



# KIMBERLEY REGION REGIONAL FUEL MANAGEMENT PLAN



Department of **Biodiversity,  
Conservation and Attractions**



## Document history

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|-----------------------|------------|
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## Custodian

Department of Biodiversity, Conservation and Attractions, Parks and Wildlife Service  
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# 1. Introduction

This regional fuel management plan (RFMP) assesses risks associated with bushfire in the Parks and Wildlife Service of the Department of Biodiversity, Conservation and Attractions' (the department) Kimberley Region to assist planning the department's fuel management program. It interprets the department's Bushfire Risk Management Framework into regional indicators of acceptable bushfire risk and recommends tactics by which these may be achieved. The annual comparison of the current landscape condition to the indicators will inform planning for fuel management in the region.

The RFMP addresses bushfire risk at a regional scale. Fire management requirements relating to Aboriginal sites, places and values, species, or populations of species are addressed separately in documents such as nature conservation strategies, local area management plans, species recovery plans, and individual burn prescriptions.

The RFMP considers the hazard posed by bushfire to people, communities, infrastructure, and the natural environment. It is underpinned by the principle that managing the fuel available to bushfire is the most efficient and effective way to reduce the impacts of unplanned bushfire. This plan should be read in conjunction with the department's Bushfire Risk Management Framework which further describes this principle and bushfire risk management criteria.

Targets in the RFMP apply to land managed by the department and the tactics proposed are restricted to prescribed burning and physical fuel management such as scrub rolling. Other key aspects of managing bushfire-related risk (including preparation for, response to and recovery from bushfire) are not within the RFMP scope.

The RFMP will be reviewed annually, and a comprehensive review undertaken at the end of its five-year life at the beginning of 2031. Any important new information that emerges between reviews will be incorporated immediately and the plan re-endorsed if those changes are significant.

## 2. Bushfire risk criteria

### 2.1. Bushfire risk management zones

A bushfire risk management zone (BRMZ) is an area with similar environmental variables, land use and cultural conditions and therefore a similar characteristic risk profile. It is an area within which fuel management activities are guided by a single set of bushfire risk indicators. Western Australia's BRMZs are defined and described in the department's Bushfire Risk Management Framework.

The department's Kimberley Region lies within the Tropical and Desert BRMZs.

### 2.2. Fire management areas

The department divides the land it manages into six fire management areas (FMAs) to guide bushfire risk assessment and fuel management planning. These areas are defined according to the primary purpose of fuel management in the area and described relative to their proximity to assets.

The department's indicators of acceptable bushfire risk (defined in the department's Bushfire Risk Management Framework) allow fuel management activities to be tailored according to the risk profile and the management purpose of the land, including designating areas where there are no targets due to the limited capacity or requirement to manage fuels. The settlement-hazard separation (SHS),

landscape risk reduction (LRR) and remote area management (RAM) categories are applied to the Kimberley Region.

**Table 1: Fire management areas in the DBCA Kimberley Region. (Refer to the department’s Bushfire Risk Management Framework for more information.)**

| Fire management area               | Description   |
|------------------------------------|---|
| Settlement-hazard separation (SHS) | <ul style="list-style-type: none"> <li>• An area of managed fuel adjacent to towns, subdivisions, and other areas of human settlement.</li> <li>• Management objective is to reduce the likelihood of direct flame contact, damaging intensities of radiant heat and ember attack from posing a threat to people.</li> <li>• Breadth of area considers the fuels, climate and topography of the area and the nature of the appropriate fuel management strategies.</li> <li>• Fuels are managed relatively intensively to minimise the likelihood of a bushfire being sustained and to facilitate fire suppression.</li> <li>• The use of fuel management to achieve other land management objectives is supported where it is complementary to the primary management intent.</li> </ul> |
| Landscape risk reduction (LRR)     | <ul style="list-style-type: none"> <li>• Encompasses areas where the density or significance of infrastructure, economic activity or environmental assets necessitates fuel management at a landscape scale.</li> <li>• Fuel management will achieve a range of outcomes, including preventing the occurrence of large bushfires that may threaten life, damage infrastructure, cause financial or social impacts, degrade the natural environment, or threaten SHS or CIB fire management areas.</li> <li>• This is usually achieved by creating a mosaic of fuel ages to reduce the likelihood of fires igniting and spreading and provides greater opportunity for suppression.</li> </ul>   |
| Remote area management (RAM)       | <ul style="list-style-type: none"> <li>• Areas where remoteness, inaccessibility, resource constraints and a lack of consequential assets make it impractical or unnecessary to intervene in the prevailing fire regimes.</li> <li>• Fuel management activities are a lower priority but may still occur where required to achieve land management outcomes.</li> </ul>   |

The RFMP identifies where each FMA occurs in the region and details bushfire risk indicators for each fuel type within them. The effective management of bushfire risk in the Kimberley Region requires complementary activities in the FMAs including SHS and LRR. These areas have differing management intents, but do not represent a hierarchy of priorities for fuel management.

### 2.3. Asset value

The department’s Bushfire Risk Management Framework applies the National Emergency Risk Analysis Guidelines (NERAG) and the State Emergency Management Prevention and Mitigation Procedure (SEMPMP) to group and prioritise assets at risk from bushfire. These priorities are used to define FMAs and guide the planning of mitigation activities.

