GOVERNMENT OF WESTERN AUSTRALIA

Draft

Forest Management Plan 2024–2033

October 2022




GOVERNMENT OF WESTERN AUSTRALIA

Conservation and Parks Commission

Department of **Biodiversity, Conservation and Attractions**

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WARNING: This plan may show photographs of and refer to quotations from people who have passed away.

This plan was prepared by the Conservation and Parks Commission and Department of Biodiversity, Conservation and Attractions.

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This document is available in alternative formats on request.

Main image: 100-year forest, Donnelly State Forest Pemberton - Michael Pez, DBCA
Small images: Noongar Seasons © Linda Loo/Copyright Agency, 2022.

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Forest Management Plan 2024–2033

October 2022

Old Growth Boranup Karri Forest - Tourism Western Australia

Foreword

The *Draft Forest Management Plan 2024-2033* reflects an exciting new policy context for the management of our south-west forests.

In February 2021, the South West Native Title Settlement, the largest and most comprehensive native title agreement in Australian history, became operational. Partnering with traditional owners will be an important aspect of implementing the forest management plan.

On 8 September 2021, the State Government announced that it was ending commercial timber harvesting from 2024. These landmark changes demonstrate the growing sense of stewardship for our native forests, and the deeper respect we have for our rich and biodiverse natural environment.

Against this new setting, the *Draft Forest Management Plan 2024-2033* outlines our approach to protecting and managing forests in Western Australia's south-west national parks, conservation parks, nature reserves, State forests and timber reserves through four strategic goals:

1. To value and protect Noongar culture and heritage and support Noongar traditional owner involvement.
2. To conserve biodiversity and support ecosystem resilience.
3. To maintain or improve forest health and enhance climate resilience.
4. To deliver social and economic benefits through the provision of goods and services.

During the development of this draft plan, our engagement with stakeholders and the community saw many people place high value on biodiversity and natural ecosystems, habitats for flora and fauna, and recreation, as important features of our south-west forests. We also saw growing community support to more actively respond to the impacts of climate change, and a concern for the future of our iconic native species.

A fundamental element of the *Draft Forest Management Plan 2024-2033* is responding to the ongoing consequences of climate change on our south-west native forests. Declines in rainfall and more frequent heatwaves are forecast to continue in future decades. The anticipated changing climate in the planning area over the next 10 years, and the need to mitigate this, has been a key consideration during the development of this draft plan.

The end of large-scale commercial timber harvesting from 2024 presents an opportunity to preserve and protect the unique biodiversity in the south-west native forests, while allowing us to enjoy the beauty of these exceptional natural areas now for many generations to come. In recognition of this, during the term of this plan, the review of proposals to create new national parks, conservation parks and nature reserves will be prioritised.

Our new approach to forest management prioritises forest health and biodiversity within the 10-year span of this plan to meet both the socio-economic and cultural aspirations of current generations, while balancing the sustainability of our beloved forests for future generations.

Professor Chris Doepel PSM
Chair

Invitation to Comment

The *Draft Forest Management Plan 2024-2033* has been released for a minimum two-month period to provide the public with an opportunity to comment on the future management of south-west forests.

To ensure your submission is as effective as possible:

- be clear and concise
- refer your points to the page numbers or specific sections of the plan
- say whether you agree or disagree with any or all of the management arrangements – clearly state your reasons, particularly if you disagree
- where possible provide sources of information to support your comment
- suggest alternatives for those aspects of the plan with which you disagree.

The draft management plan will be reviewed in light of submissions, according to the criteria outlined below. A summary of public submissions will be made available when the final management plan is released, however responses to individual submissions will not be provided.

The management plan **may be** modified if a submission:

- provides additional information of direct relevance to management
- indicates a change in (or clarifies) government legislation or management policy
- proposes strategies that would better achieve management objectives
- indicates omissions, inaccuracies or a lack of clarity.

The management plan **may not be** modified if a submission:

- clearly supports proposals in the plan
- makes general or neutral statements
- refers to issues beyond the scope of the plan
- refers to issues that are already noted within the plan or already considered during its preparation
- is one among several widely divergent viewpoints received on the topic but the approach in the plan is still considered the best option
- contributes options that are not feasible (generally due to conflict with legislation or government policy)
- is based on unclear or factually incorrect information.

For more information on making a submission, and to view supporting resources such as fact sheets and frequently asked questions, visit: dbca.wa.gov.au/forest-management-plan.

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"Protecting and managing our south-west forests for the benefit and enjoyment of current and future generations."

Tuart tree, Maidens Reserve, Kalgulup Regional Park - Jodie Deely, DBCA

Acknowledgement of country

The Government of Western Australia acknowledges the traditional owners throughout Western Australia and their continuing connection to the land, waters and community. We pay our respects to all members of Aboriginal communities and their cultures; and to Elders past, present and emerging.

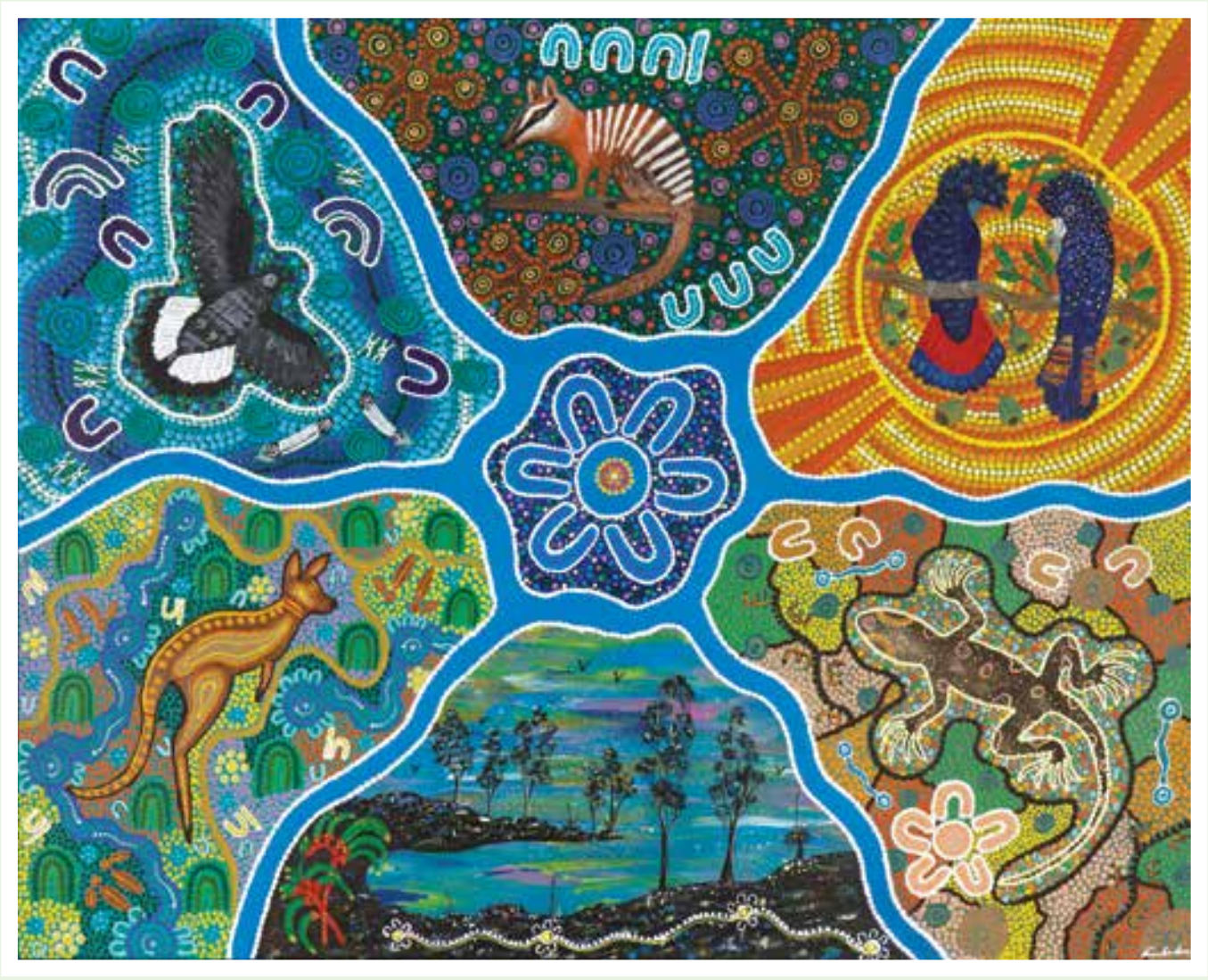
In particular, the Conservation and Parks Commission and Department of Biodiversity, Conservation and Attractions acknowledges the Noongar people as the traditional owners within the Forest Management Plan area in the south-west of Western Australia and respects the continuing connection and importance of forests to their cultural, physical and spiritual health.

Forests – Djarlma

When the great Waugal created the boodja (land/country), he ensured that there were wirrin or spirits to look after the land and all that it encompassed. Some places such as the kaart (hills) and ngamar (waterholes) boya (rocks), bilya (rivers) and boorn (trees) were created as sacred sites and hold wirrin, both warra (bad) and kwop (good). Noongar believe that the spirits of their ancestors live in the forests. The ancestral spirits of their demanggar (grandparents) are there to give them their healing and their food. Everything in Noongar boodja has a purpose; if the forests are not preserved and maintained then they will have no ancestral spirits to guide them and give them sustenance and healing, the forest spirits will go to sleep forever and Noongar will become sick in both mind and body.

(Courtesy of the South West Aboriginal Land and Sea Council)

The Department of Biodiversity, Conservation and Attractions commissioned Noongar artist Linda Loo (Linlelu Arts) to create an original artwork for the *Forest Management Plan 2024-2033*. Linda's painting represents the Noongar Seasons in the south-west, and elements of her artwork have been incorporated into the design of this document.



Noongar Seasons © Linda Loo/Copyright Agency 2022

1 New directions for forest use and management

Boranup karri forest, Leeuwin-Naturaliste National Park - Tourism Western Australia

Native forests on public lands, vested in the Conservation and Parks Commission (the Commission), in the south-west of Western Australia are managed in accordance with a *Conservation and Land Management Act 1984* (CALM Act) management plan known as a Forest Management Plan (FMP). The FMP facilitates management of the multiple values and uses of south-west forests, including biodiversity conservation, customary practices, recreation and tourism, and other forest-based industries.

Since January 2014, when *Forest Management Plan 2014-2023* (FMP 2014-2023) commenced, there have been significant changes in government policy settings affecting management of the south-west forests. These are reflected in this draft FMP for the years 2024-2033 prepared by the Department of Biodiversity, Conservation and Attractions (DBCA, or the department) on behalf of the Commission.

On 25 February 2021 the South West Native Title Settlement became operational. This is the largest and most comprehensive native title agreement in Australian history and will provide long-term benefits and opportunities for developing Noongar[1] interests. The area covered by the FMP is part of the South West Native Title Settlement Area.

On 8 September 2021, the State Government announced a number of new policy settings relating to the future use and management of the south-west forests, many of which will be reflected and implemented through this FMP.

Recent research shows that climate change has had a considerable impact on Australia's natural environment, including the native forests of the south-west. Average temperatures and heat extremes have increased, and the south-west has experienced a 20 percent decrease in May-July rainfall since 1970. Such climatic changes are placing some forest ecosystems under stress, driving tree mortality and localised collapse of forest structure. These trends are forecast to continue in future decades.

1 Noongar can be spelt in a number of ways: Nyungar, Nyoongar, Nyoongah or Noongah. Noongar is not a written language – it is an oral language, hence the writing of Noongar language is somewhat difficult because of the different ways the words have been spelt over time. One spelling of a Noongar word is not necessarily more correct than another, and in this plan, Noongar is used.

The most significant change for forest management from 2024 will be the cessation of large-scale commercial timber harvesting in native forests. In future the only timber to be removed from native forests will be sourced from management activities that improve forest health (such as ecological thinning) or clearing for approved mining operations and infrastructure.

Ecological thinning is an active forest management tool that involves the selective removal of individual trees to improve or maintain ecological values and reduce the current and future moisture stress of a given area. Ecological thinning aims to reduce competition between trees and facilitate persistence of the remaining vegetation, thereby maintaining greater structural diversity of habitat types. This also enhances forest resilience to high intensity bushfires, helps maintain carbon stores, and supports the development of tree hollows for a variety of species.

At least 400,000 additional hectares of native forests will be preserved as a result of the decision to cease large-scale commercial harvesting. Over the term of Forest Management Plan 2024-2033 (FMP 2024-2033), new conservation reserves will be created following consultation with traditional owners to ensure permanent protection of high conservation value areas. Existing proposals to create national parks, conservation parks and nature reserves that have yet to be completed from previous FMPs will also be prioritised during the term of this plan.

1.1 Noongar involvement in forest management

The Noongar people are formally recognised, through the *Noongar (Koorah, Nitja, Boordahwan) (Past, Present, Future) Recognition Act 2016*, as the traditional owners of the south-west region of Western Australia. This historic Act fulfilled a central condition to the commencement of the South West Native Title Settlement (the Settlement).

Comprising six Indigenous land use agreements (ILUAs), the Settlement was negotiated between the Noongar people and the State Government. The full details of the Settlement are recorded in the six identical ILUAs with the Ballardong, Gnaala Karla Booja, Karri Karak (formerly South West Boojarah), Wagyl Kaip and Southern Noongar, Whadjuk, and Yued groups, made in compliance with the *Native Title Act 1993* (Cth).

The Settlement will enable the State Government to work in partnership with the Noongar people to improve economic, social and cultural outcomes for the Noongar community. Six Noongar Regional Corporations will represent the rights and interests of each of the six Agreement groups.

The Noongar peoples' strong relationship to their boodjar[2] (land/country) is reflected in many components of the Settlement package, including the creation of the Noongar Land Estate; recognition of the Noongar people as the traditional owners of the south-west region and a standard heritage process.

Tuart tree, Maidens Reserve, Kalgalup Regional Park BCA

2 All spelling and use of Noongar words in this plan have been endorsed by the Noongar Boodjar Language Centre.

The South West Conservation Estate (the Estate) covers approximately 3.8 million hectares, a larger extent than the planning area[3]. The Estate refers to all CALM Act lands and waters within the Settlement Area, including State forests, national parks, nature reserves and other areas set aside for conservation. The department and each of the Noongar Regional Corporations will enter into a Cooperative Management Agreement to cooperatively manage the Estate in each of the Noongar agreement areas. These agreements will acknowledge the continuing cultural, spiritual and social connections of the Noongar people to the region, and their unique traditional knowledge and expertise in the future management of the Estate.

The establishment of these management partnerships, which cover the extent of the planning area, marks a new era of collaboration and provides opportunities to continue to develop the department's forest and fire management practices in the south-west region. The partnerships present exciting land management opportunities and will ensure the south-west forests are cared for using Noongar and Western methods.

1.2 Responding to climate change

In November 2020, the State Government released the *Western Australian Climate Policy – 'A Plan to position Western Australia for a prosperous and low-carbon future'*[4] (Department of Water and Environmental Regulation 2020). The Western Australian Climate Policy details the Government's commitment to adapting to climate change and working with all sectors of the economy to achieve net zero emissions by 2050. Within the policy, the 'storing carbon and caring for our landscapes' theme has several actions that relate to forest management, including expanding the conservation estate and areas of the softwood plantation estate. Carbon farming is an emerging area which is likely to develop over the life of this plan.

Forests provide an important source of carbon sequestration, which reduced Western Australia's 2020 net carbon emissions by more than 10 million tonnes (10.7 percent) over that year (CO_2 equivalent) (Department of Industry, Science, Energy and Resources 2020). Managing forests to maximise carbon storage and improve climate resilience are key components of this plan.

1.3 Enhancing the conservation reserve system

Western Australia has a network of marine and terrestrial reserves (the conservation reserve system), including national parks, conservation parks, nature reserves, State forests and other lands and waters managed under the CALM Act that conserve biodiversity.

The conservation reserve system plays a pivotal role in conserving the State's rich biodiversity, which displays a high level of endemism (plants and animals occurring nowhere else). The conservation reserve system also contributes to:

- protecting and conserving the value of the land to the culture and heritage of Aboriginal people and supporting Aboriginal connection to country through customary activities and joint management
- community wellbeing through provision of ecosystem services
- nature appreciation and recreation opportunities, and
- State and regional economies through nature-based tourism and sustainable resource use and extraction.

The State Government is committed to the development of a Comprehensive, Adequate and Representative (CAR) reserve system, as a fundamental component of biodiversity conservation. Continuing to build on the CAR reserve system will be a key deliverable of this plan.

3 For comparison, the area of CALM Act lands in the planning area is approximately 2.4 million hectares.

4 wa.gov.au/system/files/2020-12/Western_Australian_Climate_Policy.pdf

1.4 A new era for forest management

These changes over the last decade have culminated in the opportunity to pursue a new approach to management of the south-west forests. Such an approach prioritises forest health and biodiversity within the 10-year life of this plan to meet both the socio-economic and cultural aspirations of current generations, whilst balancing sustainability of the forests for future generations.

This new approach to forest management in Western Australia for the period 2024-2033 is incorporated within the following strategic goals of this plan:

1. To value and protect Noongar cultural heritage and support Noongar Traditional Owner involvement.
2. To conserve biodiversity and support ecosystem resilience.
3. To maintain or improve forest health and enhance climate resilience.
4. To deliver social and economic benefits through the provision of goods and services.

Camera checking, Tone State Forest, Manjimup - DBCA

2 Background

Warren National Park - DBCA

2.1 Structure

This plan adopts an alternative structure from previous FMPs to provide clearer linkages between the values and pressures of the south-west forests and the associated management objectives and activities.

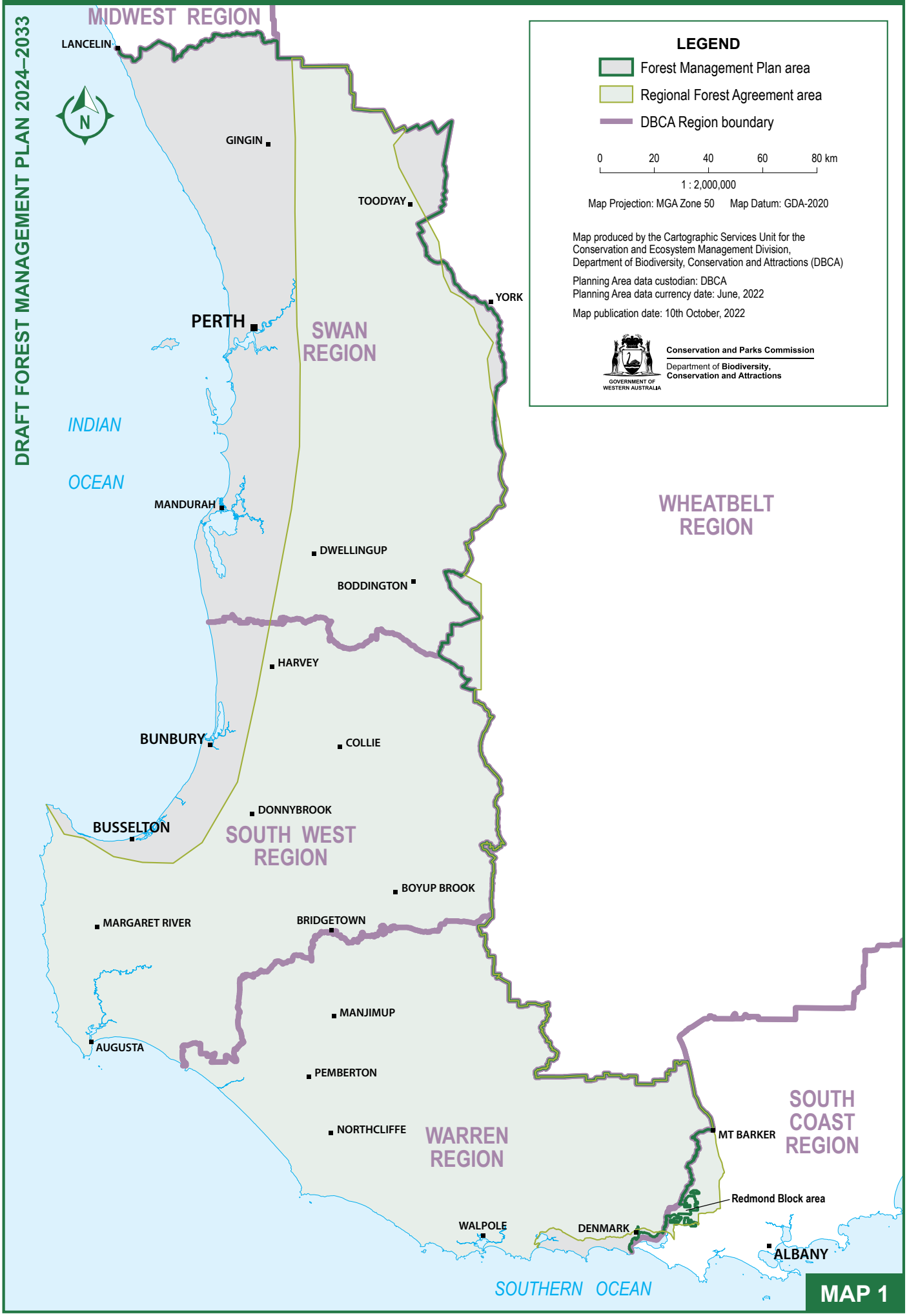
The plan is presented in five parts:

- *Directions and Background* – provides an overview of the scope and development of the plan, outlines the frameworks and principles of ecologically sustainable forest management (ESFM) and sets the strategic goals.
- *Part A Valuing our south-west forests* – describes the key natural, cultural, social and economic values and uses of the forests.
- *Part B Pressures on our south-west forests* – describes the major pressures or threats to these key values.
- *Part C Managing our south-west forests* – defines the purpose, term and operation of the plan, and provides the objectives, activities and key performance indicators (KPIs) for the four management 'foundations' of this plan.
- *Part D Plan implementation, assessment and adaptive management* – provides an overview of how the plan will be implemented, including an outline of the adaptive management framework and the proposed approaches to monitoring, research, and reporting.

The Background, Part A and Part B are provided as context only and do not constitute a formal part of this plan. The operative text of the plan, as required by section 55 of the CALM Act is contained in Parts C and D and relevant associated appendices.

Opposite *Map 1 Forest management plan area*

FOREST MANAGEMENT PLAN AREA



MAP 1

2.2 Scope

This plan applies within the geographic area of the department's Swan, South West and Warren regions (other than marine waters), and the lands collectively referred to as 'Redmond' forest block within the South Coast region (Map 1).

This planning area covers the management of approximately 2.5 million hectares of the following lands vested in the Commission (Map 2):

- Nature reserves, national parks, conservation parks and other land referred to in section 5(1)(g) and (h) of the CALM Act that has a conservation purpose.
- Indigenous State forest and timber reserves, including State forest classified as a forest conservation area through section 62(1) of the CALM Act.
- State forest and timber reserves planted with exotic species. The application of the plan to these areas is limited to specific proposed management activities labelled for plantations in section 5.6.3.

An explanation of the categories of lands vested in the Commission is provided in Appendix 1a and the area of lands is provided in Appendix 1b.

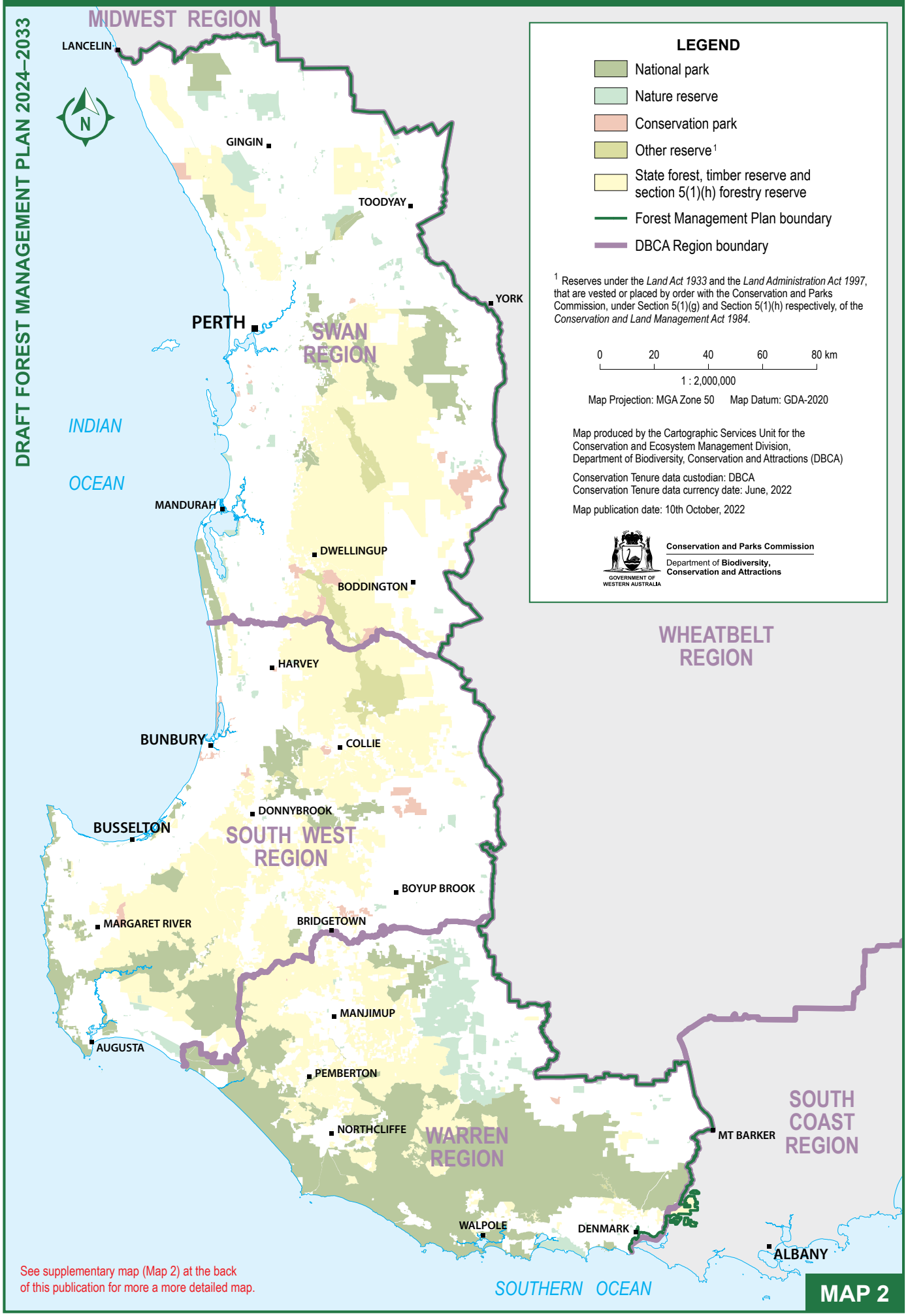
This plan is largely focussed on the management of forest ecosystems (categorised as State forest and timber reserves) where a broad range of uses and disturbance activities occur. It also, however, provides for infrastructure and management activities across CALM Act lands in the planning area. On the lands subject to this plan, there are about 2.4 million hectares of native vegetation, of which approximately 75 percent is forest (see Appendix 1c).

The management objectives, activities and monitoring are focussed on the forest ecosystems of the planning area, acknowledging that the values, habitats and pressures on the Swan Coastal Plain differ from those of the south-west forests.

This plan will also function as a management plan for conservation reserves where no specific area management plan exists, including those on the Swan Coastal Plain. Management frameworks of existing area management plans (see Map 3) or those developed during the period of this plan which apply to specific parks and reserves and have precedence over this plan.

Opposite *Map 2 Existing land categories*

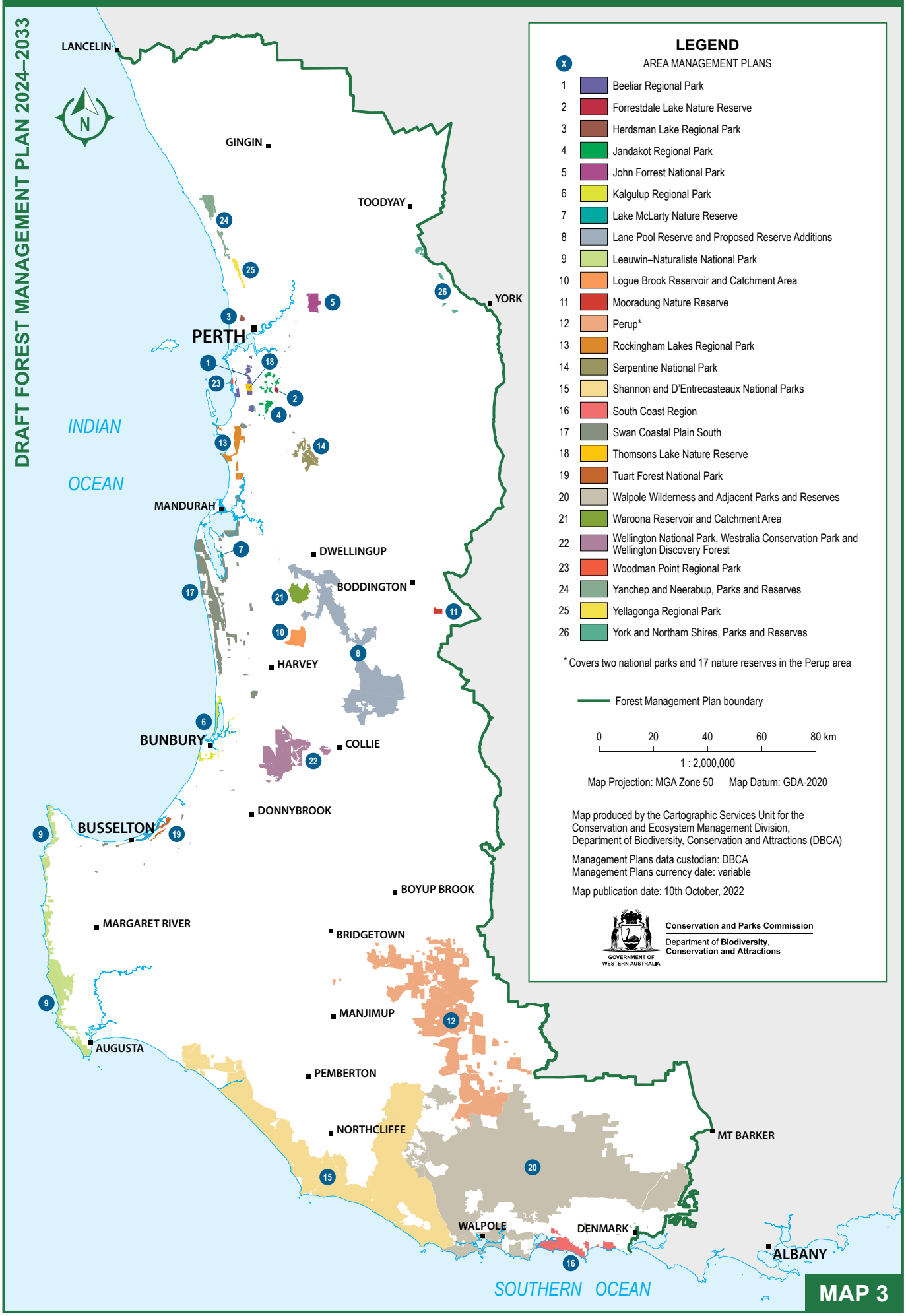
EXISTING LAND CATEGORIES



See supplementary map (Map 2) at the back of this publication for more a more detailed map.

MAP 2

EXISTING AREA MANAGEMENT PLANS WITHIN THE FOREST MANAGEMENT PLAN AREA



Opposite *Map 3 Existing area management plans within the Forest Management Plan area*

2.3 Development of the plan

The Commission has developed this plan through the agency of DBCA, in consultation with the Forest Products Commission (FPC) with regard to State forest and timber reserves, and with the Department of Water and Environmental Regulation (DWER) in respect of public drinking water source areas (PDWSAs). The plan has been prepared following wide-ranging consultation with other agencies, key stakeholders and the public. The plan is also informed by scientific research and investigation carried out by staff from the department, input from technical experts, other published science and management experience and results from monitoring and evaluation processes.

In mid-2021, the Western Australian Government sought the views of the community on the value and use of the south-west forests through an online survey developed and administered by the Western Australian Biodiversity Science Institute (Subroy *et al.* 2021). As a component of pre-draft consultation for this plan, the department conducted a public survey in early 2022. This was accompanied by a series of key stakeholder focus groups across representative sectors. Additional stakeholder meetings were held with more than 20 individual organisations, including peak bodies, industry organisations, community-based groups and government departments and authorities.

Further information and reports from these consultation and engagement processes are available on the FMP website[5].

An independent silvicultural review panel assisted in adapting silvicultural guidance and practices to inform the plan (Burrows *et al.* 2022). In addition, the Commission's end-of-term performance review provided directions based on the monitoring and evaluation of FMP 2014-2023 (Conservation and Parks Commission 2022).

This draft plan has also been prepared to support the Commission's referral of the plan to the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986* (EP Act) for determining a level of assessment. The outcome of the EP Act process will be reflected during finalisation of this plan.

2.4 Approaches to forest management

The forest ecosystems of the south-west have evolved over millions of years, adapting to cycles of climate, fire and human influences. Over the last 200 years the magnitude and rate of change has increased dramatically in some areas due to disturbance from mining, timber harvesting and water abstraction, the introduction and spread of exotic diseases, weeds and pest animals, and more recently the frequency and intensity of extreme summer bushfire events. Most recently, altered weather patterns, attributed to climate change, are creating additional pressures as ecosystems respond to warming and drying conditions that are likely to have both short-term effects (such as localised structural loss) and long-term effects (such as shifts in floristic composition to favour plants more adapted to these conditions).

Section 19(2) of the CALM Act provides for the Commission to consider and advise the Minister for Environment on application of the five principles of ESFM in the management of State forests and timber reserves and forest produce throughout the State. These principles concern sustainability and equity, the precautionary approach, intergenerational equity, conservation of biodiversity and ecological integrity, and economic efficiency when guiding decisions to achieve a balance between the different values and uses of forests.

A suitable framework for planning, implementing, monitoring and reporting on the application of sustainability principles across all tenures is essential for evaluating progress toward sustainable forest management. In 1998 Australia adopted the framework of criteria and indicators of sustainable forest management known as the Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process; see Appendix 2). Under the Commonwealth *Regional Forest Agreements Act 2002*, Australia reports five-yearly on the Montreal Indicators. Western Australia has contributed to these reports since 1998, the latest being the 2018 State of the Forests Report (Montreal Process Implementation Group for Australia 2018).

The *Regional Forest Agreement for the South-West Forest Region of Western Australia* (WA RFA) is a 20-year agreement between the Western Australian and Commonwealth Governments on the management and use of the south-west

5 dbca.wa.gov.au/forest-management-plan

forests. It was first signed in March 1999 and extended for a further 20 years in March 2019. The WA RFA provides a strategic framework for forest management, including consideration of ESFM principles, in combination with the establishment of a CAR reserve system, to ensure the long-term conservation and protection of forest biodiversity, old-growth forest and wilderness values; the management of multiple-use forests outside reserves; and supporting the sustainable development of forest-based industries. The WA RFA region is a subset of the planning area as illustrated on Map 1.

The Montreal Process adopts seven criteria (with 54 indicators) for sustainable forest management: conservation of biological diversity; maintenance of productive capacity of forest ecosystems; maintenance of ecosystem health and vitality; conservation and maintenance of soil and water resources; maintenance of forest contribution to global carbon cycles; maintenance and enhancement of long-term socio-economic benefits to meet the needs of societies; and legal, institutional and economic frameworks for forest conservation and sustainable management.

A healthy forest is one in which the natural processes that have sustained all components of the ecosystem continue (Burrows *et al.* 2022). The forest structures, composition and functions we see today are the outcome of cumulative processes interacting at the patch, stand and landscape scales. Multiple pressures and threatening processes will persist throughout the south-west forests, but appropriate active management can mitigate their impact on forest health, biodiversity values and in some cases restore degraded landscapes. This plan incorporates a range of management activities to be variously undertaken at the patch, stand and landscape scales to manage threats, reduce pressures, and protect intact ecosystems over the next 10 years.

Actions to conserve, protect and restore forest ecosystems, together with targeted management to adapt to the impacts of climate change, will reduce the vulnerability and improve the resilience of forests (Intergovernmental Panel on Climate Change 2022). However, forest ecosystems are complex, dynamic, and their long-term responses to many management activities is uncertain. This is particularly an issue for actions taken to address climate change because our knowledge of ecosystem responses is based on measurements and observations obtained under historic climatic conditions.

Tingle forest, Wilsons Inlet Denmark - Shem Bisluk DBCA

When actions are new, exploratory, or their outcomes uncertain, application of an adaptive forest management framework provides a systematic approach to monitoring and learning from the outcomes of management. Adaptive forest management involves appropriate design, monitoring, evaluation and reporting on the outcomes of practices, accompanied by commitment to continuous improvement of practices based on learnings, experience and observations.

This plan will be implemented using an adaptive forest management approach, as detailed in Part D.

2.5 Strategic goals

A set of strategic goals has been developed for the planning area that align with legislation, government policy, ESFM principles and the Montreal Process Criteria. The strategic goals are:

1. To value and protect Noongar cultural heritage and support Noongar Traditional Owner involvement.
2. To conserve biodiversity and support ecosystem resilience.
3. To maintain or improve forest health and enhance climate resilience.
4. To deliver social and economic benefits through the provision of goods and services.

These strategic goals are supported by a number of subsidiary management objectives for which the plan sets out a range of management activities to be undertaken during the 10-year life of the plan (see Part C – Managing our south-west forests).

3 Part A – Valuing our south-west forests

Karri forest, Warren National Park, Pemberton - DBCA

The Western Australian community places a very high value on the native biodiversity and ecosystems of our south-west forests, as well as the cultural, recreational and socio-economic benefits that the forests provide (DBCA 2022). The values of the south-west forests are those attributes or features that require special consideration in planning and when undertaking management activities.

3.1 Our unique south-west forests

Our unique south-west forest and woodland ecosystems have evolved over millions of years, with their distinctive ecology shaped by varying climates and an ancient landscape. The 2.4 million hectares of native vegetation within the planning area are a subset of the broader Southwest Australian Floristic Region, globally recognised for its rich diversity of plants and animals.

The south-west is also renowned as a hotspot for geographically isolated plants and animals with ancient genetic lineages, such as the Albany pitcher plant (*Cephalotus follicularis*), honey possum (*Tarsipes rostratus*), western swamp tortoise (*Pseudemydura umbrina*), sunset frog (*Spicospina flammocaeruluea*) and assassin spiders (Archaeidae) (Hopper 2009). These species survived amid the climatic fluctuations of the Pleistocene era (from about 2.6 million to 10,000 years ago) and increasing aridity that also favoured the expansion of sclerophyllous (hard-leaved) vegetation. This includes the well-known eucalypts, paperbarks, banksias, acacias and grevilleas which are a feature of the forests seen today.

The unique evolutionary history of the south-west forests underpins their biological diversity. Beyond the narrow coastal plains, most of the south-west forest area sits over ancient geological formations that date from over 1000 million years ago. Over time, weathering of overlying strata has formed the low, rounded granite (and associated rock types) peaks and slopes that characterise the region. The south-west landscape has been very stable over much of the last 250 million years as the absence of glaciation and volcanic activity, which rejuvenates landscapes, has allowed uninterrupted evolution on weathering landforms. This has resulted in a relatively flat terrain and nutrient-low soils and has supported the emergence of the distinctive characteristics of the region's flora and fauna.

While forests are widespread in the region, vegetation types often form a mosaic that varies over relatively short distances (Gole 2006). Granite outcrops, for example are recognised as important refugia (Schut *et al.* 2014) due to the different environmental conditions from surrounding landscapes which allow many species to persist. Although they comprise small areas within the south-west region, at least 1200 vascular plant taxa are associated with them (Hopper *et al.* 1997), as well as a substantial proportion of the region's reptile, bird, invertebrate and mammal fauna (Withers and Edward 1997; Pinder *et al.* 2000).

Human interaction with these unique landscapes commenced over 50,000 years ago (Turney *et al.* 2001). Noongar peoples have continuously occupied these lands, influencing fire regimes and in some instances the composition and relative abundance of preferred plants and animals (Lullfitz *et al.* 2017).

Today, the dynamic forest ecosystems of the south-west comprise a complex mosaic of structure and condition. Appropriate management is critical to conserving the biodiversity and sustaining a suite of values recognised by the community. This section describes the multiple values to be managed under this plan.

Karri forest Pemberton - Tourism Western Australia

3.2 Noongar cultural heritage values

The Noongar people are traditional owners of the south-west region of Western Australia and the planning area (see Map 4). The Noongar Nation is one of the largest Aboriginal cultural blocks in Australia and Noongar people have a profound physical and spiritual connection with their boodjar (land/country). There is also significant diversity among Noongar people, with 14 different language groups (nine of which are covered by the planning area) and three main dialects (see Map 5). Each of these language groups correlates with different geographic areas with ecological distinctions.

The planning area includes about half of the South West Conservation Estate (i.e. approximately 2.46 million hectares), with the FMP footprint primarily over the Whadjuk, Gnaala Karla Booja, Karri Karak (formerly South West Boojarah) and the Wagyl Kaip and Southern Noongar Agreement areas. Noongar heritage and boodjar are interconnected. This is explained through lore and customs, creation stories and songs, traditional knowledge of the land and its biodiversity and other cultural practices transferred through generations. Noongar heritage also involves both the archaeological records of Noongar areas of mythological or ceremonial importance, places where traditional and cultural events took place, and the ongoing physical and spiritual involvement of the people with boodjar. Noongar heritage provides an essential emotional, physical and spiritual link to their traditions, culture, practices and identity. It is recognised that heritage places are still used today and provide a means of maintaining Noongar cultural heritage. The protection of Noongar heritage is therefore a matter of maintaining Noongar cultural identity and facilitating access to the land to look after these heritage places and values.

