.8.24, 12.8.25, 12.8.26, 12.9-10.2, 12.9-10.3, 12.9-10.4, 12.9-10.7, 12.9-10.7a, 12.9-10.8, 12.9-10.12, 12.9-10.12a, 12.9-10.13, 12.9-10.17, 12.9-10.17b, 12.9-10.19, 12.9-10.19a, 12.9-10.21, 12.9-10.23, 12.9-10.24, 12.11.5, 12.11.5a, 12.11.5e, 12.11.5h, 12.11.5j, 12.11.5k, 12.11.6, 12.11.7, 12.11.8, 12.11.15, 12.11.17, 12.11.18, 12.11.18a, 12.11.19, 12.11.22, 12.12.3, 12.12.9, 12.12.11, 12.12.12, 12.12.21, 12.12.22, 12.12.24, 12.12.24x1, 12.12.25, 12.12.27, 12.12.28, 12.12.28x1, 12.9-10.9, 12.3.11a, 12.8.8a, 12.2.8, 12.5.7a, 12.5.11, 12.8.1, 12.8.1a, 12.8.2, 12.8.10, 12.8.11, 12.8.12, 12.9-10.17a, 12.9-10.17c, 12.9-10.17d, 12.9-10.18a, 12.11.3, 12.11.3a, 12.11.3b, 12.11.9, 12.11.16, 12.11.16x1, 12.11.23, 12.12.3a, 12.12.4, 12.12.6x1, 12.12.15, 12.12.20, 12.12.23.</td>
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<tr>
<td>1</td>
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<td>Wet open forest</td>
<td>OFg</td>
<td>12.3.3, 12.3.3a, 12.3.3b, 12.3.3d, 12.3.9, 12.3.10, 12.3.11, 12.5.2, 12.8.16, 12.8.17, 12.9-10.18, 12.11.14, 12.11.20, 12.12.5, 12.12.7, 12.12.8, 12.8.14, 12.8.14a, 12.8.14x1.</td>
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<td>Shrubby</td>
<td>Wet open forest</td>
<td>OFs</td>
<td>12.2.6, 12.5.3, 12.5.3a, 12.5.5, 12.5.6, 12.5.6b, 12.5.6c, 12.5.12, 12.7.1, 12.7.2, 12.8.20, 12.9-10.5, 12.9-10.5a, 12.9-10.5b, 12.9-10.5c, 12.9-10.20, 12.12.6, 12.12.14, 12.9-10.1, 12.9-10.1x1, 12.12.2, 12.12.2a, 12.12.2b, 12.9-10.14, 12.9-10.14a, 12.9-10.14b.</td>
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<td>2</td>
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<td>Wet open forest</td>
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<tr>
<td>Fire vegetation group</td>
<td>Fire regime group</td>
<td>Map label (if required)</td>
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<tr>
<td>Grassland</td>
<td>Grassland</td>
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<tr>
<td>Montane heath</td>
<td>Dry coastal heath</td>
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<td></td>
</tr>
<tr>
<td>Hm</td>
<td>Hdc</td>
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<td>12.8.19, 12.12.10.</td>
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<tr>
<td></td>
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</tr>
<tr>
<td>Wet coastal heath</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hwc</td>
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<td>Chapter</td>
<td>Issues</td>
<td>Fire vegetation group</td>
<td>Fire regime group</td>
<td>Map label (if required)</td>
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<tr>
<td>---------</td>
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<td>------------------------</td>
</tr>
<tr>
<td>5</td>
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<td>Melaleuca communities</td>
<td>Melaleuca mixed</td>
<td>12.2.7, 12.3.12, 12.9-10.10, 12.9-10.11, 12.11.21, 12.3.3c, 12.3.4, 12.3.4a, 12.3.5, 12.3.5a, 12.3.6, 12.2.5a, 12.2.7a, 12.2.7c, 12.5.4a, 12.5.9a.</td>
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<tr>
<td>6</td>
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<td>Coastal fringing forest and headlands</td>
<td>Fringing swamp she-oak</td>
<td>12.1.1.</td>
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<tr>
<td>7</td>
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<td>Riparian, foredune, coral cay island and beach ridge communities</td>
<td>Riparian, foredune, coral cay and beach ridge</td>
<td>12.2.14, 12.3.7, 12.3.7a, 12.3.7b, 12.3.7c, 12.3.7d, 12.2.17, 12.2.17a, 12.2.17b, 12.2.17c, 12.2.18, 12.2.18a, 12.2.18b, 12.2.19, 12.2.19a, 12.2.19b, 12.2.19c, 12.2.19d, 12.2.19e, 12.2.20, 12.2.20a, 12.2.20b, 12.2.5, 12.2.11.</td>
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</tbody>
</table>
### Regional ecosystems
(Sattler and Williams 1999; Queensland Herbarium 2011a; 2011b).

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Issues</th>
<th>Fire vegetation group</th>
<th>Fire regime group</th>
<th>Map label (if required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
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<td>Rainforest, dry vine forest and brigalow</td>
<td>Rainforest</td>
<td>12.8.3, 12.8.4, 12.11.10, 12.12.16, 12.8.5, 12.8.6, 12.8.7, 12.8.18, 12.2.1, 12.2.1a, 12.2.2, 12.2.3, 12.3.1, 12.11.1, 12.12.1, 12.2.21, 12.2.21a, 12.2.21b, 12.2.21c, 12.2.21d.</td>
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<td>Mangroves and saltmarsh</td>
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<td>Mangroves</td>
<td>12.1.3.</td>
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<td>1</td>
<td>Saltmarsh</td>
<td>Saltmarsh</td>
<td>12.1.2, 12.3.8.</td>
</tr>
</tbody>
</table>
The spatial data is based on version 6.1 of the “Queensland Remnant Vegetation Cover 2006” layer (16 September 2011) data (refer to Figure 1).