**Table 2: Asset class categorisation and prioritisation used when assessing bushfire risk.**

| Asset class                       | Priority | Description   |
|-----------------------------------|----------|---|
| Settlements                       | 1        | Areas of higher population density and low resilience to bushfire: <ul style="list-style-type: none"> <li>• settlements, towns, and subdivisions</li> <li>• recreation and camping sites with high fire-season visitation.</li> </ul>   |
| Dispersed population              | 2        | Areas of low or transient population density and low resilience to bushfire: <ul style="list-style-type: none"> <li>• individual dwellings</li> <li>• roads with high usage in fire-vulnerable areas</li> <li>• recreation and camping sites with moderate fire-season visitation.</li> </ul>   |
| Critical infrastructure           | 2        | Locations where there is a considerable threat to critical infrastructure with State-level significance and no redundancy: <ul style="list-style-type: none"> <li>• major highways and other primary distributors</li> <li>• major rail routes</li> <li>• major infrastructure associated with electricity generation</li> <li>• gas transmission pipelines</li> <li>• water supply and pipelines and associated pumps and pumping stations</li> <li>• major optical TELCO cables</li> <li>• major wastewater treatment sites.</li> </ul> |
| Protected species and communities | 2        | Areas that are critical to the survival of a legislatively protected species or threatened ecological communities (TEC) with low resilience to fire.  |
| Economic assets                   | 3        | Locations where bushfires may have a significant effect on the livelihood of individuals or community financial sustainability, such as: <ul style="list-style-type: none"> <li>• farmland</li> <li>• infrastructure of local and/or regional significance</li> <li>• major industry e.g. mine sites, refineries, manufacturing plants</li> <li>• water supply catchments.</li> </ul>   |
| Other assets                      | 3        | Other significant built, natural, or cultural assets, such as: <ul style="list-style-type: none"> <li>• infrastructure of local significance</li> <li>• significant ecological communities or species habitat</li> <li>• areas with specific fire regime requirements</li> <li>• fire vulnerable Aboriginal or European heritage sites.</li> </ul>  |

## 2.4. Asset resilience

The likelihood that the potential consequences of a bushfire will be realised depends partly on the resilience of the asset to fire. It is difficult to model resilience given there are many variables that affect the outcome of a fire, however some considerations for determining the resilience of an asset are shown in Table 3 and Table 4 (biodiversity assets).

**Table 3: Factors affecting the resilience of settlements to bushfire.** Some of these factors are also applicable to other built assets and recreation sites.

| <b>More resilient to fire</b>                        | <b>Less resilient to fire</b>                   |
|--|---|
| <b>Interface community<sup>1</sup></b>               | Intermix community <sup>2</sup>                 |
| <b>Hardened urban area without vegetation</b>        | Vegetation exists within developed area         |
| <b>Multiple access routes</b>                        | One access route                                |
| <b>Access routes highly trafficable</b>              | Access routes have limited trafficability       |
| <b>Access routes protected by low fuel buffers</b>   | Access routes have adjacent vegetation          |
| <b>Surrounding vegetation is fragmented</b>          | Surrounding vegetation is continuous            |
| <b>Adequate refuge available (oval, beach etc.)</b>  | Little refuge available                         |
| <b>Most residents are capable of self-evacuation</b> | Large population of elderly, infirm or children |
| <b>Local population well prepared for fire</b>       | Population has low level of preparedness        |
| <b>Adequate water supply</b>                         | Limited water available for fire fighting       |
| <b>Most dwellings constructed of brick</b>           | Dwellings constructed of timber or fibro        |
| <b>Building APZs<sup>3</sup> well maintained</b>     | Building APZs poorly maintained                 |
| <b>Permanent resident population</b>                 | Campsite or tourist/transient population        |

<sup>1</sup> An interface community is where a clear demarcation exists between urban areas and native vegetation and bushland does not continue into the developed area.

<sup>2</sup> An intermix community is where structures occur throughout a bushland area without a clear demarcation between urban and bushland areas.

<sup>3</sup> Asset protection zone: a low-fuel area maintained around a building to increase the likelihood that it will survive a bushfire.

**Table 4: Factors affecting the resilience of species, communities, and ecosystems to bushfire.**

**More resilient to fire** → **Less resilient to fire**

|  |   |
|--|---|
| <b>Key plant species are resprouters</b>                 | Key plant species are obligate seeders          |
| <b>No other threatening processes occurring</b>          | Fire may exacerbate other threatening process   |
| <b>Species have short juvenile periods</b>               | Species have long juvenile periods              |
| <b>Species have wide distributions</b>                   | Species have restricted distributions           |
| <b>Species have multiple populations</b>                 | Species have few populations                    |
| <b>Connections exist between populations</b>             | Populations are isolated                        |
| <b>Fauna is more mobile</b>                              | Fauna is less mobile                            |
| <b>Fauna is adapted to persistence in refugia</b>        | Fauna has limited ability to persist in refugia |
| <b>Fauna can utilise a variety of habitats</b>           | Fauna has specialised habitat requirements      |
| <b>Habitat re-establishes rapidly post-fire</b>          | Habitat slow to re-establish post-fire          |
| <b>Fauna has a broad diet or can vary diet post-fire</b> | Fauna has specific dietary requirements         |
| <b>Fire has little effect on predation rate</b>          | Fauna vulnerable to post-fire predation         |
| <b>Fauna has high rate of population increase</b>        | Fauna has low rate of population increase       |

Asset resilience is combined with the asset class priority rating (Table 2) to provide a regional priority for each asset. This is done using the matrix in Table 5. The regional priority is recorded in Table 8 of the RFMP and will guide the programming of works to mitigate bushfire risk.