3.2.1 Nyidiny and spiritual connections with the land

Under their traditional lore and customs, Noongar people have responsibilities for looking after country and everything within it. This responsibility was handed down from the Nyidiny or creation times, which means 'cold', 'ice age', 'cold time' or 'ancestral times'. It is the time before time, when spirits rose from the earth and descended from the sky to create the landforms and all living things. Nyidiny stories laid down the lore for social and moral order and established cultural patterns and customs. Noongar spirituality lies in the belief of a cultural landscape and the interconnectedness between the human and spiritual realms.

Everything in the vast landscape has meaning and purpose. Life is a web of inter-relationships where maaman and yok (men and women) and nature are partners, and where koora (past) is always connected to yeyi (present). Noongar Elders have the ability to comprehend the knowledge and to maintain it in an unchanging way. Noongar creation stories can vary from region to region, but they are part of the interconnectedness between all living things.

3.2.2 Traditional knowledge

Noongar kadidjiny (know, thinking, listening, learning, understanding) and understanding of boodjar reflects the deep spiritual and physical connection to country and to places of significance. The Noongar people have developed, refined and employed knowledge of the natural environment for tens of thousands of years, and there is a duty to pass on kadidjiny and connection to country to the next generation. This traditional knowledge is also extremely valuable in enhancing contemporary land management practices.

Noongar people have traditionally hunted and gathered food according to their six bonar (seasons): Birak (December and January), the first summer; Bunuru/Boonaroo (February and March), the second summer; Djeran (April and May), cooler weather begins; Makuru/Mookaroo (June and July), the first rains and the coldest season; Djilba (August and September), the second rains; Kambarang (October and November), longer dry periods[6]). The bonar are based on weather patterns and which plant and animal resources are plentiful during those times. Noongar people have always practised sustainable harvest strategies to ensure the survival of the species they depended on for food, water and medicine.

6 noongarculture.org.au

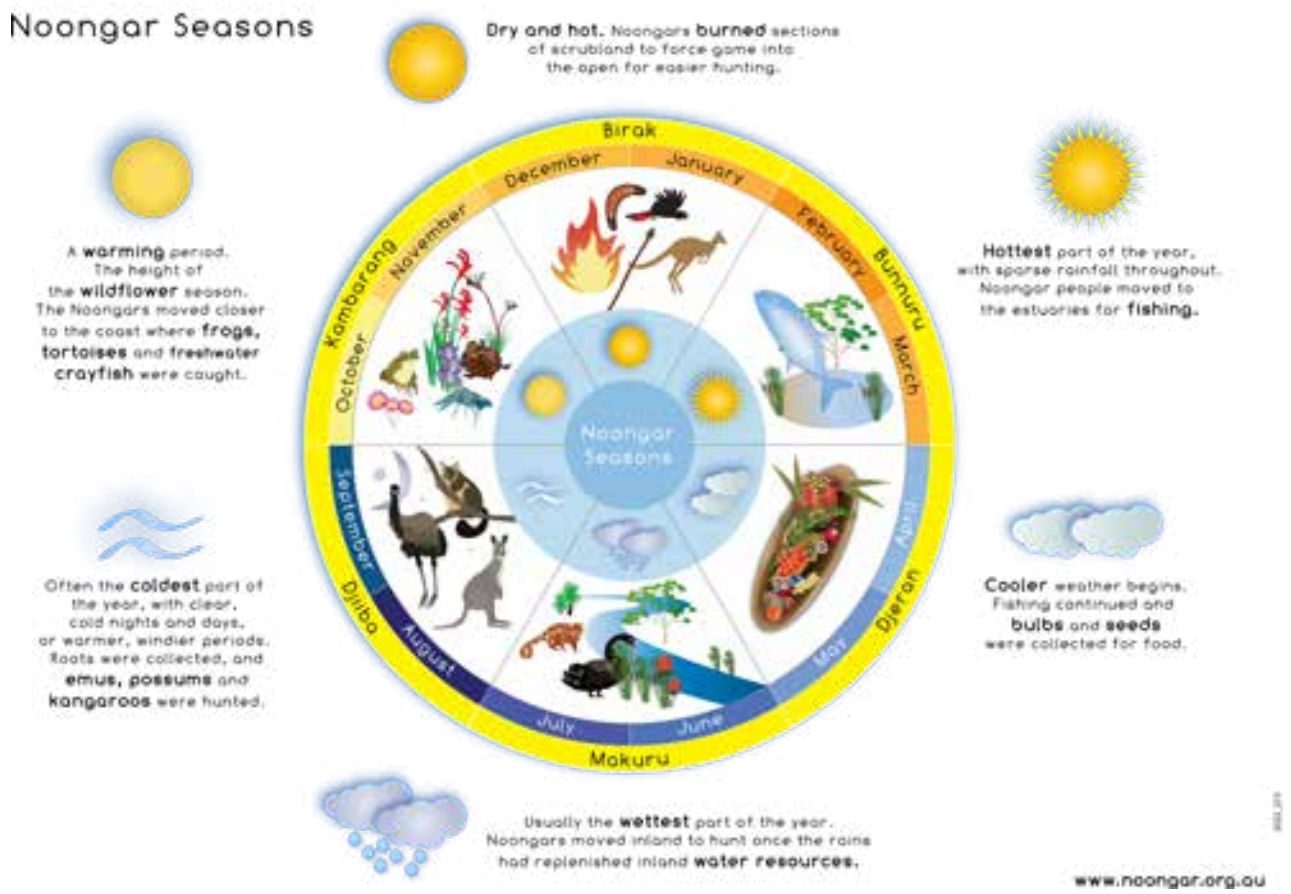


Figure 1. Noongar seasons calendar provided by South West Aboriginal Land and Sea Council (SWALSC)

Noongar Traditional Owners have long used fire for different purposes such as cleaning country, clearing paths, encouraging new vegetation growth, propagating seeds, hunting, cooking, warmth, light, making tools, signalling, ceremonies and for managing the land. Burning with a fire regime appropriate to seasons and forest type reduced the risk of large bushfires, encouraged the growth of bush tucker and medicines, and provided forage for native animals. Forest management provides unique opportunities to link Noongar kadidjiny with contemporary conservation science.

3.2.3 Sites of significance

A large number of Aboriginal cultural sites have been recorded within the planning area. These are places of importance and significance to Noongar people and to the cultural heritage of the State. Aboriginal sites are a diverse range of places including archaeological sites associated with past Noongar land use, and ethnographic and historical sites of ongoing spiritual, historical, and cultural importance and significance to Noongar people.

Mia mia, a traditional Noongar shelter - Photo courtesy SWALSC

For the majority of traditional owners, there is a desire to continue living on country from time to time, learning about and enjoying important areas of the forests and utilising the resources of boodjar. Therefore, the ability to access the planning area for customary practices is considered essential.

As of 30 June 2022, there were almost 900 sites within the planning area on the State's Register of Aboriginal Sites. However, it is highly likely other Aboriginal sites exist that are not recorded on the Register.

Registered sites and their associated values in the planning area include mythological and ceremonial sites connected to Nyidiny, artefact sites, painting and engraving sites, burial sites, fishing and hunting places and water sources.

3.2.4 Enjoyment of country and customary activities

The south-west forests encompass the traditional lands (or 'country') of several different Noongar groups. Some Noongar people who identify with particular areas are descendants of the Noongars who always lived in those places. Others forcibly removed from their homelands have settled and have a strong sense of affiliation to particular areas. For the majority of traditional owners, there is a desire to continue living on country from time to time, learning about and enjoying important areas of the forests and utilising the resources of boodjar. Therefore, the ability to access the planning area for customary practices is considered essential.

3.3 Physical values

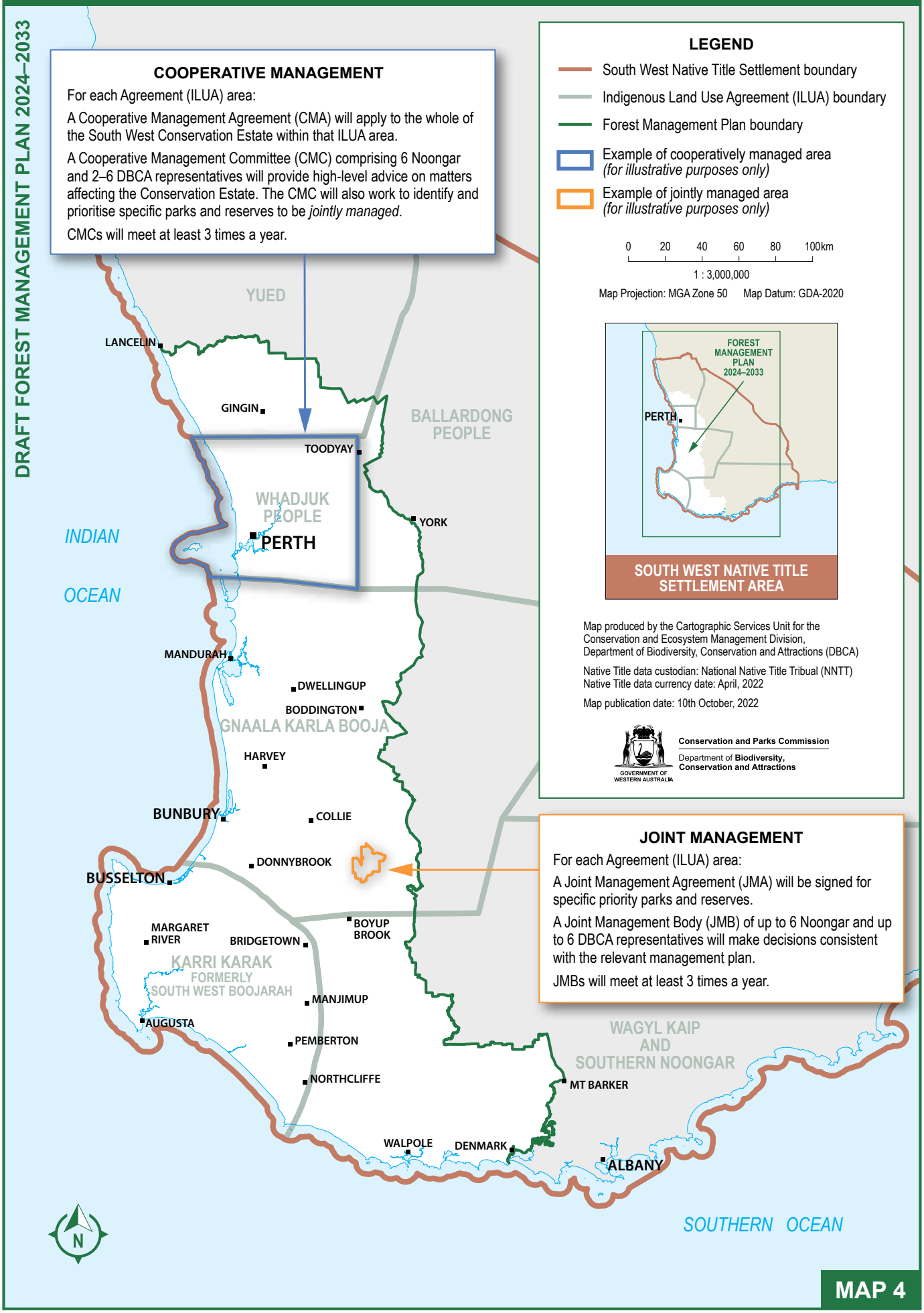
The physical characteristics of the south-west provide important drivers for the unique ecology of our forest ecosystems. The geology, topography and climate are major determinants of the vegetation and fauna communities. Within these broader landscape characteristics, variations of landforms, soils and hydrology provide the conditions for the range of forest ecosystems and the species they support.

3.3.1 Climate

The climate of the south-west region is a typically Mediterranean type, with cool, wet winters and warm, dry summers.

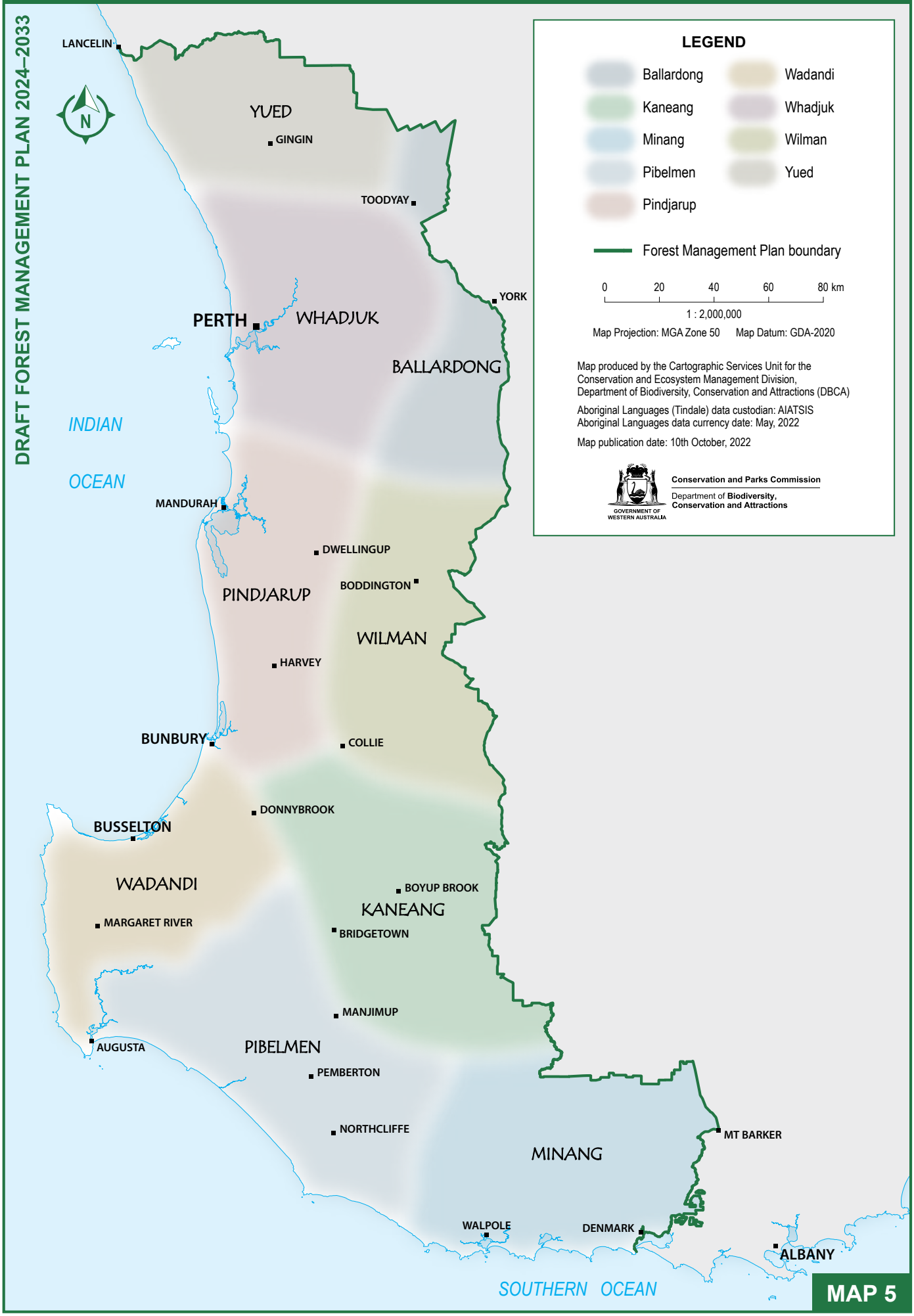
Most rain (about 80 percent) falls between May and October and the summer drought can last four to seven months in the northern part of the region (Gentilli 1989). Rainfall in the northern part of the forest ranges from 635mm per annum at the eastern edge, to 1300mm per annum approximately 10km east of the Darling Scarp, reflecting the rain shadow effect of the escarpment. Average rainfall in the southern part of the forest region exceeds 1400mm per annum at some locations (rainfall data Bureau of Meteorology 2016, see Map 6). The region experiences mean maximum temperatures ranging from about 29°C in summer to around 16°C in winter, and minimum temperatures from 18°C in summer to 7°C in winter. Maximum temperatures can exceed 35°C during the summer, while winter nights may experience frost, occasionally dropping to -5°C.

RELATIONSHIP OF FOREST MANAGEMENT PLAN TO SOUTH WEST NATIVE TITLE SETTLEMENT

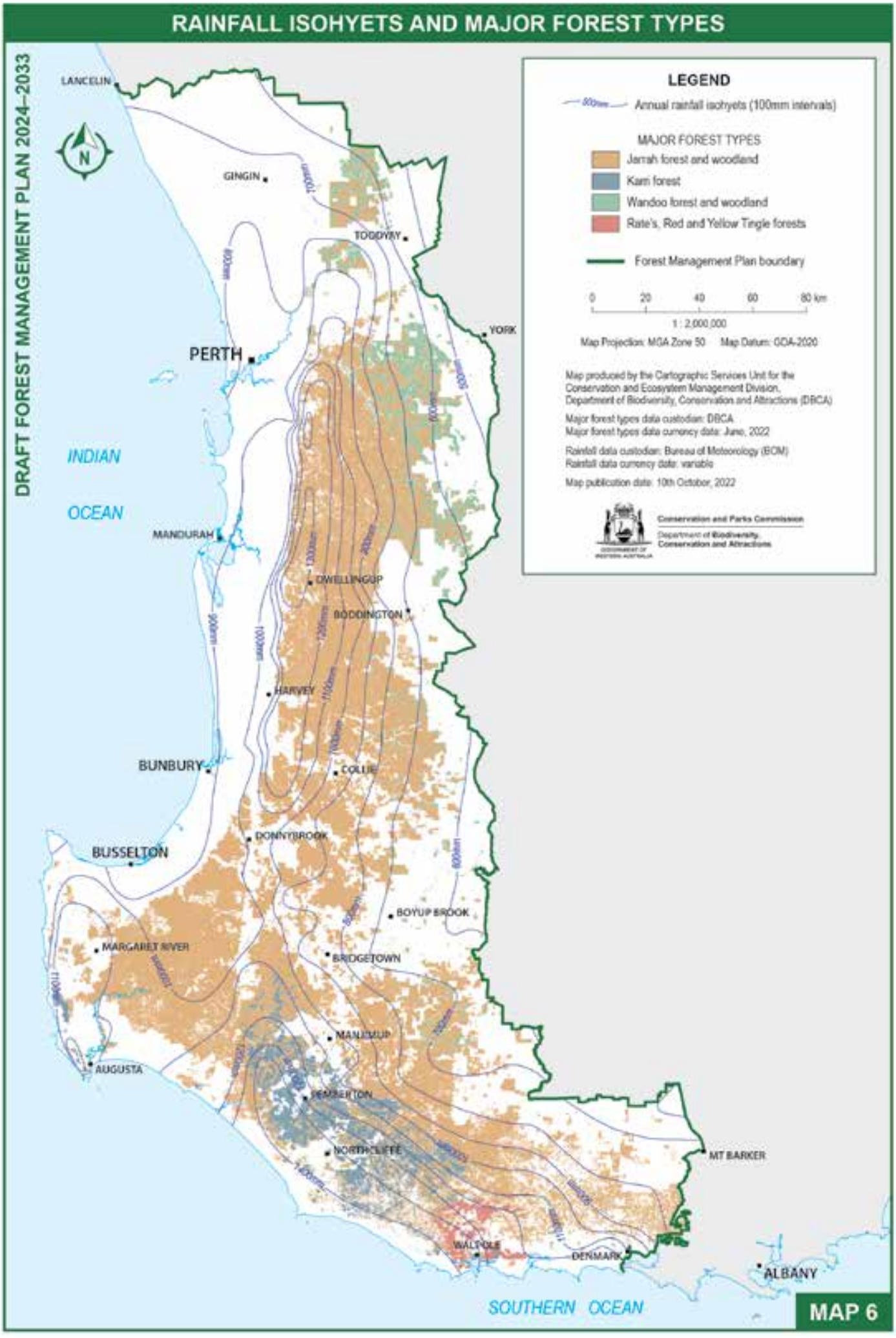


MAP 4

ABORIGINAL LANGUAGE GROUPS



MAP 5


RAINFALL ISOHYETS AND MAJOR FOREST TYPES
DRAFT FOREST MANAGEMENT PLAN 2024–2033
LEGEND
Annual rainfall isohyets (100mm intervals)
MAJOR FOREST TYPES
Jarrah forest and woodland
Karri forest
Wandoo forest and woodland
Rate's, Red and Yellow Tingle forests
Forest Management Plan boundary
0 20 40 60 80 km
1 : 2,000,000
Map Projection: MGA Zone 50 Map Datum: GDA-2020
Map produced by the Cartographic Services Unit for the Conservation and Ecosystem Management Division, Department of Biodiversity, Conservation and Attractions (DBCA)
Major forest types data custodian: DBCA
Major forest types data currency date: June, 2022
Rainfall data custodian: Bureau of Meteorology (BOM)
Rainfall data currency date: variable
Map publication date: 10th October, 2022
Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions
LANCELIN
GINGIN
TOODYAY
YORK
PERTH
INDIAN
OCEAN
MANDURAH
DWELLINGUP
BODDINGTON
HARVEY
BUNBURY
COLLIE
DONNYBROOK
BUSSELTON
BOYUP BROOK
MARGARET RIVER
BRIDGETOWN
MANJIMUP
AUGUSTA
PEMBERTON
NORTHCLIFFE
MT BARKER
WALPOLE
DENMARK
ALBANY
SOUTHERN OCEAN
MAP 6

3.3.2 Geology

Most of the south-west is part of the Yilgarn Craton, a large block of the earth's crust that has been relatively tectonically stable for much of the last billion years. The bedrock of the craton is mainly granites and gneiss. The Perth Basin, along the west coast, and the Albany Fraser Orogen, along the south coast, fringe the Yilgarn Craton and together they define the three major geological units of the planning area.

The stability of the Yilgarn Craton has resulted in a relatively flat terrain with deeply weathered zones containing ancient, nutrient-low soils. High rainfall and low evaporation during the Tertiary period (66-2.6 million years ago) caused deep *in situ* weathering of the granites and gneiss bedrocks of the craton. This led to the development of an extensive lateritic soil profile, which consists of ironstone and lateritic gravels or sand over mottled and pallid clays, and a clay rich saprolite (weathered bedrock layer). Many of the ancient valleys have been infilled with eroded sediments and wind-blown sands (Tille *et al*. 2001). The granite/gneiss bedrock is visible on the slopes of the Darling Scarp and as isolated outcrops across the region.

The main landforms of the planning area are the Darling and Blackwood plateaux with deeply weathered lateritic soils, and the Swan and Scott River coastal plains with soils dominated by sand and sediment deposited by the ocean or material eroded from the plateaux.

The planning area contains ore bodies with commercially viable minerals. Bauxite deposits are located under the lateritic hardcap in the Darling Plateau; gold is mined near Boddington; lithium at Greenbushes; and coal, east of Collie.

3.3.3 Hydrology

Groundwater

Unconfined aquifers occur within sandy soils of the Scott River and Swan Coastal plains where water tables are generally shallow (3-10m). On the Yilgarn Craton water tables vary in depth from 0 to more than 40m. These superficial aquifers tend to occur as localised systems, sitting above the bedrock; within valley infill sediments; and within cracks and fissures within basement geology (Harper *et al.* 2019).

Within the Perth Basin there are two major confined aquifers, the Leederville and the deeper Yarragadee aquifer. Superficial aquifers are mainly used to provide water for industry, horticulture, green space and garden bores while the Leederville and Yarragadee aquifers are used by the Water Corporation for scheme supply (DWER 2021a).

Saline and hypersaline groundwaters can be found in the east of the planning area, while to the west and the south the salinity of groundwaters is generally lower.

Groundwater levels on the Swan Coastal Plain have been declining due to a combination of water extraction and reduced rainfall. On the Darling and Blackwood plateaux groundwater levels have generally declined since 1975 (Department of Water 2007). The disconnection of groundwater from the stream zone as the climate dries has been associated with sudden and lasting drops in annual streamflow (Kinal and Stoneman 2012).

Wetlands and waterways

Variation in topography, geology, soils and climate have shaped a wide array of aquatic habitats in the planning area including rivers and their riparian zones through to estuarine saltmarshes, clay pans, ephemeral and permanent lakes, damplands, inter-dunal swales, peat wetlands, ngamar on granite outcrops, and subterranean habitats. There are thousands of individual wetlands and over 6000km of perennial rivers in the south-west region. The major rivers include the Moore, Swan, Murray, Collie, Blackwood, Donnelly, Warren, Deep, Kent and Hay Rivers. There is also an estimated 41,300km of creeks constituting a significant proportion of the total stream zone length.

Due to seasonal rainfall patterns and streamflow, few natural wetlands have surface water year-round, so seasonal drying is the norm and many wetlands may only retain water for short periods. Along the south coast there are large seasonally filled basins, some with peat deposits and dominated by sedge, rush and shrub communities. In the planning area, five wetland suites are recognised under the international Ramsar Convention for their internationally significant values, particularly as waterbird habitat. They are Muir-Byenup System, Vasse-Wonnerup System, Peel-Yalgorup System, Becher Point Wetlands and Forrestdale and Thomsons Lakes. A further 39 sites are listed on the Directory of Important Wetlands of Australia.

Aquatic ecosystems in the planning area are important for supporting biodiversity including many threatened and priority species and ecological communities and migratory birds. Healthy wetlands and waterways are valued for their natural scenic beauty, flora and fauna and recreational pursuits, and waterways in PDWSAs and clearing-controlled catchments provide high quality water resources. Rivers, streams and wetlands are also important to traditional owners as drinking water and food sources and have significant cultural value. Dreaming trails often encompass entire rivers and their tributaries, which also provide recreation and camping opportunities.

Wild Rivers are Western Australia's most pristine river systems with the least disturbed catchments. There are six Wild River catchments within the planning area, namely Doggerup Creek, Blackwater Creek, Shannon River, Deep River, Forth River and Inlet River.

3.4 Biodiversity values

Biodiversity means the variability among living organisms and the ecosystems of which those organisms are a part and includes the following:

- diversity within native species and between native species
- diversity of ecosystems
- diversity of other biodiversity components (*Biodiversity Conservation Act 2016* (BC Act)).

Conserving biodiversity requires representation of the full array of habitats and ecological processes at various spatial scales, from entire forested landscapes to localised habitats. It also includes sustaining populations and maintaining their genetic diversity.

While more is generally known about vascular plants and vertebrate animals, these constitute a relatively small proportion of the total species richness in south-west forests. The long-term FORESTCHECK monitoring project found that nearly 80 percent of species biodiversity in the jarrah (*Eucalyptus marginata*) forest were fungi, cryptogams and invertebrates, with the remainder being vascular plants, and terrestrial vertebrates (birds, frogs, reptiles and mammals) (FORESTCHECK in preparation).

It is noted that Noongar knowledge of plants, animals, ecosystems and seasons has developed over tens of thousands of years and contributes to biodiversity conservation, just as the protection of biodiversity helps conserve and protect Noongar cultural values.

3.4.1 Vegetation and flora

The planning area supports more than 3750 vascular plant species and subspecies – a remarkable richness considering the limited topographic and climatic variation across the region. The number of known species continues to grow with new discoveries and the application of genetic tools to taxonomic research.

The high species richness in the flora of the south-west region is underpinned by high levels of genetic diversity both in species that are widespread across the planning area, and those found only in restricted areas.

As at 1 September 2022, 124 plant taxa in the planning area are listed as threatened under the BC Act, with a further 583 taxa listed as 'Priority' flora (see Appendix 3).

There are 33 threatened ecological communities (TECs) recorded in the planning area, with an additional 68 priority ecological communities (PECs). The TECs and PECs in the planning area are described based on their different types of biota (flora, fauna, macrofungi or microbes) and occur in many types of habitats. Eighteen of the 33 TECs and 10 of the 68 PECs in the planning area are plant-based community types, most occurring on the Swan Coastal Plain.

All of the TECs and 57 (85 percent) of the PECs are endemic to the planning area. There is a total of approximately 21,000 mapped occurrences of TECs and PECs covering a total of 265,000 hectares. Of this total, 243,000 hectares (92 percent) occur on the Swan Coastal Plain where there is a very high diversity of habitats and vegetation along with high-level pressures from urban and associated development.

3.4.2 Old-growth forest

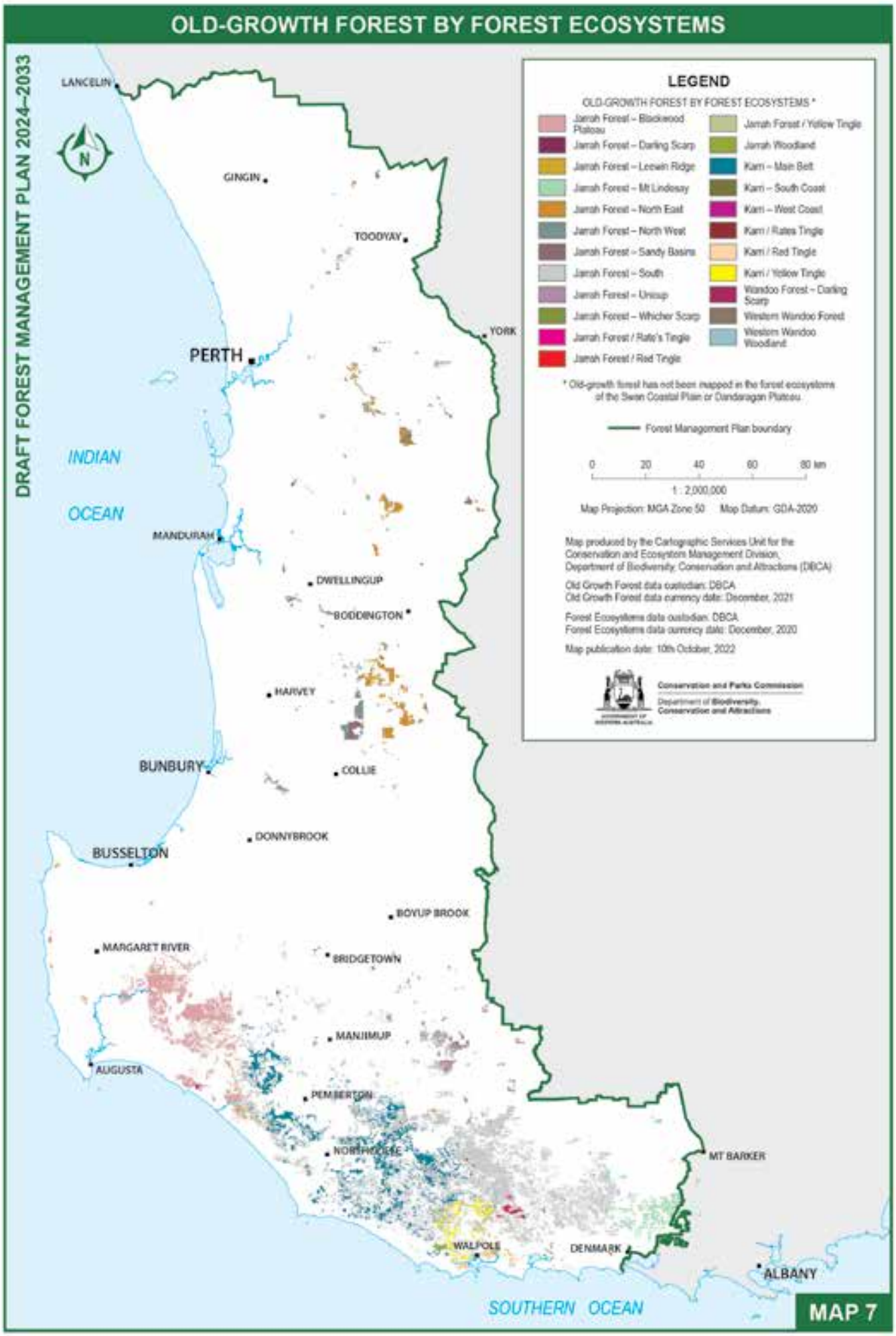
Old-growth forest is defined in the National Forest Policy Statement (1992) as *"Ecologically mature forest where the effects of unnatural disturbance are now negligible. The definition focuses on forest in which the upper stratum or overstorey is in a late mature to senescent growth stage"* (Commonwealth of Australia 1992). Essentially old-growth forests are those that have not been subject to major disturbance by timber harvesting, grazing, mining, or introduced diseases, and that remain dominated by larger, older trees.

Old-growth forests may be representative of the ecosystems and processes evident before arrival of Europeans in the 1820s. Old-growth forests therefore are of special significance to Noongar communities (Regional Forest Agreement Steering Committee 1997; SWALSC 2009) and are a key component of the conservation reserve system. They are highly valued by the community for their biodiversity, connection to nature, aesthetics, and as some of the most carbon-dense areas in the south-west.

Since 2001, all old-growth forests in the south-west on CALM Act lands have been protected from timber harvesting. As at December 2021, a total of 337,230 hectares of old-growth forest has been identified, comprising 259,490 hectares of jarrah, 65,400 hectares of karri (*Eucalyptus diversicolor*) and 12,340 hectares of wandoo (*Eucalyptus wandoo*) forest and woodland (see Map 7).

Opposite *Map 7 Old-growth forest*

Marri blossom Corymbia calophylla - DBCA


OLD-GROWTH FOREST BY FOREST ECOSYSTEMS
DRAFT FOREST MANAGEMENT PLAN 2024–2033
LANCELIN
GINGIN
TOODYAY
YORK
PERTH
INDIAN
OCEAN
MANDURAH
DWELLINGUP
BODDINGTON
HARVEY
BUNBURY
COLLIE
DONNYBROOK
BUSSELTON
BOYUP BROOK
MARGARET RIVER
BRIDGETOWN
MANJIMUP
AUGUSTA
PEMBERTON
NORTHCLIFFE
MT BARKER
WALPOLE
DENMARK
ALBANY
SOUTHERN OCEAN
LEGEND
OLD-GROWTH FOREST BY FOREST ECOSYSTEMS *
Jarrah Forest – Blackwood Plateau
Jarrah Forest – Darling Scarp
Jarrah Forest – Leeuwin Ridge
Jarrah Forest – Mt Lindesay
Jarrah Forest – North East
Jarrah Forest – North West
Jarrah Forest – Sandy Basins
Jarrah Forest – South
Jarrah Forest – Uniciup
Jarrah Forest – Whicher Scarp
Jarrah Forest / Rate's Tingle
Jarrah Forest / Red Tingle
Jarrah Forest / Yellow Tingle
Jarrah Woodland
Karri – Main Belt
Karri – South Coast
Karri – West Coast
Karri / Rates Tingle
Karri / Red Tingle
Karri / Yellow Tingle
Wandoo Forest – Darling Scarp
Western Wandoo Forest
Western Wandoo Woodland
* Old-growth forest has not been mapped in the forest ecosystems of the Swan Coastal Plain or Dandaragan Plateau
Forest Management Plan boundary
0 20 40 60 80 km
1 : 2,000,000
Map Projection: MGA Zone 50 Map Datum: GDA-2020
Map produced by the Cartographic Services Unit for the Conservation and Ecosystem Management Division, Department of Biodiversity, Conservation and Attractions (DBCA)
Old Growth Forest data custodian: DBCA
Old Growth Forest data currency date: December, 2021
Forest Ecosystems data custodian: DBCA
Forest Ecosystems data currency date: December, 2020
Map publication date: 10th October, 2022
Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions
MAP 7

The size of old-growth forest patches can vary from as small as a few hectares to several thousand hectares. Only small, isolated patches of old-growth forest persist in the northern jarrah and wandoo forests due to extensive timber harvesting, mining, and spread of *Phytophthora* dieback over the last century. In contrast, large expanses of jarrah/tingle and karri/tingle old-growth forests occur in the southern forests, a reflection of the extensive conservation reserves and shorter period that sawmills were operating prior to the cessation of timber harvesting in old-growth forests in 2001.

Tuart forest, Kalgulup Regional Park - Shem Bisluk, DBCA

3.4.3 Fauna

Mammals

Thirty-four species of native mammals are found in the planning area, including nine species of bats. The south-west forests are a refuge for numerous native species that had wider historical ranges across Australia. This is especially so for threatened mammals, including the critically endangered woylie/walyo[7] (*Bettongia penicillata*), endangered numbat (*Myrmecobius fasciatus*), and vulnerable tjooditj (chuditch – *Dasyurus geoffroii*). The upper Warren area of the southern jarrah forest is particularly important, supporting the largest remaining and most genetically diverse populations of a number of threatened and priority listed mammals.

The forests are also important for Western Australian endemic species, such as the critically endangered ngwayir (western ringtail possum – *Pseudocheirus occidentalis*), vulnerable quokka (*Setonix brachyurus*), ballawara (brush-tailed phascogale – *Phascogale tapoatafa* – wambenger) and kwer (western brush wallaby – *Notamacropus irma*). The forests also support populations of kwenda (quenda-southern brown bandicoot – *Isoodon fusciventer*), koomal (common brushtail possum – *Trichosurus vulpecula*), and yongka (western grey kangaroo – *Macropus fuliginosus)*.

7 Noongar plant and animal names are used throughout the plan where possible.

Chuditch - Kimberley Page, DBCA

Birds

One hundred and forty-one native terrestrial bird and 113 waterbird species have been recorded in the south-west forests. Thirty-six bird species are listed as threatened under the BC Act, with a further 15 taxa listed as 'Priority' fauna.

The planning area is the stronghold of most of the 13 bird species endemic to the south-west region including the strikingly plumaged red-capped parrot (*Purpureicephalus spurius*), and three threatened black cockatoo species; kaarak (forest red-tailed – *Calyptorhynchus banksii) - vulnerable;* ngoolyanak (Baudin's – *Calyptorhynchus baudinii*), and ngoolyak (Carnaby's – *Calyptorhynchus latirostris*) – both endangered.

Frogs and reptiles

There are 89 reptile species and 25 frog species having distributions overlapping the south-west forest region. Of these, 15 reptiles and 11 frogs are restricted to the forest region, or nearly so. There are seven species of reptiles and four frogs listed under the BC Act occurring in the planning area. Three threatened frogs (white-bellied frog – *Anstisia alba* [8]– critically endangered; sunset frog – *Spicospina flammacaerulea* and orange-bellied frog – *Anstisia vitellina* – both vulnerable) are all restricted to the forest region and have both small distributions and population sizes.

Red-tailed Black Cockatoo - Doug Coughran

All the forest reptiles and frogs are predators or consumers, largely of ground invertebrates, some with highly specialised diets, and consequently for their long-term survival are dependent on functional forest ecosystems that maintain biological productivity and overall species diversity. Collectively these attributes make reptiles and frogs important indicators of environmental health.

Terrestrial invertebrates

The south-west forest region has a diverse range of terrestrial invertebrates. Total numbers of species are unknown but expected invertebrate richness for the

8 Prior to 2022 *Anstisia alba* and *A. vitellina* were classified in the genus *Geocrinia.*

forest area is in the tens of thousands of species (Abbott 1995, Yeates *et al.* 2003, Majer *et al.* 2007). DBCA projects have collected some 4200 species of macro invertebrates (greater than 10mm in size) from sites in the jarrah forest and adjacent heathland.

Orange-bellied frog (Anstisia vitellina) - Christine Taylor, DBCA

The composition of invertebrate communities at sites within the forest changes over relatively small areas (Farr *et al.* 2011). This can be due to the need for a specific host (Moir *et al.* 2011), post fire changes in composition of communities (Brennan *et al.* 2006), and/or variation in temperature and rainfall (Wills and Farr 2017).

Threatened fauna and ecological communities

A total of 190 species are listed as threatened in the planning area. See Appendix 4 for a breakdown of categories of threatened and priority species across fauna types.

In the last 100 years, there has been at least one extinction (the western subspecies of Lewin's Rail - *Lewinia pectoralis clelandi*) and several local extinctions in south-west forests including mammals; boodie (burrowing bettong – *Bettongi lesueur*), and dalgyte (greater bilby – *Macrotis lagotis*); and birds; noisy scrub-bird (*Atrichornis clamosus*), western bristlebird (*Dasyornis longirostris*), western whipbird (*Psophodes nigrogularis*) and western ground parrot (*Pezoporus flaviventris*).

There are five invertebrate TECs that occur in water-filled caves, and one in a very rare mound spring habitat in permanently damp peat. Three TECs and four PECs are microbialites (limestone-like structures formed by microbes in wet habitats).