Some of the regional ecosystems (RE) listed will not be matched in the spatial data. This may be because the RE is ‘not of a mappable size’, the RE ‘has been moved’ (i.e. it has been reclassified into a new RE code), the RE exists only as a sub-dominant RE within the spatial data or the RE has not yet been mapped. In the regional ecosystems description database (REDD) system, the comments section (of the spatial data) indicates if the RE is not of a mappable size or if it has been moved.

The RE’s listed below do not have any matching records in version 6.1 of the Survey and Mapping of 2006 Remnant Vegetation Communities and Regional Ecosystems of Queensland spatial layer (16 September 2011).

<table>
<thead>
<tr>
<th>Unmatched regional ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.12.19x4, 12.2.15b, 12.2.15c, 12.2.15d, 12.2.15e, 12.2.17, 12.2.17a, 12.2.17b, 12.2.17c, 12.2.18, 12.2.18a, 12.2.18b, 12.2.19, 12.2.19a, 12.2.19b, 12.2.19c, 12.2.19d, 12.2.19e, 12.2.20, 12.2.20a, 12.2.20b, 12.2.21, 12.2.21a, 12.2.21b, 12.2.21c, 12.2.21d, 12.9–10.10, 12.2.1a, 12.3.3d, 12.5.6b, 12.9–10.14b.</td>
</tr>
</tbody>
</table>
Mosaic burning is an approach to planned burning which aims to maintain and maximise diversity within fire-adapted vegetation communities. At various scales, a mosaic of vegetation in different stages of post-fire response can provide a greater range of habitats for plants and animals including those that prefer open country, those that need dense vegetation or the presence of a particular food source and all ecological requirements in between.

In practice, mosaic burning is achieved through the use of appropriate weather conditions, variation in topography, frequency, intensity, season and ignition patterns to create a patchwork of burnt and unburnt areas. Over time the patches overlay to build a more complex mosaic of vegetation at various stages of response from fire (Figures 1–5 provide a simplified example). This practice can apply to burning at a landscape scale — how much of a particular fire vegetation group is targeted within a given year (across a bioregion or management area) or can refer to the area burnt within an individual fire event. Both are important.

The land manager should apply mosaic burning and be guided by the recommended fire frequency. Note that it is a common mistake to interpret the fire interval as a formula for applying fire. Consider the following example:

A fire strategy might recommend burning with a fire interval of between 8–12 years. In this case the land manager would apply mosaic burning (as often as required) but generally not burning any single patch more frequently than the minimum fire interval (e.g. eight years), or less frequently than the maximum fire interval (e.g. 12 years) (refer to Figures 1–5).

This is relevant because the minimum fire interval represents the amount of time it takes for each species to regenerate sufficiently to tolerate a second fire, and the maximum fire interval represents the amount of time an ecosystem can be left without fire before it begins to decline in health and species might be lost.

As ParkInfo/geographic information systems (GIS) and monitoring tools evolve it will become easier to evaluate if the fire vegetation groups are on track in terms of maintaining an age class distribution and conforming to recommended fire frequencies. Irrespective of monitoring and GIS tools it is important to learn to observe the health of the country and to understand its fire management needs to appropriately apply fire in a way that maintains a healthy ecosystem. This planned burn guideline provides key indicators supported by photographs to help you assess the health of the ecosystems and their fire management needs.

**Figure 1:** Map of Queensland indicating the different GIS data sources used to produce the spatial fire vegetation group mapping product.
Appendix 2: Mosaic burning

Mosaic burning is an approach to planned burning which aims to maintain and maximise diversity within fire-adapted vegetation communities. At various scales, a mosaic of vegetation in different stages of post-fire response can provide a greater range of habitats for plants and animals including those that prefer open country, those that need dense vegetation or the presence of a particular food source and all ecological requirements in between.

In practice, mosaic burning is achieved through the use of appropriate weather conditions, variation in topography, frequency, intensity, season and ignition patterns to create a patchwork of burnt and unburnt areas. Over time the patches overlay to build a more complex mosaic of vegetation at various stages of response from fire (Figures 1–5 provide a simplified example). This practice can apply to burning at a landscape scale—how much of a particular fire vegetation group is targeted within a given year (across a bioregion or management area) or can refer to the area burnt within an individual fire event. Both are important.

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Figure 1: Example area between fireline and creek burnt in a wildfire—year 0. (Recommended fire interval for fire vegetation group is eight–12 years).

Figure 2: Planned mosaic burn—year 8.
Figure 3: Planned mosaic burn—year 20.

Figure 4: Planned mosaic burn—year 28.
Southeast Queensland Bioregion Planned Burn Guidelines: Appendix 2–Mosaic burning

Figure 5: Fire history summary—year 28.
Wildfire and mosaic burn patterns overlaid (with years since last burnt).

Mosaic burn on Moreton Island National Park showing ~30 per cent coverage across the landscape.
Galen Matthews, QPWS, Moreton Island National Park (2010).
Southeast Queensland Bioregion Planned Burn Guidelines: Appendix 2—Mosaic burning

Figure 5: Fire history summary—year 28. Wildfire and mosaic burn patterns overlaid (with years since last burnt).