**Table 5: Matrix for determining the regional priority of assets in each class.** The asset class priority is shown in Table 2, and the asset resilience is set with guidance from the criteria in Table 3.

| Asset class priority | Resilience |        |     |
|----------------------|------------|--------|-----|
|                      | High       | Medium | Low |
| 1                    | 3          | 2      | 1   |
| 2                    | 4          | 3      | 2   |
| 3                    | 5          | 4      | 3   |

## 2.5. Risk treatment strategies

The department applies two broad strategies for managing fuels to reduce bushfire risk:

1. Establishment and maintenance of low fuel areas close to assets or in strategic locations in order to interrupt a fire run. Low fuel areas may be established by prescribed burning or physical fuel modification.
2. Landscape-scale fuel management using prescribed burning to create a mosaic of fuel availability within which there is reduced potential for the development of large bushfires and increased opportunities for successful fire suppression.

These strategies are applied individually or in combination to achieve the fuel conditions required by the indicators of acceptable bushfire risk.

## 2.6. Tolerable fuel age

The tolerable fuel age is the maximum age at which fuel in an FMA is deemed to be in a managed state. It is defined as the age at which the fuel will burn with an intensity that is double the upper limit at which machine and tanker attack on the head fire is possible under 95<sup>th</sup> percentile fire danger index (FDI) weather conditions<sup>4</sup> (see Section 2.7). This is determined by using fuel accumulation and fire behaviour models for the appropriate fuel type. Where this period is unknown, an alternative figure of 1.5 times the minimum period required post-fire before the vegetation will again sustain a bushfire is used.

**Table 6: Maximum intensity and rate of spread thresholds for head fire attack on a bushfire.**

|   |   |
|---|---|
| <b>Machine and tanker attack possible</b> | Intensity < 2000kW/m and/or ROS < 400m/hr in forest     |
|   | Intensity < 2000kW/m and/or ROS < 1000m/hr in shrubland |
|   | Intensity < 5000kW/m and/or ROS < 6500m/hr in grassland |

## 2.7. Weather conditions

When defining the range of each FMA and the tolerable age of fuels within it, the department's bushfire risk management criteria require the application of the conditions that produce the 95<sup>th</sup> percentile FDI in the area. Worse fire conditions than this would only be expected to occur approximately seven times per year.

The 95<sup>th</sup> percentile weather conditions have not been applied to the Kimberley Region RFMP. Weather conditions derived from the Bureau of Meteorology weather reanalysis project were not considered to accurately reflect extreme fire conditions in the region. This is likely due to there being only five years' data currently available from the weather reanalysis project. Weather variables

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<sup>4</sup> The intensity values for machine and tanker attack are doubled because the thresholds in Table 6 relate to head fire intensity, while the department's usual approach to a direct attack on a bushfire is to begin from the tail fire and work along the flank to the head. This means that most of the suppression effort is undertaken on parts of the fire exhibiting much lower fire intensity than the head fire. Flank fire intensity may be up to four times lower than head fire intensity, but a more conservative two-fold factor is used to set the risk indicators.

considered to represent extreme fire weather conditions have been contributed by experienced DBCA fire staff. This will be reviewed as more data becomes available.

### 3. The Kimberley Region

The Kimberley Region has two major centres (Broome and Kununurra), where conservation reserves are managed more intensively in built-up areas. Other settlements such as Fitzroy Crossing and Halls Creek also have departmentally managed lands in proximity. Although the Kimberley Region is sparsely populated, there are numerous Aboriginal communities, tourism operations, pastoral properties with infrastructure and mining operations which all require analysis and consideration regarding fire management.

The Kimberley Region encompasses an area of almost 425,000 square kilometers, extending northwards from the red dune fields of the Great Sandy Desert to the uplands, rugged escarpments, and coastal islands of the sub-humid Kimberley Plateau. The coastline faces the Indian Ocean to the west and the Timor Sea to the north. It is bordered by the Pilbara to the south and the Northern Territory to the east.

The Kimberley has been recognised as one of Australia's 15 biodiversity hotspots: it supports at least 230 plant, 31 reptile, 16 fish, 10 frog, six mammal and two bird species that are found nowhere else. It has a rich Aboriginal heritage, with Traditional Owners retaining strong links and responsibility for Country including some of the greatest diversity of ancient rock art in Australia. These values, and the vast, spectacular and intact landscapes make the Kimberley a major tourist destination.

Several private and public operations conduct business across the Kimberley Region. Tourism, mining, pearling, horticulture, oil, gas, agriculture, and fishing generate more than \$1.5 billion a year for the regional economy. Pastoral and other leases cover about half of the region, producing beef and horticultural products. The department's fire management program has the potential to impact some of these industries to varying extents. Fire that crosses tenure, escaped burns, or bushfires emanating from conservation lands, can impact on pastoral productivity.