3.4.4 Forest ecosystems

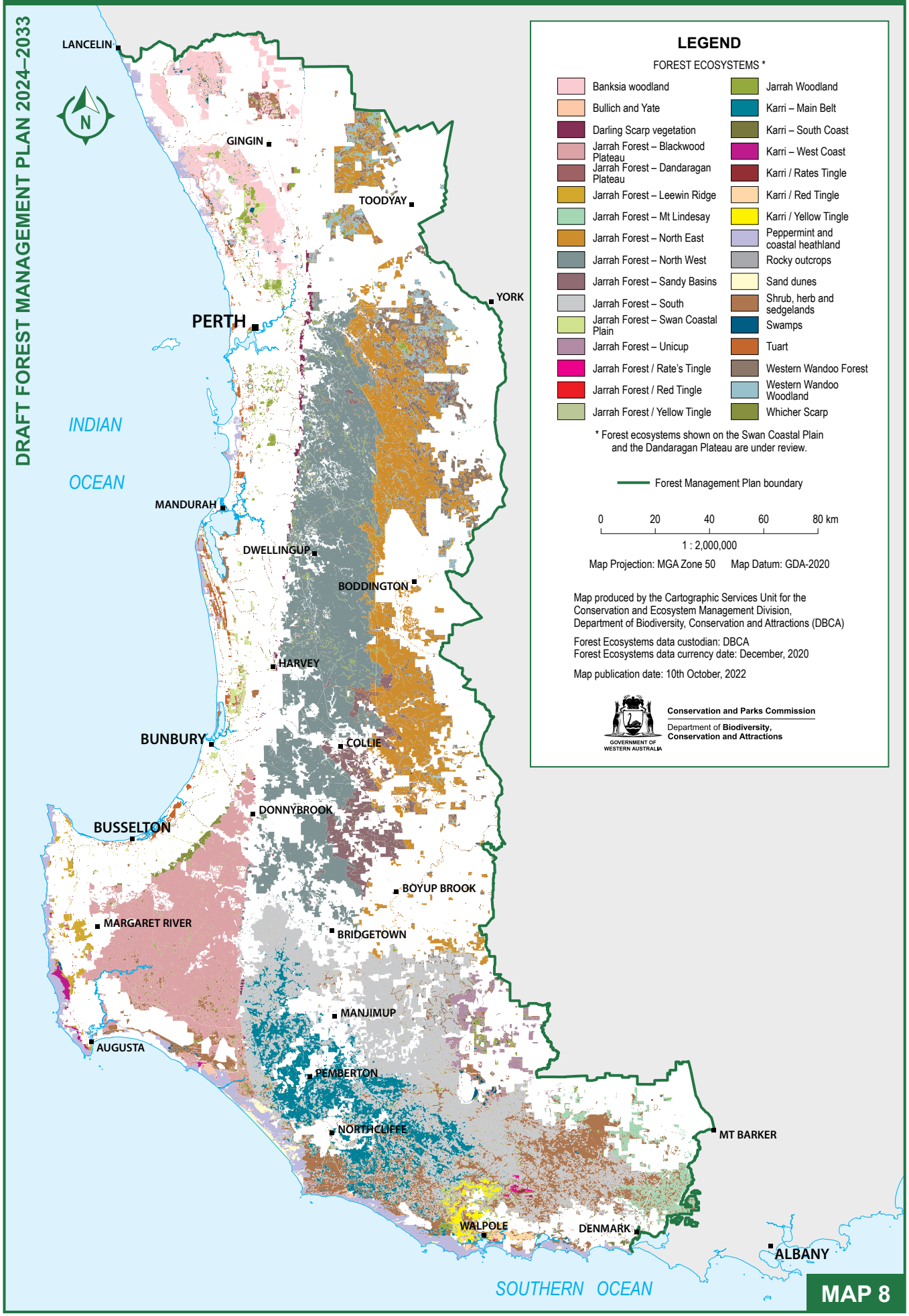
Forest ecosystems are the combination of species, soils, geology, topography, and climate tied together by physical and biological processes specific to any one site, with trees as the dominant vegetation.

The diversity of ecosystems is reflected in the occurrence of more than 312 vegetation complexes in the forest area (Bradshaw 2015). Twenty-six broad floristic formations, or 'forest ecosystem types' were identified for the WA RFA as a basis for varying forest management settings and evaluating conservation reserve design (see Map 8).

Jarrah and karri forest ecosystems are the most extensive ecosystem types in the planning area (Bradshaw 2015). Jarrah forest ecosystems occur on lateritic soils throughout the northern part of the region and over large areas of the southern part where annual rainfall ranges from 900 mm to 1100mm. The overstorey is dominated by jarrah and marri (*Corymbia calophylla*) with minor occurrences of species such as yarri (*Eucalyptus patens*), bullich (*Eucalyptus megacarpa*) and flooded gum (*Eucalyptus rudis*). Wandoo forest and woodland ecosystems occur in the drier eastern and northern areas (Commonwealth of Australia 1998). Other non-forest ecosystems such as rocky outcrops, sand dunes, shrub, herb and sedgelands and swamps, are interspersed throughout the forest area.

Opposite *Map 8 Forest ecosystems*

FOREST ECOSYSTEMS



The major ecosystem processes that take place in south-west forest ecosystems include carbon, water and nutrient cycles; and supporting processes such as litter fall and decomposition; hydrological dynamics; fire and post-fire recovery; pollination and seed dispersal; seasonal movements of fauna; soil processes such as aeration, seed burial and water infiltration mediated by digging animals; and the uprooting of trees and other small-scale disturbances.

Forest carbon storage

Carbon in forest ecosystems is stored in the soil (breakdown of plants, animal wastes and microorganisms), in below-ground organic matter (roots, charcoal) and above-ground organic material (trees, understorey plants, leaf litter and fallen trees and branches). Atmospheric carbon dioxide is taken up by plants during photosynthesis (to add to storage) but is also released back into the atmosphere through plant respiration, decay, and combustion during fires (Montreal Process Implementation Group 2018).

Increasing levels of carbon dioxide and other greenhouse gases in the atmosphere are a driving factor in global climate change. Globally, forests store a large percentage of the total terrestrial carbon pool, so minimising the loss of carbon stored in forests while maximising the rate of atmospheric carbon sequestered by plants as they grow, is essential to mitigate climate change (Intergovernmental Panel on Climate Change 2022).

Current carbon stocks vary between forest ecosystems depending on their natural site productivity and previous harvest and fire history. Estimates compiled for the FMP 2014-2023 suggest the combined above- and below-ground forest carbon stock in 2012 was around 600 million tonnes CO_2-equivalents (Conservation Commission of Western Australia 2013). This was around seven times Western Australia's total annual greenhouse gas emissions in 2017 of 88 million tonnes CO_2-equivalents (EPA 2020).

3.4.5 Forest habitats

Forest ecosystems contain a vast array of habitat types for plants, animals, fungi and cryptogams, and microorganisms. Habitat elements include the forest canopy; tree hollows, branches and trunks; understorey; roots; soils; leaf litter or fallen logs and branches as well as rocky surfaces. Non-forested areas such as rock outcrops and wetlands add provide additional habitat features.

Hollows

Hollows in dead and live standing trees are an important and potentially limited habitat resource in south-west forests. Hollows are used for shelter, being particularly important in extreme weather; nocturnal/diurnal resting; protection from predators; and as a safe environment to breed and raise young.

At least 42 vertebrate species use standing tree hollows including marsupials, bats and birds. The majority of these are highly reliant on suitable hollows for successful breeding (Abbott and Whitford 2001). Hollow logs are also important for ground-dwelling mammal species such as the tjooditj and numbat.

Coarse woody debris

In forest ecosystems fallen trees and branches provide shelter and foraging sites for native mammals, reptiles, invertebrates and frogs. Micro-organisms and fungi are also important in the breakdown of wood and recycling of nutrients back into the soil. Invertebrates can also feed on, or in, wood-decomposing fungi and cryptogams. One invertebrate group that relies on large fallen trees and branches are velvet worms (Onychophora). These are an ancient group that evolved during the past rainforest climate and require conditions of 100 percent humidity to survive. In summer these conditions are present in the fissures of large fallen tree branches and tree stumps.

Granite outcrops

Granite outcrops are a feature of the south-west forest region and support high species richness. Granite outcrops are often important Noongar heritage sites.

High solar radiation, rapid rainfall runoff and shallow soils combine to allow the formation of microhabitats supporting distinctive ecological communities in these habitats. Some species on granite outcrops are adapted to very dry and extreme temperature and moisture conditions. Others are remnants from an earlier, wetter climate.

Small rain-filled pools on these outcrops, known as ngamar, have formed through weathering of the granite (Timms 2021). The deeper 'pit' ngamar are an important source of water for Noongar people. The shallower 'pan' ngamar and their

associated moss beds support distinctive flora (for example, quillworts - Isoetes) and invertebrates, highly adapted to the seasonal presence of water coupled with extreme drying.

3.5 Other Australian heritage values

Since the 1820s, the timber industry has been an important part of establishing European settlements in the south-west. From when the first ships arrived on the coast of south-western Australia in 1826, trees were used as a resource for vessel maintenance, shelter and heating. Timber soon became used for local consumption and export to other Australian states and overseas. The industry was largely responsible for major developments in the south-west, leaving a rich legacy of heritage places (Carron 1985).

As people took up forestry as an opportunity to earn money in difficult times, temporary camps were set up to house workers. Once the timber resource in an area had been harvested, workers would move camp. Camps later developed into settlements, and eventually towns, as facilities were added to support the growing population of workers and their families. Several south-west towns, such as Manjimup, began as workers' camps. The Donnelly River mill town is now a picturesque, heritage-listed holiday destination and stopover on the Bibbulmun Track and the Munda Biddi Trail. Pemberton townsite was first settled in 1912 and the Pemberton Timber Mill Workers' Cottages Precinct is also listed on the State Register of Heritage Places (Heritage Council 2021).

The timber industry developed rapidly during the 1890s and reached a peak of production in 1913 (Carron 1985). Integral as it was in the development of settlements and the economy, the unsustainable exploitation of native timber, and clearing for agriculture, led to a widespread decline in ecosystem health and biodiversity. In 1894-95, the Government employed a Conservator of the Forests whose duties included designing new forestry regulations, preventing the destruction of young trees, cultivating softwoods and managing the industry generally. The *Forests Act 1918* introduced greater regulation and planning for the use of forests, including the creation of State forests and the Forestry Department.

Following bushfires in the early twentieth century, many aspects of rural fire management improved, including organisation of bushfire brigades and extension of the forest fire tower detection and reporting system. Eight lookout trees were established in the south-west between 1937 and 1952. Three of these are popular tourist attractions, being the Diamond, Gloucester and Dave Evans Bicentennial trees.

Throughout the history of the timber industry in the south-west there are ties to the development of settlements, transport and bushfire events that have left behind remnants such as railway stations, old settlement houses, fire lookout towers, sawmills, dams, jetties, and cemeteries.

There is a wide range of places within the planning area that are on local government heritage lists (available on each local government website), the State Register of Heritage Places[9], the National Heritage list[10] and the Commonwealth Heritage List[11].

3.6 Economic and social values

The south-west forests are important to the economic and social fabric of Western Australia, generating tangible and intangible benefits. Tangible benefits include the provision of jobs and economic outputs for a range of industries, such as tourism and recreation, basic raw materials (BRM), and forest-based produce and resources. Intangible benefits relate to the inherent value of the natural environment and the wellbeing, health, and quality of life benefits to people from connecting with nature.

3.6.1 Forest-based produce and resources

Historically the native timber industry has been one of the main forest-based industries in the south-west. Under previous FMPs native timber and forest products have been a major resource use and socio-economic output from State forests and timber reserves.

9 wa.gov.au/government/document-collections/the-state-register-and-other-heritage-listings

10 dcceew.gov.au/parks-heritage/heritage/places/national-heritage-list

11 dcceew.gov.au/parks-heritage/heritage/places/commonwealth-heritage-list

From 2024, large-scale commercial timber harvesting in native State forests will cease. Limited native forest timber will continue to be available from mine clearing and forest management activities, such as ecological thinning for forest health, that will provide direct and indirect socio-economic benefits.

State forest and timber reserves supply other forest produce or material such as firewood, burls, cones, craftwood, seeds, honey, and gravel and other material. They also provide access to wildflowers and other native flora desired by the flora industry. Demand for this other forest produce, wildflowers and flora fluctuates considerably. Supply is affected by a range of factors, including seasonal and temporal variability and access constraints.

Mining operations

Existing and substantial mining operations for bauxite, coal, gold, mineral sands, lithium and other minerals occur throughout the planning area. While these operations are not approved under the CALM Act and do not rely on forest management practices to occur, they may be subject to other environmental approval processes. The socio-economic value of mining is therefore not included in this plan.

BRM include sand (including silica sand), clay, hard rock, limestone (including metallurgical limestone), gravel and other materials used in construction and road building. These materials may be sourced from State forest and timber reserves for other government agencies and local governments. The department uses these raw materials to support its own management activities, such as road and track construction and maintenance, and development of recreation sites.

Plantations

There are approximately 50,100 hectares of softwood (pine) plantations on State forests and timber reserves within the planning area. These are managed for sawn timber and engineered wood products. They mainly comprise of radiata pine (*Pinus radiata*) and maritime pine (*Pinus pinaster*) but small amounts of other pine species are included.

A log is hauled on rails out of the South West forest by horses, probably near Lyalls Mill - State Library of Western Australia -Image 107037PD

Softwood and some hardwood plantations established on Crown land are managed in accordance with the CALM Act and the *Forest Products Act 2000* (FP Act) to '*achieve the optimum yield in production consistent with the satisfaction of long-term social and economic needs*', which includes meeting supply obligations under State Agreement Acts.

Pine plantations on State forests and timber reserves within the planning area store significant quantities of carbon. Their ongoing contribution to the carbon cycle will vary according to the levels of thinning, clearfelling and replanting undertaken, as well as the in-service life of the wood products generated.

Some plantation areas are also important for water catchment protection, public recreation and provide an important food source for some native fauna (for example ngoolyak). The use of plantations for recreation is generally accommodated, although public access may need to be temporarily suspended during harvesting operations or for other reasons.

Wood products are harvested from plantations by the FPC under planning and approval processes established by the department.

Firewood

Firewood is extensively used in homes throughout the planning area, particularly in regional towns as a cost-effective form of heating, particularly where natural gas is not connected.

Firewood is currently available from commercial firewood suppliers, being sourced through production contracts awarded under the FP Act and managed by the FPC. Firewood is also available in particular locations in the planning area for the public to collect, through the designation of 'public firewood areas,' under Part 15 of the Forest Management Regulations 1993 (FM Regulations). There is a long tradition of public firewood being available for collection by residents across the south-west, however the quantity of firewood collected from public firewood areas is not known.

Honey and related products

Apiculture is an expanding industry in Western Australia. The forests of the south-west are an important resource to this industry and honey and beeswax are considered forest produce under the CALM Act. Honeybees (*Apis mellifera*) provide a number of ecosystem services, such as enhanced pollination to increase crop yields, and honeybee products provide valued raw material for food, medicine and cosmetics. There are a number of apiary products with a clear economic value including honey, wax, pollen, propolis, royal jelly, venom, queens, bees and even larvae.

Commercial apiary sites underpin the honey products industry in Western Australia. At the date of publication, the department had issued licences to beekeepers to collect honey in the planning area on 1,751 sites which represents approximately 25 percent of the State's hives.

Public drinking water source areas (PDWSAs)

PDWSAs or water catchment protection areas provide drinking water to cities and towns from both surface water and groundwater sources. Within the planning area, there are significant areas of PDWSAs that supply water to Western Australia's population. Accordingly, management of the land and permitted disturbance activities have important consequences for water quality, supply and public health.

3.6.2 Recreation and tourism

The quality and experience of nature-based recreation is heavily reliant on the perceived beauty and 'naturalness' of the environment in which activities are undertaken. Certain landscape characteristics are accorded with a higher 'value' by the community and provide opportunities for recreation and tourism and fulfil a psychological need in providing a contrast to the urban environments in which the majority of Australians live (Western Australian Planning Commission 2007). The planning area contains many areas of perceived high natural beauty and presents ongoing opportunities for considered nature-based recreation and tourism developments.

There is a growing demand for outdoor recreation and nature-based tourism. Outdoor recreation contributes to public understanding and appreciation of nature, conservation and forest management, and the social, spiritual, psychological, physical and economic wellbeing of the community. The recreational benefits of Western Australia's parks and reserves include physical and mental health, connection to and increased appreciation of nature and community wellbeing (Aerts *et al.* 2018; Qiu *et al.* 2021).

There is a range of nature-based tourism offerings available in the planning area which provide social, educational and economic benefits including bushwalking, running, cycling, camping, swimming, fishing, canoeing, four-wheel driving, trail bike riding and caving. There are a number of important tourist attractions in the south-west including the Valley of the Giants and Tree Top Walk, the Bibbulmun Track, the 1000km Munda Biddi Trail, and Calgardup, Giants and Mammoth Caves. Many national parks in the region also provide for outdoor recreation and nature-based tourism such as Wellington, Beelu, Warren, Leeuwin-Naturaliste, Walpole-Nornalup, Gloucester and Greater Beedelup. A growing number of regional towns and locations are an important element of various trail networks.

Camping is a very popular activity that draws people to the region, and campers are an important part of many local and regional economies. The most popular camping destinations in the south-west are Lane Poole Reserve, and Leeuwin-Naturaliste and Wellington national parks.

Tourism and recreation in the planning area includes both facilities and experiences provided by the department, such as trails and camping areas, as well as by the private sector, where authorised, such as licensed tour operators or accommodation provided under leases. In this way, the department partners with the private sector to broaden the range of facilities and experiences available for people to visit and appreciate the planning area, in a way that contributes to regional economies through local businesses. The role of the south-west forests as a destination for recreation and tourism is expected to remain high given the popularity of nature-based activities, and development of new adventure-based visitor experiences such as Lake Kepwari near Collie, Collie Adventure Trails, and Dwellingup Adventure Trails.

Dave Evans Bicentennial Tree, Warren National Park - Tourism Western Australia

Annual visitation to DBCA-managed recreation sites in the planning area in the 2020-21 financial year totalled 12.65 million, which is 40 percent higher than the visitation of 9.05 million in the 2012-13 financial year when the last FMP was published. The greatest visitor numbers were recorded in Swan and South West regions. The average visitor satisfaction level increased to 92.3 percent in 2020-21, compared to 88 percent in 2012-13.

Trail bike riding and four-wheel driving continue to be popular recreational activities in the planning area. The demand is currently largely unmet with limited provision for road registered and off-road registered trail bikes and vehicles. It is therefore regularly reported as an unauthorised activity in parks and reserves (see 4.7 Unauthorised activities).

Permitted areas for off-road registered vehicles and trail bikes on department-managed lands are in former pine plantation areas at Gnangara and Pinjar. Opportunities specific to road-registered vehicles and trail bikes include the Captain Fawcett Track. Further areas may need to be identified to meet the demand and counter unauthorised use.

Events provide an opportunity for visitors to explore parks in a different and varied way. They range from small, local club events to major international events, and include competitive and non-competitive (participation) events, adventure racing and cultural immersion events. The department issues lawful authorities or licences for organised events on land which it manages, including trail running, mountain biking, horse riding, adventure racing, opera and other arts events and rallies.

3.6.3 Amenity and aesthetic value

The natural landscapes in the planning area are valuable for their intrinsic qualities, for the quality of life and enjoyment of people, and for the economic benefits they generate. Identifying and protecting the visual amenity of natural areas ensures those values are protected and maintained for the social, spiritual, cultural, and economic benefit of the community. Visual landscape management guides the planning and implementation of activities that may impact the visual quality of a landscape, ensuring uses and activities complement, rather than detract from, the inherent visual qualities of the landscape.

Visually significant landscape elements include undulating and steeply sloping landforms, well defined and deeply incised valleys, flat plains, permanent rivers and standing pools, expansive forest with minimal disturbance and granite domes and outcrops.

These landscape elements are features of numerous reserves in the planning area including Lane Poole Reserve, Tuart Forest National Park, Boranup forest in Leeuwin-Naturaliste National Park, Walpole Wilderness Area, Blackwood State Forest and Wellington National Park.

Lane Poole, Dwellingup - DBCA

4 Part B – Pressures on our south-west forests

Walpole treetop - DBCA

Our south-west forests and the biodiversity they support are under increasing pressure from threats such as climate change, habitat loss and fragmentation, weeds and pest animals, altered hydrological regimes and inappropriate fire regimes.

Maintaining ecosystem health and resilience is important for sustaining the various values and uses of natural areas, including biodiversity and Noongar cultural heritage values.

Understanding the nature of disturbances and their effects on ecosystem health and resilience is important. An ecosystem's responses to disturbances can vary over space and time due to:

- the type of disturbance; whether abiotic (such as bushfires, frosts, storms and climate change), biotic (such as weeds, pests and disease-causing pathogens) or human induced (such as timber harvesting and development requiring vegetation clearing)
- the characteristics of the disturbance, which includes timing, intensity, frequency, and scale
- interactions with other pressures and drivers of change, whose effects can be cumulative or synergistic, and
- characteristics of the species, populations, and communities involved.

The capacity of ecosystems to recover from disturbances is dependent on the rate (faster change is more challenging) and extent of change. Ecosystems and species have evolved over time and have some level of flexibility and adaptability. Disturbance can have a fundamental role in regenerating and maintaining biodiversity. The ephemeral plant species that germinate after fire are an example of the so called 'pioneer' species that do best after disturbance.

Most of the forest ecosystems as we see them today have been affected to varying degrees by actions or practices introduced since colonisation by Europeans commenced in 1826. By 2022 approximately 337,000 hectares or 8 percent of the estimated 3.97 million hectares of jarrah, karri and wandoo forests present in 1826 remain as old-growth forest in a largely unaltered condition.

The structure and condition of the forest overstorey has been markedly altered across different eras of timber extraction and mining operations. Timber harvesting was initially uncontrolled in the 1800s, then from 1918, occurred with silvicultural management to ensure the regeneration of trees. Most jarrah and wandoo forests north of Bridgetown, have been selectively cutover for jarrah sawlogs at least once, while extensive areas north of Collie have been cutover up to four times. These cutover jarrah and wandoo forests now comprise a higher proportion of regrowth stems, with nearly 169,000 hectares of cutover jarrah silviculturally treated during the 1930s depression to encourage tree growth. Harvesting in karri forests commenced much later than in jarrah forests and included management practices such as clearfelling. Consequently, past practices have led to changes in the structural composition of previously harvested jarrah and karri forest.

The present-day distribution and abundance of native fauna within the forests has been significantly influenced by introduced predators, particularly the European fox (*Vulpes vulpes*) since the 1930s and feral cats (*Felis catus*). Similarly, the introduction of the plant pathogen *Phytophthora cinnamomi* (*Phytophthora* dieback) has had major impacts on the floristic composition and abundance of plant species, with almost 15 percent of south-west forests now mapped as infested.

Changes in fire regime (seasonality, frequency and intensity) also has an ongoing influence on vegetation and habitat condition, including the regeneration of key plant species.

Since at least the 1970s, climate change has created a shift to drier and warmer conditions across the region, leading to reduced streamflow and runoff. Other disturbances may cause long lasting changes (for example, persistent drought) that may not become fully evident for some time, and which are difficult, if not impossible, to reverse.

The community regards managing pests and feral animals, managing diseases, and protecting threatened species and communities as important management priorities to respond to known pressures (DBCA 2022). This section covers these pressures along with threats associated with climate change, weeds, fire and vegetation clearing.

4.1 Climate change

The sixth report of the Intergovernmental Panel on Climate Change (IPCC) was released in early 2022 and highlights an urgent need for global action to reduce greenhouse gas emissions to limit the impacts of global warming (IPCC 2021). Changes to the climate of the south-west region have already been observed, and with future projections from all global climate models forecasting further warming and drying, climate change will be a persistent, escalating stressor on all ecosystems in the planning area.

4.1.1 Observed and predicted climate for the south-west

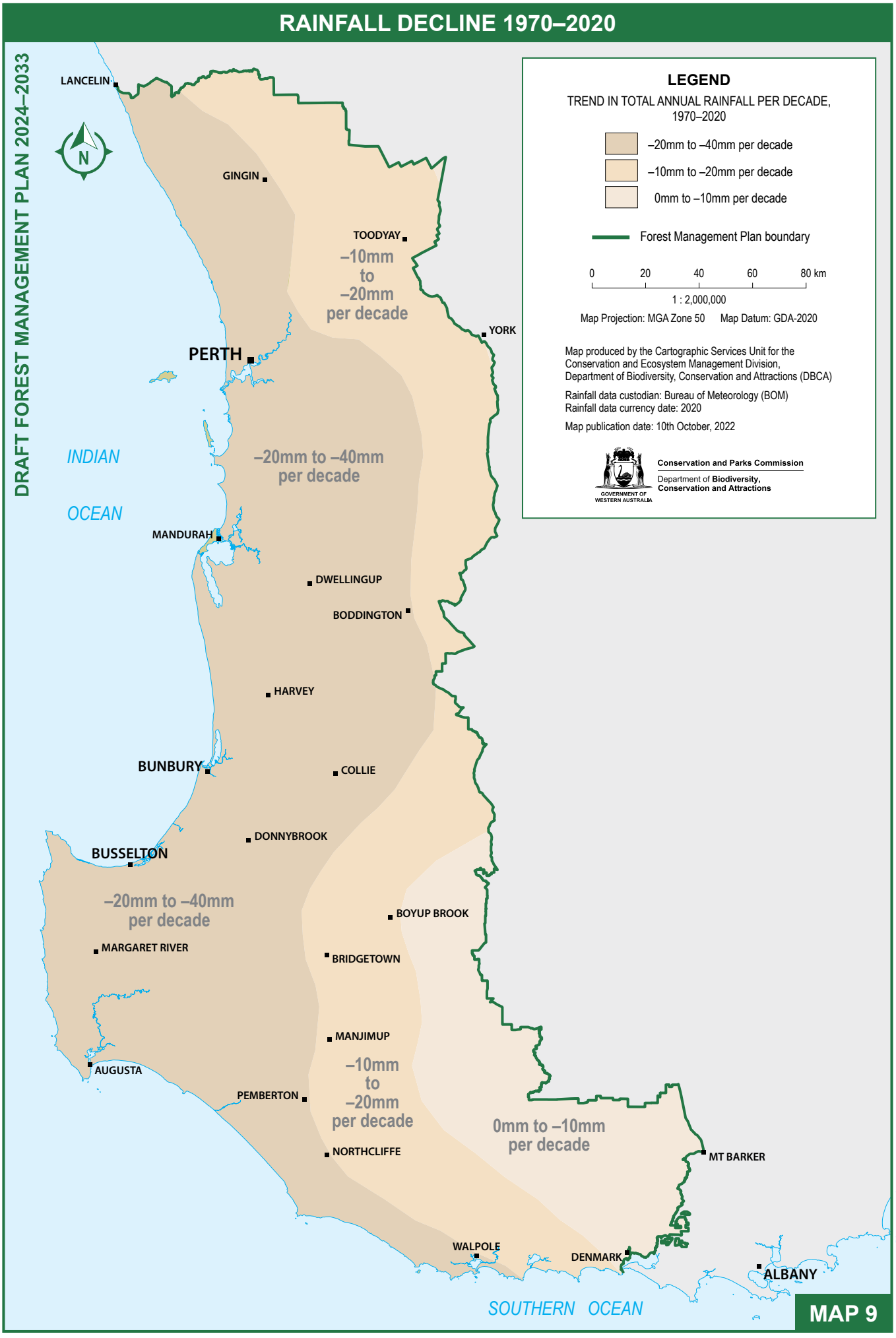
The climate of the south-west has experienced substantial natural variability in rainfall over the last seven centuries (O'Donnell *et al.* 2021). The last 50 years, however, has seen a consistent trend toward reducing annual rainfall (see Map 9) and increasing average temperatures across the planning area. Accompanying the reduction in total rainfall have been shifts in rainfall seasonality, with a 20 percent decline in May to July rainfall in the region since 1970 (relative to the 1900-1969 average). The reduction for May to July rainfall has been greater in the last two decades at around 28 percent since 2000 (Bureau of Meteorology (BOM) and CSIRO 2020). Mean temperatures have increased in the region by about 1.1^0 C since 1910, with the rate of warming higher since 1960 (DWER 2021b). Summer heatwaves and prolonged drought periods have also been more frequent in recent decades.

The south-west is predicted to experience continued drying and warming trends over the coming decades (Andrys *et al.* 2017; DWER 2021b).

Map 9 depicts the trend in rainfall from 1970 to 2020. It illustrates a decrease of up to 40mm per decade in total rainfall in parts of the region.

The rate and magnitude of projected changes in rainfall, temperature and evaporation vary between different climate models and assumptions about future emissions and mitigation outcomes. However, there is agreement on the overall trends and patterns, including the projections on rainfall and temperature summarised in Table 1.

RAINFALL DECLINE 1970–2020



Opposite *Map 9 Climate change rainfall deficit*

Table 1 Projected climate changes in south-west Western Australia

Rainfall	Temperature
Winter rainfall is projected to reduce by up to 15 percent by 2030 relative to the 1981-2005 period under all emissions scenarios (DWER 2021b).	Higher mean, maximum and minimum temperatures are expected (Hope *et al.* 2015).
By 2090 the winter rainfall reduction could be up to 25 to 45 percent relative to the 1981-2005 period depending on assumed emission scenarios (DWER 2021b).	By 2030 the mean annual warming across all emissions scenarios is projected to be about 0.5 to 1.1^{0} C above the average climate of 1986-2005 (DWER 2021b).
Rainfall declines are forecast to vary across the region, with the north-east of the planning area likely to experience the largest proportional decline (Andrys *et al.* 2017). This is consistent with the pattern of rainfall and vegetation canopy declines recorded to date (Conservation and Parks Commission 2022).	The temperature and frequency of very hot days are expected to increase, and heatwaves will get longer and more intense (DWER 2021b).
The duration and severity of droughts are predicted to increase (Hope *et al.* 2015), along with potentially large fluctuations in the number and intensity of summer rainfall events (Andrys *et al.* 2017).	There are likely to be fewer frost events across the region (Hope *et al.* 2015), but they may increase at a local scale (Matusick *et al.* 2014, 2016).

4.1.2 Potential consequences of climate change

Climate change presents significant challenges for maintaining forest health. An increase in moisture stress is expected across the south-west due to future drying and warming conditions, shifts in seasonality of rainfall, and increased risk of extreme weather events. The resilience of forests will vary depending on site characteristics such as soil type and depth, elevation, and aspect, as well as the structure and density of vegetation.

The progressively drier and warmer conditions will interact with existing stressors operating within these landscapes, such as fire, disease, weeds or pest animals, with potentially additive or synergistic effects. Where climate-related extreme weather events occur such as heatwaves, higher bushfire intensities, or storms, they may amplify the impact of other pressures on native species.

The exact consequences of changing climate on the natural ecosystems of the south-west are difficult to predict due to the:

- inherent uncertainty of climate projections
- complex interactions between ecosystem components and their interactions with other pressures, and
- incomplete knowledge of the 'normal' range of functioning and tolerance of ecosystem processes to altered temperature, rainfall and seasonal variability.

While changes are expected to put significant pressure on a broad range of organisms, understanding the responses to climate change and the underlying mechanisms to inform mitigation actions will remain a priority over the life of the plan, as recommended in the end-of-term review of performance of the FMP 2014-2023 (Conservation and Parks Commission 2022).

A summary of research findings related to potential climate change consequences as they apply in the planning area is provided in Table 2.

Table 2: Potential consequences of climate change for the south-west forests

Summary of research findings
Hydrology The level of moisture stress varies across seasons and depends on such factors as rainfall, soil depth and water holding capacity, vegetation composition and density. Surface and groundwater-dependent ecosystems such as wetlands are highly vulnerable to hydrological changes including TECs and PECs. Vegetation associated with shallow groundwater, streams and riverine areas will also be at risk of drying and contracting, with significant implications for aquatic fauna and threatened species such as the sunset frog.
• Declining rainfall has been closely linked to declining streamflows and increasing depth to groundwater in northern jarrah forest catchments (Silberstein *et al.* 2012; Raiter 2017; Harper *et al.* 2019). • In some catchments there is evidence of groundwater disconnecting from the valley floors, with streams then ceasing to flow (Kinal and Stoneman 2012). • Observed changes have been attributed to a combination of drying climate and an increasing proportion of young, dense regrowth forests in the landscapes (Liu *et al.* 2019). • Reduced surface run-off and increasing depth to groundwater has also been recorded in southern jarrah and karri catchments albeit at lesser levels in higher rainfall areas (Hughes 2021). • Further declines in rainfall, runoff and aquifer storage are projected to continue under forecast drying conditions (McFarlane *et al.* 2020; Hughes and Wang 2022). • Declining water quality in wetlands and waterways due to reduced rainfall, surface water flow (less flushing) and groundwater inputs and increased bushfires (Kauhanen *et al.* 2011). • Drying of peat-based wetlands causing exposure of acid sulfate soils, leading to acidification (Partridge and Finlayson 2022).

Sunset Frog - Perth Zoo, DBCA

Vegetation and flora

Ecological responses to date range from landscape scale changes, demographic shifts within vegetation communities, to individual plant mortality and die-off events and timing of reproductive cycles. Whether forest patches remain healthy or adjust to warmer and drier conditions via shedding of leaves, or plant mortality, will depend on a species' ability to manage moisture stress (and biotic co-factors such as pests), the magnitude of drought/heat events, and the level of competition at a site.

- Studies have documented declines in net primary productivity and vegetation cover in the northern forests and woodlands (Brouwers and Coops 2016; Wallace *et al.* 2009; Mattiske 2012).
- There have been vegetation community shifts away from species that prefer seasonally moist soils (Maher *et al.* 2010).
- As rainfall declines along the eastern boundary of the planning area, shifts in forest cover and species distribution are likely, including transition from forest to more open woodland structure (Yates *et al.* 2010a, b; Molloy *et al.* 2014).
- Modelling of climate change impacts on key plant species and fauna habitat has predicted range contractions and shifts towards higher rainfall areas (Brouwers *et al.* 2013; Matusick *et al.* 2013).
- Areas of the northern jarrah forest on vulnerable, shallow soils with limited water holding capacity have experienced canopy die-off associated with acute drought and heatwave events (MacFarlane *et al.* 2018).
- Although forest structure has changed at these sites, survival and recovery of individual trees highlights their ability to use groundwater where available, but not rely on it (Challis *et al.* 2016).
- Studies of the effects of heatwaves on marri have shown that warmer, drier areas have greater capacity to recover from water deficit than cool, wet areas (Filipe *et al.* 2022).
- Jarrah has a lower optimal seed germination temperature and a narrower range for germination compared to marri (Hossain 2020).
- Drought conditions can predispose marri to canker disease, particularly when followed by wetter conditions conducive to pathogen growth. Drier conditions may also exacerbate the expression of leaf blight in marri (Ahrens *et al.* 2019b).
- Climate change has also been implicated as contributing to declines of wandoo and canopy die-off events in tuart (*Eucalyptus gomphocephala*) and *Banksia* spp. (Brouwers *et al.* 2013; Matusick *et al.* 2013; Challis *et al.* 2016).

Fauna

Species generally considered most vulnerable to climate change include those with restricted and/or fragmented ranges, low genetic variation, dependence on a particular disturbance regime and reliance on a particular moisture regime or habitat. Historically many forest-dwelling mammal species had natural distribution ranges that extended into drier habitats to the north and east. The south-west forests are therefore considered a refuge for many species, and the potential contraction or degradation of forest habitat may be a particularly important aspect of climate-driven change in the short term for these mammal species. A range of other threatened and/or more forest-dependent fauna may also be at risk.

- By group, amphibians are considered the most vulnerable to climate change, followed by reptiles, mammals and birds (Lee *et al.* 2015).
- On this basis, among the most vulnerable terrestrial vertebrates (not including fish) to climate change in the south-west forests include threatened frog species (orange bellied, white-bellied and sunset), western swamp tortoise, ngwayir and quokka (Hoffman and Mitchell 2022).
- This is supported with modelling for quokka and ngwayir that suggests there may be substantial range contractions with continued climate change (Gibson *et al.* 2010).
- Potential stand-level die-off of vegetation in a drying climate can lead to changes in fauna ranges, foraging and community dynamics, habitat, and soil microbial communities (Gibson *et al.* 2010; Molloy *et al.* 2014; Angel *et al* 2021).
- Maintaining the connectivity of moist areas in forested landscapes, such as along vegetated riparian corridors, is essential for the survival and movement of some fauna populations (Gibson *et al.* 2010; Moore *et al.* 2015; Molloy *et al.* 2016; Hopkins *et al.* 2018).
- Potential consequences of climate change on invertebrate fauna are less well understood (Bain *et al.* 2019).
- Periodic outbreaks of endemic insects, such as jarrah leaf miner (*Perthida glyphopa*) and gum leaf skeletoniser (*Uraba lugens*), have historically caused broadscale defoliation of jarrah forest canopies and have been linked to fluctuations in amount and seasonality of rainfall (Wills and Farr 2017).
- As drought events and temperatures are anticipated to increase over the region, it is expected that the food resources during the breeding season for threatened cockatoos will become increasingly limited in time and space (Mastrantonis *et al.* 2019).
- Critical habitats of threatened fish such as Balston's and little pygmy perch, burrowing crayfish with restricted ranges and Carter's freshwater mussel are predicted to contract under the warming, drying climate increasing their vulnerability (Department of Conservation and Land Management 2008).

Carbon

Declining rainfall is expected to lead to long-term declines in the net primary productivity of forest ecosystems, and hence the carbon carrying capacity of sites.

- At jarrah forest sites where the 2010/11 drought induced canopy die-off an average of 49 tonnes per hectare of live standing carbon was converted to dead standing carbon (Walden *et al.* 2019).

Fire frequency and behaviour

Climate change is affecting landscape dryness and fuel availability, and the frequency and intensity of extreme fire weather, causing the potential for bushfires to be more frequent, larger and more damaging. Continuing to focus prescribed burning efforts in landscape zones that protect settlements and other assets, combined with other risk mitigation activity will mitigate bushfire risk to communities.

- An increased frequency of drought and heatwave events may increase the likelihood of bushfires starting and decrease the likelihood of their rapid suppression (Di Virgilio *et al.* 2019).
- In the Warren Region, the decade from 2002/03 onwards experienced the four most active lightning fire seasons on record and has seen the extension of the fire season into early spring and late autumn (McCaw and Read 2012).
- Climate projections forecast harsher fire weather conditions in the future with the number of days with 'severe' fire danger rating projected to increase 19 percent by 2030, based on the 1986-2005 period (Hope *et al.* 2015; DWER 2021b).
- Bushfires may occur earlier in the season, and prescribed burning windows are also shifting. This is both a challenge for fire management and may interact with the regeneration responses of plant populations (Miller *et al.* 2019, 2021).
- Plant populations may have reduced regenerative capacity, as maturation, growth, flowering and seedbank production is slowed by years of below average rainfall pre-fire and seedling survival is impacted by post-fire drought (Enright *et al.* 2014, 2015).
- Dryer landscapes make ecosystems previously protected by retained moisture such as riparian areas, swamps and peat systems vulnerable to burning. As well as impacting these systems directly, this also impacts their effectiveness in slowing or preventing fire spread and reduces landscape refuges and recolonisation nodes (Burrows and Middleton 2016).
- Peat wetlands that are drying due to climate change are more vulnerable to fire (Partridge and Finlayson 2022).
- Increased occurrence of fire interacts with other threats such as by enhancing the spread of invasive weed species (Bain *et al.* 2019).

4.2 Minerals and resource development

Commercial mining operations have been occurring in the south-west forests since the 19th century. The total area of forest cleared for mining purposes (excluding BRM) to date is estimated by the department at approximately 50,000 hectares (see Map 10).

While mining for a variety of minerals has occurred, the commodities being extracted influence the level of impact on the forest environment during and following mining operations.

Mining of coal, tin and certain other minerals often leads to deep and large-scale excavations, and the need for storage of non-productive material (tailings) at each site. Deep mining of coal over many years has resulted in deep mine voids and large waste landforms which are difficult and expensive to return to a state resembling natural forest ecosystems and uses. This leads to challenges in carrying out progressive rehabilitation and achieving mine closure outcomes that are both economically feasible and allow the return of the forest landform, soil profile, vegetation, and pre-mining land use.

Conversely, mining of bauxite and mineral sands has occurred since the 1960s and involves laterally extensive but relatively shallow excavation of mineral ore material and smaller volumes of material transfer. While usually affecting more substantial areas of forest than open cut mining, these operations more readily permit progressive rehabilitation and return of landform and soil conditions that enables establishment of ecosystems resembling natural forests.

Mineral and petroleum exploration and development may be approved within the planning area subject to requirements for assessment and approval under relevant legislation. Each year, approximately 1000 hectares of State forests and timber reserves are subject to mining and petroleum operations, principally for extraction of bauxite (Darling Scarp north and east from Collie), coal (east of Collie) and gold (near Boddington). This could increase in the future with expansion of existing operations, and if new mineral or petroleum deposits are identified and additional resource development proposals are approved.

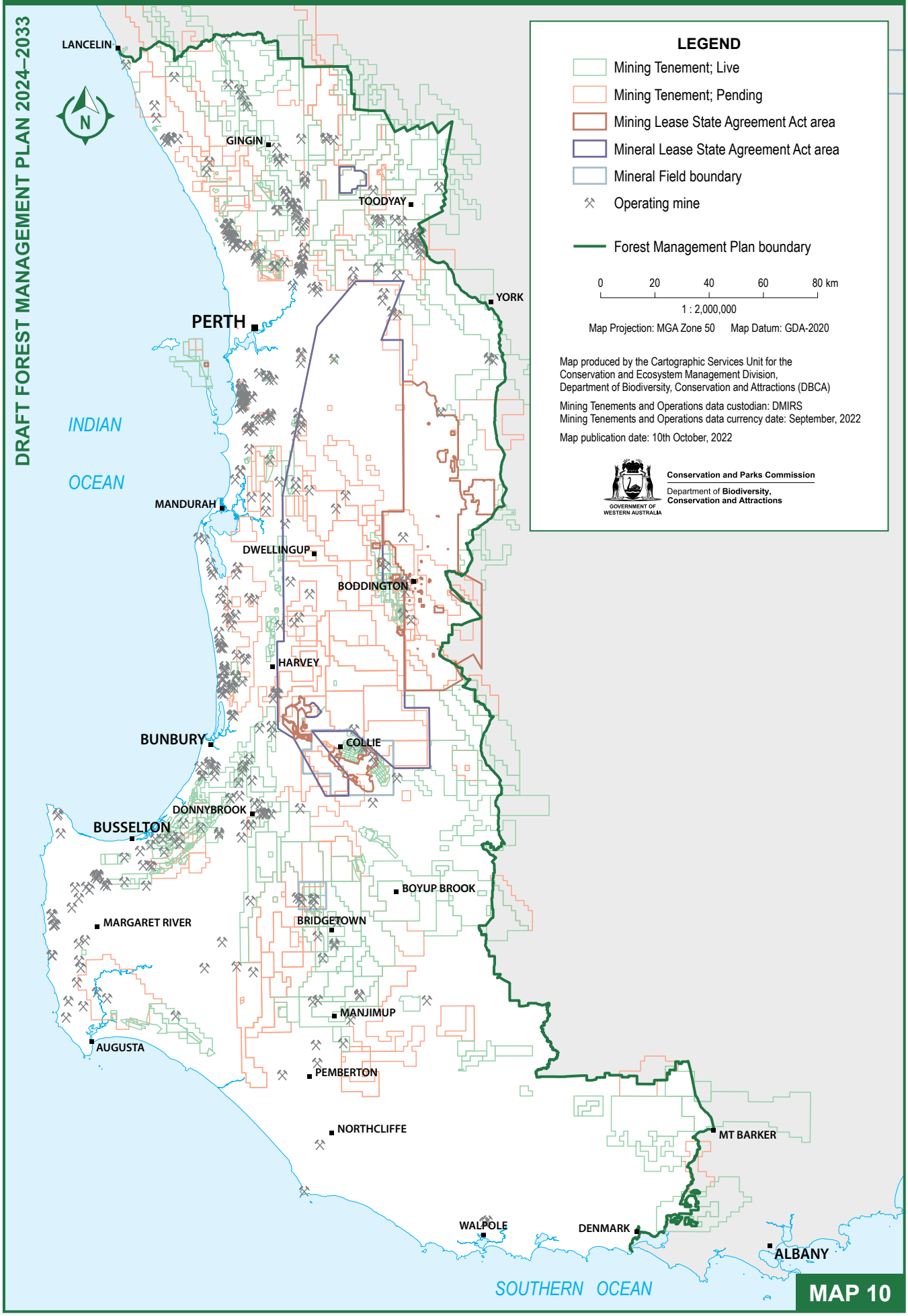
Exploration, extraction, and rehabilitation activities are primarily approved and governed by processes managed by other government agencies under legislation such as the EP Act, *Mining Act 1978* (Mining Act), *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) and various State Agreement Acts. The Minister for Environment has a role in many of these decisions and there is considerable input from the Commission and the department in relation to processes associated with assessment and approvals, oversight of current operations, development of rehabilitation requirements (including completion criteria) and post hand-back management of rehabilitated sites (see section 5.5.9).

