

Draft Proposed Forest Management Plan 2024–2033

May 2023

Conservation Parks Commission
and
Department of Biodiversity, Conservation and Attractions

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



Conservation and Parks Commission

Department of Biodiversity, Conservation and Attractions

Draft Proposed Forest Management Plan 2024–2033 May 2023

Contents

1	New directions for forest use and management	2
1.1	Noongar involvement in forest management	3
1.2	Responding to climate change	4
1.3	Enhancing the conservation reserve system	4
1.4	A new era for forest management	5
2	Background	6
2.1	Structure	6
2.2	Scope	8
2.3	Development of the plan	11
2.4	Approaches to forest management	11
2.5	Strategic goals	13
3	Part A – Valuing our south-west forests	14
3.1	Our unique south-west forests	14
3.2	Noongar cultural heritage values	16
3.2.1	Nyidiny and spiritual connections with the land	16
3.2.2	Traditional knowledge	16
3.2.3	Sites of significance	17
3.2.4	Enjoyment of country and customary activities	18
3.3	Physical values	18
3.3.1	Climate	18
3.3.2	Geology	22
3.3.3	Hydrology	22
3.4	Biodiversity values	23
3.4.1	Vegetation and flora	23
3.4.2	Fungi	24
3.4.3	Old-growth forest	26
3.4.4	Fauna	28
3.4.5	Forest ecosystems	30
3.4.6	Forest habitats	30
3.5	Other Australian heritage values	31
3.6	Economic and social values	31
3.6.1	Forest-based produce and resources	31
3.6.2	Recreation and tourism	34
3.6.3	Amenity and aesthetic value	35
3.6.4	Land use planning	36

Contents

4	Part B – Pressures on our south-west forests	36
4.1	Climate change	37
4.1.1	Observed and predicted climate for the south-west	37
4.1.2	Potential consequences of climate change	39
4.2	Minerals and resource development	44
4.3	Inappropriate fire regimes	46
4.4	Weeds	46
4.5	Pest animals	47
4.5.1	Pest vertebrates	47
4.5.2	Pest invertebrates	47
4.6	Diseases	48
4.7	Unauthorised activities	50
4.8	Other native vegetation clearing	50
4.9	Soil degradation	50
5	Part C – Managing our south-west forests	51
5.1	Term and operation of the plan	52
5.2	Management context	52
5.3	Foundation 1: Noongar cultural heritage and management partnerships	53
5.3.1	Cooperative and joint management	53
5.3.2	Protection of Noongar cultural heritage	54
5.4	Foundation 2: Biodiversity conservation	56
5.4.1	Maintaining and expanding the conservation reserve system	56
5.4.2	Conserving biodiversity	59
5.4.3	Managing permitted disturbance activities	61
5.5	Foundation 3: Forest health and climate resilience	63
5.5.1	Climate mitigation: carbon storage	63
5.5.2	Climate adaptation: active forest management and ecological thinning	65
5.5.3	Climate science	72
5.5.4	Fire management	72
5.5.5	Weeds	75
5.5.6	Pest animals	76
5.5.7	Diseases	78
5.5.8	Soil and water	80
5.5.9	Regeneration and rehabilitation	82
5.5.10	Unauthorised activities	84
5.6	Foundation 4: Social and economic benefits and opportunities	85
5.6.1	Nature-based tourism and recreation	85
5.6.2	Other Australian heritage	87
5.6.3	Forest-based resources	87
5.6.4	Access	92
5.6.5	Stakeholder and community engagement	93

Contents

6	Part D – Plan implementation, assessment and adaptive management	96
6.1	Plan	96
6.2	Implement	97
6.2.1	Forest Management System	97
6.2.2	Monitor	
6.2.3	Research	98
6.3	Evaluate and learn	99
6.3.1	Key performance indicators (KPIs)	99
6.3.2	Periodic assessment	100
6.3.3	Management effectiveness evaluation	100
6.3.4	State, national and international reporting obligations	100
6.4	Adjust	100