There is a limited transport network in the region with the Great Northern and Victoria Highways the major logistical corridors. The Gibb River and Kalumburu Roads provide dry season transport between the regional centres and allow access to remote Aboriginal communities, pastoral properties, significant tourist attractions, camp sites and national parks. The region allows for livestock movement as well as being a significant attraction for tourism.

#### 3.1. Tenure and management arrangements

The department is responsible for the management of over 2.1 million hectares of terrestrial lands not including unallocated Crown land (UCL) with the major reserves being Fitzroy River, Prince Regent, Drysdale River, Purnululu and Mirima national parks, and the Wunaamin Miliwundi Ranges Conservation Park. There are reserves in remote areas of the Kimberley and smaller reserves surrounding the Broome and Kununurra townsites that the department is also responsible for managing. These reserves and national parks are important to respective Traditional Owners, with many managed in partnership. Joint management arrangements facilitate collaboration and common objectives between the department and Traditional Owners. Land management initiatives including prescribed fire include input from both the department and Traditional Owners through well-structured fire planning. Native title holders that are integral to the management of department lands in the Kimberley requiring ongoing input into this RFMP include:

- Gooniyandi
- Jaru
- Yurriyangem Taam
- Ngarla
- Nyangumarta
- Karajarri
- Dambimangari
- Wilinggin
- Wunambal Gaambera (portion of Prince Regent NP)
- Yawuru
- Miriuwung Gajerrong
- Balanggarra
- Bunuba.

### 3.2. Climate and vegetation

Rainfall is the predominate driver of fire patterns in the Kimberley Region, with greater than 90 per cent of the average annual falling between November and April during the monsoonal wet season. Annual rainfall ranges from 1400mm in the sub-humid north-west to 350mm in the semi-arid south. This rainfall drives rapid vegetation growth. The intervening period is characterised by little to no rain, when grasses and other vegetation cure and become more flammable as the dry season progresses. The end of the dry period is characterised by hot temperatures and frequent dry lightning activity that is conducive for bushfire conditions until the wet season onset.

The Kimberley landscape is dominated by open-canopied savanna woodland with a prominent grass layer. Savannas are one of the most fire-prone landscapes on Earth. Fires in Australia's high rainfall tropical savanna can recur annually and, if unmanaged, burn significant areas of the high (>1000mm) and low rainfall (1000–600mm) zones.

Kimberley savannas are punctuated by strips of riverine forest, small patches of rainforest, coastal ecosystems such as mangrove, and desert sand dunes. Rivers lined with paperbarks and pandanus rise in savannas of the Kimberley Plateau. Most flow north or west, incising sandstone gorges in their descent to the mangrove-fringed estuaries of the Arafura and Timor Seas. In draining the inland margins of the Plateau, others have formed extensive alluvial plains to its south and east. This varied terrain has evolved over 250 million years and supports its own distinctive flora and fauna. The Kimberley shows closer affinities to the rest of northern Australia than other parts of Western Australia.

### 3.3. Fire management considerations

#### Protection of life and property

The Kimberley Region's vegetation is highly fire prone with fuels generally becoming available to burn one year post fire with fuel accumulation aligned with rainfall patterns. Historically, areas of the Kimberley are subject to significant fire events two years post wet season. These factors result in the bushfire risk to life and property requiring continual management across the region. The region also experiences a high number of anthropogenic fires, both accidental and deliberate.

Containment of fires in remote areas of the Kimberley can be difficult as there relatively few access tracks and limited man-made barriers to fire spread. Suppression efforts rely on fire scars in the

landscape, primarily from early dry season burning and features in the landscape like creeks and geological features. Townsites rely on early season burning as well as firebreak maintenance to facilitate successful bushfire response.

The department manages significant conservation areas immediately adjacent to the townships of Kununurra and Broome (Mirima National Park and Broome 'in town' reserves respectively) and has significant built assets in reserves it manages where visitation is encouraged. This includes day use and camping sites at Windjana Gorge, Geike Gorge, Purnululu National Park, Wolfe Creek Meteorite Crater National Park, and Wunaamin Miliwundi Ranges Conservation Park. Commercial tour operator camps in Purnululu National Park and Wunaamin Miliwundi Ranges Conservation Park, as well as departmental assets (e.g., houses, compounds, power supply units) are at risk of fire impacts.

Tourist visitation is driven by the climatic conditions; the highest volume is during the dry season where travel and temperature are best suited for visitation to remote areas. During this time, commercial tour operators, intra and interstate travellers as well as international tourists visit the region. The majority of visitors stay close to major centres or along well-established tracks. There are groups that conduct remote bushwalks where no trails exist, this adds to the complexity of prescribed burning and bushfire response as not all visitors will register their location throughout this time.

The transport corridor network is limited within the Kimberley Region with vehicles restricted to a few major roads such as the Great Northern and Victoria Highways and Gibb River Road. The planned upgrade of Tanami and Duncan roads will see increased access for tourism and transport from Northern Territory and South Australia to the Kimberley via Halls Creek. Road users can be exposed to bushfire over long distances and the closures of any of these roads can leave people isolated in remote areas without any services or facilities.