While many areas affected by resource development activities are rehabilitated following disturbance, there may be enduring impacts on landform, habitat and biodiversity, soils, water, carbon, forest produce, and recreation values. In certain soil types, activities that alter groundwater levels have the potential to cause soil acidification, commonly through exposure of iron sulphides to air.

There has been an evolution of approval requirements and case-by-case assessment of resource development proposals over many decades. This has resulted in multiple rehabilitation prescriptions, completion criteria and closure and relinquishment processes established under State Agreement provisions, EP Act approvals conditions, Mining or PGER Act requirements and other arrangements for mining companies.

Opposite *Map 10 Mining tenements and operations*

MINING TENEMENTS AND OPERATIONS



4.3 Inappropriate fire regimes

The south-west forest landscapes have evolved in the presence of fire. The biota of forest and shrubland ecosystems is resilient to a range of fire frequency and most flora and fauna species have adapted to coexist with fire to some extent. Species have a range of mechanisms to either survive through fire or recolonise into recovering habitat after fire. Fire becomes a threat to biodiversity and forest health if it lies outside the normal range of fire regimes.

Fire at varying frequency and intensity has been a periodic disturbance to ecosystems within the planning area, contributing to essential nutrient cycling, germination and habitat regeneration processes.

Warmer, drier conditions will influence the flammability of vegetation, particularly during periods of extended drought. An increased frequency of drought and heatwave events may increase the likelihood of bushfires starting and decrease the likelihood of their rapid suppression (Di Virgilio *et al.* 2019).

Large, high-intensity bushfires can be a threat to many values, including human communities and forest health. The short-term impacts of high severity fires include the loss of greater numbers of animals, changed plant composition, loss of habitat and refugia for wildlife, and longer times for recovery and recolonisation of affected areas. Loss of vegetation can cause soil erosion and sedimentation of waterways. Recovery can also be significantly hampered by weeds and feral animals. All of these can result in a changed trajectory with the system never returning to the pre-fire state.

Increased drought and heatwaves also influence the resilience of populations and ecosystems to fire. These conditions affect pre-fire seedbanks, resprouting resources for plants, condition of fauna, and make conditions for recovery of seedlings, and young animals after fire more challenging.

4.4 Weeds

Weeds are transforming Western Australia's landscapes, including the south-west forests. They pose a serious threat to ecosystem health, resilience and vitality. Many weeds are successfully invading natural areas, where they can disrupt or modify ecosystem processes, adversely impacting biological diversity at genetic, species and community levels.

Competition from weeds impacts many threatened flora and ecological communities in the planning area, particularly those restricted to small, disturbed areas highly vulnerable to invasion. Weeds can have an adverse effect on Noongar cultural heritage values. They can also increase fuel loads, affecting both the occurrence and frequency of bushfires.

There are 76 high priority weed species identified in the planning area. Of these, seven species are common – bridal creeper (*Asparagus asparagoides*), gladioli (*Gladiolous* sp.), narrowleaf cottonbush (*Gomphocarpus fruticocus*), blackberry (*Rubus* spp.), cape tulip (*Moraea* spp.), Victorian tea tree (*Leptospermum laevigatum*) and arum lily (*Zantedeschia aethiopica*). The department seeks to identify, monitor and manage these species where possible.

Periwinkle *weed, Beelu National Park - Lyn Marshall, DBCA*

4.5 Pest animals

4.5.1 Pest vertebrates

Pest animals can present major threats to the health, resilience and vitality of forest ecosystems.

Vertebrate pest animals are often exotic species but may also include native Australian animals outside their natural range (for example, kookaburras, *Dacelo novaeguineae)* or native species that can have an undesirable impact on the ecosystem or forest values/assets (for example, grazing marsupials).

The European red fox and feral cat are the major causes of the decline or extinction of many Australian mammal species (Woinarski *et al.* 2015; Stobo-Wilson *et al.* 2022). Feral cat and fox activity is greatest, and native species most vulnerable, following disturbances such as fire and vegetation clearing (McGregor *et al.* 2016).

Fox captured on remote camera - DBCA

The arrival of the fox in the south-west region in the late 1920s coincided with a steep decline in the numbers of smaller native mammals in the southern part of the State. The effect of foxes on native fauna is emphasised by monitoring that identified areas baited for foxes had three times more individuals of native terrestrial vertebrates than areas not subject to fox management (Wayne *et al*. 2011).

Feral cats have a broad diet, taking prey up to the size of a koomal and quokka. In Western Australia, mammal, bird, frog, reptile and fish species are vulnerable to predation by feral cats. Key native species that have experienced declines in the planning area due to feral cat predation include woylie/walyo, koomal, tjooditj, kwenda, numbat, western ground parrot, Gilberts potoroo and quokka.

Feral pigs (*Sus scrofa*) have multiple impacts on biodiversity values such as destroying vegetation leading to erosion along watercourses and siltation of waterways, outcompeting native animals for food, consuming eggs of native species and facilitating the spread of *Phytophthora* dieback. Those impacts are particularly evident along watercourses and in swampy areas. Seven genetically differentiated populations of feral pigs have been detected in the south-west region (Spencer and Hampton 2005) with six of these occurring within the planning area. Due to habitat requirements the movement and dispersal of feral pigs occurs primarily along water courses (Hampton 2003), and from their illegal movement, presumably by recreational hunters (Spencer and Hampton 2005).

Feral pigs Dwellingup - Stephen Crane, DBCA

Three species of deer have established free-ranging populations in Western Australia (Long 2003). Distribution and abundance of feral deer in the planning area are believed to be small and localised. Feral deer are known to occur in the Lake Muir, Perth Hills, and Harvey areas. They can significantly impact vegetation communities, spread weeds, and cause soil erosion.

4.5.2 Pest invertebrates

Invertebrate threats to forest ecosystem and plantation health arise from two sources: endemic insects which outbreak, or invasion by exotic pests.

The two most notable endemic insect pests of forest trees in the planning area are jarrah leaf miner and gum leaf skeletoniser, which can cause widespread, temporary canopy defoliation. Research by the department suggests that drier, warmer winters and autumn drought expected with climate change may lead to more frequent outbreaks of gum leaf skeletoniser but may result in reduced impacts from jarrah leaf miner.

Other endemic invertebrate pests with consequences for tree health (particularly in overstocked regenerating stands) include endemic longicorn borers (*Phoracantha* spp.). These species are known to be responsive to physiological stress in trees induced by extremes of temperature and drought. Some tree decline syndromes such as wandoo decline result from an interaction of both pathogen and insect responses to a drying climate.

Feral bees compete with native bees, can displace native fauna from tree hollows, and can disrupt pollination mechanisms of native flora. Competition for hollows by introduced species such as feral bees also limits availability for native species. Feral bees and hives can also occupy recreation infrastructure and aggregate at water sources, disrupting their amenity.

There are numerous other potential pest species not yet detected in Australia that have the potential to damage forest health if introduced. Biosecurity is essential to protect forest ecosystems from potential future pest outbreaks.

4.6 Diseases

The agents of plant disease and tree decline can be biotic, abiotic, or a combination of both. Abiotic plant diseases occur when plants are exposed, often over extended periods, to sub-optimal conditions. Under a changing climate, these conditions are predicted to increase in intensity and duration in the south-west region, placing additional stress on plant communities. Plant pathogens, which are biotic factors, are known to contribute to 'tree declines' that have been observed for several decades in the south-west forests, affecting a range of key species including tuart, flooded gum, wandoo, red tingle (*E. jacksonii*) and marri.

Phytophthora dieback attacks the roots of plants, cutting off water and nutrients to the crown (leaves and branches), resulting in plant death. In Western Australia's south-west bioregion, more than 40 percent of native plant species are considered susceptible to the disease including many banksia, hakea, eucalypt and grass-tree species. Threatened flora are at even greater risk with around 56 percent being considered susceptible (Shearer *et al.* 2004).

Apart from the direct impacts of *P. cinnamomi*, the indirect effects of loss of canopy and understorey and increased area of bare ground are thought to extend to groups of fauna and non-susceptible flora, natural and cultural heritage values, carbon stores, soil microbial profiles, site hydrology, susceptibility to fire, and weed invasion.

As of December 2021, at least 242,100 hectares of CALM Act lands in the planning area are known to be infested with *P. cinnamomi* (see Map 11). Several other *Phytophthora* species contribute to the decline in health of forest ecosystems, though further research is required to ascertain their importance and to develop appropriate management responses.

There are other key biosecurity threats of management significance should they spread to the forests in the planning area. One example is the polyphagous shot-hole borer (*Euwallacea fornicates*), a tiny beetle native to south-east Asia which has a symbiotic relationship with *Fusarium* fungus. Polyphagous shot-hole borer is known to cause *Fusarium* dieback in over 400 host species overseas, and is recognised as a significant environmental, forestry and agricultural pest.

Myrtle rust on wandoo - L Morin, CSIRO

Myrtle rust (*Austropuccinia psidii*) is another threat which is established in eastern Australia and recently detected in northern Western Australia. Myrtle rust could have major impacts in our south-west forests if it is introduced, causing dieback and death of Myrtaceous plants, which include eucalypts, bottlebrushes, peppermint trees and melaleucas.

There are several tree declines in the south-west of Western Australia that have been in progress for several decades affecting tuart, flooded gum, wandoo, red tingle as well as marri canker and blight. Several plant pathogens are implicated as contributing factors in tree declines: *P. multivora* in tuart decline, *P. multivora* and several other *Phytophthora* species in flooded-gum decline. The native fungal plant pathogen *Quambalaria coyrecup* is the main contributing and highly visible factor in marri canker, and where *Phytophthora* species are present the incidence of marri canker is greater. Human disturbance appears to be a consistent predisposing factor in tree decline (Sapsford *et al.* 2021).

Opposite *Map 11 Phytophthora dieback occurence*


PHYTOPHTHORA DIEBACK OCCURRENCE
DRAFT FOREST MANAGEMENT PLAN 2024–2033
LEGEND
Phytophthora dieback occurrence, intensive field survey[1]
Remnant vegetation
Annual rainfall isohyets
Forest Management Plan boundary
[1] Compilation of data collected at varying times over last 45 years, not adjusted for subsequent spread
0 20 40 60 80 km
1 : 2,000,000
Map Projection: MGA Zone 50 Map Datum: GDA-2020
Map produced by the Cartographic Services Unit for the Conservation and Ecosystem Management Division, Department of Biodiversity, Conservation and Attractions (DBCA)
Dieback infestation data custodian: DBCA
Dieback infestation data currency date: December, 2021
Rainfall isohyets data custodian: BOM
Rainfall isohyets data currency date: variable
Map publication date: 10th October, 2022
Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions
LANCELIN
GINGIN
TOODYAY
YORK
PERTH
INDIAN
OCEAN
MANDURAH
DWELLINGUP
BODDINGTON
HARVEY
BUNBURY
COLLIE
BUSSELTON
DONNYBROOK
BOYUP BROOK
MARGARET RIVER
BRIDGETOWN
MANJIMUP
AUGUSTA
PEMBERTON
NORTHCLIFFE
MT BARKER
WALPOLE
DENMARK
ALBANY
SOUTHERN OCEAN
MAP 11

4.7 Unauthorised activities

Unauthorised activities can cause environmental degradation, destruction or degradation of Noongar cultural heritage sites, affect visitor experience and satisfaction, and impact visual quality and amenity of the planning area.

Illegal dumping, Perth Hills - Doug Giles, DBCA

The most common unauthorised activities in south-west forests are illegal dumping, off-road vehicles and bikes, unsanctioned tracks and trails and collection of firewood in unsanctioned areas. Unlawful vegetation clearing, illegal campfires, large gatherings and parties have also been identified as management challenges for the department.

Community feedback indicates concern about the level of illegal dumping and littering in forests and highlights the need to restrict vehicles off-road, particularly in disease risk areas and sensitive sites. In other locations, there may be a need to identify additional designated areas for off-road vehicle users.

4.8 Other native vegetation clearing

As discussed in Section 4.2, clearing of native vegetation may be authorised by other decision-making authorities, consistent with the relevant legislation. The department may also authorise clearing of native vegetation in accordance with the CALM and BC Acts.

Maintaining the total area of forest and minimising fragmentation arising from permanent clearing are key elements of biodiversity conservation strategies. Historically a large network of infrastructure associated with essential public or private utilities has been developed on lands (primarily State forest) vested in the Commission within the planning area. Applications for these activities are considered by the department on a case-by-case basis. Clearing followed by revegetation occurs in areas associated with a number of non-permanent disturbance activities.

At a local level, vegetation clearing may be undertaken by the department for activities such as fenceline or firebreak construction, or for recreation site developments, and track and trail alignments. As well as the direct loss of native vegetation and habitat, permanent infrastructure corridors, tracks and trails can increase opportunities for the introduction and spread of weeds, pest animals and plant diseases such as *Phytophthora* dieback.

4.9 Soil degradation

Soils degraded through erosion, compaction or salinisation have altered chemical properties which can adversely affect associated ecosystem and hydrologic processes and water quality. Activities which result in major soil disturbance include the use of heavy vehicles, road construction and maintenance, planned and unplanned fire, and excavation of acid sulphate soils. Chemical contamination of soil can result from the misuse or spills of solvents, pesticides, herbicides and fuel spills. Disturbance to vegetation from mining, prescribed burning, pest animals, grazing, roading, and other approved activities, can cause erosion and may result in decreased soil fertility, increased surface water flows and sediment delivery to streams and rivers.

Access road Perth Hills - DBCA

Whilst anecdotal evidence suggests that climate induced lowering of groundwater may reduce salinity risks within forested catchments, salinisation of valley floors and stream salinity remains a problem originating from cleared areas in the vicinity of the planning area. Management of salinity on these lands is not subject to this plan.

In certain soil types, activities that alter groundwater levels have the potential to cause soil acidification, commonly through exposure of iron sulphides to air. Activities that may activate acid sulfate soils include mining, road construction, excavation, as well as direct drawdown of groundwater by pumping.

5 Part C – Managing our south-west forests

Pemberton Pools, Pemberton - Tourism Western Australia

Combined with other pressures – invasive pest animals, weed and plant disease spread, high intensity bushfires and human use – the cumulative effects of climate change are likely to have significant impacts on some south-west landscapes. In a recent global review of future climate impacts on Mediterranean biomes (including the jarrah/marri forests) Safford and Vallejo (2019) considered changes in forest structure, function, composition and dynamics are inevitable but of uncertain magnitude and direction.

Safford and Vallejo (2019) concluded that a range of active management tactics undertaken within an adaptive management framework should be considered to increase resilience of forest ecosystems to further impacts. These include:

- maintaining a comprehensive conservation reserve system, with complementary management for biodiversity outcomes in broader landscapes
- providing for habitat connectivity to assist species migration and habitat protection across scales of management, through the retention of vegetated corridors or zones
- increasing landscape and habitat heterogeneity
- implementing active or passive forest treatments that restore resilience at large spatial scales, such as reducing drought stress, fire risks, and/or reducing forest density and homogeneity, and
- mitigating threats posed by invasive species, diseases, deforestation or land use changes.

The strategic goals, management objectives and management activities developed in this plan are responsive to these recommended tactics.

The operative text of the plan, as required by section 55 of the CALM Act is contained in Parts C and D and any associated appendices.

These Parts describe the policies and guidelines proposed to be followed and the purpose, term and operations of the plan proposed to be undertaken during the term of the plan. Parts C and D indicate how the reserves in the planning area will be managed in accordance with the CALM and BC Acts, other departmental policies and other legislation.

The strategic goals have been developed in the context of relevant legislation, government policy, Commission and

departmental policy, community feedback, ESFM principles and Montreal Process Criteria. Under each strategic goal, management objectives and activities have been designed to address identified pressures and/or protect specific values that reflect the objectives of the CALM Act. Each strategic goal also has a KPI, which is comprised of measures (indicators of effectiveness in achieving management objectives) and targets (specific end points of management; providing a benchmark to assess the level of success of management responses).

The strategic goals are presented in Part C as four management foundations:

1. Noongar cultural heritage and management partnerships
2. Biodiversity conservation
3. Forest health and climate resilience
4. Social and economic benefits and opportunities

Contextual information on policy (including management considerations) influencing management objectives and activities is included in each foundation. Existing Commission position statements[12] and DBCA policies[13] and guidelines that support, or have relevance to the management objectives and activities, are listed in the respective summaries.

There is a range of other regional, State and national policies and strategies that may be relevant to the plan. Where required, or appropriate, the Commission and the department endeavour to ensure that activities are aligned with these. These other documents are not necessarily identified within this plan.

It is important to note that many management activities support objectives across multiple foundations. To avoid duplication, management activities are allocated to a single foundation, which best represents that activity.

5.1 Term and operation of the plan

Subject to approval by the Minister for Environment this plan will come into operation on 1 January 2024 and unless amended, continue to operate until 31 December 2033. The gazetted plan will revoke and replace FMP 2014-2023. The plan will be implemented according to available resources.

The FMP reflects and gives effect to elements of the WA RFA, including establishment and ongoing enhancement of a CAR reserve system, addressing climate change implications on the sustainability of forest uses and appropriate periodic assessment. The bilateral RFA agreement largely removes the need for approvals under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) for forest operations undertaken in accordance with the RFA, recognising that State-level processes provide the necessary environmental controls. Wood sourced from an RFA forest is also exempt from requiring an export licence under the *Export Control Act 2020* (Cth).

In the following parts of this plan, reference is made to various policies and guidelines of the department (and in some cases, where relevant, those of others endorsed by the department). These policies and guidelines are strategic and address major business obligations, services and matters of corporate significance. These may be revised from time to time or be replaced during the term of the plan. Other relevant policies and guidelines may be developed during the term of the plan that the department (and others, where required) may also need to have regard to when undertaking proposed management activities.

5.2 Management context

CALM Act management plans are designed to achieve or promote the purpose for which land is reserved. In particular, section 56 of the CALM Act specifies the purposes for managing different land categories.

Indigenous State forests and timber reserves are managed for the purpose, or combination of purposes provided for in a management plan. Those purposes must be drawn from the purposes specified in section 55(1a) or prescribed in Regulation 81 of the Conservation and Land Management Regulations 2002 (CALM Regulations).

12 conservation.wa.gov.au/publications/position-statement

13 dbca.wa.gov.au/about/governance-and-corporate-documents-policies

Indigenous State forest and timber reserves will be managed under this plan for a combination of the following purposes:

- Conservation
- Recreation
- Water catchment protection and
- Each of the other purposes prescribed by Regulation 81.

The purposes prescribed by Regulation 81 allow the taking, storage and removal of water; the location of infrastructure, and other similar facilities that serve the public interest, to the extent to which this is not inconsistent with the other purposes for which the land is reserved; and the removal of salvaged forest products, if the opportunity for the salvage arises from an activity carried out for a conservation purpose (for example, ecological thinning), clearing for mining, or clearing for infrastructure and other similar facilities that serve the public interest.

State forest or timber reserves which are planted with exotic species (plantations) are to be managed to achieve the optimum yield in production, consistent with the satisfaction of long-term social and economic needs.

The purpose of national and conservation parks is to fulfil so much of the demand for recreation, as is consistent with conservation of the natural environment, the protection of flora and fauna, and the preservation of any feature of archaeological, historic or scientific interest.

The purpose of nature reserves is to conserve the natural environment, protect, care for and promote the study of flora and fauna, and to preserve any feature of archaeological, historic or scientific interest.

Management of section 5(1)(g) and 5(1)(h) lands is based on the purpose for which the land has been vested.

In accordance with section 56(2) of the CALM Act, this management plan also has an overarching objective to protect and conserve the value of the land to the culture and heritage of Aboriginal people. This objective prevails over an objective set out in section 56(1) where they conflict or are inconsistent.

The strategic goals, management objectives and management activities in this plan have been designed to advance the purposes outlined above. Management activities will be differentially applied so that they are consistent with the purpose for which particular land is reserved. A description of the purposes that management objectives and activities contribute to and which land categories they apply to, is provided in each section within Part C.

5.3 Foundation 1: Noongar cultural heritage and management partnerships

Strategic goal: To value and protect Noongar cultural heritage and support Noongar Traditional Owner involvement.

Foundation 1 covers cooperative and joint management arrangements, how Noongar cultural heritage will be valued and protected and how Noongar Traditional Owners will be involved in forest management and the implementation of this plan.

5.3.1 Cooperative and joint management

Through the Settlement, Noongar people and the department will enter into formal agreements to recognise their mutual rights and obligations in managing the South West Conservation Estate (i.e. CALM Act land). These cooperative and joint management arrangements will be established in a two-staged process. See Map 4 and Appendix 5 for further details.

New partnerships offer the potential for improved understanding of Noongar traditional knowledge and customary practices with associated values, protocols and management systems applicable to forest management. These partnerships also highlight opportunities to integrate traditional knowledge with contemporary science, raise traditional owner awareness and understanding about the mutual benefits of existing practices and contribute to social and economic outcomes for Noongar people.

Elders, Aboriginal rangers, archeologists and DBCA staff discuss prescribed burn at William Bay National Park,Sonya Stewart, DBCA

Opportunities for employment will deliver a range of social, cultural and economic benefits for Aboriginal people across boodjar, and align closely with whole-of-government initiatives such as Closing the Gap[14], the Aboriginal Empowerment Strategy[15], and the Aboriginal Procurement Policy[16].

5.3.2 Protection of Noongar cultural heritage

Significant progress has been made by the department over the last decade in recognising and understanding what the concept of protecting and conserving the value of the land to the cultural heritage of Aboriginal persons entails. Aboriginal cultural heritage values are dynamic and all encompassing, and include physical, spiritual and social elements that are both tangible and intangible. As well as focusing on protection of tangible values such as culturally significant sites, this plan recognises the broader landscape and intangible values and concepts including traditional knowledge, cultural responsibilities and practices, and associations with specific plants and animals.

All Aboriginal sites, registered or otherwise, are protected under the *Aboriginal Heritage Act 1972* (AH Act). The *Aboriginal Cultural Heritage Act 2021* (once commenced) will replace the AH Act and offer improved protection for significant sites and Aboriginal cultural heritage. This legislation allows for special heritage places, including cultural landscapes, to be named as Protected Areas.

Provisions of the CALM Act enable Aboriginal people to access country and undertake customary activities, such as hunting and gathering food and medicine, camping outside designated camping sites, and engaging in artistic or ceremonial activities on land vested in the Commission. While most customary activities can be carried out without impacting on biodiversity and public safety, regulations exist that restrict customary activities where there are real and significant risks to public safety and flora and fauna values. If Noongar people wish to undertake restricted activities, informal agreements known as local area arrangements can be negotiated between DBCA and specific groups and families to ensure public safety and the protection of both the cultural and environmental values of country.

A summary of management objectives and management activities (management directions) and related policies and guidelines for Foundation 1 – Noongar cultural heritage and management partnerships is outlined in Table 3, with the associated KPI outlined in Table 4. Management directions for this foundation are not specific to a land category and contribute to the purpose of determining the value of the land to the culture and heritage of Aboriginal people.

14 closingthegap.gov.au

15 wa.gov.au/organisation/department-of-the-premier-and cabinet/aboriginal-empowerment-strategy-western-australia-2021-2029

16 wa.gov.au/government/publications/general-procurement-direction-202108-aboriginal-procurement-policy

Table 3: Summary of management directions for Noongar cultural heritage and management partnerships.

Key points and considerations	
• The Noongar people are recognised as traditional owners of the south-west region of Western Australia and the planning area. • Noongar Traditional Owners have responsibilities for looking after boodjar (land/country). • Noongar people bring unique kadidjiny (knowledge), perspectives of boodjar and its biodiversity and have a duty to pass on knowledge to younger generations and help Noongar culture to remain strong. • A large number of significant Noongar sites have been recorded in the planning area, many of which are still used today. Other culturally important sites and places are not registered. • The Noongar peoples' strong relationship to boodjar is reflected in the many components of the Settlement, including cooperative and joint management arrangements of the South West Conservation Estate. The planning area constitutes about two-thirds of the Estate.	
Management objectives	**Management activities**
1. Partner with Noongar Traditional Owners through Cooperative Management Committees to protect Noongar cultural heritage values in the planning area.	Collaborate with Noongar Traditional Owners to protect cultural heritage in accordance with the Aboriginal Cultural Heritage Act and protocols established under Cooperative Management Agreements and Cooperative Management Committees.
	Promote awareness of Noongar cultural heritage values with departmental staff, volunteers and contractors.
2. Support Noongar Traditional Owners to carry out customary activities in the planning area.	Explore opportunities with Noongar Traditional Owners to determine sites of high cultural sensitivity in the planning area that may require special protection including access arrangements.
	Continue to facilitate and support Noongar customary activities.
3. Support Noongar employment and economic development opportunities in the planning area.	Through cooperative and joint management arrangements, consider approaches for sharing knowledge of Noongar kadidjiny and western science into forest management.
	Endeavour to increase employment and training of Noongar Traditional Owners to participate in on-ground management in the planning area.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 18: Value of the land to Aboriginal persons Corporate Policy Statement 86: Aboriginal customary activities Corporate Policy Statement 87: Aboriginal joint management Corporate Guideline 11: Development and management of Aboriginal joint management arrangements Corporate Guideline 22: Aboriginal customary activities	

Table 4: Key performance indicator: Foundation 1

Engagement and involvement of Noongar Traditional Owners in management of lands covered by the plan	
Strategic goal	To value and protect Noongar cultural heritage and support Noongar Traditional Owner involvement.
Performance measures	**Management targets**
Level of engagement with Noongar Traditional Owners through Cooperative Management Committees, including employment and economic opportunities.	Cooperative Management Committees provide input to support management, employment and economic development, to further the terms of the Settlement.
Noongar Traditional Owners are able to access the planning area for customary activities and fulfilling responsibilities to boodjar (land/country) and culture.	Local area arrangements and protocols for customary activities continue to be established and implemented within each ILUA area covered by the plan.

5.4 Foundation 2: Biodiversity conservation

Strategic goal: To conserve biodiversity and support ecosystem resilience.

Biodiversity of south-west forests is a key value that is highly regarded by the community and a fundamental consideration of ESFM. This foundation covers three related aspects of biodiversity conservation:

1. Maintaining and expanding the conservation reserve system across the planning area.
2. Conserving biodiversity and biodiversity components, utilising the frameworks that the department uses to plan for, and manage biodiversity.
3. Managing and reducing the impact of permitted disturbance activities on biodiversity, through advisory and rehabilitation processes.

5.4.1 Maintaining and expanding the conservation reserve system

Previous FMPs have identified significant additions to the conservation reserve system, which when formally implemented will meet the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* (Commonwealth of Australia 1997). A description of the various reserve categories, classifications, and purposes relevant to the planning area is provided in Appendix 1a. Proposed reserve categories are shown in Map 12 and listed in Appendix 6.

For the period of this plan, maintaining and expanding the CAR reserve system through implementing the 320,360 hectares of commitments identified in previous FMPs is a priority. Consultation with the relevant agencies on some of these earlier proposals is in progress, while others are yet to commence.

In addition, this plan provides for a process to investigate areas of State forest and timber reserves that are no longer available for large-scale commercial timber harvesting for inclusion in new or expanded conservation reserves, including national parks, conservation parks and nature reserves, following consideration of anticipated future activities and uses. Determining appropriate reserve boundaries and type will occur in consultation with traditional owners and stakeholders, including the resources sector, conservation groups, local government and other parties.

There is also an opportunity to include areas of regrowth forest, after they have been ecologically thinned, into new or expanded conservation reserves. Together, these processes will lead to improved protection for at least 400,000 hectares. Ecological thinning candidate areas are shown on Map 13 as indicative areas for increased protection.

Consideration of the remainder of State forest (other than plantations) will be undertaken for addition to the conservation reserve system, including in State Agreement Act areas, noting the agreement of the relevant party will be required.

These investigations will lead to progressive additions to the conservation reserve system over the life of this plan. Indicative areas for increased protection that will be investigated through this process are illustrated in Map 13. Percentage representation of forest ecosystems in existing and proposed reserves, and indicative areas for improved protection, is provided in Appendix 7.

DBCA will initiate the processes for land category changes proposed by undertaking fine scale reserve design for indicative areas for increased protection. Following the reserve design and consultation process, DBCA will consult with the Commission prior to advising the Minister for Environment on recommended final reserve boundaries. Formal tenure proposals are subject to a number of considerations, including consultation processes, Statewide priorities and available funding. These processes are often lengthy and dependent on available resources to complete.

This plan proposes activities at the whole of forest scale for the purpose of complementing the function of the formal conservation reserve system in the conservation of biodiversity. FMP 2014-2023 applied several mechanisms to achieve this outcome, including forest conservation areas (FCAs), established under section 62(1) of the CALM Act. FCAs were applied in locations where there was an impediment to being considered for a formal reserve category (for example resource development) but where maintenance of biodiversity values was a priority. In FMP 2014-2023 FCAs were not available for timber harvesting.

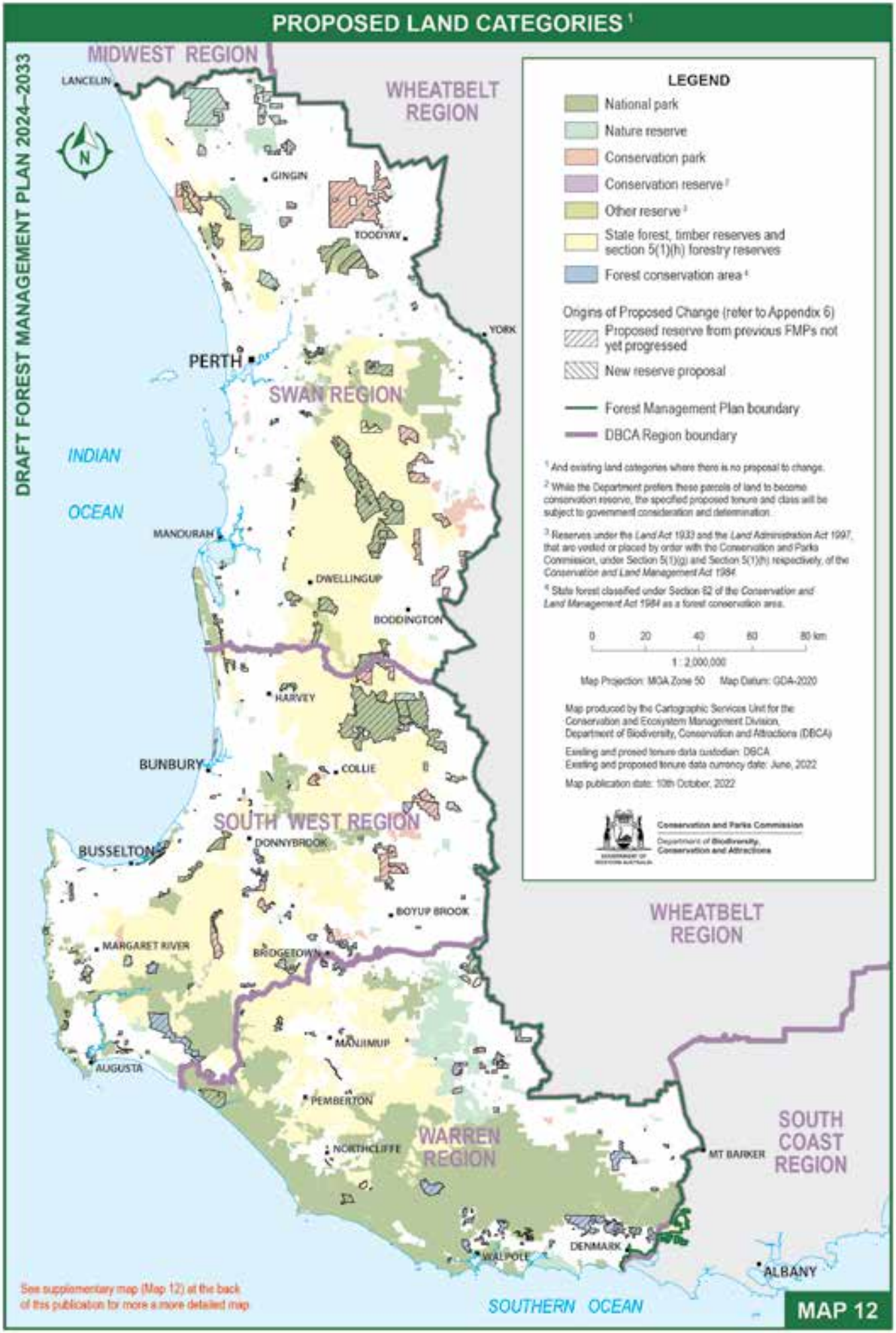
Areas that have been identified in the two prior FMPs as FCAs will be reviewed for the suitability of that classification. FCAs may be applied through the land category review process where it provides an additional mechanism to restrict specific activities in designated areas in order to maintain biodiversity values.

In addition, FMP 2014-2023 continued a network of areas defined as 'Informal reserves', and revised a network of Fauna Habitat Zones, all of which were identified and managed to prevent or minimise disturbance on particular forest values, primarily from timber harvesting.

Informal reserves are relatively undisturbed areas distributed across State forest and timber reserves to protect aquatic ecosystems, provide connectivity, landscape heterogeneity and stand structural complexity, thereby making an important contribution to conservation outcomes. It is intended to maintain the system of Informal reserves and Fauna Habitat Zones within State forest and timber reserves, as a means of continuing to minimise disturbance to the values they contain. It is proposed that Informal reserves and Fauna Habitat Zones collectively be renamed as Disturbance Avoidance Zones. Definitions of these zones are provided in Appendix 1d.

Old-growth forest outside the formal reserve system was previously an informal reserve type, that was primarily identified only prior to disturbance activities occurring. There may be additional areas of old-growth forests yet to be identified, which would be included in the Disturbance Avoidance Zone network.

A summary of management directions for maintaining and expanding the conservation reserve system is outlined in Table 5, with the associated KPI for Foundation 2 – Biodiversity conservation outlined in Table 8. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. With respect to State forest and timber reserves, these directions also support purposes of recreation and water catchment protection.


PROPOSED LAND CATEGORIES [1]
DRAFT FOREST MANAGEMENT PLAN 2024–2033
MIDWEST REGION
WHEATBELT REGION
LANCELIN
GINGIN
TOODYAY
YORK
PERTH
SWAN REGION
INDIAN
OCEAN
MANDURAH
DWELLINGUP
BODDINGTON
HARVEY
BUNBURY
COLLIE
SOUTH WEST REGION
BUSSELTON
DONNYBROOK
BOYUP BROOK
WHEATBELT REGION
MARGARET RIVER
BRIDGETOWN
MANJIMUP
AUGUSTA
PEMBERTON
NORTHCLIFFE
WARREN REGION
MT BARKER
SOUTH COAST REGION
WALPOLE
DENMARK
ALBANY
SOUTHERN OCEAN
LEGEND
National park
Nature reserve
Conservation park
Conservation reserve [2]
Other reserve [3]
State forest, timber reserves and section 5(1)(h) forestry reserves
Forest conservation area [4]
Origins of Proposed Change (refer to Appendix 6)
Proposed reserve from previous FMPs not yet progressed
New reserve proposal
Forest Management Plan boundary
DBCA Region boundary
[1] And existing land categories where there is no proposal to change.
[2] While the Department prefers these parcels of land to become conservation reserve, the specified proposed tenure and class will be subject to government consideration and determination.
[3] Reserves under the Land Act 1933 and the Land Administration Act 1997, that are vested or placed by order with the Conservation and Parks Commission, under Section 5(1)(g) and Section 5(1)(h) respectively, of the Conservation and Land Management Act 1984.
[4] State forest classified under Section 62 of the Conservation and Land Management Act 1984 as a forest conservation area.
0 20 40 60 80 km
1 : 2,000,000
Map Projection: MGA Zone 50 Map Datum: GDA-2020
Map produced by the Cartographic Services Unit for the Conservation and Ecosystem Management Division, Department of Biodiversity, Conservation and Attractions (DBCA)
Existing and proposed tenure data custodian: DBCA
Existing and proposed tenure data currency date: June, 2022
Map publication date: 10th October, 2022
Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions
See supplementary map (Map 12) at the back of this publication for more a more detailed map
MAP 12

Opposite *Map 12 Proposed land categories*

Table 5: Summary of management directions for maintaining and expanding the conservation reserve system

Key points and considerations	
• The establishment and maintenance of a CAR reserve system is fundamental to the conservation of biodiversity in the planning area. • Existing proposals for creation of reserves are to be carried forward in this plan. • Areas of State forest and timber reserves are proposed to transition to different conservation classifications. • Informal reserves and Fauna Habitat Zones are proposed to be collectively renamed as Disturbance Avoidance Zones. • Old-growth forest remains a key value within the conservation reserve system.	
Management objectives	**Management activities**
1. Conserve biodiversity and self-sustaining populations of native species and communities through a system of reserves that is comprehensive, adequate and representative.	Progressively review and implement tenure changes to achieve reservation targets (Appendix 6).
	Progressively assess indicative areas for increased protection based on reserve design principles, and traditional owner and stakeholder consultation processes.
	Pursue opportunities to implement land category changes for indicative areas for increased protection.
	Make decisions on proposed activities or permitted disturbances in areas proposed for reserves (Appendix 6) consistent with the intended land category.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 2: Implementation of conservation reserve proposals Corporate Policy Statement 36: Conservation reserve system Corporate Policy Statement 62: Identification and management of wilderness and surrounding areas	

5.4.2 Conserving biodiversity

The department has a strong focus on conserving biodiversity, both within the conservation reserve system and across the wider landscape. Populations of threatened and priority flora and fauna, and TECs and PECs, occur within the planning area and protection of these is considered through processes relating to species and communities listing, determining conservation status and recovery planning.

The BC Act provides a statutory basis for the listing of threatened species, specially protected species, TECs, critical habitat and key threatening processes. Priority plants, animals and ecological communities are possibly threatened but do not meet listing criteria because they are poorly known (for example, do not meet survey criteria or are data deficient) or they are adequately known but are rare, near threatened, or have been recently removed from the threatened species list.

Guidance documents, such as recovery plans and other approaches can be prepared for the conservation, protection and management for one or more threatened species or TECs, or a combination of threatened species and TECs. Under the BC Act a recovery plan must provide for research and management actions to stop the decline, and support the recovery, of each threatened species or threatened ecological community so that its chances of long-term survival in the wild are maximised. Interim recovery plans may be prepared where a plan is required but where there is insufficient data available to prepare a full recovery plan. Lists of threatened flora, fauna, and threatened and priority ecological communities that have recovery plans are available on the DBCA website[17].

Biodiversity conservation is implemented through targeted management actions. These are informed by reserve

17 dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities

management plans, regional conservation plans that outline prioritised conservation actions for each of the three departmental regions in the planning area, and actions for threatened and priority species and ecological communities as identified in recovery plans, or by recovery teams. Actions may include protecting habitat, maintaining populations, surveys, population supplementation and translocations, monitoring, and undertaking research to address knowledge gaps. Ex-situ conservation actions are also important to achieving successful biodiversity conservation outcomes, including seed banking, maintaining living collections and captive breeding.

In this regard, the FMP, regional conservation plans and other guidance documents are complementary and identify priority conservation actions to be undertaken to maintain or improve status and condition of key biodiversity values.

A summary of management directions for integrated planning for biodiversity is outlined in Table 6, with the associated key performance indicator for Foundation 2 – Biodiversity conservation outlined in Table 8. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose.

Table 6: Summary of management directions for conserving biodiversity

Key points and considerations	
• South-west forests are rich in biodiversity at genetic, species and ecosystem levels. • Biodiversity conservation planning processes are undertaken to ensure that threatened and priority species and communities, particularly in the conservation reserve system, are managed. • Management under the FMP complements regional conservation plans, reserve management plans and recovery plans for threatened species and communities. • Priority conservation actions will be undertaken to manage and conserve biodiversity and biodiversity components and support ecosystem resilience.	
Management objectives	**Management activities**
1. Conserve and protect biodiversity including threatened and priority species and ecological communities in the planning area.	Where possible implement priority conservation actions and undertake monitoring for biodiversity.
	Undertake research into conservation of biodiversity to inform management actions.
	Undertake targeted biological surveys in poorly sampled forest ecosystems where required to improve understanding of biodiversity and inform conservation management actions.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 35: Conserving threatened species and ecological communities Corporate Guideline 35: Listing and recovery of threatened species and ecological communities Corporate Guideline 36: Recovery of threatened species through translocation and captive breeding or propagation Corporate Guideline 37: Assessing risks to the conservation of biodiversity associated with threatened species and threatened ecological communities	

5.4.3 Managing permitted disturbance activities

Different types of permitted disturbance activities have different impacts, varying in scale and duration. Key large-scale disturbances with potentially significant impacts on biodiversity include mining activities, and regional infrastructure development and maintenance.