Appendices	101
Appendix 1a	Land categories by extent within the planning area (as of June 2022)
Appendix 1b	Areas of forested lands vested in the Commission
Appendix 1c	Disturbance Avoidance Zones in State forest and timber reserves
Appendix 2	Montreal Process criteria for the conservation and sustainable management of temperate and boreal forests
Appendix 3	Number of species listed as threatened and priority flora in the planning area
Appendix 4	Number of species listed as threatened and priority fauna in the planning area
Appendix 5	Cooperative and Joint Management
Appendix 6	Processes for consent to undertake mineral, petroleum and geothermal resource activities in State forests and other CALM Act land.
Appendix 7	Reserve proposals
Appendix 8	Percentage reservation levels of forest ecosystems
Appendix 9	New reserve design and creation – priority areas of State forest for consideration
Appendix 10	Process for preparation of silvicultural guidelines for ecological thinning
Acronyms	
Noongar Glossary	
Glossary	
References	

Tables

Table 1:	Projected climate changes in south-west Western Australia	39
Table 2:	Potential consequences of climate change for the south-west forests	40
Table 3:	Summary of management directions for Noongar cultural heritage and management partnerships	55
Table 4:	Key performance indicator: Foundation 1	56
Table 5:	Summary of management directions for maintaining and expanding the conservation reserve system	59
Table 6:	Summary of management directions for conserving biodiversity	60
Table 7:	Summary of management directions for managing permitted disturbance activities	62
Table 8:	Key performance indicator: Foundation 2	63
Table 9:	Summary of management directions for climate mitigation – carbon storage	64
Table 10:	Areas of rehabilitated forest within age class at 2023	68
Table 11:	Area of jarrah regrowth forest within age class at 2023	69
Table 12:	Area of karri regrowth forest within age class at 2023	69

Contents

Table 13:	Area of wandoo regrowth forest within age class at 2023	69
Table 14:	Summary of management directions for climate adaptation – ecological thinning	71
Table 15:	Summary of management directions for climate science	72
Table 16:	Summary of management directions for fire management	74
Table 17:	Summary of management directions for weeds	75
Table 18:	Summary of management directions for pest animals	77
Table 19:	Summary of management directions for diseases	79
Table 20:	Summary of management directions for soil and water	81
Table 21:	Summary of management directions for regeneration and rehabilitation	83
Table 22:	Summary of management directions for 17nauthorized activities	84
Table 23:	Key performance indicator: Foundation 3	84
Table 24:	Summary of management directions for nature-based tourism and recreation	86
Table 25:	Summary of management directions for other Australian heritage	87
Table 26:	Summary of management directions for plantations	88
Table 27:	Summary of management directions for forest-based resources (excluding plantations)	91
Table 28:	Summary of management directions for access	93
Table 29:	Summary of management directions for stakeholder and community engagement	95
Table 30:	Key performance indicator: Foundation 4	95

Maps

Map 1	Forest management plan area	7
Map 2	Existing land categories	9
Map 3	Existing area management plans within the Forest Management Plan area	10
Map 4	Relationship of Forest Management Plan area to South West Native Title Settlement	19
Map 5	Aboriginal language groups	20
Map 6	Rainfall isohyets and forest types	21
Map 7	Old-growth forest by forest ecosystems	25
Map 8	Forest ecosystems	29
Map 9	Rainfall decline 1970-2020	38
Map 10	Mining tenements and operations	44
Map 11	Phytophthora dieback occurrence	49
Map 12	Proposed land categories	58
Map 13	Indicative areas for increased protection	67

Figures

Figure 1.	Noongar seasons calendar	17
Figure 2.	Broad outline of the approach to planning of the department's prescribed burning program	73
Figure 3.	Forest management adaptive management cycle	97



“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

Draft Proposed Forest Management Plan 2024-2033 VI

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, water supply 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 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 Noongar¹ interests. The area covered by the FMP is part of the South West Native Title Settlement Area.

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.

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

The most significant change for forest management resulting from these policy changes is the cessation of large-scale commercial timber harvesting in native forests. 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 may also enhance forest resilience to high intensity bushfires, help maintain carbon stores, and support the development of tree hollows for a variety of species.

The policy settings also commit to an expansion of the formal conservation estate. 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) at least 400,000 additional hectares of national parks, conservation parks and nature reserves will be created, following consultation with traditional owners, to ensure permanent protection of high conservation value areas.

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 Karrak (formerly South West Boorah), Wagyl Kaip and Southern Noongar, Whadjuk, and Yued groups, made in compliance with the *Native Title Act 1993* (Cth).

The Settlement enables 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 represent the rights and interests of each of the six Agreement groups.