### Commercial operations

Mitigation strategies provide a mechanism to minimise the impact of uncontrolled fires on commercial tourism operations. With a short window in which to generate income, park closures caused by bushfires can affect their financial viability. Prescribed burning operations early in the dry season (before the parks open depending on conditions) can assist in minimising disruption when bushfires become more prevalent later in the dry season.

Scenic flights are a popular means of seeing the Kimberley but can also be impacted by smoke from fires. This includes both prescribed burning and bushfires. Scenic flights operate principally in Purnululu National Park and Horizontal Falls Marine Park.

Pastoralism is a significant industry in the Kimberley that can be negatively impacted by fire through the loss of pasture and infrastructure. Most pastoral stations are also conducting early dry season prescribed burning to mitigate late dry season fire. The level of participation in mitigation activities across the region is variable and dependent on a variety of factors. As neighbouring stakeholders to many departmentally managed areas, the level of land management across tenure can have significant impact on both parties.

### Biodiversity

There are many fire sensitive elements embedded within the Kimberley's highly flammable landscape. For instance, the region contains remnant rainforest patches, which support many endemic species, including nearly a quarter of all plant species found in the Kimberley.

Inappropriate fire regimes pose one of the biggest risks to terrestrial biodiversity in the Kimberley. Indigenous people historically managed fire throughout the region, which included fine scale prescribed burning across a variety of vegetation types and around important cultural and food resource sites. This resulted in a mosaic of burnt and unburnt vegetation and provided buffers against bushfires around critical biodiversity refuges. These fire patterns were replaced over the past few decades with one that was increasingly dominated by extensive and intense mid to late dry season fires. However, since 2007, Parks and Wildlife and its predecessors refocused prescribed burning activities to those more akin to traditional fire patterns, with greater emphasis on early dry season burning.

Altered fire regimes, interacting with other degrading processes such as feral herbivores, has led to:

- a decline in critical weight range mammal species richness and abundance
- structural and floristic changes in vegetation, especially in fire sensitive communities (e.g. sandstone pavements, Callitris woodlands)
- declines in vegetation cover and critical resources such as tree hollows and fruiting and flowering plants
- an increase in the size of individual burns, and a consequent increase in the distance between unburnt patches (critical for the movement of small animals)
- increased soil erosion after heavy rains, leading to increased sedimentation in stream beds
- increased predation by feral cats
- a decrease in the amount of >3-year-old older-aged vegetation, critical for some species
- increased greenhouse gas emissions, contributing to global warming
- increased bushfire risk to communities, critical infrastructure and commercial enterprises
- enhancing the spread of cane toads through large, open expanses caused by late dry season fires.

Although the region has been through a period of altered inappropriate fire regimes, with all its incumbent issues as listed above, a greater emphasis on early dry season burning since 2007 has led to marked improvements in environmental condition in some areas according to many metrics and collected data. This resilience provides fire operatives with opportunities for continual improvement, and unless active fire management continues, the impacts of fire are likely to revert to pre-prescribed fire regimes of one to two years late and intense fire frequency. Data continues to be collected annually to document and review changes and trends in relation to flora and fauna in a fire prone landscape.

### Cultural sites

The State Government made significant amendments to the *Conservation and Land Management Act 1984* (the CALM Act) and related regulations in 2012 to allow conservation reserves to be jointly managed by the Parks and Wildlife Service and the local Traditional Owners. Allowing for customary activities to occur, and introducing a new goal to protect and conserve the lands' value to the culture and heritage of Aboriginal people, provided a framework to support Traditional Owners and land management practices. The Kimberley is identified as having a rich Aboriginal heritage including a vast array of cultural sites. It also supports Aboriginal mythological sites, rock engravings, stone arrangements, and Macassan trepang sites. These sites can be impacted by land management activities or lack thereof. In the context of fire management, many sites are under threat of degradation due to the intensity or duration of late dry season fire as opposed to less intense fire

coupled with site identification and other mitigation activities (raking, hand burning around sites etc.), in early dry season fire mitigation work.

Although connections to Country are strong, there remain many undocumented sites. Improving knowledge to allow these sites to be protected is a fundamental objective of the region's joint management arrangements. Parks and Wildlife Service actively works to include Traditional Owners in prescribed burning operations.

A variety of lodged, registered and unregistered Aboriginal heritage sites and cultural landscapes exist in the region which can be adversely impacted by bushfire and prescribed burning activities. To achieve appropriate fire management planning and operational outcomes the department will undertake thorough assessment of Aboriginal culture as part of its burn planning process and where possible develop and implement strategies to protect cultural values.

### Weather

Most of the Kimberley prescribed burn programs are during the late wet and early dry season. The highly variable monsoonal weather conditions are closely monitored to determine the most appropriate opportunity to undertake prescribed burning. As much of the burning occurs in savanna fuel types, curing rate is also a major factor to be considered in prescribed burning. Curing rates indicate the amount of fuel available to burn as well as the rate of self-extinguishment.