Exploration, extraction and rehabilitation activities relating to resource development activities (mining or petroleum) operations and infrastructure are predominantly approved through processes managed by other government agencies under legislation such as the EP Act, Mining Act, PGER Act and State Agreements. The Commission and the department provide advice in relation to these processes, associated with protection and management of biodiversity values, approvals, oversight of proposals being implemented, development of rehabilitation requirements and completion criteria for hand-back of rehabilitated sites (also see 5.5.9 in Foundation 3).

This advice may relate to:

- avoiding, minimising, mitigating and/or offsetting the permanent loss of native vegetation and/or impacts on its integrity
- promoting the construction of linear infrastructure in corridors, while minimising construction in sensitive areas
- minimising impacts to cultural values, visual amenity, natural scenic qualities, and significant landscapes, and
- determining post disturbance land use.

The department's Disturbance Approval System (DAS) is used to assess impacts of planned disturbance activities or necessary operations on CALM Act lands, other than from resource development activities. The purpose of DAS is to inform the assessment of risk to environmental, social and economic values of a proposed activity. This helps to ensure approved activities are consistent with departmental objectives, management plans and land use categories and minimises impacts on identified values to as low as reasonably practicable.

DAS provides a comprehensive checklist of environmental and cultural assessment questions consistent with the seven Montreal Criteria to ensure that all relevant factors of a proposed disturbance are assessed. Amongst other factors, populations and occurrences of threatened species and communities are considered and any measures to protect them are determined and included in the conditions of approval, if granted by the department. The system provides a consistent, accessible mechanism for all disturbance activities (except resource development activities) to be assessed, enabling consideration to be given to avoiding or mitigating impacts on biodiversity and conservation assets.

Numerous planned disturbances and developments proposed by the department and other proponents require assessment and management through DAS. These include recreation site development, access maintenance, and work carried out on boundaries of prescribed burns and bushfires. It is proposed that individual ecological thinning operations will also be assessed and managed through DAS.

Given the potential cumulative, long-term impacts on biodiversity and the conservation reserve system from disturbances and developments, this plan includes a number of proposed management activities.

A summary of management directions for managing permitted disturbance activities is outlined in Table 7, with the associated KPI for Foundation 2 – Biodiversity conservation outlined in Table 8. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. With respect to State forest and timber reserves, these directions also support purposes of recreation and water catchment protection.

Table 7: Summary of management directions for managing permitted disturbance activities

Key points and considerations	
• Key permitted disturbances with potential impacts on biodiversity are resource development activities, infrastructure development and maintenance, work carried out on boundaries of prescribed burns and bushfires, and ecological thinning. • The department's DAS enables assessment of planned disturbance activities on CALM Act lands, to avoid, minimise, manage and/or mitigate impacts on biodiversity and other values (such as ground and surface water). • The Commission and the department provide advice to the approval processes for resource development and infrastructure, oversight of current operations, development of rehabilitation requirements and completion criteria for hand-back of rehabilitated sites.	
Management objectives	**Management activities**
1. Manage and minimise the impact of permitted disturbance activities, development and infrastructure projects on values of the planning area.	Provide advice on the impacts of proposed disturbance activities, development and infrastructure on the values of the planning area.
	Provide advice and work with relevant agencies and industry proponents to establish post disturbance land use for areas within the planning area; develop agreed outcomes, objectives, standards and completion criteria for specified regions and ecosystems; and, employ systematic monitoring to ensure completion criteria are met.
	Assess relevant proposed disturbance activity on CALM Act lands using DAS to avoid or mitigate impacts on biodiversity and other values and assets.
	Seek to minimise the area of permanent vegetation loss to development.
	Report periodically on the total extent of CALM Act land disturbances, including areas disturbed in that year and areas remaining under rehabilitation.
	Following development where rehabilitation to the original land use and values of an area is not considered feasible, pursue available alternative opportunities and the provision of compensatory additional land for reservation or other forms of compensation or offset.
	Continue to ensure that any rehabilitation undertaken by a proponent meets the agreed rehabilitation completion criteria prior to hand back to the department so the land is able to be incorporated into the normal departmental management of the surrounding area.
	Maintain and enhance DAS capabilities to support and underpin impact assessment, decision making and reporting.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 3: Mineral and petroleum exploration and development on lands vested in the Conservation and Parks Commission Corporate Policy Statement 4: Environmental offsets	

Table 8: Key performance indicator: Foundation 2

Representation and condition of forest ecosystems/biodiversity	
Strategic goal	To conserve biodiversity and support ecosystem resilience.
Performance measures	**Management targets**
Area of land protected in formal reserves.	An increase of at least 400,000 hectares in the area of lands that contribute to a CAR reserve system.
Trend of key biodiversity components as measured through a forest health monitoring program.	Status and condition of key biodiversity values is maintained or improved.

5.5 Foundation 3: Forest health and climate resilience

Strategic goal: To maintain or improve forest health and enhance climate resilience.

This plan adopts a combination of active and passive forest treatments to address the cumulative stressors on ecosystems. Foundation 3 covers a range of management programs and approaches that can improve conservation outcomes, forest health and resilience. Programs and operations will be developed and implemented using a coordinated approach, such that management activities consider and address multiple pressures and threats.

Climate change is a well-recognised pressure on the values of the south-west forests and presents significant challenges for maintaining forest health. This plan specifically focuses on forest management in response to a changing climate. Climate action typically falls into one of two categories: climate mitigation, meaning actions to reduce emissions that cause climate change, or climate adaptation, meaning actions to manage the risks of climate change impacts. This plan incorporates both climate mitigation and climate adaptation measures to manage the impacts of climate change within the planning area. Mitigation measures include enhanced carbon stores through an expanded reserve system (Foundation 2), protecting carbon-dense forest stores and promoting rapid recovery from disturbance. Adaptation measures focus on ecological thinning, assisted gene migration to improve adaptive capacity and increasing knowledge of climate science.

Climate change has interactions with other threatening processes so active management includes practices such as reducing the impacts of pest animals, weeds and diseases and applying prescribed fire for bushfire mitigation. These approaches will build on, and integrate with, existing programs of the department for feral animal control, prescribed fire and biodiversity conservation and operate at the landscape or whole of forest scale. Where possible management activities will consider and address multiple pressures and threats.

The scale and type of management activities taken to build ecosystem resilience are intended to influence long-term biodiversity conservation outcomes, just as global actions taken during the next 10 years will be critical to mitigate the level of climate change.

5.5.1 Climate mitigation: carbon storage

Carbon storage is an important element of the plan given the role of forests in storing carbon. In the short-term, carbon stored in trees in areas that would otherwise have been harvested will persist, with additional growth contributing to the amount of carbon stored in the forest pool. In the longer term, the carbon carrying capacity of many landscapes within the planning area is likely to reduce as progressively drier and warmer conditions lead to lowered site productivity. In addition, episodic drought and heatwave events are considered likely to lead to forest structural changes in affected areas.

There is currently no suitable methodology to generate Australian Carbon Credit Units (ACCUs) from native forests within the planning area. The Commonwealth Government undertakes an annual review process to identify the need for and prioritise the development of new carbon farming methods where opportunities exist. A method for generating ACCUs from native forests may be developed by the Commonwealth Government's Clean Energy Regulator during the life of this plan.

Fire plays an important role in the natural carbon cycle. Carbon stock losses from biomass burning do not increase the accumulated atmospheric CO_2 concentrations under historical fire regimes. However, carbon stock dynamics may alter if fire regimes are impacted by climate change through an increase in the size and scale of large, intense summer bushfires. Proactive fire management through the implementation of the department's prescribed burning program and maintaining a rapid bushfire detection and response capability are essential mitigation measures to protect carbon stores by reducing the risk of large-scale bushfires emitting significant quantities of carbon.

The overall forest carbon storage in the planning area is anticipated to remain relatively stable as most of the forests won't be subject to significant disturbance over the next decade unless large-scale bushfires or other natural events occur.

A summary of management directions for climate mitigation – carbon storage is outlined in Table 9, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose.

Table 9: Summary of management directions for climate mitigation – carbon storage

Key points and considerations	
• Projected climate change is likely to create a long-term trend of diminished site productivity and hence carbon carrying capacity of south-west forests. Overall forest carbon storage is anticipated to remain relatively stable over the next 10 years. • Carbon storage is influenced by factors such as forest growth rates, extent of clearing, extent of rehabilitation and extent and relative intensity of fire. • There is currently no suitable methodology to generate ACCUs from native forests in the planning area, although a suitable method may be developed during the life of this plan.	
Management objectives	**Management activities**
1. Identify carbon sequestration opportunities across the planning area.	Prioritise the protection of carbon stored within carbon-dense forest ecosystems by managing the risk of landscape-scale high intensity bushfires through prescribed burning and fire suppression.
2. Explore additional climate mitigation opportunities to reduce carbon emissions during the life of this plan.	Seek to promote recovery of carbon stores following disturbance events where appropriate, including through: • regeneration following bushfire • rehabilitation following other disturbance events or in degraded areas.
	Investigate carbon farming methodologies to identify emerging opportunities to enhance carbon storage on lands within the planning area.
	Contribute to national and state-level carbon accounting and reporting processes.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 19: Carbon farming on lands vested in the Conservation and Parks Commission	

5.5.2 Climate adaptation: active forest management and ecological thinning

Large-scale studies in several headwater catchments across the northern and southern jarrah forests have demonstrated the effects of forest thinning in promoting groundwater recharge and streamflow (Bari and Ruprecht 2003; Kinal and Stoneman 2011, 2012; Ruprecht 2018), while many international studies have demonstrated that forest thinning can lead to medium to long-term reductions in the susceptibility of forest stands to droughts and heatwaves (Sohn *et al.* 2016; Tague *et al.* 2019). As the water cycle is fundamental to ecosystem health and function, and hence the persistence of biodiversity, a key action under this plan to promote forest health and resilience to climate change will be to reduce chronic moisture stress by reducing the stocking density of vegetation (thinning) in targeted forest areas that are vulnerable to drying and warming conditions.

Native forests at risk of significant tree mortality often have substantial dense regrowth of woody vegetation and a predominantly even-aged structure. While dense regrowth will naturally self-thin, the timeframe for this to occur can be decades.

Additional active management approaches will be required to maintain forest health and improve resilience of forests in a changing climate context. Active management includes those programs and practices detailed in Foundation 3. It is intended that the FPC will provide contract management, planning and operational support for ecological thinning for forest health.

An independent expert panel was engaged by the department to provide advice on the need and possible approaches to ecological thinning in the south-west forests. Their report (Burrows *et al.* 2022) provides valuable background information and, along with input from a range of consultation processes, has helped to frame the approach proposed in this plan.

Regrowth forests with a high number of trees per unit area (stocking density) are vulnerable to moisture stress and competition for other resources. Some forest stands have a high tree density due to past silvicultural treatments, bushfires, or rehabilitation practices after clearing. Thinning will allow the remaining trees to grow more quickly, develop improved fauna habitat characteristics, store more carbon and improve their resilience to drought and bushfire events.

Ecological thinning

The primary objective of ecological thinning is to promote forest health and resilience in order to conserve biodiversity.

For the purposes of this plan, 'ecological thinning' will take place in 'Forest Enhancement Areas'[18] and involve the removal of a proportion of trees from an area to provide the retained trees and understorey with greater access to site resources (reduce competition) and improve resilience to environmental stressors, particularly water availability. Ecological thinning prescriptions or 'regimes' will therefore vary across forest ecosystems within the planning area.

Where predominantly even-aged regrowth forests are thinned, a secondary objective may include progressively restoring some areas to a multi-aged structure that more closely resembles the likely condition of pre-European forests. Similar restoration forestry objectives are being pursued in many other forests around the world (O'Hara 2014).

18 Equivalent to 'coupe' for the purposes of the Forest Management Regulations 1993.

Candidate areas

Under this plan, areas of vulnerable forest structure or condition within State forests and timber reserves will be considered for ecological thinning. While this will largely exclude areas within existing and proposed formal reserves and Disturbance Avoidance Zones, limited ecological thinning activity within such areas may be considered on a case-by-case basis by the Commission where there is a high likelihood that thinning would enhance conservation outcomes, such as the maintenance of habitat critical to threatened species or groundwater-dependent ecosystems. This approach recognises that the impacts of climate change will occur across tenures, and further knowledge on the location of vulnerable sites, and understanding of thinning benefits will accrue from adaptive management trials during the plan period.

Areas of densely stocked young regrowth forest are considered particularly vulnerable to elevated levels of moisture stress over the period of this plan and are a priority for thinning (Burrows *et al.* 2022; Ferguson *et al.* 2013). Densely stocked stands in this context are those at or approaching full site occupancy and the degree of crowding (number of trees per unit area) is likely to give rise to tree mortality (generally the smaller trees) due to the onset of competition for moisture and other site resources. The thinning treatments will seek to reduce competition for moisture by selectively removing some of the trees. Because the understorey, ground flora and bare soil area also contribute to overall stand and catchment water balance, understorey management strategies will also be a consideration in adaptive management for climate change in south-west forests (Wardell-Johnston *et al.* 2015).

A focus on young regrowth stands reflects the comparatively higher water use of younger trees with large sapwood area relative to mature or old, senescent trees. As the maximum biological age of jarrah and karri trees can exceed 400 and 250 years respectively, 'younger' regrowth stands in this context are considered those regenerated since 1970 (younger than around 50 years of age). Within this age range, areas suitable for ecological thinning will be informed by stand density management principles, landscape vulnerability to moisture stress, site characteristics and other factors including potential habitat for threatened species.

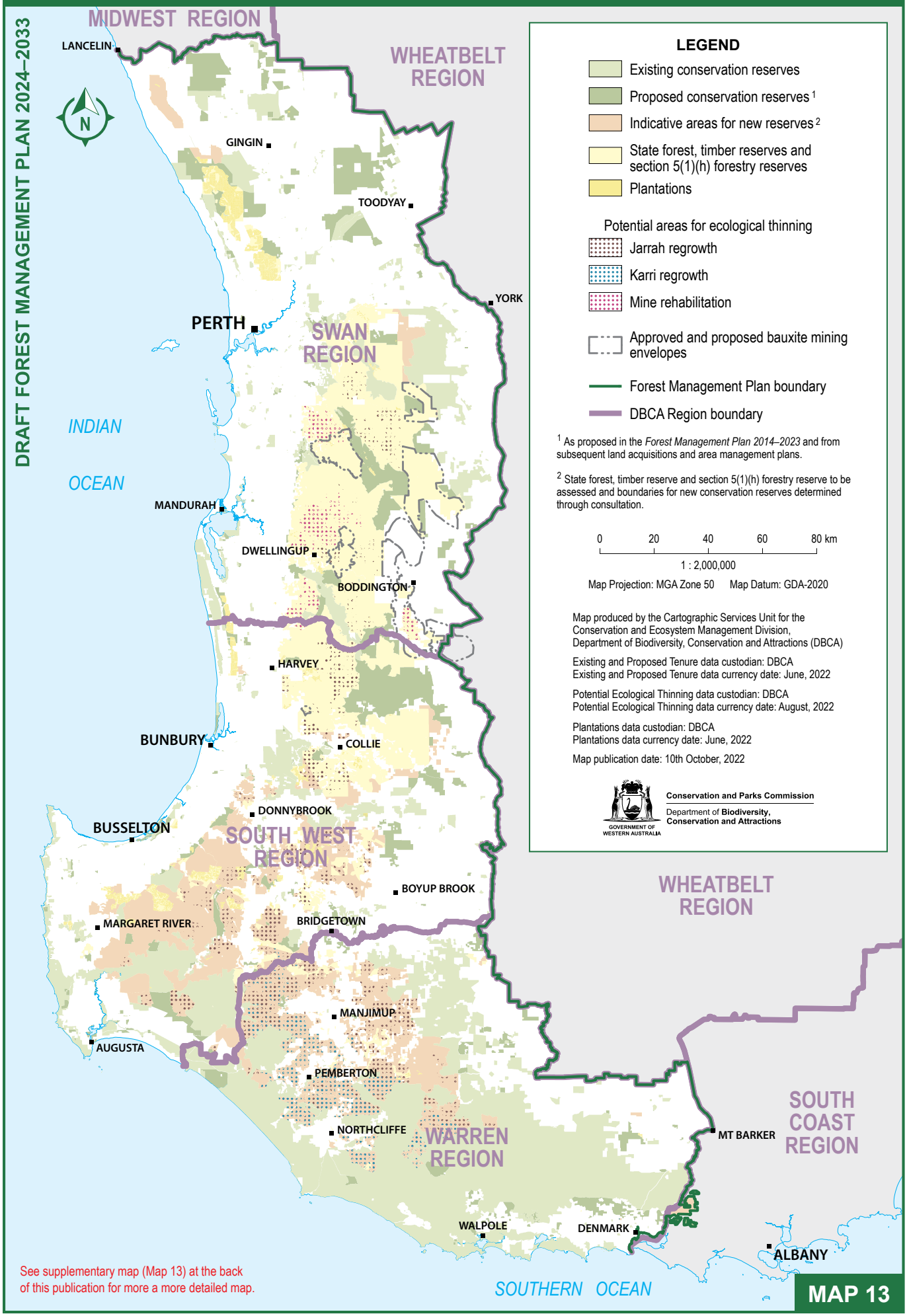
Past regeneration and rehabilitation practices in the jarrah, karri and wandoo forests have given rise to several categories of forest that may benefit from thinning. Each of these categories is described below and their indicative location is depicted in Map 13.

Munro trial site (Balingup) pre thinning - Shem Bisluk, DBCA

Munro trial site (Balingup) post-thinning - Martin van Rooyen, DBCA

Opposite *Map 13 Indicative location of potential ecological thinning activities*

INDICATIVE AREAS FOR INCREASED PROTECTION



See supplementary map (Map 13) at the back of this publication for more a more detailed map.

MAP 13

Mining rehabilitation

Ecological thinning could be applied to areas of State forest rehabilitated following mining operations, including bauxite mining within State Agreement Act leases. Aside from two areas near Jarrahdale, totalling 1,355 hectares, full management responsibility for these stands has yet to be returned to the State so collaboration with mining companies will be necessary to progress thinning proposals. Two broad categories of rehabilitation are identified – those areas dominated by older mixed plantings of mostly eastern states (exotic) eucalypts, and areas rehabilitated since 1988 which are dominated by seeded jarrah-marri.

Table 10: Areas of rehabilitated forest within age class at 2023

Dominant species	Area (hectares) of rehabilitated forest within age class at 2023					
	11-20 years	21-30 years	31-40 years	41-50 years	>50 years	Total
Exotic species	0	430	1710	1380	180	3700
Jarrah - marri	Low priority	5570	2030	400	70	8070

The areas of exotic species rehabilitated from 1966 to 1987 had highly variable growth rates and vary considerably in tree size, current stocking levels and site occupancy. Burrows *et al.* 2022 recommended these stands be converted to native forest species, if necessary, through repeated heavy thinning with supplemental planting of jarrah and marri. This approach is consistent with an objective to re-establish self-sustaining native forest ecosystems, and the department will consider proposals which facilitate this outcome.

Rehabilitation standards for stands established by Alcoa Australia from 1988 to 2001 incorporated high initial stocking rates (greater than 3000 trees per hectare) comprising a seed mix of 80:20 jarrah:marri. These stands are now at full site occupancy and trials have demonstrated positive effects from thinning on catchment water yield and tree growth without significant changes to understorey species composition or fauna use of areas (Norman *et al.* 2006; Grigg and Grant 2009; Stokes *et al.* 2010). Stands older than 20 years have generally had at least one prescribed burn as part of larger integrated burns.

The initial stocking density of trees and understorey seeding rate were substantially reduced after 2001, partly in consideration of declining rainfall and the high water-use of densely stocked regrowth forests.

This plan proposes ecological thinning be undertaken in areas of densely stocked, older mining rehabilitation to promote stand health. Maximising the area thinned during this 10-year plan would address an escalating risk of significant stand mortality and probably assist overall resilience in these structurally fragmented landscapes.

Jarrah regrowth

Areas of predominantly even-aged regrowth jarrah-marri are dispersed across forests previously cutover since 1970 (see Map 13). The patch size of regrowth areas varies from more than 100 hectares (older harvested areas) to less than 10 hectares (harvested since 1994), depending on the silvicultural prescription at the time of harvest, which aimed to achieve full stocking of regrowth trees. Tree growth rates have varied at sites across the planning area, impacted in some instances by disease, insect attack, bushfire and weather events. Apart from some small trials, these stands have not had their stocking density reduced by thinning, and the older stands are generally experiencing high levels of density-induced competition.

Table 11: Area of jarrah regrowth forest within age class at 2023

Location	Area (hectares) of regrowth forest within age class at 2023					
	11-20 years	21-30 years	31-40 years	41-50 years	>50 years	Total
North of Preston River	440	10,410	11,240	4030	30	26,150
South of Preston River	Lower priority	23,590	32,260	8610	0	64,460

This plan proposes ecological thinning be undertaken in areas of densely stocked, regrowth jarrah stands to promote forest health and resilience and support biodiversity conservation. Prioritisation of stands for thinning will initially involve consideration of their relative density (informed by stand density management principles and existing tree growth simulators that have been developed to investigate thinning responses). While thinning older regrowth stands will provide immediate benefits, Burrows *et al.* (2022) also recommended exploration of thinning practices to reduce stocking density in very young stands, in part to reduce the accumulation of flammable fuels. Abbott and Loneragan (1986) demonstrated the benefits of thinning at very young ages on tree growth rates and it is proposed that adaptive trials be implemented in targeted areas to monitor effects on hydrological benefits to wetter parts of the landscape.

Karri regrowth

Table 12: Area of karri regrowth forest within age class at 2023

Thinning status	Area (hectares) of regrowth forest within age class at 2023					
	11-20 years	21-30 years	31-40 years	41-50 years	>50 years	Total
Unthinned	7030	13,360	6830	3830	3350	34,400
Thinned	0	110	3270	6380	4500	14,260

Thinning in advance of significant tree mortality provides the opportunity to enhance resilience given the uncertain manner in which climate change may manifest across forest ecosystems. There are significant additional conservation benefits that could be achieved at the landscape scale from thinning densely stocked young regrowth karri stands beyond maintaining the water balance of riparian habitat and vegetation communities. These are discussed in Burrows *et al.* (2022) and include the faster progression to areas dominated by larger trees with greater resilience to bushfires and a higher proportion of mature tree habitat characteristics. The opportunity to create heterogeneity (diversity) of stand structure through variable density thinning will also be important because there are currently large expanses of densely stocked, uniform even-aged karri forest in these landscapes. Vertical and horizontal complexity in vegetation structure, including clumping of trees at the patch scale, are important habitat characteristics for many fauna species (Bain 2016).

This plan proposes ecological thinning be undertaken in areas of densely stocked regrowth karri to promote forest health and resilience and support biodiversity conservation.

Wandoo

Table 13: Area of wandoo regrowth forest within age class at 2023

Dominant species	Area (hectares) of regrowth forest within age class at 2023					
	11-20 years	21-30 years	31-40 years	41-50 years	>50 years	Total
Wandoo	120	30	10	0	0	160

Given the woodland structure and regeneration characteristics of wandoo only very small patches of even-aged regrowth have been mapped that could be considered for ecological thinning. While the department does not envisage

any substantial thinning activity would be a priority, circumstances or new knowledge may emerge that indicate thinning in wandoo areas would promote positive conservation outcomes. This may be most appropriate where community, traditional owners or other groups seek to partner with the department in targeted local projects.

Other vulnerable areas

Many densely stocked regrowth forests are located within a mosaic of forest structures at the catchment and landscape scales. Improved water balances may require thinning beyond the regrowth patches, to ensure hydrological benefits to wetter parts of the landscape, and this may encompass other forest structures. In such instances the same principles of thinning the younger smaller trees with retention of all mature and legacy habitat elements will apply, but further work is required to inform strategies. Burrows *et al.* (2022) recommended, and this plan proposes, a series of operational trials be established within an adaptive management framework to explore approaches relative to ongoing climate change.

Overall scale of ecological thinning operations

The total area of thinning undertaken in any forest category during the 10-year period of the plan will depend on several factors. A key driver will be the preferred rate at which improved forest health and resilience at the stand and landscape scales is sought. Other determinants will include the level of resourcing made available to undertake these activities, the technical feasibility and availability of suitable equipment to undertake the new thinning, and consultation outcomes during development of thinning plans. The area thinned annually may also fluctuate as the status and condition of suitable areas are progressively refined. In jarrah forest seasonal access restrictions to protect forest health from the introduction or spread of *Phytophthora* dieback will also influence the operation of programs.

Tables 10 to 13 list the area within age classes for the regrowth forest and rehabilitation categories and provide an indication of the potential scale of ecological thinning activity during the plan period. Depending on site and other factors listed above not all the area within an age class would necessarily be a priority for thinning. Any operational trials at a catchment scale (around 400-500 hectares each) or other emerging vulnerable areas would also contribute to the total area thinned. A goal of reducing moisture stress and promoting forest health at the patch level across all categories within the plan period would likely require an overall annual thinning program up to 8000 hectares. The Minister for Environment may approve additional areas where ecological thinning can be undertaken to improve forest health (e.g. thinning following an unplanned event such as a bushfire or treatment of other vulnerable areas outlined above).

Essential components of ecological thinning

Managing the potential for trees to resprout following felling or prescribed fire to reduce the fuel loads generated, are also essential components of an ecological thinning regime.

The hydrological benefits of reducing stocking density in regrowth stands can be short-lived if vigorous resprouting (coppicing) from stumps occurs. Approved herbicides can be applied to prevent resprouting, and this will probably comprise part of the operations in regrowth jarrah and mining rehabilitation stands. Where areas have high biodiversity or other values at risk but are highly sensitive to ground disturbance the department will consider notching or ring-barking and retention of dead standing trees to reduce moisture stress. These instances are likely to be limited and need consideration of bushfire and prescribed burning implications.

Recent studies in mixed conifer forests of similar Mediterranean climate highlight the importance of integrating fire regimes with stocking density management to promote resilience in frequent-fire environments (North *et al.* 2022). Integrated planning of ecological thinning within broader landscape scale programs for prescribed fire and predator control will therefore be necessary to maximise forest health and biodiversity outcomes.

Potential co-benefits to improving forest health by ecological thinning

In line with the principles of ESFM, ecological thinning regimes can be tailored with varying emphasis to meet multiple objectives alongside thinning to improve forest health. Improved visual amenity by reducing uniformity of structure and stocking density, as well as potential improvement in the distribution of fuel loads within the landscape can be co-benefits of ecological thinning. Where salvage and removal of forest products is considered acceptable, socio-economic benefits can accrue through the provision of direct and indirect employment, downstream processing, and potentially climate mitigation, depending on the longevity of end use of the forest products. The sale of forest products that result from ecological thinning may enable costs of thinning to be offset, enabling a larger area to be treated and hence improve patch and landscape resilience.

A summary of management directions for climate adaptation – ecological thinning is outlined in Table 14, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. Where these activities apply to State forest and timber reserves, the primary objective is conservation. These activities may also support purposes of recreation, water catchment protection and other purposes prescribed by Regulation 81 of the CALM Regulations. If considered for other land categories the activities are also to be consistent with the objective of conservation.

Table 14: Summary of management directions for climate adaptation – ecological thinning

Key points and considerations	
• Ecological thinning involves the removal of trees from an area to reduce competition among retained trees and understorey for moisture and other resources. • Ecological thinning activities will be undertaken to promote forest health and resilience, including to the impacts of climate change, in order to conserve biodiversity. • Areas of densely stocked young regrowth forest are considered particularly vulnerable to elevated levels of moisture stress and are a priority for thinning. • Thinning is proposed for mining rehabilitation areas, and regrowth jarrah, karri and wandoo forest categories. • Ecological thinning prescriptions will vary across forest ecosystems to achieve improved forest health and climate resilience. • Ecological thinning regimes can be tailored to meet multiple objectives including improved visual amenity, improvement in the distribution of fuel loads within the landscape, and, where salvage and removal of forest products is considered acceptable, socio-economic benefits can accrue.	
Management objectives	**Management activities**
1. Undertake ecological thinning activities in densely-stocked regrowth forests and other vulnerable landscapes to promote forest health and resilience in order to conserve biodiversity.	Develop and implement silvicultural, soil and water, and fire management guidelines for the application of ecological thinning regimes to manage outcomes for stocking density, structural heterogeneity, fuel management and biodiversity values.
	Adopt an adaptive management approach to ecological thinning trials informed by research findings, exploring a range of thinning prescriptions to enhance ecological values and progressively refine guidelines as results become available.
	Maintain strategic forest inventories and undertake modelling to inform adaptive measures at the patch, local and landscape scales.
	Prepare publicly available plans identifying candidate areas for ecological thinning and resulting scheduled salvage operations.
	Undertake research into use of ecological thinning as an adaptation strategy to minimise impacts of climate change.
	Assess through DAS and implement approved proposals to undertake ecological thinning in mining rehabilitation, regrowth jarrah, regrowth karri or regrowth wandoo forests.
	Evaluate landscape vulnerability using risk assessment principles to inform application of ecological thinning through a combination of remote sensing, mapping of site characteristics, field assessment and modelling.
	Make available forest products from ecological thinning operations in State forests and timber reserves for salvage, removal and sale by the FPC.
	The FPC will provide operations and contract management support for ecological thinning in State forests and timber reserves, and inform the area planning processes in cases where forest products could be salvaged and removed.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 20: Responding to climate change in the context of lands and waters vested in the Conservation and Parks Commission	

5.5.3 Climate science

The effectiveness of the plan is dependent largely on the knowledge that informs management directions and actions. Science aims to provide the knowledge for informed decision making on climate mitigation and adaptation.

A summary of management directions for climate science is outlined in Table 15, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions are designed to meet general functions of the department.

Table 15: Summary of management directions for climate science

Key points and considerations	
• Management will be informed by understanding how climate change affects forest health and interacts with other pressures. • Information gathered through monitoring and research will inform adaptive management in relation to climate change.	
Management objectives	**Management activities**
1. Increase knowledge and understanding of climate science and trends, and the impacts and responses of forest values to a changing climate, to inform an adaptive approach to management.	Monitor the trends in climate, the impacts on key values in the planning area, and the response of forest vegetation cover to climate variability and natural events.
	Undertake research into impacts of climate change on species persistence in forest areas and trial adaptation strategies such as assisted gene migration.
	Incorporate the latest climate science and down-scaled climate projections for the south-west forests in biodiversity conservation planning, ecological thinning trials and operations, prescribed fire planning and plantation management.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 20: Responding to climate change in the context of lands and waters vested in the Conservation and Parks Commission Corporate Policy Statement 28: Science	

5.5.4 Fire management

Fire regimes that are sympathetic to the ecological requirements of forest ecosystems are essential for their effective functioning. Fire can assist in the regeneration of native vegetation and promote the germination of seed, the maintenance or modification of habitats, and release and cycling of nutrients. Fire has a role in a range of other ecosystem processes, including hydrology, and in the management of certain weeds, pests and diseases. Fire regimes that are characterised by an appropriate range and diversity of fire intensities, seasonality, frequency (burn intervals) and spatial heterogeneity will promote ecosystem health and vitality, thereby providing greater resilience to climate change. Fire regimes must also accommodate requirements for bushfire risk mitigation and facilitate the provision and protection of various values, such as water and forest produce.

The department's fire management and prescribed burning program aims to manage biodiversity at a range of spatial scales and is informed by landscape, regional and local requirements. Burning mainly occurs over autumn and spring. In the wettest forests, prescribed burning is also undertaken in summer under safe conditions. These burns are mostly low or moderate intensity, and often include many unburnt patches. Prescribed burn planning typically intends to avoid some parts of the planning area, such as wetlands, riparian vegetation, and rocky outcrops. The mean return fire interval in the south-west forests is around 10-18 years.

This fire management approach is underpinned by legislation and supported by research and over 60 years of operational evidence. Peer-reviewed research shows that the fraction of the forest landscape that experienced fire in the previous six years was associated with lower annual extent of bushfire events (Boer *et al.* 2009).

The department has a framework and process for planning, implementing and reviewing its prescribed burning program that is aligned with the international standard for risk management – ISO 31000. This considers biogeography, land use, community protection and other factors, such as the available resources.

Each planned burn has management objectives, burn strategies and success criteria. The burn program aims to:

- protect the key values of the planning area, including fire-sensitive ecosystems
- consider any other relevant management objectives in areas subject to planned burning
- seek to address the risk presented by bushfire on CALM Act lands and the risk associated with movement into surrounding tenure
- seek to manage carbon emissions and avoid major emissions from catastrophic bushfires
- support biodiversity and facilitate spatial and temporal habitat diversity, and
- integrate weed and pest management activities for areas pre- and post-burn and post bushfire suppression.

Burn program development facilitates this by applying a consistent process to prepare three-year and annual Burn Options Programs that reflect the objectives and priorities set out in Regional Fuel Management Plans. This process is undertaken annually to ensure a three-year plan is always available to support long-term planning and the scheduling of preparatory work. The annual Burn Options Program enables detailed planning and burn implementation work to be undertaken. Individual prescribed fire plans are then developed for each planned burn (Figure 1). Knowledge and experience acquired through the process contributes to adaptive management (such as adjustment of burn timing and pattern in a warmer and drier climate) and continuous improvement.

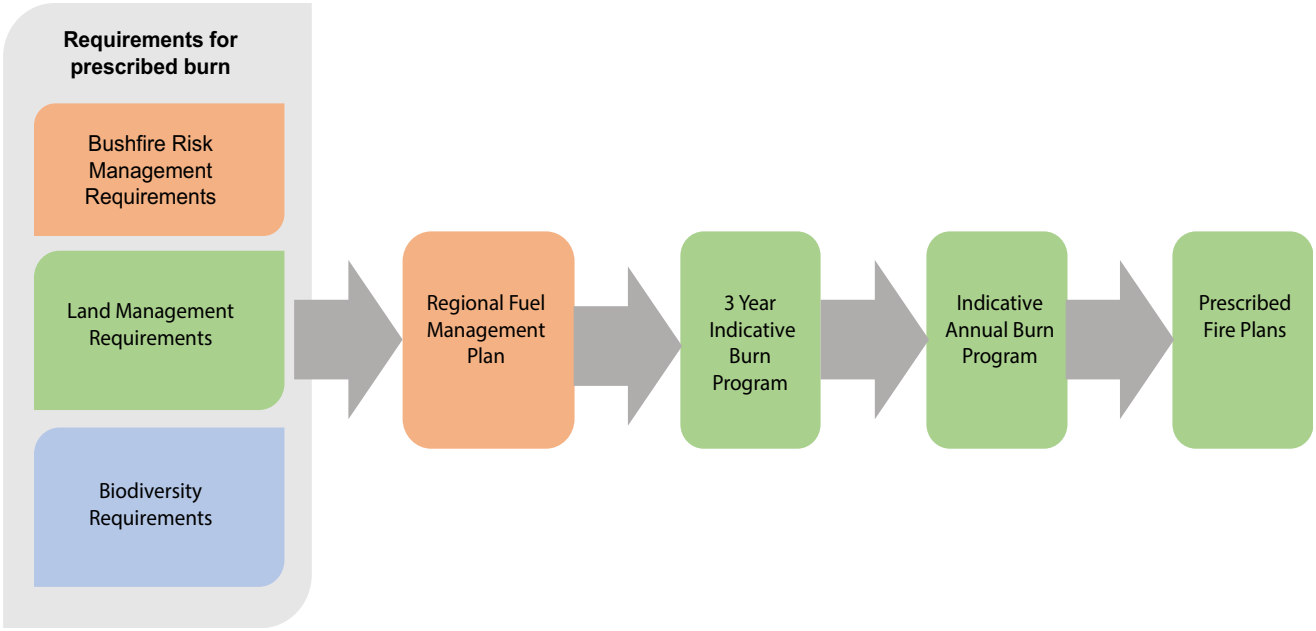


Figure 2 : Broad outline of the approach to planning of the department's prescribed burning program

Input from the stakeholder and community engagement during the development of this plan called for more consultation with Aboriginal people, particularly in relation to fire and cultural burning practices.

DBCA is committed to working with traditional owners through management partnerships in helping to share (two-way learning), maintain, connect and where possible rebuild Aboriginal people's connection to country, including gaining knowledge of cultural fire practices and how these principles can assist in guiding the use of fire in the context of today's landscapes.

Prescribed burning is generally applied under mild conditions to establish a range of different fuel ages across the landscape. Variations in fire interval together with seasonality, intensity, scale, and patchiness of burning are important components of contemporary fire management practices that assist in ensuring the best possible outcomes for our

communities, the environment and for biodiversity. These principles are consistent with those of cultural burning. Contemporary planned burning strategies also need to consider assets within and adjoining burn areas including communities, industry, agriculture and infrastructure.

A summary of management directions for fire management is outlined in Table 16, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23 . These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. These directions may also support purposes of recreation and water catchment protection.

Table 16: Summary of management directions for fire management

Key points and considerations	
• The protection of life (people and communities) is the primary consideration when planning and implementing fire management activities. • Fire is an important component of forest health and for ecosystem functioning, including regeneration and nutrient cycling. Species have a range of mechanisms to persist through fire or recolonise after burning. • Reducing fuel build up reduces the intensity of large-scale bushfires, which impact on biodiversity and forest health. • The risk of bushfire is expected to increase in a warming and drying climate over the next decade. An adaptive approach is required to planning and implementing prescribed burns to continue to mitigate this risk. • Fire management practices are closely linked to climate mitigation and adaptation activities. • The department is committed to working with Noongar Traditional Owners through a partnership approach to better understand, share and incorporate cultural fire knowledge.	
Management objectives	**Management activities**
1. Manage fire in the planning area to protect life, communities and assets from the impacts of bushfire. 2. Use and respond to fire to promote the maintenance and improvement of forest health, the conservation of biodiversity and mitigate the risk of adverse impacts of bushfire in the planning area.	Maintain capability in fire management, including prescribed fire, bushfire risk mitigation, detection and suppression.
	Undertake annual prescribed burning program in a manner that considers land management and biodiversity requirements within a risk management framework.
	Undertake bushfire suppression with regard to the department's fire management policies, guidelines and operating procedures.
	Engage with stakeholders and the community on the planning and implementation of prescribed burning to develop understanding of, support for and collaboration in, fire management efforts.
	Undertake research into fire behaviour and fire ecology to assess impacts of fire and inform management effectiveness and forest health, and work collaboratively with other agencies and institutions on matters of mutual interest.
	Undertake monitoring of fire impacts and outcomes from prescribed burning to inform fire response and use of planned fire in management of forest health and biodiversity values.
	Ensure that the community continues to be provided with appropriate and timely information and advice on the department's Annual Burn Options Program and day-to-day prescribed burning operations.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 1: Prescribed burning on vested lands Corporate Policy Statement 19: Fire management Corporate Policy Statement 88: Prescribed burning	

5.5.5 Weeds

For most weed species, control or eradication is expensive. Preventing their introduction and spread is a more cost-effective option. Effective ecosystem-based management of weeds relies on suitable surveillance systems and implementation of biosecurity hygiene measures within and between sites in the planning area and beyond to mitigate weed threats. There is also the need to focus on rehabilitation and regeneration to increase resilience to threats, including changing climate. Strategic investment in potential new technologies supporting next generation biological control – for instance, biocontrol for arum lily – will be an important tool in effective, cross tenure integrated weed management within and beyond the planning area (Sheppard and Glaznig 2021; Scott *et al*. 2014).

The department has responsibilities under the *Biosecurity and Agriculture Management Act 2007* with regard to declared pests and seeks to achieve weed management objectives within its available resources, working in partnership with the Department of Primary Industries and Regional Development (DPIRD) and other stakeholders where relevant.

The management goals for priority weed species include localised eradication, density reduction and containment, based on the biodiversity assets being threatened and the size and density of the weed population. In the period 2014 to 2021, there was a focus on responding to infestations of weeds in areas of higher conservation value and implementing subsequent monitoring. A similar approach will also be required for weeds threatening priority areas and values for the term of this plan.

A summary of management directions for weeds is outlined in Table 17, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose.

Table 17: Summary of management directions for weeds

Key points and considerations	
• Approximately 75 high priority weed species have been identified in the planning area. • Competition from weeds affects many threatened flora and ecological communities, particularly those restricted to small, disturbed areas. • The suite of weed species will probably change in a warming climate, with some species becoming more invasive. • Management responses are based on the values being impacted and the size and density of the weed population.	
Management objectives	**Management activities**
1. Minimise the impact of existing and emerging priority weeds on forest health in the planning area, including from plantations.	Maintain and support weed prioritisation processes including surveillance, monitoring, and recording management activities and effectiveness.
	Promote appropriate notification of weed species.
	Encourage the coordinated involvement of government, industry, the community, and other land managers in addressing priority weeds, including facilitating knowledge transfer, awareness raising, management and capacity building.
	Undertake research to improve weed identification, knowledge of weed impacts, invasiveness and management to enhance effectiveness.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 14: Weeds management	

5.5.6 Pest animals

Western Shield is the largest conservation program in Australia, focused on managing introduced predators, namely foxes and feral cats, that impact native fauna. The program delivers fox and feral cat management to over 85 percent of the planning area. The primary management tools are toxic baits containing the naturally occurring poison sodium fluroacetate (1080), found in native plants of the genus *Gastrolobium* or 'poison peas', to which native animals have developed a tolerance.