The Noongar peoples' strong relationship to their boodjar² (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 -

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 area³. 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. Within Western Australia, forests reduced the State's 2020 net carbon emissions by more than 10 million tonnes (10.7 percent) over that year (CO₂ equivalent) (Department of Industry, Science, Energy and Resources 2022). Managing forests to maintain or enhance 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
- research and education 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](https://www.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, cultural and economic benefits through the provision of goods and services.



Camera checking, Tone State Forest, Manjimup - DBCA

2 Background



Warren National Park - Bron Anderson, DBCA

2.1 Structure

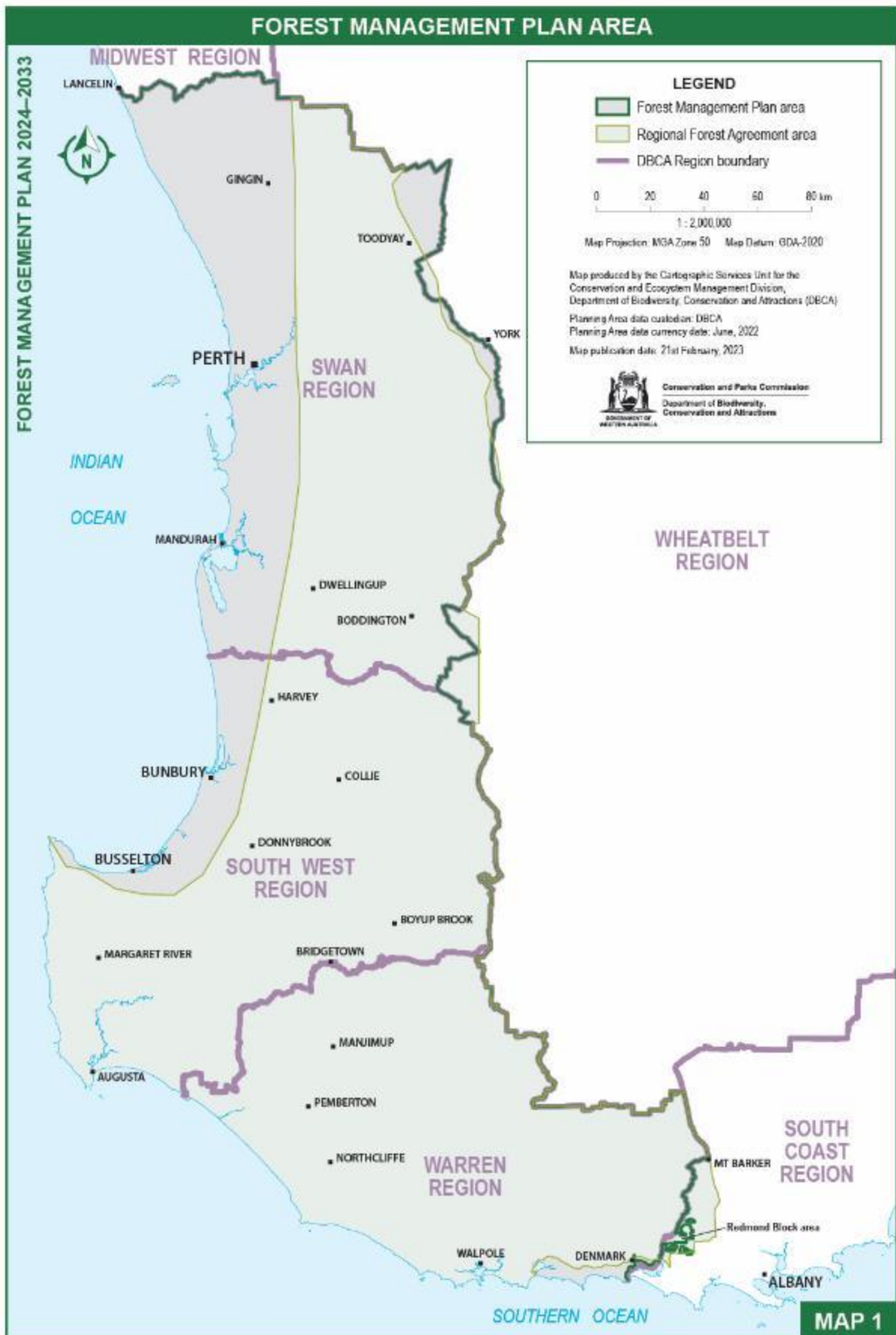
This plan adopts a structure that provides clear linkages between the values and pressures of the south-west forests and the associated management objectives and activities.