A prevailing weather condition of the Australian winter/dry season is high pressure systems progressing from west to east across the Australian southern coast. These high-pressure systems require close attention as they have significant influence on the Kimberley Region and result in strong east-south-easterly winds. Many of the prescribed burns undertaken in the region are significant in size so localized weather effects, topography, and the limitations of incident weather forecasts must be taken into consideration. Currently, there is limited weather data available across the region that is determined to be standardized by the Bureau of Meteorology (BOM).

With the onset of the wet season, generally around October, lightning associated with storms is a significant cause of bushfires through to December when there is an increase in precipitation associated with storm activity.

### Use of the WA Spinifex model

The 2018 Burrows WA Spinifex model is used in hummock grassland vegetation in the southern Kimberley arid zone (sub 600mm rainfall). In higher rainfall areas (600mm–1000mm+), close to the coast and high fire frequency areas differing spinifex species, grassland composition, soil types and increased fuel accumulation decrease the tolerable fuel age compared to arid zone spinifex models developed in other regions of WA. In these areas expert judgement is applied as outlined in Table 7.

### Carbon abatement

#### The Emissions Reduction Fund

The Emissions Reduction Fund is a voluntary scheme that aims to reduce Australia's greenhouse gas emissions by providing incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions.

Emissions Reduction Fund projects must be conducted according to an approved method. Several activities are eligible under the scheme and individuals and organisations taking part may be able to earn Australian carbon credit units (ACCUs). One ACCU is earned for each tonne of carbon dioxide

equivalent (tCO<sub>2</sub>-e) stored or avoided by a project. ACCUs may be sold to generate additional income, either to the government through a carbon abatement contract or on the secondary market.

### Savanna burning methodology

Savanna woodlands cover about 25 per cent of the Australian continent, across the northern parts of Western Australia, Queensland, and the Northern Territory. In these tropical regions, reliable summer rainfall drives periods of rapid plant growth, alternating with intense seasonal drought during which grasses dry rapidly. This annual cycle of rapid fuel production, followed quickly by dry windy conditions, makes the savannas extraordinarily prone to fire. More than 23 million hectares are burned annually.

A savanna burning abatement activity involves the application of a strategic early dry season burning regime to reduce the risk and extent of late dry season bushfires. Strategic early dry season burning involves planning for and implementing burning practices.

Under the savanna burning methods, abatement is determined by calculating the annual emissions in the reporting period and comparing this with average emissions during the baseline period (the 10 years in the 1000mm rainfall zone and 15 years in the 600-1000mm zone, prior to the year your project commences).

It is acknowledged that savanna burning projects do not provide a fire management panacea for a variety of key regional conservation, production, and cultural management issues. Rather, savanna burning projects can provide an effective operational funded framework to assist with delivering various landscape-scale management objectives due to the significant cost associated with prescribed burning and fire suppression activities on a landscape scale with limited on-ground resources.

### Kimberley carbon projects

There are currently 13 groups with registered carbon abatement projects, generating significant economic, environmental, cultural, and social benefits. To date, the Department of Biodiversity, Conservation and Attractions has registered four outlined Savanna Fire Management—Emissions Avoidance projects over the conservation estate. The projects provide a platform for potential revenue generation which is then reinvested to support maintaining and improving biodiversity. This remains the focus for the region. The four projects on DBCA tenure are:

- Prince Regent Nature Reserve (fully operational),
- Wunaamin Miliwundi Conservation Park (King Leopold Ranges (conditional)
- Drysdale River National Park (conditional)
- Purnululu National Parks (conditional).

The financial benefits available to organisations through carbon abatement has led to scepticism by some individual and interest groups of fire regimes applied by the various land managers in the Kimberley. There is also a risk that prescribed burning or bushfires originating or escaping from DBCA tenure can impact neighbouring carbon abatement profitability. Reducing LDS bushfires and total area burnt by fire also has the added benefit of reducing greenhouse gas (GHG) emissions and generating carbon credits which can be sold to fund enhanced fire management and biodiversity outcomes.

### 3.4. Key fuel management strategies

The primary objective of the department's fire management in the Kimberley Region is to protect human life (people and communities) and important community infrastructure. The department also aims to manage fire in a way that promotes ecosystem health and avoids compounding the effects of other threatening processes.

To achieve these objectives, the department:

- uses prescribed burning to maintain a landscape scale mosaic of fuel age and structure to inhibit the spread of bushfires, create opportunities for successful fire suppression, and maintain adequate habitat linkages to support biota
- uses prescribed burning to maintain a mosaic of fuel age and structure within reserves to reduce bushfire risk to and from surrounding lands and to support ecosystem resilience
- uses prescribed burning or other forms of fuel management to maintain areas of low-fuel adjacent to private property and important infrastructure
- applies prescribed fire to the landscape with consideration of ecosystems and the requirements of important species and ecological communities.
- complements prescribed burning with remote bushfire suppression (remote Insertion firefighting, aerial suppression) to limit the extent and intensity of late season bushfire.

## 4. Kimberley Region risk criteria

The Kimberley Region lies within the Tropical and Desert BRMZs. The indicators of acceptable bushfire risk are based upon the fuel and fire behaviour characteristics of tropical savanna, hummock grassland (600-1000mm+), hummock grassland (<600mm) and Pindan which have been broadly grouped across the region.