Feral cat and fox activity often increases following disturbances such as vegetation clearing, bushfire and prescribed burns, and additional baiting is proposed following disturbance activities when specific values are at risk. A monitoring framework across 21 sites has been developed under the program, including broadscale monitoring of fauna populations to progressively refine the frequency and season of baiting, as well as the relative effectiveness of control efforts.

Western Shield will continue to be a key approach for biodiversity conservation and maintaining and improving forest health over the next 10 years. The department will also seek to identify new and or innovative approaches to managing foxes and feral cats.

Feral pigs are distributed across the majority of the forest ecosystems within the planning area although densities vary. Given that feral pigs are contained within six genetically defined populations, the potential for effective management and localised eradication is feasible. The department will continue to undertake and deliver feral pig control activities with increased effort in areas of high conservation value.

Feral deer are considered an emerging problem. Due to their cryptic nature feral deer are difficult to manage, however populations in the south-west forests are currently small and localised and with effort could be effectively controlled or eradicated.

Feral cat with native phascogale prey captured on remote camera - DBCA

Feral cat and fox activity often increases following disturbances such as vegetation clearing, bushfire and prescribed burns, and additional baiting is proposed following disturbance activities when specific values are at risk.

A summary of management directions for pest animals is outlined in Table 18, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose.

Table 18: Summary of management directions for pest animals

Key points and considerations	
• Foxes and feral cats are the most significant pest animals in the planning area due to their impact on native fauna. Fox and cat activity often increases following disturbances. • The *Western Shield* program delivers fox and feral cat management to 85 percent of the planning area and will continue to be a key approach for biodiversity conservation and maintaining and improving forest health. • Feral pigs are distributed across the planning area however densities vary. Pigs have multiple impacts, particularly in wetter areas. • As feral deer populations are currently small and localised, the opportunity exists to control or eradicate them from the planning area. • Endemic insect pests that impact forest trees include jarrah leaf miner and gum leaf skeletoniser. Several exotic invertebrate pests represent ongoing biosecurity threats to native forests and plantations.	
Management objectives	**Management activities**
1. Minimise and reduce the risk of introduction, spread and impact of pest animal species on ecosystems, including from plantations.	Maintain, adapt and improve the *Western Shield* fauna recovery program, including implementation of the *Western Shield* monitoring plan across the planning area.
	Optimise the frequency of fox baiting across the area baited within the planning area and integrate feral cat baiting in suitable areas to reduce predation pressure.
	Consider supplemental fox and feral cat baiting requirements when approving disturbance activities through DAS and following landscape-scale bushfires.
	Apply and support management efforts to control feral pigs, deer and other pest animals particularly to protect priority habitat and key conservation values.
	Encourage the coordinated involvement of government, industry, the community, and other land managers in addressing priority pest animals, including facilitating knowledge transfer, awareness raising, surveillance, monitoring, incursion management and capacity building.
	Undertake research into pest animal (vertebrate and invertebrate) management to enhance management effectiveness and identify novel strategies.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 12: Pest animal management Corporate Guideline 39: Use of dogs for feral pig control activities on CALM Act land	

5.5.7 Diseases

To date, disease management in the planning area has focused on minimising the spread of *Phytophthora* dieback into uninfected areas. This remains an important objective given the severe negative impacts of the pathogen *P. cinnamomi* on biodiversity and forest health, and the known high risk of spreading the disease through disturbance activities (particularly in moist-to-wet soil conditions). Mapping the occurrence of dieback on CALM Act lands, implementing hygiene protocols, and training are key to managing dieback and other diseases.

Dieback mapping is a resource intensive activity supported by field-based sampling, and there is potential to increase its effectiveness with innovative techniques. Existing and emerging technologies for controlling the spread and impact of dieback should also be considered over the term of this plan. Major technological breakthroughs for consideration include aerial phosphite treatment of infested communities to protect key susceptible threatened flora and ecological communities, use of metham sodium treated gravel where dieback-free material is needed for road construction and maintenance, and integrated methods for containment and eradication where a new infestation is highly localised.

Other diseases such as marri canker and myrtle rust also pose a risk to south-west forests and may require increasing management.

A summary of management directions for diseases is outlined in Table 19, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose.

Table 19: Summary of management directions for diseases

Key points and considerations	
• *Phytophthora* dieback is the most significant plant disease affecting values in the planning area, with many native flora and threatened species considered susceptible. Of CALM Act lands vested in the Commission intensively mapped to date, 28 percent (248,700 hectares) is infested. • Despite a drying climate, conditions in the planning area will remain favourable for *P. cinnamomi* and could potentially increase dieback expression and impacts. • Management of *Phytophthora* dieback has primarily focused on minimising the spread into uninfected areas through training in dieback awareness and use of appropriate hygiene. This will continue to be an important approach, together with new techniques and technologies. • New and emerging diseases are also a threat to the values of the planning area.	
Management objectives	**Management activities**
1. Minimise the impact of plant disease and associated tree declines on the values of the planning area. 2. Minimise the risk of introduction of exotic plant disease and protect those areas currently free from disease symptoms.	Maintain a *Phytophthora* dieback mapping program by retaining capacity, standards of interpretation, and laboratory-based diagnostic capability.
	Apply tactical procedures and operational controls for *Phytophthora* dieback, including through use of emerging technologies such as metham sodium treatment of basic raw materials (BRM), and through monitoring the efficacy of longstanding procedures and controls.
	Develop and implement management guidelines and processes to allow for sterilised BRM, including that from other land tenures, to be used in areas with at-risk biodiversity values.
	Monitor the long-term impacts of *Phytophthora* dieback and other priority plant diseases on forest health.
	Work cooperatively with relevant agencies and land managers to identify, prepare for and respond to plant biosecurity threats (for example, myrtle rust), enabling a swift response.
	Undertake research into improving disease identification and detection, knowledge of disease impacts and management methodologies to enhance management effectiveness.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 7: The threat of *Phytophthora* dieback to biodiversity values on lands vested in the Conservation Commission of Western Australia Corporate Policy Statement 3: Management of *Phytophthora* disease	

5.5.8 Soil and water

The conservation of soil and water is closely linked to the conservation of biodiversity, Noongar cultural heritage, and to sustaining the ecological capacity and health of forest ecosystems.

Forest disturbance activities such as mining and other approved activities can be detrimental to soil and water resources if not properly managed. The extent of the impact from these operations can be minimised using appropriate management techniques, such as protecting and maintaining waterways and their foreshore areas, protecting and maintaining wetlands and their buffers, contamination identification and management and minimising soil compaction.

Vehicle impacts on soil physical characteristics are immediate, generally obvious and often decrease soil fertility. Principles and tactics developed during the previous FMP to protect soils and manage surface water during timber harvesting and roading activities, such as maximising the use of previously disturbed areas or favouring access under dry soil conditions will be applied to ecological thinning operations. The risk of increasing stream salinity from rising groundwater following thinning has diminished further with significant increases in depth to groundwater. However, measures in place during the previous FMP will continue to apply and be reviewed should ecological thinning be proposed in 'salt sensitive' or 'high salt risk' areas of forest.

As noted in Part B the management of the land and permitted disturbance activities in the planning area have important consequences for water resources, including their biodiversity, physical condition and ecological health, water quality, water supply and public health, and a range of legislation, policies and guidelines apply.

DWER has a key role with respect to water resource protection and management, including allocation planning, protecting PDWSAs and assessment of waterway health, hydrology and hydrogeology. Policies and procedures in the planning area are also implemented by the Water Corporation, which has delegated responsibility in PDWSAs under the relevant legislation.

Within the planning area, waterways and their foreshore areas and wetlands and their buffers play an important role in the conservation of biodiversity, forest health and ecological function. To help protect water quality, biodiversity and the physical condition and ecological function of water resources, the use of certain products, practices or activities may be limited or controlled in some areas (for example, in PDWSAs or near waterways and wetlands). Additional safeguards minimise the risk of clearing riparian or wetland vegetation, harm to the physical condition and ecological function of water resources, sediment movement, turbidity and contamination of water bodies.

Lake C.Y. O'Connor and Mundaring Weir, Beelu National Park, Mundaring - DBCA

DWER and the Department of Health have best practice management guidance for pesticide use in PDWSAs and the type and levels of recreational activities that are permitted may also be restricted.

A summary of management directions for soil and water is outlined in Table 20, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. As these directions primarily apply to State forest and timber reserves, they may also support purposes of recreation and water catchment protection.

Table 20: Summary of management directions for soil and water

Key points and considerations	
• Soil and water are important components of forest health in the planning area. Managing access and disturbance activities is important to minimise detrimental impacts to soil and water resources. • A range of Acts, policies and subsidiary documents apply to protecting and maintaining soil and water resources. • The department works cooperatively with other relevant agencies, land managers and proponents to identify, plan for, manage and monitor activities that may be detrimental to soil and water resources. DWER and the Water Corporation also have responsibilities and processes relevant to the planning area. • Any activities that may activate acid sulphate soils, contaminated sites or have potential to increase salinity are identified in DAS.	
Management objectives	**Management activities**
1. Minimise and manage the risk of adverse impacts of soil disturbance from activities undertaken in the planning area. 2. Protect soil and water quality and the physical condition and ecological health of water resources in the forested catchments of the planning area. 3. Protect water supplies, including the quality and flow of water to surface water reservoirs and groundwater recharge areas in PDWSAs.	Ensure activities undertaken in the planning area do not significantly impact soils and water quality and quantity. Review and maintain subsidiary guidelines, procedures, training programs and reporting mechanisms to minimise and address disturbance of soil and water values. Develop and provide training for staff and proponents in the management of soils and water. Undertake research into trends in quantity and quality of surface and groundwater levels and assess the impact of management on the water-related ecological values and water supply. Undertake research into soil health, soil biodiversity, and monitor impacts from management activities that lead to soil disturbance, as well as recovery and restoration of soil health post disturbance.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 11: The protection of surface and groundwater biodiversity values of lands vested in the Conservation Commission of Western Australia Corporate Policy Statement 40: Road management	

5.5.9 Regeneration and rehabilitation

Regeneration and rehabilitation of native vegetation cleared during both permitted and unplanned disturbances is undertaken to restore and maintain a wide range of biodiversity, cultural and social values.

Regardless of the type of disturbance, regeneration can be achieved where landforms and soil profiles are appropriately returned, and rehabilitation undertaken using endemic species. Sourcing seed for rehabilitation can generally be undertaken at a regional scale to maximise genetic diversity and adaptive capacity as most widespread and common species show low genetic structure and broad provenance. The identification of adaptive variation associated with climate gradients in jarrah and marri suggests that a climate adjusted provenancing approach that sources seed from drier areas can be considered as a climate adaptation strategy for these dominant tree species (Ahrens *et al.* 2019a; Filipe *et al.* 2022a). Where disease is present it may be appropriate to consider the use of disease resistant genotypes if available.

Where disturbances occur, the objective should be to minimise impacts, and for regeneration and rehabilitation to restore capacity for the area to be self-sustaining and, after time, provide for a diverse range of environmental and social values. This objective similarly applies to regeneration of historically disturbed areas where rehabilitation was either not required or not undertaken.

The south-west forests have experienced a range of patch-level clearing disturbances where rehabilitation may be incomplete or deferred. A process to systematically identify, assess and prioritise areas will facilitate rehabilitation when opportunities arise. Rehabilitation generally aims to restore pre-clearing ecosystem composition and function, however, in practice that may not be achievable. In those cases, such sites may be able to provide particular outcomes (for example, enhanced water supply) with appropriate design and management intervention.

Restoration following natural disturbance events

Natural disturbance events such as bushfire, drought, pest and disease outbreaks can impact forests at a range of scales, from small patch to landscape-scale, and at varying intensities. Small scale or localised low impact occurrences are generally considered part of natural forest ecosystem dynamics. Occasionally, large-scale events result in extensive tree mortality and forest structural change such as occurred in the high-intensity bushfires near Northcliffe in 2015 and Waroona in 2016. Forest restoration plans incorporating strategies for regenerating overstorey composition, restoring biodiversity values and promoting forest health can assist forest recovery. Such plans may be developed as needed, building on strategies and processes implemented during the previous FMP.

Rehabilitation following cessation of plantation activities

Within State forests there are areas where plantations have been felled and left fallow pending opportunities to re-establish native vegetation. The Gnangara-Moore River State Forest is an ex-plantation area, where a 1996 Government decision was taken to remove the pine plantations to increase recharge to the Gnangara groundwater system to ensure the ongoing use of groundwater, and to protect the values it supports. Opportunities are being pursued to replant these areas to native vegetation, to provide environmental and social benefits, including food resources for ngoolyak, while ensuring ongoing management is balanced with the primary objective of maximising groundwater recharge.

Rehabilitation following permitted disturbance

Rehabilitation of native forest cleared during permitted disturbance operations such as resource development activities, quarrying, BRM extraction or establishment of (now redundant) roads, tracks and landings is undertaken to restore a wide range of forest values over time.

While commercial timber harvesting will cease by the end of 2023, silvicultural treatments will need to continue in a selection of coupes until regeneration is satisfactorily achieved.

There are circumstances where permitted disturbance activities and methods (for example, open cut mining) mean it is not practical or economically feasible to rehabilitate the post mining landform to its original condition. In such cases, it is important that the post-disturbance outcomes and land use are identified and agreed at the development assessment stage and completion criteria are developed that are specific, measurable, achievable, relevant and timebound.

A summary of management directions for regeneration and rehabilitation is outlined in Table 21, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. As these

directions primarily apply to State forest and timber reserves, they may also support purposes of recreation and water catchment protection.

Table 21: Summary of management directions for regeneration and rehabilitation

Key points and considerations	
• Regeneration and rehabilitation may be required following permitted, unplanned and historical disturbances. • Rehabilitation of areas affected by permitted disturbance activities is a formal requirement under legislation and several State Agreement Acts, or other statutory approvals. Requirements for rehabilitation and 'completion' are set in the disturbance approval process (also refer to 5.4.3). • Adherence to best-practice principles and approaches when sourcing seed increases the success of restoration and rehabilitation efforts. • Achieving pre-clearing species composition and ecosystem function is often difficult. It may not be feasible to restore some disturbed areas of forest.	
Management objectives	**Management activities**
1. Develop and maintain self-sustaining ecosystems of native species following disturbance activities in the planning area, where practicable and appropriate.	Continue silvicultural and post-harvest regeneration activities for areas harvested under FMP 2014-2023.
	Establish a program to identify candidate sites for regeneration / rehabilitation of historically disturbed areas.
	Develop and implement restoration project plans as necessary for areas significantly disturbed by natural events.
	Develop and implement a guideline for best practice rehabilitation / regeneration of FMP areas post disturbance.
	Undertake research to develop best practice approaches to restoration and regeneration for disturbed areas.
	Maintain expertise and capacity (including seed collections) to undertake regeneration.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 3: Mineral and petroleum exploration and development on lands vested in the Conservation and Parks Commission	

5.5.10 Unauthorised activities

A summary of management directions for unauthorised activities is outlined in Table 22, with the associated KPI for Foundation 3 – Forest health and climate resilience outlined in Table 23. These management directions apply to all land categories the subject of this plan, with a primary objective of contributing to a conservation purpose. As these directions primarily apply to State forest and timber reserves, they may also support purposes of recreation and water catchment protection.

Table 22: Summary of management directions for unauthorised activities

Key points and considerations	
• Unauthorised activities can harm the environment, impact cultural sites and detract from visitors' enjoyment of the forest. • Enforcement responses are subject to case-by-case regional risk assessments and available resources. • Illegal firewood collection is expected to remain challenging to manage due to a range of reasons..	
Management objectives	**Management activities**
1. Manage unauthorised activities to reduce adverse impacts on the values of the planning area 2. Promote appropriate behaviour in the planning area through education, visitor interpretation and environmental stewardship.	Continue to implement a compliance and enforcement framework and explore opportunities to work cooperatively with other agencies and land managers (for example, DWER and Water Corporation).
	Seek to enhance compliance capacity to respond to high impact and/or high-risk unauthorised activities, such as illegal firewood collection, illegal hunting and unsanctioned trails.
	Endeavour to develop and implement a behaviour change program, incorporating messaging for unauthorised activities.
	Develop recreational guidelines for clubs and other recreational forest users.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 38: Compliance and enforcement	

Table 23: Key performance indicator for Foundation 3

Condition of indicators of forest health affected by management in the planning area	
Strategic goal	To maintain or improve forest health and enhance climate resilience.
Performance measures	**Management targets**
The spatial extent and changes in the condition of forest ecosystems.	Maintenance or improvement of the condition of forest ecosystems in the planning area through management activities.
Trend of key forest health indicators measured through forest health monitoring program.	Maintenance or improvement of key forest health indicators in the planning area through management activities.

5.6 Foundation 4: Social and economic benefits and opportunities

Strategic goal: To deliver social and economic benefits through the provision of goods and services.

Socio-economic issues are an important consideration in ESFM. The planning area provides various goods and services that provide a range of social and economic benefits for the community. In terms of revenue and direct and indirect employment the most significant industries relate to forest-based resources and recreation and tourism sectors. Native timber available from salvage from forest management activities that improve forest health or from approved mine clearing, will also provide socio-economic benefits.

Foundation 4 focuses on forest-based resources, recreation and tourism, other Australian heritage, access, certain BRM and leases and licences. Stakeholders and the community have an important role in the management of the planning area and stakeholder and community engagement is included in this section.

5.6.1 Nature-based tourism and recreation

The planning area provides important opportunities to meet the growing public demand for outdoor recreation and nature-based tourism in the south-west. People are more likely to appreciate and understand the values of the south-west forests when they have opportunities to visit and experience them through recreation and tourism activities. The benefits of nature for physical and mental wellbeing are increasingly understood and documented, so providing for visitors has both social and economic value to the community.

The recreation and tourism industries also make valuable contributions to regional economies, both directly and indirectly. Partnerships with Local Government Authorities (LGAs), other government agencies and the tourism industry are important in the planning, funding, delivery and governance of recreational facilities and experiences.

The visual qualities and landscapes of the planning area must be considered when planning new infrastructure, promoting increased public access and changing land use. To do this it is necessary to identify the landscape types and features requiring special attention, and to develop and implement appropriate management and planning policies that contribute to their maintenance and enhancement.

The *Control of Vehicles (Off-road Areas) Act 1978* provides for areas where the use of off-road vehicles is permitted and prohibits their use in certain places. Permitted areas under this Act are established in State forest and timber reserves and on CALM Act section 5(1)(g) and (h) reserves consistent with Corporate Guideline 32. Further areas may need to be identified to meet the demand and counter unauthorised use. Sites require careful assessment due to impacts from noise, dust and requirements to manage trail creep outside of designated areas in addition to minimising potential environmental and cultural impacts.

A summary of management directions for nature-based tourism and recreation is outlined in Table 24, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions apply across land categories the subject of this plan, although with limited application to nature reserves. These directions have a primary objective of contributing to a recreation purpose.

Valley of the Giants Tree Top Walk, Walpole-Nornalup National Park - Tourism Western Australia

Table 24: Summary of management directions for nature-based tourism and recreation

Key points and considerations	
• The planning area contains many areas of perceived natural beauty that provide opportunities for nature-based tourism and recreation. • Annual visits to the planning area have increased by more than 40 percent in the last 10 years, to 12.65 million visitors in 2020-21. The south-west forests are expected to remain an important destination for recreation and tourism. • Outdoor recreation contributes to public understanding and appreciation of nature, conservation and forest management, as well as providing physical and mental health benefits for the community. • There is a need to balance the provision of enjoyable and enriching visitor experiences with the protection and conservation of other values and uses. Visitor planning is a key tool to ensure public access is well considered, does not impact other values and to address overcrowding or over tourism.	
Management objectives	**Management activities**
1. Provide for a range of recreation and nature-based tourism opportunities, through visitor planning that seeks to minimise impacts on other values and uses and delivers economic benefits to meet public demand. 2. Seek to enrich visitor experiences and promote environmental stewardship, by providing opportunities to learn, explore and interact with the natural and cultural environment.	Plan for and provide a range of quality recreation and nature-based tourism facilities and services in suitable locations, including through commercial concessions.
	Assess recreation and tourism proposals to ensure that approved activities enhance, or do not negatively impact on, the area's key values, visitor experiences and sense of place.
	Monitor visitor use and satisfaction to inform planning, operations, and commercial opportunities.
	Manage and maintain recreation sites to maintain visitor satisfaction and manage visitor risk.
	Collaborate across government and the community to plan for strategic investments in visitor infrastructure development to create new and improved visitor experiences.
	Encourage and support opportunities for Aboriginal cultural tourism including events, tours and recreation businesses that create jobs for Aboriginal people and enrich experiences for visitors.
	Support environmental stewardship and appropriate visitor behaviour by providing a suite of educational information in the form of interpretive signage, education programs, ranger talks, media and publications.
	Encourage and facilitate access to the planning area by people of all abilities and culturally diverse backgrounds.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy 18: Recreation, tourism and visitor services Corporate Guideline 32: Recreation, tourism and visitor services	

5.6.2 Other Australian heritage

The State Register of Heritage Places is a statutory list of places that represent the story of Western Australia's history and development and is created by the *Heritage Act 2018*. Heritage lists can also be recorded by local government under the *Planning and Development Act 2005* and local planning schemes.

A summary of management directions for historic heritage is outlined in Table 25, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions apply across national and conservation parks and nature reserves to preserve sites of historic interest. These may also be applied where historic sites occur on other land categories in the planning area, where not inconsistent with their purpose.

Table 25: Summary of management directions for other Australian heritage

Key points and considerations	
• The timber industry has been an important part of the history of early settlement and development in the south-west region. • There is a wide range of historic places in the planning area, some of which are listed on the State Register of Heritage Places.	
Management objectives	**Management activities**
1. Identify and manage other Australian heritage values in the planning area.	Promote awareness and understanding of the importance of protecting heritage places.
	Seek to ensure that departmental systems contain records of the presence and type of heritage places.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Guideline 32: Recreation, tourism and visitor services	

5.6.3 Forest-based resources

Forest-based resources include native forest and plantation timber, firewood, honey (from beekeeping), wildflowers and seeds. Water may be stored and taken where it is in the public interest and BRM can be taken for public purposes.

Native forests

Circumstances under which forest products may be salvaged and removed from State forests or timber reserves under FPC production contracts include areas being cleared for mining, or public and DBCA-related infrastructure, ecological thinning operations, natural disturbance events giving rise to landscape restoration activities, and the maintenance or construction of DBCA forest roads, firebreaks and fire access tracks. 'Forest products' do not include fallen timber made available for public collection in public firewood areas, which is dealt with below.

Plantations

Plantations of pines and eucalypt species have been established within the area covered by the plan for the purpose of supplying wood products to industry. State Agreement Acts have been enacted to attract large-scale investment in processing of pine logs. Harvesting operations are conducted in accordance with a range of subsidiary documents and any specific site-level approval conditions.

Production from plantations may be affected by:

- Climate change: it is expected that the long-term productive capacity of south-west forest ecosystems (and plantations) will continue to be affected by drier and warmer conditions.
- Degradation: for example, with an increase in bushfire frequency, intensity and scale, and prolonged droughts, it is possible that more plantations will be affected. Plantations often will not recover from bushfire.

This plan seeks to sustain the productive capacity of plantations as they progressively adapt to changing climate conditions.

A summary of management directions for plantations is outlined in Table 26, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions apply to State forest and timber reserves and are to meet the purpose of optimising yield to meet supply obligations.

Table 26: Summary of management directions for plantations

Key points and considerations	
• The FPC has responsibility for the implementation of management activities relating to plantations. Plantations will continue to be managed to achieve optimal production yields. • Climate change and predicted increase in bushfire may affect production for plantations. • Tenure for plantations will remain as State forest or timber reserve. • The plantation estate can play a key role in carbon sequestration, local land remediation and provide long-term renewable resources.	
Management objectives	**Management activities**
1. Manage plantations for: • wood products and ecosystem values • community benefits • industry for the future.	Seek to maintain the area of plantation estate by replanting pines in all suitable areas of State forest and timber reserves that have previously been planted with pines and have been clearfelled, except where not consistent with government policy.
	Manage the silviculture and harvesting of forest products from plantations to optimise yield to meet supply obligations.
	Where not inconsistent with meeting supply obligations, manage plantations to take account of recreation use and seek to minimise adverse impacts on this and other values when undertaking silvicultural operations and harvesting.
	Incorporate into plantation management the latest climate science and down-scaled climate projections for the south-west.
	Develop a Memorandum of Understanding between DBCA and FPC to address respective roles and funding arrangements for plantation fire protection, weed management and other operational activities.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 11: Regulation of the forest products industry Corporate Policy Statement 19: Fire management	

Public Firewood Areas

Public Firewood Areas provide a mechanism for the department to specify where already fallen timber can be taken as firewood by the public from State forest and timber reserves. Before access to the public is permitted, firewood areas are subject to a thorough site assessment of resource availability, impact on the water catchment, risk of spreading diseases such as *Phytophthora* dieback, impacts on threatened fauna and flora, and impacts on recreational and cultural heritage values. Access to public firewood areas is based on members of the public adhering to provisions of the FM Regulations to reduce the environmental impact of collecting firewood.

Under this plan it is proposed that public firewood areas be made available from:

- areas that have been subject to ecological thinning, and areas where activities necessary to maintain and restore forest health have been carried out
- areas that have been recently harvested in the term of FMP 2014-2023 and
- areas that were historical (pre-FMP 2014-2023) harvest coupes and where the removal of firewood would not be incompatible with a conservation purpose.

To address the environmental impacts of unauthorised firewood collection, the department will consider enforcement strategies and behaviour change initiatives, with the aim of reducing firewood consumption. Measures to improve public awareness and encourage voluntary compliance through communication and education campaigns, will also be pursued.

Honey and related products

The department administers an apiary site authority system that allows apiarists to access CALM Act land and certain other Crown lands, such as unallocated Crown land for the purpose of beekeeping activities. DBCA policy and guidelines provide guidance on assessing the suitability and management of apiary sites. Some activities required for the establishment of apiary sites also require approval under the EP Act. Approved sites are managed under conditions, including those that address management of impacts from apiary.

Wildflowers and seeds

The management of the native flora industry in Western Australia is undertaken by the department through the provisions of the BC Act, using a system of licensing, area and species-specific management and monitoring to help ensure the conservation of flora being harvested. Within the planning area the take of wildflowers for commercial purposes is limited to State forest and timber reserves.

Basic raw materials (BRM)

State forest and timber reserves contain supplies of gravel, shale, clay, sand, limestone and rock that are known as BRM. There is an ongoing need for these materials from the department, Main Roads Western Australia (Main Roads), the FPC and local government. The State Gravel Strategy developed by Main Roads assesses the State's BRM requirements.

The assessment of proposals, and the establishment of BRM extraction pits is governed and enabled by separate pieces of legislation including the CALM Act, *Main Roads Act 1930*, *Land Administration Act 1997*, EP Act and Mining Act.

Proposals by Main Roads to extract BRM on land to which the plan applies will require an agreement with the department that governs the requirements for pit approvals, establishment, management and costs.

Proposals by local government to extract BRM on land to which the plan applies will require a licence issued by the department that governs the requirements for pit approvals, establishment, management and costs. Approval for BRM extraction will also be assessed against the Local Government Guidelines for Road Gravel Supplies in Western Australia[19].

19 walga.asn.au/getattachment/Policy-Advice-and-Advocacy/Infrastructure/Roads/Gravel-supplies-for-Public-Roadworks-v4-July-2021.pdf

Water storage and take

The main State legislation that governs water resource management is the *Rights in Water and Irrigation Act 1914* (RIWI Act), which is administered by DWER. DBCA provides input and advice into water allocation planning and licensing processes associated with the taking of water from land vested in the Commission.

The CALM Act allows for the department to issue a licence for water storage and take where the proposal meets the requirements of the CALM Act. State forest and timber reserves may be used for the storage and taking of water (dam sites), associated infrastructure, and other similar facilities, that serve the public interest, to the extent to which locating such infrastructure and facilities would not be inconsistent with achieving the other purposes for which the area is reserved.

In a drying climate, there may be increased demand for the storage and removal of water from the planning area for commercial or public purposes, which must be balanced with the value of these water resources in sustaining aquatic ecosystems.

A summary of management directions for forest-based resources (excluding plantations) is outlined in Table 27, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions apply primarily to State forest and timber reserves and meet purposes prescribed by Regulation 81 of the CALM Regulations and may also support the purpose of recreation. These activities are also consistent with the functions of the department under the CALM and BC Acts.

Table 27: Summary of management directions for forest-based resource (excluding plantations)

Key points and considerations	
• Forest-based resources includes 'forest products' as defined in the FP Act (which includes trees and timber) BRM, water, firewood, apiary products, wildflowers and seeds. • Apiculture is a significant and growing industry in Western Australia. Within the planning area, apiary sites are assigned and managed using apiary site authorisations. • BRM such as sand, clay, rock and gravel are used in the building and construction industries and for management purposes in the planning area. Extraction and assessment of proposals is managed by various Acts. • Proposals for the storage and take of water from State forest and timber reserves are assessed by the department.	
Management objectives	**Management activities**
1. Removal of forest products from indigenous State forests and timber reserves consistently with the purposes described in Regulation 81(e) of the CALM Regulations. 2. Facilitate use of CALM Act land for apiary activities to a sustainable level. 3. Allow for the availability of BRM while managing the impacts of extraction and use of BRM. 4. Assess proposals in a consistent manner for the storage and take of water and installation of associated infrastructure. 5. Manage the removal of other forest -based resources (not referred to above) in a manner which satisfies public demand, so far as is practicable, sustainable and consistent with the CALM Act.	Liaise with beekeepers, the Bee Industry Council of Western Australia, and DPIRD to provide for the efficient and sustainable use of apiary sites. Regulate the supply of other forest produce through the administration of relevant licensing frameworks. Identify suitable locations within State forest and timber reserves for the gazettal of public firewood areas and refine conditions to improve sustainability of collection. Prepare and implement a Public Firewood Management Strategy to address behaviour change on firewood use and collection methods. Monitor wildflower and seed collection supply patterns to inform understanding of sustainability and implement appropriate management responses as required. Seek to ensure that all BRM removals: • comply with relevant legislation, policies and guidelines • are in the interests of the public • contribute to the ongoing implementation of relevant Government strategies, including the State Gravel Supply Strategy • are sourced from a network of strategic pits where possible, to be identified in consultation with relevant agencies and BRM users. Contribute to the establishment and maintenance of a database to capture the location, condition, use and other criteria of BRM sites. Other than for legacy leases and licences, continue to assess proposals for storage and take of water which are in the interests of the public, where the proposal can be accommodated without unacceptably impacting on values of the planning area and/or delivers a positive management outcome.
Relevant Commission position statements and DBCA policies and guidelines	
Position Statement 12: Basic raw materials Corporate Policy Statement 37: Management of wildlife utilisation Corporate Policy Statement 41: Beekeeping on Crown Land Corporate Guideline 21: Beekeeping on Crown Land	

5.6.4 Access

Roads and bridges

A well-designed and managed system of roads and bridges is essential to connect towns and communities and provides:

- access for neighbours and visitors to enjoy recreational opportunities
- easements for utilities such as water, gas, electricity and communications
- access for management purposes, including to facilitate rapid response to bushfires and other emergencies, and
- access for ongoing commercial activities.

The road network in the planning area, including many culverts and bridges, is extensive and expensive to maintain. A reduction in timber harvesting will result in a reduction in road maintenance programs.

Bridges on the strategic road network intersect with permanent and seasonal waterways and often provide access to water source points. In undertaking its normal operations of fire protection and replacing bridges in accordance with the CALM Act, the department will need to disturb the beds and banks of waterways to provide for strategic water and a road network for public safety. Interference with a watercourse may require authorisation and a permit issued under section 17 or section 25 of the RIWI Act.

Leases and licences

Leases and licences for access to, and use of the land to which the plan applies have been granted for uses including communication towers, utilities infrastructure, grazing to reduce fuel loads, water storage, and for recreation and tourism facilities, including cafes, caravan parks and other accommodation, as well as activities such as tours and other commercial recreation activities (including organised events and filming).

The department may enter into a lease or licence where they meet the requirements of the CALM Act and are compatible with the purposes for which the land is reserved under the CALM Act and the relevant management plan. Leases and licences may have conditions attached that provide a regulatory basis for managing and monitoring permitted activities.

A summary of management directions for access is outlined in Table 28, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions apply across land categories, with a primary purpose of recreation. On State forest and timber reserves these directions may also support recreation, and other purposes prescribed by Regulation 81 of the CALM Regulations.

Table 28: Summary of management directions for access

Key points and considerations	
• A strategic access network is important for a range of purposes, including public access, management, maintenance of public utilities and provision of recreational services (commercial activities). • Leases and licences are granted for appropriate facilities and uses to provide socio-economic benefits while managing environmental impacts and considering the value of land to culture and heritage of Aboriginal persons.	
Management objectives	**Management activities**
1. Maintain a safe and adequate access network for management purposes and to provide for social and economic benefits and opportunities. 2. Enable access to and uses of land that are compatible with the purposes for which the land is reserved.	Prioritise maintenance and upgrade of selected roads to preserve strategic access.
	Establish new bridges and replace existing bridges on the department's road network as required.
	Maintain and establish new water points as required to provide for effective fire response and public safety.
	Assess applications for leases and licences to access and use land taking into account impacts on values of the land, other users and public benefit.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy 18: Recreation, tourism and visitor services Corporate Policy 40: Road management Corporate Policy 55: Commercial filming Corporate Policy 68: Management of events and group activities Corporate Guideline 13: Management of events and organised group activities Corporate Guideline 20: Commercial filming Corporate Guideline 32: Recreation, tourism and visitor services	

5.6.5 Stakeholder and community engagement

Stakeholder and community involvement is an integral part of the department's operations, and the contributions made by volunteers are highly valued. The department values public participation and recognises the need to continue to consider, in a meaningful way, the knowledge and opinions of others as part of its decision-making process. Volunteers expand the department's work capabilities, knowledge and skills base and are valuable to the department because they build communication links and understanding between the department and the community. Public participation, volunteering and stakeholder engagement is formalised under relevant policies and guidelines.

During the development of this plan, the department undertook broad-ranging consultation with stakeholders and the public to understand their views, priorities and aspirations relating to the health and management of the south-west forests. Consultation identified that stakeholders and the public have a genuine desire to contribute to biodiversity conservation and forest management beyond the planning phase, and as part of the implementation of the plan.

Analysis of feedback from stakeholders and the public informed the development of this plan. Detailed reports are available on the DBCA website[20]. Stakeholder and community engagement emerged as a dominant theme. This theme can be broken down into five sub-themes:

1. Engagement with Noongar Traditional Owners and incorporation of kadidjiny (covered in Foundation 1).
2. Greater and ongoing public participation in development and implementation of forest management approaches.
3. Education on forest management practices and sustainable forest use.
4. Improved two-way communication with stakeholder and user groups.
5. Collaboration with university and student research and data collection and citizen science programs.

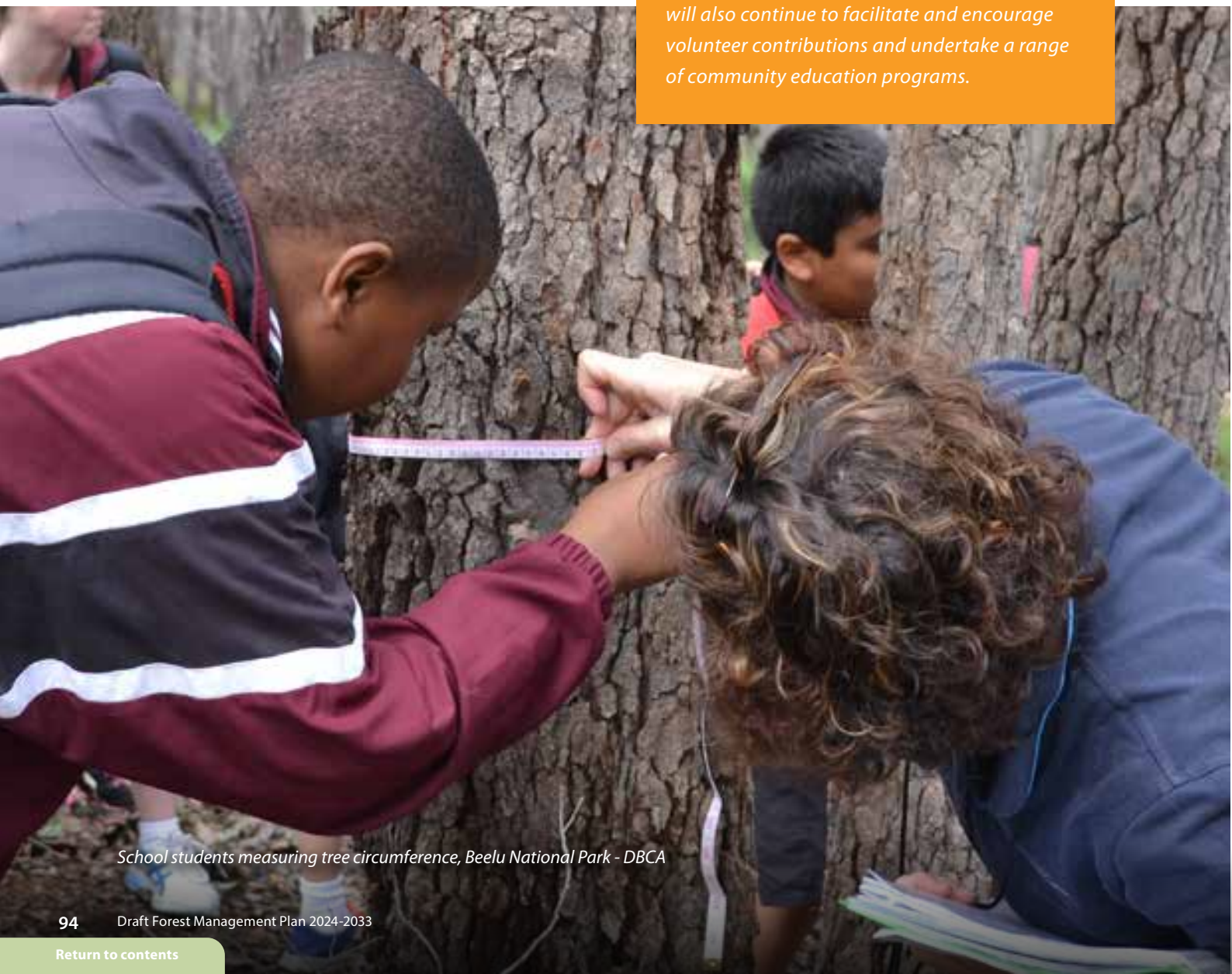
This plan seeks to engage with the public and stakeholders to co-design how the department undertakes stakeholder engagement on forest management activities.

In implementing this plan, the department will also continue to facilitate and encourage volunteer contributions and undertake a range of community education programs.

A summary of management directions for stakeholder and community engagement is outlined in Table 29, with the associated KPI for Foundation 4 – Social and economic benefits and opportunities outlined in Table 30. These management directions are designed to meet general functions of the department.

20 dbca.wa.gov.au/forest-management-plan

In implementing this plan, the department will also continue to facilitate and encourage volunteer contributions and undertake a range of community education programs.



School students measuring tree circumference, Beelu National Park - DBCA

Table 29: Summary of management directions for stakeholder and community engagement

Key points and considerations	
• Community involvement is an integral part of the department's operations. In particular, the contributions made by volunteers are recognised and highly valued. • Community and stakeholder engagement during the FMP planning process identified that stakeholders and the public have a desire to contribute to the development and implementation of the plan.	
Management objective	**Management activities**
1. Provide for a range of opportunities for stakeholder and community engagement.	Seek to develop an engagement platform and approaches to facilitate stakeholder and community participation in the implementation of this plan.
	Provide for and encourage community participation in voluntary activities including conservation works, citizen science, monitoring, educational and social development programs.
	Provide targeted education programs and materials for schools, general community, and stakeholder groups that shape understanding, appreciation and sustainable use of the south-west forests and their management.
	Provide clear and easily accessible information about the values, pressures, use and management of the south-west forests through a mix of communication materials, to reach a range of audiences.
Relevant Commission position statements and DBCA policies and guidelines	
Corporate Policy Statement 15: Volunteers and community involvement	

Table 30: Key performance indicator for Foundation 4 - Social and economic benefits

Visitor experience and access to goods and services on lands covered by the plan	
Strategic goal	To deliver social and economic benefits through the provision of goods and services.
Performance measures	**Management targets**
Visitor satisfaction at DBCA recreation sites.	Meet or exceed 85 percent (DBCA benchmark) for visitor satisfaction.
Trend in utilisation of forest goods and services.	Provide access to the forests for economic and social uses.

6 Part D – Plan implementation, assessment and adaptive management

Pemberton Pools, Pemberton - Tourism Western Australia

Adaptive management, or 'learning by doing' has long been the basis of many environmental programs. Adaptive management will be a key component of the management approach to implement this plan (refer to Figure 3), recognising that there is an incomplete knowledge of values and forest ecosystems, their responses to natural and human-induced disturbances and the effects of management practices. The capability to undertake adaptive management depends on effective collaboration and learning to continually improve planning, implementation, evaluation and adjustment processes.

6.1 Planning

Western Australia's national parks, conservation parks, nature reserves, State forests and timber reserves are vested in the Commission, an independent body established under the CALM Act. Its functions include preparation of management plans for these lands as prescribed in Part V of the CALM Act. DBCA manages land vested in the Commission (CALM Act land) according to CALM Act management plans and within available resources. Under the BC Act, DBCA also has responsibility for the protection of indigenous flora and fauna across all land tenures in Western Australia.

This plan is a statutory management plan prepared in accordance with Part V of the CALM Act. The Commission has developed this plan through the agency of DBCA, in consultation with FPC in respect of State forest and timber reserves, and with DWER in respect of PDWSAs. As detailed in Section 2.3, the plan has also been informed by consultation with other agencies, key stakeholders and the public.

This FMP establishes strategic goals which provide direction based on legislation, government policy, community feedback, ESFM principles and Montreal Process Criteria (see Section 2.5).

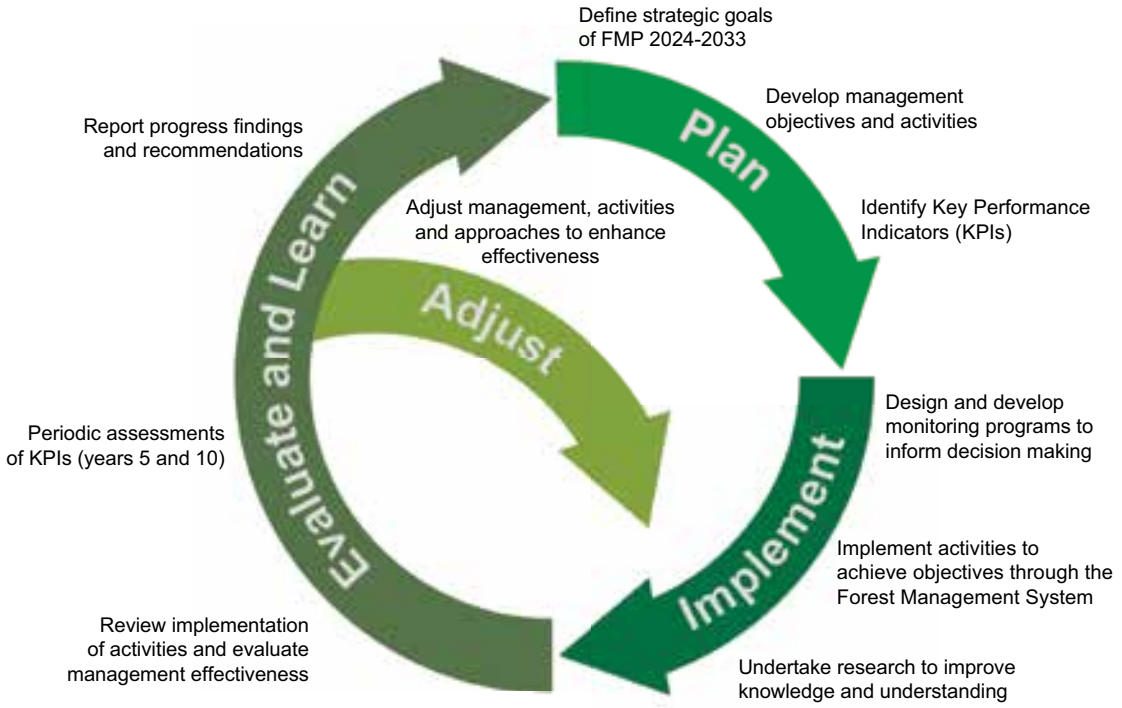


Figure 3. Adaptive management cycle and relationship to FMP 2024-2033

6.2 Implementation

This plan will be implemented through the State's Forest Management System, and through monitoring and research, according to available resources.

6.2.1 Forest Management System

Implementation of management activities will be through the Forest Management System guided by the suite of legislation, policies and guidelines, codes of practice, procedures, plans and management processes for forest management, of which this plan is an important component. It is designed to achieve conservation and management outcomes across both public and private land tenures within the south-west region. The system has a hierarchy of integrated components, including an overarching legislative (both Commonwealth and State) framework, supported by national and state policies, and underpinned by the planning and operations management systems that guide forestry activities. A description of the Forest Management System is on the DBCA Managing our forests page[21].

The key State and Commonwealth legislation which underpin the Forest Management System and have relevance to this plan and the planning area have been referenced throughout the plan. Copies of legislation are available on the Western Australian Legislation website[22].Relevant position statements of the Commission and DBCA policies and guidelines also guide implementation (refer to Part C).

An implementation plan will be prepared that considers and defines the roles, responsibilities and resourcing for the management activities detailed under the four foundations in Part C.

Formal management partnerships will be established between DBCA and the respective Noongar Regional Corporations for State forests, timber reserves and conservation reserves in the planning area. These new cooperative and joint management arrangements recognise that Noongar people have continuing connections to the area and a cultural responsibility to care for country.

6.2.2 Monitoring

Implementation will be assisted by monitoring programs to inform decision making for ongoing forest management for the life of the plan, and to provide information to support reporting requirements. Management will be informed

21 dbca.wa.gov.au/forest-management

22 legislation.wa.gov.au/legislation/statutes.nsf/

by understanding how pressures and disturbances are addressed through management intervention and how key values and components of forest health change over time. Consistent with the principles of adaptive management, improvement of management activities will continue to be informed by monitoring.

The department will implement an integrated approach, involving the systematic collection and collation of data and knowledge to monitor, identify and analyse changes and trends, and contribute to the evaluation of management effectiveness. Monitoring data will be collected in a statistically rigorous manner, that facilitates analysis. Additionally, anticipated advances in monitoring technologies, statistical analysis and other methodological aspects over the next decade will be adopted as appropriate. This integrated approach will enable the monitoring, evaluation and reporting of both outcome-focused key performance indicators and output-focused management activities.

Forest health monitoring

The forest health monitoring component will contribute to the evaluation of effectiveness of the performance measures outlined in Foundations 2 and 3, addressing strategic goals that aim to conserve biodiversity, maintain or improve forest health, and enhance climate resilience.

The forest health monitoring program will determine the status of key biodiversity and environmental components of forest ecosystem condition; detect and quantify changes in key forest ecosystem components to understand and predict patterns and drivers of change (pressures); assess the effectiveness of biodiversity conservation and environmental management activities (response) and inform forest managers, the broader community and policy makers.

The forest health monitoring program will determine the status of key biodiversity and environmental components of forest ecosystem condition; detect and quantify changes in key forest ecosystem components to understand and predict patterns and drivers of change (pressures); assess the effectiveness of biodiversity conservation and environmental management activities (response) and inform forest managers, the broader community and policy makers.

Suitably informative and cost-effective monitoring indicators will be identified across key forest ecosystem components, relating to biodiversity, forest structure, processes affecting forest health, soil and water, and carbon dynamics.

Monitoring of forest health will be scientifically robust, contributing to decision support tools and models, as well as a broader ecological understanding of forest ecosystems. Data collected through forest health monitoring will inform decision making for ongoing forest management for the life of the FMP, meet the reporting requirements of Australia's State of the Forests Report and be aligned with relevant Montreal Process Criteria.

Other monitoring programs relevant to the implementation of this plan will have a focus on disturbance activities, visitor satisfaction and the levels of traditional owner engagement and involvement.

6.2.3 Research

To more fully understand inter-relationships within and between key values, components of forest health, pressures and management activities, research will be undertaken to support progress towards achieving strategic goals. The department seeks to target scientific research related to issues of high priority for management of biodiversity conservation and landscape scale land management. Research in collaboration with Noongar Traditional Owners is also anticipated to be an emerging area over the life of this plan.

Achievement of the objectives identified in this plan will be facilitated by research that improves knowledge and understanding of key values and the response to disturbances and management intervention. Where knowledge is incomplete and the understanding of the impacts is uncertain, proposed operations identified in this plan are conservative, based on a precautionary approach, and may be adapted as new knowledge becomes available.

Measuring vegetation surface moisture content using a fine fuel moisture meter, Donnelly State Forest, Manjimup - DBCA

Knowledge gaps and research opportunities

While there is a great deal of evidence to support current practices, there remain many important knowledge gaps that need to be addressed to improve understanding and inform future management. This is particularly the case with the change in direction of forest management and the ongoing impacts of climate change. Key knowledge gaps relating to forest health and forest management and areas for further research are summarised below. Addressing these knowledge gaps will improve forest health outcomes and enable the department to anticipate and respond to future changes including climate.

Research will be prioritised to address knowledge gaps related to forest conservation, forest health and forest management, such as:

- Biodiversity patterns - Effective design and expansion of the conservation estate is underpinned by an understanding of the patterns in composition, diversity and distribution of the species and ecosystems it seeks to protect.
- Key species and ecosystems - Effective management of key species and ecosystems is supported by knowledge of their ecology, status and threats.
- Forest function - Understanding changes to forest health requires knowledge of forest structure and condition, and effects of ecological and physical processes.
- Fire regimes - Knowledge of fire behaviour and fire ecology will inform the application of appropriate fire regimes, balancing the protection of life and property with conservation and cultural values.
- Pest animals, disease, and weeds - Knowledge of biological threats, their interactions, and approaches for effective management, informs protection of biodiversity and forest health.
- Climate mitigation and adaptation strategies - Responding to current impacts of climate change on forest biodiversity and resilience, and forecasting future impacts, is underpinned by knowledge and understanding of mitigation and adaptation actions.
- Restoration - Effective landscape and habitat rehabilitation and restoration of degraded forest ecosystems relies on knowledge of species and processes.

Knowledge gaps will be addressed through research projects undertaken by the department and through collaborations with other research providers, and by working with non-government organisations, land management partners, traditional owners and the community. Research will be prioritised according to knowledge gaps to best facilitate effective management and improve biodiversity and forest ecosystem health.

Research initiatives may need to be designed and undertaken for other areas relevant to the plan, for example to meet obligations to protect and conserve the value of the land to the culture and heritage of Aboriginal people, and to support nature-based tourism and recreational aspects of the department's land management responsibilities.

6.3 Evaluating and learning

Progress towards achieving the objectives of this plan will be demonstrated by regular monitoring, evaluation and reporting. Mechanisms to assess the effectiveness of management are important components of an adaptive management framework and signal where management may need to be adjusted if it is not successfully meeting management objectives[23]. The Commission and DBCA will use KPIs and/or other surrogates to assess the implementation and success of this plan.

6.3.1 Key performance indicators (KPIs)

KPIs have been developed as part of the planning process to measure the overall effectiveness of management activities and progress towards achieving the strategic goals. The set of KPIs presented in Part C of this plan reflects the highest management priorities and provides a focus for monitoring, evaluation and reporting to inform an adaptive management approach. The KPIs include performance measures and management targets. Further indicators, approaches and elements may also be developed and used during the life of this plan. Protocols for collecting data and reporting for each KPI will be established and updated as required.

23 Refer to Corporate Policy Statement 2: Management effectiveness dbca.wa.gov.au/about/governance-and-corporate-documents/policies

6.3.2 Periodic assessments

The Commission has responsibility for assessing the implementation of this plan in accordance with the CALM Act[24]. Periodic assessments of the implementation of the plan enable the Commission and DBCA to ascertain the suitability, adequacy and effectiveness of management activities and to determine whether the plan, or relevant policies and guidelines, should be amended. Periodic assessments of KPIs will involve analysis of results, identifying issues and any related underlying causes and developing recommendations to improve performance. These assessments are proposed to occur at years 5 and 10 of plan implementation, with key findings and recommendations to be made available through reporting.

The outcomes of performance assessment also assist in promoting the practice of adaptive management.

6.3.3 Management effectiveness evaluations

Departmental management effectiveness evaluations will be undertaken periodically to assess progress on the delivery of management activities, the condition of values and pressures on those values. This will inform the evaluation of management effectiveness in achieving the strategic goals and management objectives of the plan, as well as contributing to the measurement of KPIs against targets. Departmental staff, including scientists, managers and policy officers, will collaborate to undertake management effectiveness evaluations.

6.3.4 State, national and international reporting obligations

The south-west forests have global significance and various obligations have been entered into for protecting and periodic reporting on particular forest values within the planning area. These include the international Ramsar Convention on Wetlands of International Importance, international Migratory Bird Agreements, the WA RFA, the national State of the Forests reports, Australia's Strategy for Nature, and a Strategy for the National Reserve System. While international and national reporting processes are usually coordinated through Commonwealth Government agencies, these reporting processes operate alongside monitoring and reporting on State or regional-level strategies such as the FMP.

The four strategic goals accommodate the seven Montreal Criteria; and management activities will be aligned with and reported against the Montreal Criteria consistent with current practices.

During the 10-year life of this plan, information on the condition of natural forest values within the planning area will also contribute to new initiatives associated with implementation of the *Native vegetation policy for Western Australia* (DWER 2022) and the *Western Australian Climate Policy* (DWER 2020).

6.4 Adjust

The fourth component of the adaptive management framework refers to the adjustment of plans and management activities and approaches in response to changes in circumstances or understanding, and using evidence and learnings to inform these decisions. An example of this process within the planning area has been the *Western Shield* program where fox baiting has been undertaken since 1996. This has included broadscale monitoring of fauna populations to progressively refine the frequency and season of baiting, as well as the relative effectiveness of baiting within different landscapes.

The adaptation or adjustment of management practices in the term of this plan will become increasingly relevant in the face of climate change. The introduction of ecological thinning in targeted forest areas that are vulnerable to drying and warming conditions will also rely on new knowledge and information from operational trials during the plan period. Such adaptive approaches will enable thinning prescriptions or regimes to be adjusted and refined across forest ecosystems, and for the necessary supporting policies and guidelines to be developed.

As part of the adaptive management cycle, existing or proposed policies and guidelines of the department (and in some cases, those of others endorsed by the department) may also be revised from time to time or be replaced during the period of the plan, further demonstrating a commitment to continuous improvement.

24 Refer to Commission Position Statement 16: Periodic performance assessment of the implementation of management plans conservation.wa.gov.au/publications/position-statement

Appendices

Appendix 1a Land categories in the planning area

Section 5 of the CALM Act specifies the categories of land to which the Act applies and section 6 defines those land categories. For the purposes of the plan the relevant land categories are: State forest, timber reserves, national parks, conservation parks, nature reserves, other land that was reserved under the (now repealed) Land Act 1933 and vested by order under that Act in the Conservation and Parks Commission ('section 5(1)(g) reserves') and any other land other than excluded waters, reserved under Part 4 of *the Land Administration Act 1997*, the care control and management of which are placed by order under that Part with the Conservation and Parks Commission ('section 5(1)(h) reserves').

The CALM Act sets out purposes that guide the design of management plans for these categories of land and the management of that land. A purpose of protecting and conserving the value of land to the culture and heritage of Aboriginal persons applies to all land managed under the CALM Act. In addition, further purposes as set out in the table below apply to particular categories of land. The FMP 2024–2033 has been designed to achieve these purposes.

Land category	Purpose
Indigenous State forests and timber reserves	The management objectives are the purposes, or combination of purposes, that are provided for in a proposed management plan. This must be one or more of the purposes listed in section 55(1) of the CALM Act and Regulation 81 of the CALM Regulations.
National park	National parks have national significance, and their purpose is to fulfil the demand for recreation by members of the public which is consistent with the proper conservation of the natural environment, the protection of flora and fauna and the preservation of any feature of archaeological, historic, or scientific interest.
Conservation park	Conservation parks are of regional or local significance, have the same management objectives as national parks and are managed identically to national parks.
Nature reserve	Nature reserves are to: • conserve the natural environment • protect, care for and promote the study of indigenous flora and fauna and • preserve any feature of archaeological, historic or scientific interest.
Section 5(1)(g) and 5(1)(h) reserves	No set purpose applies but 'recreation or conservation' is a common purpose applied to section 5(1)(g) or 5(1)(h) reserves.
Freehold land held in the name of the CALM Act CEO	No formal purpose is required with freehold. Management objectives will depend on the use to which the land is put. Predominantly this land has been used to grow exotic tree species, largely pine.

Land classifications

The land categories mentioned in the table above may be further classified into one of the categories referred to in section 62 of the CALM Act. These categories include, for example, forest conservation areas. Classification of land as a forest conservation area is used to provide a higher level of security of classification for areas that have some impediment to being considered for a formal conservation reserve category. Management priority is maintenance of biodiversity but can allow for multiple use outcomes.

Appendix 1b Areas of land categories covered by the plan (as of June 2022)

State forest (hectares)	Timber reserve (hectares)	Existing and proposed nature reserves, national parks, conservation parks, CALM Act section 5(1)(g) and 5(1)(h) lands, and State forest classified as forest conservation area (hectares)
1,150,800	44,400	1,326,700[2]
	1,195,200[5]	

Notes:

1. Areas of State forest and timber reserve are exclusive of those areas proposed for addition to reserves
2. The area of reserves includes 9,200 hectares for which the land category is yet to be determined.
3. There are 50,200 hectares set aside as pine plantation and 3,400 hectares of forest dominated by exotic eucalypt species on State forest and timber reserves (covered by this plan and included in Table 1). The exotic eucalypts are mainly within rehabilitated mining areas.
4. There are a further 12,300 hectares of pine plantation and 6,600 hectares of native forest on freehold land held in the name of the Conservation and Land Management Executive Body (not covered by this plan) within the Department's Swan, South West and Warren regions. Approximately 4,500 hectares of this native forest are available for timber harvesting and contribute to the sustained yield from native forests.
5. The area of State forest and timber reserve includes 536,200 hectares which the government is investigating for improved protection.

Appendix 1c Areas of forested lands vested in the Commission

Areas and percentage forested of FMP lands and lands vested in the Commission (as at June 2022))

	Area (ha)	% forested
Total FMP planning area (all land tenures)	2,833,300	71
Lands vested in the Commission (existing)	2,434,700	76

Appendix 1d Disturbance Avoidance Zones in State forest and timber reserves

The types, purpose of and criteria for disturbance avoidance zones are described below.

Zone Type	Purpose	Criteria for inclusion in Department's corporate database
Old-growth forest	Protect areas of old-growth forest outside the formal reserve system	Areas of ecologically mature jarrah forest larger than two hectares that have not been infested with *Phytophthora* dieback, where the effects of anthropogenic disturbance (e.g. timber production, mining, grazing) are either absent or now negligible. Areas of karri forest larger than two hectares where the effects of anthropogenic disturbance (e.g. timber production, mining, grazing) are absent and which are dominated by trees in the late mature to senescent growth stage. Areas of ecologically mature wandoo forest or woodland larger than two hectares where the effects of anthropogenic disturbance (e.g. mining, timber production) are absent.
River and stream zones	Provide forest undisturbed by timber harvesting Protect water quality Protect aesthetic and social values Protect productive capacity, soil values and carbon pools	A 60-metre wide corridor in the area of first, second and third order[25] streams, with all boundaries being at least 20 metres from the bank of the stream. A 150-metre wide corridor in the area of fourth order streams, with all boundaries being at least 50 metres from the bank of the stream. A 400-metre wide corridor in the area of fifth order streams, and streams of any higher category, with all boundaries being at least 100 metres from the bank of the stream.
Diverse ecotype zones	Protect sensitive ecosystems	Rock outcrops, greater than 0.2 hectares, swamps and wetlands, heath, sedge, herb and low-density woodland communities. Ecological characteristics will be used to determine the boundary of these zones, which are defined in the department's corporate database by vegetation codes.
Travel route zones	Protect aesthetic and social values	A corridor that extends at least 200 metres from each side of Level 1 travel routes in the Warren Region[26]. A corridor that extends at least 100 metres from each side of Level 2 travel routes in the Warren Region. A corridor that extends at least 200 metres from each side of the Bibbulmun Track.

25 Classification system for width and importance of streams, varying from one for minor streams, to seven for major streams or rivers).

26 Classification system for viewer sensitivity levels. Level one includes highways and other main roads with high (e.g. greater than 75 vehicles per day) levels of usage (sealed or unsealed). Level two includes main roads with moderate levels of usage (sealed or un-sealed). Note: except for the Bibbulmun Track, and as proposed in this plan for parts of the Munda Biddi Trail, travel route zones apply only in the Warren Region.

Zone Type	Purpose	Criteria for inclusion in Department's corporate database
Less well reserved vegetation complexes	Provide additional protection for the less well reserved vegetation complexes that occur on State forest and timber reserves	Vegetation complexes that have either: • less than five percent of their pre-European area in existing or proposed formal and informal reserves; or • between five and 10 percent of their pre-European area in existing or proposed formal and informal reserves and less than 15 percent of their pre-European area remaining. The less well reserved vegetation complexes currently on the department's corporate database are identified in this appendix.
Poorly reserved forest ecosystem	Provide additional protection for a poorly reserved forest ecosystem that occurs on State forest and timber reserves	Darling Scarp forest ecosystem that has less than 15 percent of pre-European area in existing or proposed formal plus CAR informal reserves.
RFA accredited linkage zones	Provide low disturbance linkage zones	The areas identified in the department's corporate database that provide a link between the proposed Milyeannup National Park and an adjacent stream zone, and a corridor between the Helena and Flynn parts of the proposed Helena Valley National Park.
Fauna Habitat Zones	Patches of forest systematically distributed across the landscape which are temporarily excluded from disturbance	As indicated in the Guideline for the Selection of Fauna Habitat Zones (Department of Parks and Wildlife 2017).

Appendix 2 Montreal Process criteria for the conservation and sustainable management of temperate and boreal forests

The United Nations Conference on Environment and Development (Rio Earth Summit), 1992 expediated recognition of the environmental, social and economic importance of world forests and development of the concept of sustainable forest management. In 1994 the Montreal Process Working Group[27] began developing a set of criteria and indicators as guidelines for assessing national forest trends and sustainable forest management in temperate and boreal forests. Australia is one of 12 member countries that have adopted these criteria, known as the Montreal Criteria.

Criterion 1: Conservation of biological diversity

Criterion 2: Maintenance of productive capacity of forest ecosystems

Criterion 3: Maintenance of ecosystem health and vitality

Criterion 4: Conservation of soil and water resources

Criterion 5: Maintenance of forest contribution to global carbon cycles

Criterion 6: Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies

Criterion 7: Legal, institutional, and economic framework for forests conservation and suitable management

27 montreal-process.org/The_Montreal_Process/Working_Group/

Each criterion is characterised by a set of quantitative and qualitative indicators. Measurement of each indicator over time shows changes in trends for environmental, social, economic and policy conditions. Monitoring these changes provides information needed to evaluate a country's progress to sustainable forest management and is essential to making informed forest policy decisions.

A framework for development of these criteria and indicators is described in the document, *Australia's Sustainable Forest Management Framework of Criteria and Indicators 2008-Policy Guidelines* (Commonwealth of Australia 2008).

Appendix 3 Number of species listed as threatened and priority flora in the planning area

(Western Australian status for South West, Swan and Warren DBCA Regions, table generated from Florabase, updated from the Threatened and Priority Flora database, 24 May 2022)

	EX	CR	EN	VU	P	Total
Vascular plants	4	39	47	28	583	701
Non-vascular plants		1			7	8
Lichens					13	13
Fungi					12	12

Key

EX = Extinct; CR = Critically endangered species; EN= Endangered species; VU= Endangered species; P= Priority species;

Appendix 4 Number of species listed as threatened and priority fauna in the planning area

(Western Australian status for South West, Swan and Warren DBCA Regions, list published June 2022)

	CR	EN	VU	CD	OS	P	MI	Total
Amphibians	1		2			1		4
Birds	5	14	18	1	1	9	51	99
Fish		4	4			2		10
Invertebrates	4	8	3			25		40
Mammals	2	5	6	3	1	6		23
Reptiles	1	1	5			9		16

Key

CR = Critically endangered species; EN= Endangered species; VU= Endangered species; CD= Conservation dependent; OS= Other specially protected fauna; P= Priority species; MI= Migratory species

Appendix 5 Cooperative and Joint Management

Through the South West Native Title Settlement (Settlement), Noongar people and the department will enter into formal agreements to recognise their mutual rights and obligations in managing the South West Conservation Estate (all CALM Act land in the Settlement area). The FMP area covers about half of the South West Conservation Estate. These cooperative and joint management arrangements will be established in a two-staged process:

Stage 1: Cooperative Management

Six Cooperative Management Agreements (CMAs), one for each of the six Noongar Agreement Areas, will be signed by the department and the relevant Noongar Regional Corporation (NRC). The agreements will apply to the whole of the South West Conservation Estate within that Agreement Area. As shown on Map 4, the planning area has relevance to all six NRCs, though to differing degrees. The footprint of FMP lands covers the full extent of the Whadjuk and the Karri Karak Agreement Areas; large parts of the Gnaala Karla Booja and the Wagyl Kaip and Southern Noongar Agreement Areas; and smaller portions of the Yued and the Ballardong Agreement Areas.

Cooperative management is a strategic, high-level approach to building partnerships between the department and the Noongar community and managing the Conservation Estate together. A Cooperative Management Committee (CMC) will be established to implement each Cooperative Management Agreement. Each CMC will comprise senior DBCA staff and six Noongar representatives as nominated by the respective NRC. The committees will meet at least three times a year and have the ability to establish sub-committees on specific issues. The role of the CMC includes:

- Select and advise on identifying conservation estate for formal joint management agreements under the CALM Act.
- Provide advice on management plans and Aboriginal heritage issues.
- Provide advice on how best to "protect and conserve the value of the land to the culture and heritage of Aboriginal people".
- Assist in the preparation of relevant policies, programs and other management documents.
- Provide advice on customary activities and be the key reference point for 'local area arrangements'.
- Provide advice on Aboriginal employment and economic development initiatives.
- Review opportunities for Noongar participation in contracting and other economic development activities.

Stage 2: Joint Management

Once established, the Cooperative Management Committees will, among other things, work to identify and prioritise specific areas of the South West Conservation Estate to be jointly managed by Joint Management Bodies (JMBs) established under Joint Management Agreements (JMAs). At least one JMA for a specific park or reserve in each Agreement Area will be in place within the first five years of the commencement date of the Settlement (i.e., by 25 February 2026). At least one further JMA will also be created in another part of each Agreement Area within 10 years of the commencement date of the Settlement (i.e., by 25 February 2031).

Consequently, over the life of the plan, a number of parks and reserves in the planning area will become jointly managed with Noongar Traditional Owners.

Appendix 6 Reserve proposals

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
1	1	Moore River	17,330	FMP 1994-2003 or earlier	Other, NP to NR	In progress[4]
2	2	Moore River	730	Land acquisition	Other, UCL to NR	In progress[4]
3	3	Red Gully	130	Land acquisition	Other to NR	In progress
4	4	Red Gully	2,370	Land acquisition	Other to NR	In progress
5	5	Mindarra	1,060	Land acquisition	Other to NR	In progress
6	-	Mindarra	710	Land acquisition	Other to NR	In progress
7	6	Red Gully	730	Land acquisition	Other to NR	In progress
8	7	Boonanarring	1,220	Land acquisition	Other to NR	In progress
9	-	Moore River	10	Land acquisition	Other to NR	In progress
10	8	Moore River	40	Land acquisition	Other to NR	In progress
11	9	Moore River	950	Land acquisition	Other to NR	In progress
12	10	Beermullah	4	Land acquisition	Other to NR	In progress
13	11	Beermullah	10	Land acquisition	Other to NR	In progress
14	12	Boonanarring	890	FMP 1994-2003 or earlier	Other, UCL to NR	In progress[4]
15	13	Cullalla	440	Land acquisition	Other to NR	In progress
16	-	Cullalla	1,210	Land acquisition	Other to Conservation reserve[3]	In progress
17	14	Lake Muckenburra	70	FMP 1994-2003 or earlier	Other to NR	In progress[4]
18	15	Wilbinga	60	FMP 2014-2023	UCL to CP	In progress[2,4]
19	16	Wilbinga	1,080	FMP 2014-2023	UCL to CP	In progress[4]
20	17	Caraban	2,210	FMP 1994-2003 or earlier	SF to s5(1)(h)	In progress
21	18	Caraban	3,310	FMP 1994-2003 or earlier	SF to CP	In progress
22	19	Yanchep	120	FMP 1994-2003 or earlier	SF to NR	In progress
23	20	Wabling	2,470	FMP 1994-2003 or earlier	SF, s5(1)(h) to NR	In progress
24	-	Chittering	650	Land acquisition	Other to Conservation reserve[3]	In progress
25	21	Julimar	28,580	FMP 1994-2003 or earlier	SF, other to CP; Interim FCA	Not started
26	22	Julimar	30	FMP 1994-2003 or earlier	s5(1)(g) to CP	In progress
27	23	Yanchep	70	Area management plan	Other to NP	In progress
28	24	Yanchep	20	Area management plan	s5(1)(h) to NP	In progress
29	25	Ridges	2,080	FMP 1994-2003 or earlier	SF to NP	In progress
30	26	Pinjar	690	FMP 2004-2013	SF to NR	In progress
31	27	Pinjar	4,940	FMP 2004-2013	SF to s5(1)(h)	In progress
32	-	Chandala	1,130	Land acquisition	Other to Conservation reserve[3]	In progress
33	28	Carabooda	90	FMP 2014-2023	Other, UCL to CP	In progress[2,4]
34	-	Neerabup	7	Area management plan	NP to Other	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
35	29	Neerabup	7	Area management plan	Other to NP	In progress
36	30	Neerabup	20	Area management plan	Other to NP	In progress
37	31	Neerabup	20	Area management plan	Other to NP	In progress
38	32	Neerabup	40	Area management plan	Other to NP	In progress
39	33	Neerabup	480	Area management plan	Other to NP	In progress
40	-	Nowergup	20	Land acquisition	Other to Conservation reserve[3]	In progress
41	34	Yongka (Melaleuca Park)	3,200	FMP 1994-2003 or earlier	SF to NR	In progress
42	35	Moondyne (Avon Valley)	5,170	FMP 1994-2003 or earlier	NR to NP	In progress
43	37	Toodyay (Avon Valley)	3,490	FMP 1994-2003 or earlier	s5(1)(h) to NP	In progress
44	38	Toodyay (Avon Valley)	1,690	FMP 1994-2003 or earlier	s5(1)(h) to NP; Interim FCA	Not started
45	39	Morangup (Avon Valley)	930	FMP 1994-2003 or earlier	NR, UCL to NP	In progress
46	-	Clackline NR	260	Land acquisition	Other to NR	In progress
47	40	Clackline NR	40	Land acquisition	Other to NR	In progress
48	-	Clackline NR	3	Land acquisition	Other to NR	In progress
49	-	Woodvale	3	Land acquisition	Other to Conservation reserve[3]	In progress
50	-	Maralla Road	3	Land acquisition	Other to Conservation reserve[3]	In progress
51	-	Ellen Brook	10	Land acquisition	Other to Conservation reserve[3]	In progress
52	41	Bakers Hill	360	Land acquisition	Other to NR	In progress
53	42	Inkpen	40	Land acquisition	Other to NR	In progress
54	-	Herdsman Lake	230	Area management plan	UCL, other to NR	In progress[4]
55	-	Herdsman Lake	60	Area management plan	UCL, other, s5(1)(h) to CP	In progress[4]
56	44	Beelu	1,060	FMP 2014-2023	Other, UCL to NP	In progress[4]
57	-	Mundaring (Beelu)	10	Land acquisition	Other to Conservation reserve[3]	In progress
58	45	Alfred Cove	4	Area management plan	Other to NR	In progress
59	-	Ferndale	7	Land acquisition	Other, UCL to Conservation reserve[3]	In progress
60	46	Dundas Road	10	FMP 2014-2023	Other to NR	In progress (partially completed)
61	-	Kalamunda	40	Land acquisition	Other to Conservation reserve[3]	In progress
62	47	Helena (Helena Valley)	40	RFA	SF to NP	Not progressed
63	48	Flynn (Helena Valley)	3,950	RFA	DWER freehold to NP	Not progressed
64	49	Talbot	60	RFA	Other to NR	Not progressed
65	50	Forrestdale Lake	150	Area management plan	Other to NR	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
66	51	Forrestdale Lake	110	Area management plan	Other to NR	In progress
67	53	Illawarra (Canning)	420	FMP 2004-2013	WAPC freehold to NP	Not progressed
68	-	Illawarra (Canning)	20	Land acquisition	WAPC freehold to NP	In progress
69	54	Dale	1,890	FMP 2014-2023	UCL to SF	In progress[4]
70	55	Russell	3,360	FMP 1994-2003 or earlier	SF to CP	In progress[2]
71	part 56	Leda	8	Land acquisition	Other to s5(1)(h)	Not progressed
72	-	Sloan's Ridge	10	Land acquisition	Other to Conservation reserve[3]	In progress
73	-	Whitby	50	Land acquisition	Other to Conservation reserve[3]	In progress
74	58	Monadnocks	15,340	FMP 1994-2003 or earlier	s5(1)(g) to NP	In progress
75	59	Monadnocks	7,490	RFA	SF, DWER freehold to NP	In progress
76	60	Monadnocks	1,520	FMP 2004-2013	SF to NP	In progress
77	61	Flint	1,950	FMP 2004-2013	SF, TR to CP	In progress
78	62	Gibbs	2,260	Reinstated FMP(1994) - RFA	SF to CP	In progress
79	63	Serpentine	30	FMP 1994-2003 or earlier	CP to NP	In progress[2]
80	64	Serpentine/Karnet	420	Land acquisition	Other to NP	In progress
81	65	Serpentine	40	FMP 1994-2003 or earlier	Other to NP	In progress[2]
82	66	Serpentine	120	RFA	Other to NP	Not progressed
83	67	Serpentine	280	FMP 1994-2003 or earlier	NR, s5(1)(h) to NP	In progress[2]
84	-	Goegrup Lake	10	Land acquisition	Other to Conservation reserve[3]	In progress
85	68	Black Lake	2	Land acquisition	s5(1)(h) to NR	In progress (semi complete)
86	-	Nambeelup	90	Land acquisition	Other to Conservation reserve[3]	In progress
87	69	Darling Scarp	280	RFA	SF to NR	In progress
88	70	North Dandalup	40	FMP 1994-2003 or earlier	Other to NR	In progress[2,4]
89	71	Monadnocks	4,990	FMP 1994-2003 or earlier	SF, UCL, s5(1)(h) to NP	In progress[4]
90	72	Monadnocks	680	Reinstated FMP(1994) - RFA	SF to NP	In progress
91	73	Bannister	1,170	FMP 2004-2013	SF to CP	In progress
92	74	Gyngoorda	1,330	Reinstated FMP(1994) - RFA	SF to CP	In progress
93	75	Wearne	1,510	FMP 2004-2013	TR to CP	In progress
94	76	Wandering	4,310	FMP 1994-2003 or earlier	TR, other to CP	In progress[2,4]
95	-	Austin Bay	30	Land acquisition	Other to NR	In progress
96	-	Nirimba	40	Land acquisition	Other to Conservation reserve[3]	In progress
97	-	Austin Bay	250	Land acquisition	Other to NR	In progress
98	77	Darling Scarp	160	RFA	SF to CP	In progress
99	-	Yalgorup	160	Area management plan	UCL, other to NP	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
100	-	McLarty	50	Land acquisition	Other to NR	In progress
101	78	McLarty	50	Land acquisition	Other to NR	In progress
102	-	Birchmont	20	Area management plan	UCL to NR	In progress
103	-	Lake McLarty	6	Land acquisition	Other to NR	In progress
104	-	Kooljerrenup	8	Area management plan	Other to NR	In progress
105	-	Nine Mile Lake	100	Land acquisition	Other to NR	In progress
106	-	Lake Clifton (Yalgorup)	8	Area management plan	s5(1)(g) to NP	In progress
107	-	Yalgorup	90	Area management plan	UCL to NP	In progress[4]
108	79	Clifton south	560	FMP 1994-2003 or earlier	SF to NP	In progress
109	-	Preston Beach (Yalgorup)	160	Area management plan	Other to NP	In progress
110	80	McLarty	640	FMP 1994-2003 or earlier	SF to NP	In progress
111	81	Marrarup	20	RFA	UCL to NR	In progress[4]
112	82	Lane Poole	1,730	Area management plan	CP to NP	Not in progress
113	84	Lane Poole	2,970	Area management plan	CP to NP	In progress
114	85	Icy Creek (Lane Poole)	180	FMP 1994-2003 or earlier	UCL to s5(1)(h)	In progress[2,4]
115	86	Lane Poole	1,740	Area management plan	CP to NP	Not in progress
116	87	Myalup	680	FMP 1994-2003 or earlier	SF to NP	In progress
117	88	Myalup	210	FMP 1994-2003 or earlier	SF to NP	In progress
118	89	Cookernup	70	Land acquisition	Other to NR	In progress
119	-	Cookernup	160	Land acquisition	Other to NR	In progress
120	-	Cookernup	260	Area management plan	Other to NR	In progress
121	90	Wagerup (Yarloop)	10	FMP 1994-2003 or earlier	Other to NR	In progress
122	-	Yarloop	3	Area management plan	s5(1)(g) to NR	In progress
123	91	Lane Poole	2,560	Area management plan	CP to NP	Not in progress
124	92	George	550	FMP 1994-2003 or earlier	SF to NP	Not in progress
125	93	George	140	FMP 2004-2013	SF to NP	Not in progress
126	94	George	1,170	Reinstated FMP(1994) - RFA	SF to NP	Not in progress
127	95	Lane Poole	4,340	RFA	SF, UCL, other to CP	Not in progress[4]
128	-	Yalgorup	1	Area management plan	Other to NP	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
129	-	Yalgorup	10	Area management plan	Other to NP	In progress
130	96	Byrd Swamp	40	Land acquisition	Other to NR	In progress
131	97	Clarke (Falls Brook)	40	FMP 2014-2023	Other to NR	In progress
132	98	Clarke (Falls Brook)	410	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
133	99	Clarke (Falls Brook)	200	FMP 1994-2003 or earlier	SF to NR	In progress[2]
134	100	Clarke	290	Reinstated FMP(1994) - RFA	SF to NR	In progress
135	101	Lane Poole	50	FMP 2004-2013	SF to NP	Not in progress
136	102	Lane Poole	1,530	RFA	SF to NP	Not in progress
137	103	Lane Poole	38,020	FMP 1994-2003 or earlier	s5(1)(g), TR, SF, DWER freehold, other, UCL to NP	Not in progress[4]
138	104	Lane Poole	1,090	FMP 2004-2013	SF to NP	Not in progress
139	105	Stockyard/Stene (Lane Poole)	1,990	Land acquisition	Other to NR	In progress
140	106	Lane Poole	2,430	FMP 2004-2013	SF to NP	Not in progress
141	107	Lane Poole	3,800	FMP 2004-2013	SF, TR to NP	Not in progress
142	-	Leschenault Peninsula	4	Area management plan	NR to CP	Not in progress
143	108	Leschenault Peninsula	500	FMP 1994-2003 or earlier	Other to CP	In progress
144	-	Picton	10	Area management plan	s5(1)(h), other to NR	In progress
145	-	Gervasse (Wellington)	60	Area management plan	Other to NP	In progress[4]
146	-	Lennard (Wellington)	30	Area management plan	Other to NP	In progress
147	-	Wellington	70	RFA	SF to NP	In progress
148	109	Westralia (Wellington)	1,140	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
149	110	Westralia	310	FMP 2004-2013	SF to FCA	Not started
150	111	Batalling	400	RFA	SF to NR	In progress
151	112	Boolading	20	FMP 2014-2023	UCL to NR	In progress[2,4]
152	113	The Angle	930	RFA	TR to NR	In progress
153	-	North Boyanup	170	Land acquisition	Other to Conservation reserve[3]	In progress
154	-	Franklandia	20	Area management plan	Other to NR	In progress
155	114	North Boyanup Rd (Franklandia)	4	FMP 1994-2003 or earlier	Other to NR	In progress
156	115	Dardanup	140	FMP 2014-2023	SF to CP	Not started
157	116	Dardanup	120	RFA	SF to NR	In progress
158	-	Bowelling	1,090	Land acquisition	Other to Conservation reserve[3]	In progress
159	117	Bennelaking	5,560	FMP 1994-2003 or earlier	SF, UCL, other to CP	In progress[2,4]
160	118	Cordering	1,120	RFA	TR to NR	In progress
161	120	Stratham	9	Land acquisition	Other to NR	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
162	121	Boyanup	30	RFA	SF to NR	In progress
163	122	Vasse and Wonnerup Estuary	720	Area management plan	UCL, other to NR	In progress[4]
164	123	Tuart Forest	100	FMP 1994-2003 or earlier	SF, UCL to NP	In progress[4]
165	124	Tuart Forest	890	Area management plan	SF, other, UCL to NP	In progress[4]
166	-	Tuart Forest	20	Land acquisition	Other to NP	In progress
167	-	Tuart Forest	1	Area management plan	s5(1)(h) to NP	In progress
168	-	Capel	60	Area management plan	Other to NR	In progress[4]
169	125	Whicher Scarp	4,020	FMP 2014-2023	SF, TR to NP	Not started
170	126	Ryall	910	RFA	TR, SF to FCA	Not started
171	127	Ryall	290	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
172	128	Mullalyup	540	RFA	SF, UCL to FCA	Not started[4]
173	129	Mullalyup	910	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
174	130	Harrington	690	RFA	SF to FCA	Not started
175	-	Goonac (Preston)	200	Land acquisition	Other to Conservation reserve[3]	In progress
176	131	Camballan	430	FMP 1994-2003 or earlier	UCL to CP	In progress[4]
177	132	Camballan	6,630	Reinstated FMP(1994) - RFA	UCL to CP	In progress[4]
178	133	Camballan	1,520	FMP 1994-2003 or earlier	UCL, other to CP	In progress[4]
179	134	Arthur River	100	Land acquisition	Other to NR	In progress
180	135	Kulikup	140	RFA	Other to NR	In progress[4]
181	136	Leeuwin-Naturaliste	10	Area management plan	Other to NP	In progress
182	137	Leeuwin-Naturaliste	10	FMP 1994-2003 or earlier	UCL to NP	In progress
183	138	Leeuwin-Naturaliste	7	RFA	Other to NP	In progress
184	-	Quindalup	30	Area management plan	Other to NR	In progress[4]
185	-	Broadwater	30	Land acquisition	Other to NR	In progress
186	139	Leeuwin-Naturaliste	5	Area management plan	UCL to NP	Not started[4]
187	140	Yelverton (Yelverton) (R 47672)	50	RFA	Other to NP	In progress
188	141	Yelverton NP	20	Area management plan	Other to NP	Not started
189	142	Yelverton	40	Area management plan	Other to NP	In progress[4]
190	143	Yelverton	420	RFA	TR to FCA	Not started
191	-	Kaloorup	60	Area management plan	Other to NR	In progress
192	144	Whicher	320	RFA	SF to FCA	Not started