**Table 7: Summary of bushfire risk criteria for the Kimberley Region.**

| Fuel type                                   | Tropical savanna   | Hummock grassland (600mm–1000mm+)  | Hummock grassland (arid zone <600mm)   | Pindan   |
|---|--|--|--|--|
| Fuel accumulation and fire behaviour models | CSIRO Grassland Fire Spread Meter for Northern Australia<br>CSIRO Grassland Fire Spread Meter for Northern Australia (woodland)  | Expert judgement   | WA Spinifex model  | Expert judgement<br>CSIRO Grassland Fire Spread Meter for Northern Australia (woodland)  |
| Weather parameters applied                  | Location: Kalumburu/Kununurra<br>Temperature: 40°C<br>Relative humidity: 5%<br>Wind speed: 30km/h  | Fitzroy River National Park<br>Temperature: 40°C<br>Relative humidity: 5%<br>Wind speed: 30km/h  | Location: Walyarta/Purnululu<br>Temperature: 40°C<br>Relative humidity: 5%<br>Wind speed: 30km/h   | Location: 12 Mile<br>Temperature: 40°C<br>Relative humidity: 5%<br>Wind speed: 30km/h  |
| Tolerable fuel age                          | 1  | 2  | 4  | 3  |
| Settlement-hazard separation (SHS)          | 200m surrounding settlements   | 200m surrounding settlements   | 200m surrounding settlements   | 1000m surrounding settlements  |
| Landscape risk reduction (LRR)              | As defined in Table 8  | As defined in Table 8  | As defined in Table 8  | As defined in Table 8  |
| Remote area management (RAM)                | No targets apply. Managed as required to meet broad land management objectives of +3 year vegetation dispersed evenly throughout the landscape to create a mosaic of fuel class and age. | No targets apply. Managed as required to meet broad land management objectives of +3 year vegetation dispersed evenly throughout the landscape to create a mosaic of fuel class and age. | No targets apply. Managed as required to meet broad land management objectives of +3 year vegetation dispersed evenly throughout the landscape to create a mosaic of fuel class and age. | No targets apply. Managed as required to meet broad land management objectives of +3 year vegetation dispersed evenly throughout the landscape to create a mosaic of fuel class and age. |

## 5. Asset categorisation and prioritisation

The following table applies the department's bushfire risk criteria to identify and prioritise assets in the Kimberley Region, establishing where each FMA applies. Table 9 then provides the indicators of acceptable bushfire risk for these areas.

**Table 8: Asset categorisation and prioritisation for the Kimberley Region.**

| Fire area                  | management | Asset class  | Asset description and occurrences   | Resilience | Rationale  |
|----------------------------|------------|--|---|------------|--|
| <b>Regional priority 1</b> |            |  |   |            |  |
| <b>SHS</b>                 |            | Settlements  | Parry Creek Farm, Kununurra Townsite, Broome Townsite, 12 Mile UCL, Broome Bird Observatory, Purnululu NP Airstrip, Purnululu NP Commercial Accommodation, Emma Gorge, Molly Springs, Mud Springs, Emu Creek, Wamali/Yioramalay, Galamanda, Lake Argyle Tourist Village, Yirralallem (Packsaddle Springs), Bilgungurr and Goolarabooloo   | Low        | Commercial operations, large townsites and small communities with low resilience within 1km buffer of DBCA fire management areas with permanent population or very high fire season visitation.  |
| <b>Regional priority 2</b> |            |  |   |            |  |
| <b>SHS</b>                 |            | Settlements  | Purnululu NP public camp sites, Purnululu NP walk trails, Kwarre, Kayirriwarney, Lumuku, Arboretum, Dulundi, Lennard Gorge, Old Halls Creek Road, Telegraph Hill, Marngu Billabong, Black Rock Falls, Middle Springs, Valentine Springs, Mitchell River Ranger Station, Mitchell River Campground, Windjana Ranger Station and Camp sites, Mt. Hart Homestead, Tunnel Creek car park and rec site, Geike Gorge Ranger Station, Geike Gorge Camp site, Bell Springs, Biridu/Leopold Downs Station Homestead, DarIngunaya/Old Fitzroy, Fly Well, Galamanda, Geboowama/Rocky Spring, Goodarl, Goose Hill, Jimbilum, Kartang Rija, Mallingbar/Kennedy Hill, Mirima Community, Muludja, Munthanmar, Nicholson Block, Nillir Irbanjin/1 Mile, Nullywah, RB River Junction, Hollow Springs, Wungu/Old Flora Valley Station | Medium     | Critical infrastructure for park operations and high visitation during dry season.<br>Small communities with dry season visitation.<br>Recreation sites with high dry season visitation.   |
| <b>LRR</b>                 |            | Dispersed population<br>Protected species & communities<br>Economic assets<br>Other assets | Cockburn Range UCL, Carr Boyd Range UCL, Packsaddle Springs UMR, Monsoon Rainforest and Vine Thicket Patches, TEC's, Geike Gorge NP, Purnululu NP, Prince Regent NP, Drysdale River NP, Wunaamin, Miliwundie CP, Fitzroy River National Park and Mirima NP  | Medium     | Includes areas of protected and threatened species. UCL with high fire season visitation through recreation. National Parks with significant natural and cultural values.  |
| <b>Regional priority 3</b> |            |  |   |            |  |
| <b>LRR</b>                 |            | Dispersed population<br>Protected species & communities<br>Economic assets<br>Other assets | Wolfe Creek NP Campground and Rec Sites, Ord River Regeneration Reserve, Ngamoowalem CP, Halls Creek UCL, Goomig CP, Darram CP, Windjana NP, Tunnel Creek NP, Brooking Springs CP, Devonian Reef CP, Coulomb Point CP, Dampier Peninsula UCL, Walyarta CP, Birra-mun-gan UCL, Small-medium sized mammals, Bird communities, Tropical heath, Short range endemics  | Medium     | Includes areas with high anthropogenic fire activity. Includes areas in proximity to sandalwood farms and other agricultural operations. Key ecological communities with habitat requirements. Areas of visitation and culturally significant areas. |
| <b>Regional priority 4</b> |            |  |   |            |  |
| <b>LRR</b>                 |            | Dispersed population<br>Protected species & communities<br>Economic assets<br>Other assets | Mijing CP, Darrmalanka CP, Barrbem CP, Wolfe Creek NP, Carson River HS, Malangan, Kwarre, Kayirriwarney, Cattle Creek   | High       | Includes areas with adjacent pastoral properties and recreational visitation.<br>Includes areas with proximity to Kununurra Townsite.  |

| Fire area                  | management | Asset class  | Asset description and occurrences  | Resilience | Rationale   |
|----------------------------|------------|--------------|--|------------|---|
| <b>Regional priority 5</b> |            |              |  |            |   |
| RAM                        |            | Other assets | Cape Londonderry UCL, North Drysdale UCL, Margaret River UCL, Wood River UCL, Landsdowne UCL |            | Remote UCL with targets based on land management outcomes and to prevent fire spread into DBCA National Parks or other tenure. Remote UCL with Indigenous Ranger led fire management on behalf of DBCA. |

## 6. Indicators of acceptable bushfire risk

Bushfire risk is maintained at an acceptable level in the Kimberley Region if fuels are managed to the condition described in the below table. The current landscape condition will be compared to these indicators at least annually and the outcomes of that comparison used to inform the development of the annual fuel management program.

**Table 9: Summary of indicators of acceptable bushfire risk in the Kimberley Region.**

| Fire management area               | Fuel type   | Location   | Target   |
|------------------------------------|---|--|--|
| Settlement-hazard separation (SHS) | Pindan  | 1000m surrounding settlements                      | 60% of fuel less than threshold intensity                                |
|                                    | Tropical savanna Hummock grassland  | 200m surrounding settlements                       |  |
|                                    | <i>Acacia</i> woodland, semi-arid woodland, chenopod shrubland  | N/A  | No targets apply   |
| Landscape risk reduction (LRR)     | Tropical savanna, hummock grassland, Pindan   | As defined in Table 8                              | 30% of fuel less than threshold intensity                                |
|                                    | <i>Acacia</i> woodland, semi-arid woodland, chenopod shrubland  | N/A  | No targets apply. Managed as required to meet land management objectives |
| Remote area management (RAM)       | Tropical savanna, hummock grassland, Pindan, <i>Acacia</i> woodland, semi-arid woodland, chenopod shrubland | All other Parks and Wildlife Service managed lands | No targets apply. Managed as required to meet land management objectives |

## 7. Spatial data

The descriptions of asset locations and FMA extents in Tables 8 and 9 are depicted spatially in a geodatabase that supports this RFMP. These data form the basis for comparison of the current landscape condition against the department's indicators of acceptable bushfire risk. This comparison will be conducted annually, at a minimum, and used to inform the fuel management program planning process. The master copy of the geodatabase is maintained in-house by the department's Regional Leader, Fire Management, with a copy provided to Fire Management Services Branch (FMSB) information officers to facilitate corporate reporting.

## 8. Monitoring and review

This plan will be regularly monitored and reviewed to ensure content remains accurate and up to date. The plan will be endorsed annually by the content custodian prior to being used in the burn program planning process.

FMSB will advise the Kimberley Regional Manager of any changes to the department's Bushfire Risk Management Framework that will need to be reflected in the RFMP.

The Regional Manager, or their delegate, will review the regional context statement, regional risk criteria and asset categorisation and prioritisation annually (at a minimum). The most important aspect of this review is confirmation that Table 8 continues to represent a comprehensive and accurate catalogue of the assets in the region requiring protection from bushfire. Any changes to Table 8 will also be reflected in the accompanying spatial data, including the mapping of FMA extents.

The spatial data that supports the RFMP will be reviewed at least annually to capture any changes in the distribution of assets, fuel, or department-managed tenure. Updated datasets will be provided to FMSB whenever any changes are made.

## 9. Knowledge gaps

The department's risk criteria and indicators of acceptable risk were developed using the best available science, practitioner judgement and supporting data. These inputs will be monitored by the department to ensure that the RFMP continues to reflect industry best-practice. It is expected that ongoing adjustment to the settings will be required as the State's social, political and natural environments change; better data become available, or knowledge of bushfire risk management is refined or improved. The Framework will also be updated to incorporate the findings of any relevant research or adaptive management, and as new models are developed and refined.



Department of **Biodiversity,  
Conservation and Attractions**