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
193	145	Mullalyup	1,260	FMP 1994-2003 or earlier	SF, s34(a) freehold to CP; Interim FCA	Not started
194	146	Golden Valley	60	FMP 1994-2003 or earlier	s34(a) freehold to FCA	In progress
195	147	Greenbushes	330	RFA	SF to FCA	Not started
196	148	Greenbushes	20	FMP 1994-2003 or earlier	s34(a) freehold to NR	In progress
197	149	Leeuwin-Naturaliste	20	Area management plan	Other to NP	Not started
198	150	Leeuwin-Naturaliste	270	Area management plan	UCL to NP	Not started[4]
199	-	Leeuwin-Naturaliste	7	Land acquisition	Other to NP	In progress
200	-	Leeuwin-Naturaliste	20	Land acquisition	Other to NP	In progress
201	151	St John Brook	3,540	Reinstated FMP(1994) - RFA	SF, other to CP	In progress[4]
202	152	Jarrahwood	160	RFA	Other to CP	In progress[4]
203	153	Ellis Creek	130	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
204	154	Greenbushes	530	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
205	155	Hester west	1,040	FMP 1994-2003 or earlier	SF, TR to CP; Interim FCA	Not started
206	156	Hester south	1,470	RFA	SF, other to FCA	Not started
207	-	Mayanup	110	Land acquisition	Other to Conservation reserve[3]	In progress
208	157	Leeuwin-Naturaliste	9	Area management plan	Other to NP	Not started[4]
209	158	Leeuwin-Naturaliste	20	Area management plan	UCL, other to NP	Not started[4]
210	159	Bramley	10	Area management plan	TR, UCL to NP	Not started
211	160	Bramley (R 47956)	30	RFA	Other to NP	Not started
212	161	Bramley	250	RFA	TR to FCA	Not started
213	162	Bramley (R 47956)	10	RFA	Other to NP	Not started
214	163	Bramley	5	Area management plan	Other to NP	Not started
215	164	Bramley (R 47956)	2	RFA	Other to NP	Not started
216	165	Mowen	980	Reinstated FMP(1994) - RFA	SF to NR	In progress
217	166	Butler (Butler)	1,250	FMP 2004-2013	SF to FCA (Ministerial condition)	Not started
218	167	Dalgarup	950	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
219	168	Nelson	620	RFA	SF to FCA	Not started
220	169	Dalgarup	200	Land acquisition	Other to NP	In progress
221	170	Glenlynn	1,390	RFA	TR, SF, other to FCA	Not started[4]
222	171	Kingston (Greater Kingston)	10	FMP 2004-2013	SF to NP	Not started
223	172	Wournbelup/ Chowerup	2,170	RFA	UCL, other to NR	In progress[4]

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
224	173	Wournbelup	600	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
225	174	Chowerup	710	FMP 1994-2003 or earlier	Other, UCL to SF	In progress[4,5]
226	175	Leeuwin-Naturaliste	8	Area management plan	Other to NP	Not started
227	176	Leeuwin-Naturaliste	20	Area management plan	Other to NP	Not started
228	-	Redgate	4	Land acquisition	Other to Conservation reserve[3]	In progress
229	177	Witchcliffe	1,060	FMP 1994-2003 or earlier	UCL, other to SF	In progress[4]
230	178	Witchcliffe	490	FMP 2004-2013	UCL to NP	In progress[4]
231	179	Forest Grove	30	Area management plan	UCL, other to NP	Not started[4]
232	180	Forest Grove	130	Area management plan	Other to NP	Not started
233	181	Blackwood River	200	Land acquisition	Other to NP	In progress
234	182	Beaton	440	FMP 1994-2003 or earlier	TR to CP; Interim FCA	Not started
235	-	Beaton	200	Land acquisition	Other to Conservation reserve[3]	In progress
236	183	Leeuwin-Naturaliste	310	FMP 1994-2003 or earlier	Other to NP	In progress[4]
237	184	Leeuwin-Naturaliste	490	Area management plan	UCL to NP	Not started[4]
238	185	Leeuwin-Naturaliste	70	Area management plan	Other to NP	Not started
239	186	Scott River	8	Area management plan	Other to NP	Not started
240	187	Beerup	150	Land acquisition	Other to NR	In progress
241	188	Hilliger	9,050	RFA	SF, UCL, other to FCA	Not started[4]
242	189	Easter	60	FMP 2014-2023	SF to FCA	Not started
243	190	One Tree Bridge	670	FMP 1994-2003 or earlier	SF, s34(a) freehold, UCL, other, s5(1)(g) to CP; Interim FCA	Not started[4]
244	191	Lewin	50	FMP 1994-2003 or earlier	UCL, other to SF	In progress[4]
245	192	Solai	160	FMP 1994-2003 or earlier	TR, other, UCL to SF	In progress[4]
246	193	King Jarrah	200	FMP 1994-2003 or earlier	s5(1)(h) to SF	In progress
247	194	Dingup	230	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
248	195	Weinup	80	RFA	Other to NR	Not progressed
249	196	Bolbelup	1,500	RFA	UCL, TR to FCA	Not started[4]
250	197	Bolbelup	40	FMP 1994-2003 or earlier	Other to SF	In progress
251	198	Leeuwin-Naturaliste	40	Area management plan	Other to NP	Not started
252	199	Leeuwin-Naturaliste	230	Land acquisition	Other to NP	In progress

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
253	200	Leeuwin-Naturaliste	40	Area management plan	Other to NP	Not started
254	201	Hardey Inlet	110	Draft area management plan	NP to NR	Not started
255	202	Hardey Inlet	8	Area management plan	Other to NR	Not started
256	203	Hardey Inlet	3	Area management plan	UCL to NR	Not started[4]
257	204	Augusta	70	Area management plan	UCL to CP	Not started[4]
258	205	Hardey Inlet	200	Area management plan	Other, UCL to NR	Not started[4]
259	206	Hardey Inlet	110	Area management plan	Other, UCL to NR	Not started
260	207	Scott River	110	Area management plan	Other, UCL to NP	Not started
261	-	Scott River	140	Land acquisition	Other to Conservation reserve[3]	In progress
262	208	Gingilup Swamps	100	Area management plan	UCL to NR	Not started
263	209	Gingilup Swamps	440	Area management plan	UCL to NR	Not started[4]
264	210	Gingilup Swamps	10	Area management plan	Other to NR	Not started
265	211	Gingilup Swamps	120	Area management plan	Other to NR	Not started[4]
266	212	Central (D'Entrecasteaux)	600	FMP 2004-2013	SF to NP	In progress
267	214	Strickland (Beedelup)	180	FMP 2014-2023	Other, SF to NP	Not started[4]
268	215	Sir James Mitchell NP	180	FMP 1994-2003 or earlier	NP to SF	In progress[5]
269	216	Talling (Tone-Perup)	40	FMP 1994-2003 or earlier	Other to NR	Not progressed
270	217	Perup	4,030	Area management plan	Other to Conservation reserve[3]	Not started
271	218	Bokarup	490	FMP 1994-2003 or earlier	Other, UCL to NR	In progress[4]
272	219	Quannup (D'Entrecasteaux)	4,460	FMP 1994-2003 or earlier	UCL to NP	In progress[4]
273	220	Nairn	60	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
274	221	Quindinup (Bolbelup)	110	Land acquisition	Other to NR	In progress
275	222	Talling (Lake Muir)	620	FMP 2014-2023	UCL to NR	Not started[4]
276	223	Chitelup (Lake Muir)	310	FMP 2004-2013	SF to NR	In progress
277	224	Perillup	130	RFA	NR to FCA	Not started
278	225	Kwornicup Lake	10	FMP 1994-2003 or earlier	Other to NR	In progress
279	226	Northcliffe	20	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
280	227	Pardelup	3,670	RFA	SF, TR, other, UCL to FCA	Not started
281	228	Mt Barker	260	RFA	Other, leasehold (Aboriginal) to FCA	Not started

FMP 2024 -2033 ID	FMP 2014-2023 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
282	229	Mt Barker	50	RFA	Other, UCL to FCA	Not started[4]
283	230	Northcliffe	40	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
284	231	Northcliffe	60	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
285	232	Gardner	560	FMP 1994-2003 or earlier	UCL to SF	In progress[4]
286	233	Wye-Deep	3,030	FMP 2004-2013	SF to FCA	Not started
287	234	Denbarker	230	FMP 2004-2013	UCL, other to FCA	Not started[4]
288	235	D'Entrecasteaux	1,010	FMP 1994-2003 or earlier	SF to NP	In progress
289	236	Dawson	400	FMP 2004-2013	SF to FCA	Not started
290	237	Dawson	70	FMP 2004-2013	SF, other to FCA	Not started[4]
291	238	Dawson	530	FMP 2004-2013	SF to FCA	Not started
292	239	Crown res 14325 (Walpole-Nornalup)	80	FMP 2004-2013	Other to NP	In progress[4]
293	240	Walpole-Nornalup	40	Land acquisition	Other to NP	In progress
294	241	Keystone-Swarbrick	960	FMP 2004-2013	Other, SF to FCA	Not started
295	242	Swarbrick	260	FMP 2004-2013	SF to FCA	Not started
296	243	Walpole Townsite (Walpole-Nornalup)	60	FMP 2004-2013	UCL to NP	In progress[4]
297	244	Swarbrick (Walpole-Nornalup)	200	RFA	SF to NP	In progress
298	245	Collis	310	FMP 2004-2013	SF, s5(1)(g), UCL to FCA	Not started
299	246	Collis	170	FMP 2004-2013	SF to FCA	Not started
300	247	Collis	1,120	FMP 2004-2013	SF, s5(1)(g) to FCA	Not started
301	248	Walpole-Nornalup	10	Land acquisition	Other to NP	In progress
302	249	Trent	100	FMP 2004-2013	TR to FCA	Not started
303	250	Bow River	270	FMP 2004-2013	SF to FCA	Not started
304	251	Bow River	360	FMP 2004-2013	SF, other, UCL to FCA	Not started[4]
305	252	Kent River	100	Area management plan	UCL to NR	In progress[4]
306	253	Thames	320	FMP 2004-2013	TR to FCA	Not started
307	254	Styx	20	FMP 1994-2003 or earlier	Other to SF	In progress[4]
308	255	Styx	4,420	FMP 2004-2013	Other, SF to FCA	Not started[4]
309	256	Thames	60	FMP 2004-2013	Other to FCA	Not started[4]
310	257	Harewood	3,200	FMP 2004-2013	SF, TR, other to FCA	In progress
311	258	Denmark River	50	FMP 2004-2013	SF to FCA	Not started
312	259	Harewood	110	FMP 2004-2013	SF to FCA	Not started
313	260	Harewood south east	110	FMP 2004-2013	SF to FCA	Not started
314	261	Crown res 15623	60	FMP 2004-2013	s5(1)(g) to FCA	Not started
315	262	Hay	690	FMP 2004-2013	SF, UCL to FCA	Not started[4]
316	263	Hay	910	FMP 2004-2013	TR to FCA	Not started
317	264	Redmond	70	FMP 2014-2023	UCL to SF	Not started[4]
318	265	Redmond	1,210	RFA	TR to NR	Not started
319	-	Indicative areas for new reserves	536,200[6]	FMP proposal	SF, TR to Conservation reserve[3]	In progress

Note: The proposed reserves cover a range of tenures from freehold to unallocated Crown land. Where possible, the department will manage the areas vested in the Conservation and Parks Commission consistent with their intended future purpose and relevant department policies, until they have been formally reclassified as proposed by this plan. Activity in other tenures not vested in the Commission is not necessarily affected by the proposals, until they take effect.

CP: Conservation park

DWER: Department of Water and Environmental Regulation

FCA: Forest conservation area. An FCA is SF classified as such through Section 62(1) of the CALM Act

SF: State forest

NP: National park

NR: Nature reserve

Other: Crown reserve or freehold land not vested in the Commission

s5(1)(g): CALM Act Section 5(1)(g) – land vested under the *Land Act 1933*

s5(1)(h): CALM Act Section 5(1)(h) – land vested under the *Land Administration Act 1997*

s34(a) freehold: CALM Act Section 34(a) freehold – land held by the CALM Executive Body

TR: Timber reserve

UCL: Unallocated Crown land

WAPC: Western Australian Planning Commission

[1] areas greater than 10 hectares have been rounded to the nearest 10 hectares

[2] provided for in *Reserves (National Parks, Conservation Parks, Nature Reserves and Other Reserves) Act 2004*

[3] while the Department prefers these parcels of land to become conservation reserve, the specific proposed tenure and class will be subject to government consideration and determination.

[4] in consideration for the Noongar Land Base

[5] part of the proposed State forest area is included in the indicative areas for increased protection

[6] a subset of this area will be identified to contribute to the 400,000 hectare reservation target set by the McGowan Government in 2021

Appendix 7 Percentage reservation levels of forest ecosystems

Forest ecosystem	Land Categories					
	Conservation Reserves			Other	Total Area Reserved	
	Gazetted ha	FMP Proposed ha	Investigation areas ha		ha	%
Jarrah dominant						
Jarrah Forest - Blackwood Plateau	76,480	15,300	161,980	11,060	264,820	96%
Jarrah Forest - Dandaragan Plateau	2,610	1,290	0	0	3,900	100%
Jarrah Forest - Leeuwin Ridge	7,680	730	0	1,060	9,470	89%
Jarrah Forest - Mt Lindesay	18,970	5,080	3,430	80	27,560	100%
Jarrah Forest - North East	33,960	79,230	10,840	137,450	261,480	47%
Jarrah Forest - North West	63,320	39,800	42,980	300,960	447,060	33%
Jarrah Forest - Sandy Basins	12,930	11,800	17,600	21,080	63,410	67%
Jarrah Forest - South	221,640	10,950	165,320	19,840	417,750	95%
Jarrah Forest - Swan Coastal Plain	3,050	3,900	370	850	8,170	90%

Jarrah Forest - Unicup	14,910	3,400	0	20	18,330	100%
Jarrah Forest/Rates Tingle	1,160	0	0	0	1,160	100%
Jarrah Forest/Red Tingle	220	0	0	0	220	100%
Jarrah Forest/Yellow Tingle	7,590	700	0	0	8,290	100%
Jarrah woodland	24,860	11,790	8,750	15,400	60,800	75%
Sub-total	489,380	183,970	411,270	507,800	1,592,420	
Karri dominant						
Karri - Main Belt	69,710	2,120	79,790	1,740	153,360	99%
Karri - South Coast	880	240	100	0	1,220	100%
Karri - West Coast	4,160	440	10	50	4,660	99%
Karri/Rates Tingle	790	0	0	0	790	100%
Karri/Red Tingle	5,130	80	0	0	5,210	100%
Karri/Yellow Tingle	11,190	550	0	0	11,740	100%
Sub-total	91,860	3,430	79,900	1,790	176,980	
Wandoo dominant						
Western Wandoo forest	40,650	24,690	4,700	28,530	98,570	71%
Western Wandoo woodland	18,380	15,440	3,250	7,630	44,700	83%
Sub-total	59,030	40,130	7,950	36,160	143,270	
Other						
Banksia woodland	19,710	36,000	12,510	4,620	72,840	94%
Bullich and Yate	1,630	680	20	370	2,700	86%
Darling Scarp vegetation	2,950	720	140	180	3,990	95%
Peppermint and coastal heathland	69,930	7,570	270	770	78,540	99%
Rocky outcrops	6,630	2,210	170	4,110	13,120	69%
Sand dunes	12,210	460	0	0	12,670	100%
Shrub, herb and sedgelands	218,790	21,610	19,600	10,920	270,920	96%
Swamps	7,820	1,750	100	510	10,180	95%
Tuart	7,630	3,200	140	510	11,480	96%
Whicher Scarp	650	2,740	1,540	560	5,490	90%
Sub-total	347,950	76,940	34,490	22,550	481,930	
Total	988,220	304,470	533,610	568,300	2,394,600	

Acronyms

ACCU	Australian Carbon Credit Unit
AH Act	*Aboriginal Heritage Act 1972* (to be replaced by *Aboriginal Cultural Heritage Act 2021)*
BC Act	*Biodiversity Conservation Act 2016*
BRM	Basic raw materials
BOM	Bureau of Meteorology
CALM Act	*Conservation and Land Management Act 1984*
CAR	Comprehensive, adequate and representative – as applied to the conservation reserve system
CMA	Cooperative Management Agreement
CMC	Cooperative Management Committee
DAS	Disturbance Approval System
DBCA	Department of Biodiversity Conservation and Attractions
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
ESFM	Ecologically sustainable forest management
FM regulations	Forest Management Regulations 1983
FMP	Forest Management Plan
FP Act	*Forest Products Act 2000*
FPC	Forest Products Commission
ILUA	Indigenous land use agreement
IPCC	Intergovernmental Panel on Climate Change
JMA	Joint Management Agreement
JMB	Joint Management Body
KPI	Key performance indicator
NRC	Noongar Regional Corporation
PECs	Priority ecological communities
PGER	*Petroleum and Geothermal Energy Resources Act 1967*
PDWSA	Public drinking water source area
RIWI Act	*Rights in Water and Irrigation Act 1914*
SWALSC	South West Aboriginal Land and Sea Council
TECs	Threatened ecological communities
WA RFA	Regional Forest Agreement for the South-West Forest Region of Western Australia

Noongar Glossary

Ballardong	Refers to one of the Noongar language or dialectal groups encompassing the towns of Northam, York, Quairading, Koorda, and Tammin. Ballardong is both a single dialectal group (traditional boundary) and also the name of the ILUA or agreement area (Native Title Boundary which encompasses a number of dialectal groups.
Ballawara	Brush-tailed phascogale (*Phascogale tapoatafa*)
Birak	One of the Noongar six seasons the first Summer bonar (season)
Bonar	Noongar word for season
Boodjar	Noongar land/Country
Boonaroo/Bunuru	One of the Noongar six seasons – February and March, the second summer
Djarilmari	Forest
Djeran	One of the Noongar six seasons – April and May, the cooler weather begins
Djilba	One of the Noongar six seasons – August and September, the second rains
Gnaala Karla Booja	Refers to one of the six ILUAs that make up the South West Native Title Settlement encompassing the towns of Capel, Donnybrook, Balingup, Wickepin, Narrogin, Williams, Mundijong, Kwinana, Brookton, Pingelly, Wagin, Harvey, Collie, Pinjarra, Mandurah and Boddington
Kaarak	Forest red-tailed black cockatoo (*Calyptorhynchus banksia*)
Karri karak (formerly South West Boojarah)	Refers to one of the six ILUAs that make up the South West Native Title Settlement encompassing the towns of Busselton, Margaret River, Witchcliffe, Augusta, Windy Harbour, Northcliffe, Pemberton, Manjimup, Bridgetown and Nannup
Kadidjiny	Know, thinking, listening, learning, understanding
Kambarang	One of the Noongar six seasons – October and November, the longer dry periods
Koomal	Common brushtail possum (*Trichosurus vulpecula*)
Koora	Long ago, before, in the past
Kwenda	Southern brown bandicoot (*Isoodon obesulus*)
Kwer	Western brush wallaby (*Macropus irma*)
Maaman	Man, men or father
Mookaroo/Makuru	One of the Noongar six seasons – June and July, the first rains and the coldest season
Ngooritj	Water rat (*Hydromys chrysogaster* – rakali)
Ngamar	A rock-hole
Ngoolboogoor	Honey possum (*Tarsipes rostratus*)
Ngoolyak	Carnaby's white-tailed black cockatoo
Ngoolyanak	Baudin's white-tailed black cockatoo
Ngwayir	Western ringtail possum (*Pseudocheirus occidentalis*)
Noongar Elder	The custodians of Aboriginal knowledge chosen by their communities. Highly respected keepers of the knowledge and pass that knowledge on to younger Aboriginal people.
Nyidiny	Dreaming means 'cold', 'cold times', or 'ancestral times'. The Noongar people know it as the Creation time, the time before time when spirits rose from the earth and descended from the sky to create the land forms and all living things.

Tjooditj	Western quoll or chuditch (*Dasyurus geoffroii*)
Wagyl Kaip and Southern Noongar	Refers to one of the six ILUAs that make up the South West native Title Settlement encompassing the towns of Katanning, Gnowangerup and Albany and includes the Stirling Ranges
Wakarl	Soul, spirit or breath. The Wakarl is the major spirit for Noongar people and central to Noongar beliefs and customs. The Wakarl is a snake or rainbow serpent recognised by Noongar as the giver of life, maintaining all fresh water sources. The Wakarl made Noongar people the custodians of the land.
Whadjuk	Refers to the dialectal group from the Perth area and one of the six ILUAs that make up the South West Native Title Settlement encompassing the towns of Perth, Fremantle, Joondalup, Armadale, Toodyay, Wundowie, Bullsbrook and Chidlow.
Walyo also called Woylie	Brush-tailed bettong (*Bettongia penicillata*)
Yeyi	Present (now)
Yongka	Kangaroo (Western grey kangaroo – *Macropus fuliginosus*)
Yok	Young girl (maaman and yok – men and women)
Yued	Refers to one of the Noongar language or dialectal groups and one of the six ILUAs that make up the South West Native Title Settlement encompassing the towns of Leeman, Jurien Bay, Cervantes, Two Rocks, Gingin, Calingiri, Dalwallinu, Coorow and Moora.

Glossary

Adaptive management	The term adaptive management refers to an approach to managing complex natural systems under conditions of ongoing uncertainty that builds on common sense and learning from experience, experimenting, monitoring, and adjusting practices based on what was learned. Adaptive management strategies can support managers and planners overcome the inherent uncertainty surrounding climate change, its effects, and appropriate responses. Adaptive management has been defined by the British Columbia Ministry of Forests (2004) as: "Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs".
ACCUs	Australian Carbon Credit Units an Australian based carbon credit that can be created as a result of activities that avoid or remove greenhouse gas emissions. Each ACCU is representative of one tonne of carbon dioxide having been removed, or avoided, by the eligible activity.
Apiculture	Beekeeping
Basic raw materials	Materials such as gravel, shale, clay, sand, limestone and rock used principally for road construction and building purposes.
Best practice	Best practices are the working standards or ethical guidelines that provide the best course(s) of action in a given situation.
Biological diversity (Biodiversity) (described in *Biodiversity Conservation Act 2016*)	The variability among living biological entities and the ecosystems and ecological complexes of which those entities are a part and includes: (a) diversity within native species and between native species (b) diversity of ecosystems; and (c) diversity of other biodiversity components.
Burl	A rounded knotty growth on a tree containing twisted, compact wood highly valued for figurative woodwork.
Catchment	The land area drained by a single stream, river, or drainage network.
Carbon farming	An approach aimed at sequestering atmospheric carbon into plant material with the aim to limit global carbon emissions and store CO_2 from the atmosphere and into the plants of productive landscapes.
Carbon dioxide (CO_2) equivalents	A carbon dioxide equivalent (CO2-eq) is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of gases to the equivalent amount of carbon dioxide with the same global warming potential.
Carbon sequestration	Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change.
Clearfell	A silvicultural method in which all, or nearly all, trees in a defined area are removed at one time to allow regeneration to establish and develop (note legacy elements are marked for retention, and some non-commercial trees may still remain on site).
Climate resilience	The ability to prepare for, recover from and adapt to impacts of climate change.
Coarse woody debris	Dead woody material such as boles and branches on the ground or in streams.
Completion criteria	Objectively defined criteria (agreed by the State and each proponent) used to evaluate whether areas disturbed by mining and associated operations on CALM Act lands have been returned to an acceptable state for relinquishment by the mining company and resumption of control and management, consistent with the reserved lands purpose, by the department on behalf of the Western Australian Government.
Conservation reserve	An area set aside primarily for the conservation of natural ecosystems, but which may allow a level of recreation or other uses consistent with the proper maintenance and restoration of the natural environment.
Coupe	An area of forest that is planned for harvest and silvicultural treatments as a single unit.
Criterion	A category, condition or processes by which sustainable forest management may be assessed.
Critically endangered	A taxon is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Crown (tree)	Also known as canopy it is the leaves and branches extending from the bole (stem) of a tree.
Cutover	An area that has previously been harvested.
Dieback (Phytophthora dieback)	In the south-west of Western Australia, a disease of plants caused by infection by the soil-borne organisms of the genus *Phytophthora*, of which *P. cinnamomi* is the most widespread.
Disturbance	Any relatively discrete event in time that disrupts ecosystems, communities, or population structure and changes resource availability or the physical environment. Disturbance may be natural (e.g., lightning caused fire) or human induced (e.g., roads, tracks or trails).
Disturbance activities	Are those planned disturbance activities which are approved under the DAS and unplanned disturbance activities which refers to disturbance resulting from unauthorised activities such as illegal firewood collection, driving vehicles offroad and illegal dumping.
Disturbance Approval System (DAS)	Computer application used by DBCA to assess and, as appropriate approve, disturbance activities on DBCA managed lands.
Disturbance Avoidance Zone	Areas within State forest and timber reserves where planned disturbance activities are to be avoided or minimised. The term combines the various types of informal reserves described in Appendix 1d.
Dreaming	Dreaming (nyidiny) means 'cold', 'cold times', or 'ancestral times'. The Noongar people know it as the Creation time, the time before time when spirits rose from the earth and descended from the sky to create the landforms and all living things.
Ecologically sustainable forest management (ESFM)	Forest management and use consistent with the principles described in section 19(2) of the CALM Act.
Ecological thinning	Ecological thinning is an active forest management tool that involves the selective removal of individual trees to improve or maintain ecological value and reduce current and future moisture stress of a given area.
Ecosystem	A dynamic complex of ecological communities and the non-living chemical and physical parts of their environment interacting as a functional unit.
Endangered	A taxon is endangered when it is not critically endangered but is facing a very high risk of extinction in the near future.
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region.
Ex-situ	Off site.
Exotic species	Any species growing or living outside its natural range of occurrence. This commonly refers to species purposely or accidentally introduced into countries or regions where they do not historically occur.
Fauna	The animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates. Usually restricted to animals occurring naturally and excluding feral or introduced animals. With respect to the BC Act (Section 5) fauna is (a) an animal that — (i) belongs to a native species unless the animal is determined by order under section 9(2) not to be fauna for the purposes of this Act; or (ii) is determined by order under section 9(1) to be fauna for the purposes of this Act; or (b) a native species or taxonomic grouping of native species that is determined by order under section 10(1) or (2) to be fauna for the purposes of this Act.
Fauna habitat zone	Patches of forest systematically distributed across the landscape which are temporarily excluded from disturbance.
Feral animal	An introduced or domestic animal now living in the wild.
Fire regime	The typical range of variation in the interval, severity (or intensity), and season of fire, together with relevant spatial attributes (e.g., extent, boundary shape, patchiness, heterogeneity in severity), and the interactions among these elements – that occurs at a point, or across a landscape.

Flora	The plants growing in an area; including flowering and nonflowering plants, ferns, mosses, lichens, algae and fungi. Usually restricted to species occurring naturally and excluding weeds. With respect to the BC Act (Section 5) flora is a plant that (a) i) belongs to a native species and is indigenous to the State unless the plant is determined under section 9(4) not to be flora for the purposes of this Act ii) is determined by order under section 9(3) to be flora for the purposes of this Act or (b) a native species or taxonomic grouping of native species that is determined under section 10(1) or (2) to be flora for the purposes of this Act.
Floristic	Of or relating to flowers, a flora, or the biogeographical study of plants.
Forest	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 percent.
Forest block	A named administrative subdivision of the forest, varying in size from about 3,000 to 8,000 hectares.
ForestCheck	An integrated monitoring project, designed to provide information to forest managers about changes in trends in biodiversity associated with forest activities, that was implemented under FMP 2004-2013 and FMP 2014-2023.
Forest ecosystem	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 percent. This includes Australia's diverse native forests and plantations, regardless of age. It is also sufficiently broad to encompass areas of trees that are sometimes described as woodlands.
Forest produce	For the purposes of the CALM Act, 'forest produce' includes trees, parts of trees, timber, sawdust, chips, firewood, charcoal, gum, kino, resin, sap, honey, seed, bees-wax, rocks, stone and soil but, subject to the foregoing, does not in Division 1 of Part VIII include minerals within the meaning of the Mining Act.
Forest products	As for the purposes of both the CALM Act and the Forest Products Act: trees or parts of trees; timber, sawdust or chips; charcoal, gum, resin, kino or sap; and firewood, located on public land, share-farmed land, or freehold land acquired as described in section 10(3)(fa) of the Forest Products Act.
Formal reserve	One of the land category categories of national park, nature reserve, conservation park, or CALM Act sections 5(1)(g) or 5(1)(h) reserves for the purpose of conservation.
Global carbon cycles	The global carbon cycle refers to the exchanges of carbon within and between four major reservoirs: the atmosphere, the oceans, land and fossil fuels.
Guideline	A document type that guides and directs actions for achieving consistency and required standards. Guidelines permit some flexibility in their application.
Habitat	A component of an ecosystem providing food and shelter to a particular organism.
Headwater catchment	A headwater catchment is the area of land and groundwater that contributes to the first expression of streamflow, often intermittent or ephemeral, in a creek, brook or other small stream.
Heritage	Something inherited from past generations that is valued.
Heterogeneity	The quality or state of being diverse in character or content. In this plan stand heterogeneity is defined as diversity with respect to stand structure.
High salt risk	Refers to certain river systems within the historic intermediate rainfall zone (based on data up to 1978) that are least disturbed and as such, presumed to have the most intact aquatic ecosystems and consequently are the most environmentally sensitive to rises in saline groundwater.
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the earth's crust (commonly in aquifers).
Hygiene (in relation to dieback)	The set of practices to be followed to maintain native vegetation health through protection from human and vehicle vectored spread of soil-borne *Phytophthora* species.
Indigenous flora and fauna	Refers to a plant (flora) or animal (fauna) which occurs naturally in a given geographical area. That animal and plant also occurs in other areas nearby or elsewhere in the state or country. Differs from endemic (a plant or animal that only occurs in a specific geographical area and nowhere else).
In situ	In the original place.

Informal reserve	See Disturbance avoidance zone.
Indicator	A measure (measurement) of an aspect of a criterion. A quantitative or qualitative variable that can be measured or described and that, when observed periodically, may demonstrate trends.
Integrated monitoring	For the purpose of this plan, integrated monitoring is defined as a systematic integration of data and knowledge across policy, management and science to monitor, analyse and report on the effectiveness of management in achieving FMP objectives.
Key Performance Indicators	The minimum set of performance measures identified in management plans to reflect the highest priorities of the department, joint management partner/s, the Commission and the community. They provide information on the progress in a specified reporting period towards the achievement of the related objective. They are usually presented with management targets and reporting requirements.
Landform	All the physical, recognisable, naturally formed features of land having a characteristic shape. Includes major forms such as a plain, mountain or plateau, and minor forms such as a hill, valley or alluvial fan.
Landscape scale	A term commonly used to refer to action that covers a large spatial scale, usually addressing a range of ecosystem processes, conservation objectives and land uses.
Legacy habitat elements	Refers to existing key habitat features, such as hollow-bearing trees and logs, which may take many decades to replace and which are retained after ecological thinning or remain after natural disturbance, which provide refugia and enrich the structural complexity of the new stand.
Local area arrangements	Regulations that restrict Noongar customary activities exist where activities pose real and significant risks to public safety, flora and fauna values. Local area arrangements are informal agreements negotiated between DBCA and specific Noongar groups and families for undertaking restricted activities.
Local scale	A discrete area of land to which one or more operations have been or are planned to be applied.
Management activities	Actions delivered to achieve management objectives.
Management effectiveness	Management effectiveness in DBCA is primarily the extent to which management is achieving management plan objectives, activities and targets.
Management objectives	The primary aims of management during the planning period that reflect the statutory requirements of the CALM Act [and cultural responsibilities of the Noongar traditional owners].
Measures	Indicators of effectiveness in achieving the management targets and objectives for values. For example, the diversity and abundance of species, or the level of vegetation loss/clearing. Performance measures should ideally be quantitative, representative, simple and cost-effective.
Metham sodium	A soil fumigant.
Moderate salt sensitivity zone	A spatially defined zone in Warren Region where the soil stored salt load is moderate and groundwater was historically close to valley floors.
Monitoring	The regular observation and recording of activities taking place in a project or program to check how project activities are progressing. For the purposes of the plan monitoring assesses management outcomes, the condition of the environment and resources being managed to help determine if desired outcomes are being achieved.
Montreal Process	An agreed framework of criteria and indicators that provide member countries with a common definition of what characterises sustainable management of temperate and boreal forests. (See Appendix 2).
Net zero emissions	Refers to achieving an overall balance between greenhouse gas emissions produced and greenhouse gas emissions taken out of the atmosphere.
Notching	The creation of V-shaped notches into the cambium layer around the circumference of a tree, and associated injection of herbicide to induce tree mortality.
Old-growth forest	Ecologically mature forest where the effects of unnatural disturbance are now negligible. The definition focuses on forest in which the upper stratum or overstorey is in a late mature to senescent growth stage.
Open cut mining	A surface mining technique that extracts minerals from an open pit in the ground.

Patch	A group of trees resulting from a natural regeneration event or a past forest management activity such as gap creation and regeneration. May also refer to a particular, relatively small area of forest and/or other vegetation type(s).
Performance measure	Qualitative or quantitative measures developed to assess progress toward attainment of an objective.
Periodic assessments	Refers to the CALM Act responsibility of the Commission to conduct periodic assessments of the implementation of management plans by those responsible for implementing them. The term performance review as used in this document refers to the periodic assessments undertaken for the previous FMP.
Pesticides	Includes herbicides, insecticides, fungicides and related products registered for use in pest control.
Public Drinking Water Source Area (PDWSA)	Areas managed by the Western Australian Government to ensure safe, good quality drinking water now and for the future.
Public Firewood areas	Areas designated for *firewood collection* in State forest located in DBCA's three forest regions, Swan (Perth Hills), South West and Warren.
Phytophthora cinnamomi, or P. cinnamomi	A microscopic and soil-borne organism. The pathogen that causes most *Phytophthora* dieback disease.
Policy	A document containing principles and rules that outline an organisation's position and which guides decisions and actions taken in the conduct of its activities.
Prescribed burning	Prescribed burning is the process of planning and applying fire to a predetermined area under specific environmental conditions to achieve a desired outcome. Prescribed burns follow a 'prescription' with a number of conditions that need to be met.
Previous FMP	The *Forest Management Plan 2014-2023*.
Priority Ecological Communities	Priority Ecological Communities are possible Threatened Ecological Communities that are inadequately surveyed, or that are not adequately defined or are adequately known and are rare but not threatened. PECs are ranked Priority 1 to 5, depending on the level of urgency for assessment of status.
Protectable area	Defines areas of land managed by the Department over which hygiene management rules for the plant pathogen *Phytophthora*, including clean on entry, will apply. These areas are generally free of disease.
Provenance	'Seed provenance' is where the seed geographically comes from. Seed provenance is an important factor influencing germination. Use of local seed provenances is often recommended in restoration as they are thought to be better adapted to local habitat conditions.
Recovery plan	A plan that describes the actions required to achieve the recovery of threatened species or ecological community from the current threat of extinction or destruction. May be an Interim Recovery Plan when insufficient information is available to prepare a full recovery plan.
Regrowth forest	Native forest which is dominated by similar aged stems that have not reached the mature growth stage, originating from previous harvest events, or other disturbances, such as bushfire.
Rehabilitation	The process necessary to return disturbed land to a predetermined surface, vegetational cover, land use or productivity.
Reservoir Protection Zones	Reservoir protection zones are defined in surface water catchments, and usually form a 2-kilometre buffer around the reservoir that act to control land or water-based activities to protect water quality, as established by the Department of Water and Environmental Regulation.
Resource development	Exploration and development activities undertaking for mineral and petroleum resources, under the Mining Act, PGER Act and/or State Agreement Acts.
Revegetation	The process of replanting or regrowth of disturbed land. It can be a natural process produced by recolonisation and succession or a manmade accelerated process to repair damaged land.
Resilience	The capacity of an ecosystem to withstand external pressures and, over time, return to its prior condition, including its ability to maintain its essential characteristics such as taxonomic composition, structural forms, ecosystem functions and processes (adapted from Thompson *et al.* 2009, who cite Holling 1973).

Ring-barking	The complete removal of the bark (consisting of cork cambium or "phellogen, phloem, cambium and sometimes going into the xylem) from around the whole circumference of either a branch or trunk of a woody plant. A silviculture practice to induce mortality where environmental or anthropogenic reasons are sensitive to the use of chemicals or mechanical tree reduction.
Riparian	Pertaining to the banks of streams, rivers or lakes.
Salinity	Secondary salinity is caused when groundwater levels rise, bringing naturally occurring salt to the surface and dissolving salt in previously unsaturated parts of the soil profiles. This harms salt intolerant vegetation (vegetation conditioned to grow in low salt conditions).
Sawlog	A felled tree trunk that meets minimum specified standards of diameter, length and defect for cutting into timber.
Silviculture	The theory and practice (silvicultural practices) of managing the establishment, composition, health, quality and growth of forests and woodlands to achieve specified management objectives.
Softwood	Wood from gymnosperm trees such as conifers, i.e. pines.
Specially protected	Under the BC Act specially protected species means a native species that is listed as a specially protected species under section 13(1) of the Act.
Stand	A group of trees or patch of forest that can be distinguished from other groups on the basis of size, age, species composition, structural condition or other attributes.
Stand structure	The horizontal and vertical distribution of components of a stand, often characterised by the height, diameter, crown layers and stems of trees, shrubs, herbaceous understorey and woody debris
Statistical rigour	Minimising bias in selection and data analysis. Determining the appropriate sample size for sufficient statistical power to be more confident whether false positives are being generated or false negatives are being missed.
Strategic goals	The overarching plan directions that align with DBCA's legislative responsibilities, ESFM principles and the Montreal framework criteria.
Structure	When applied to a forest, is the horizontal and vertical distribution of the live and dead vegetation.
Target	The end points of management and should be SMART (specific, measurable, achievable, relevant and time-based). Ecological targets are usually able to be represented spatially and are set as either the 'natural state' or some acceptable departure from the 'natural state'. Targets often provide a benchmark to assess success or otherwise of management responses within the life of the plan.
Threatened Ecological Communities	Threatened ecological communities are naturally occurring groups of plants, animals and other organisms that occur in a particular type of habitat and are at risk of collapse due to threats such as land clearing, grazing, weed invasion, hydrological changes and inappropriate fire regimes. They are ranked in three categories: critically endangered, endangered or vulnerable.

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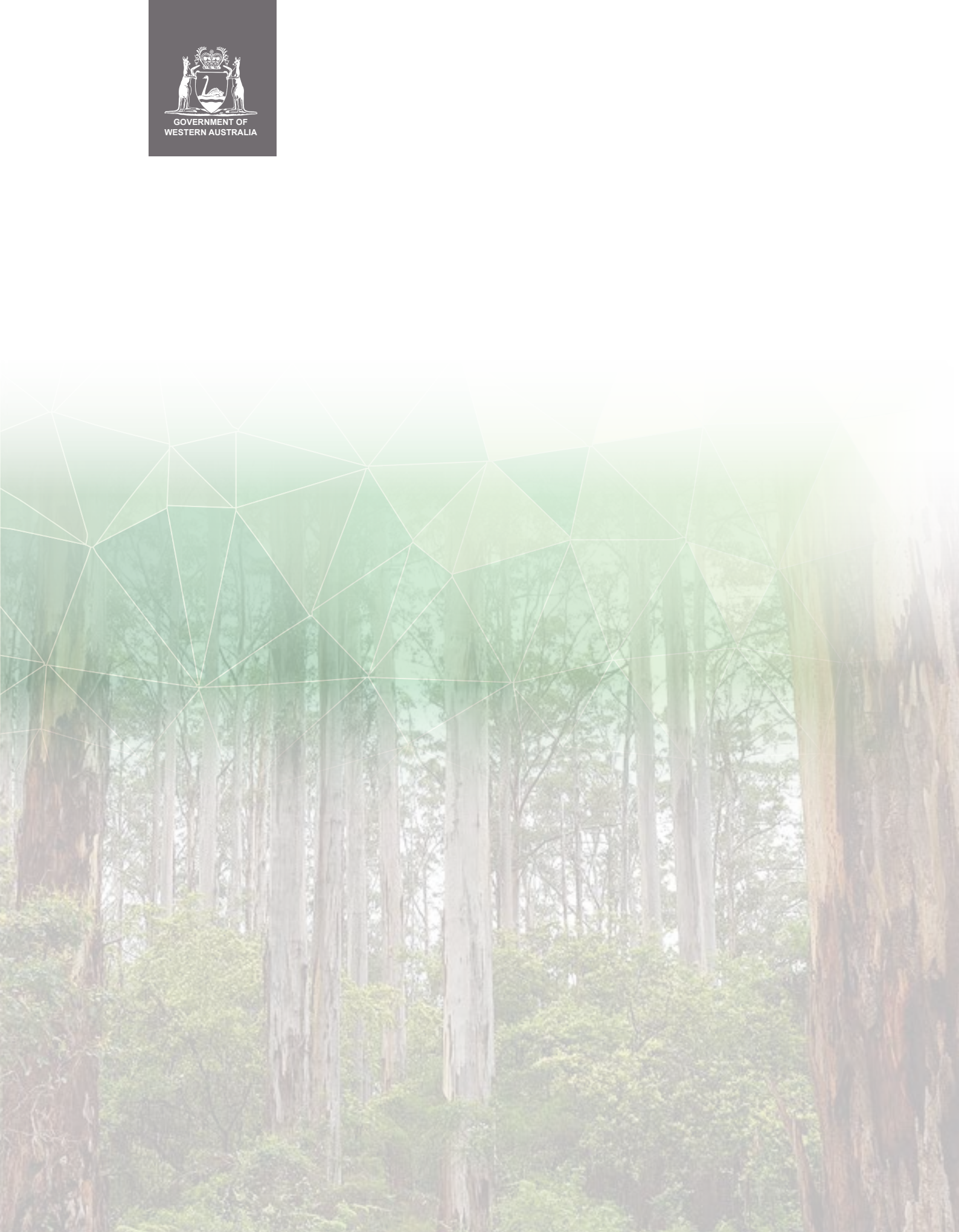

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