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*



22 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 2.4 million hectares of the following lands vested in the Commission (See Map 2 for areas currently vested in the Commission; Maps 12 and 13 include proposed areas to be vested in the Commission):

- 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 and areas of lands vested in the Commission is provided in Appendix 1a.

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 80 percent is forest (see Appendix 1b).

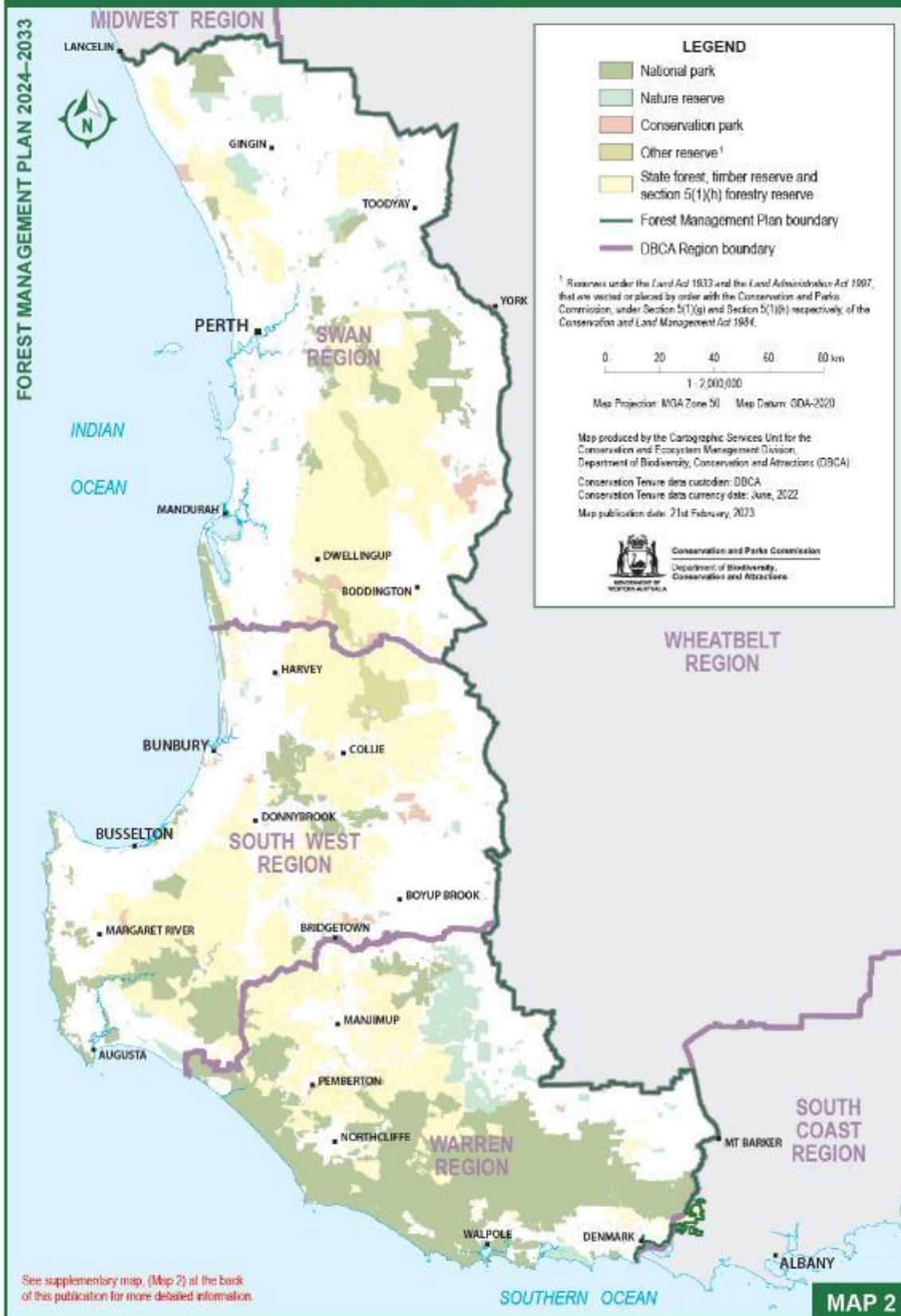
The management objectives, activities and monitoring are focussed on the forest ecosystems of the planning area, acknowledging that the values, habitats and pressures on the Swan Coastal Plain differ from those of the south-west forests.

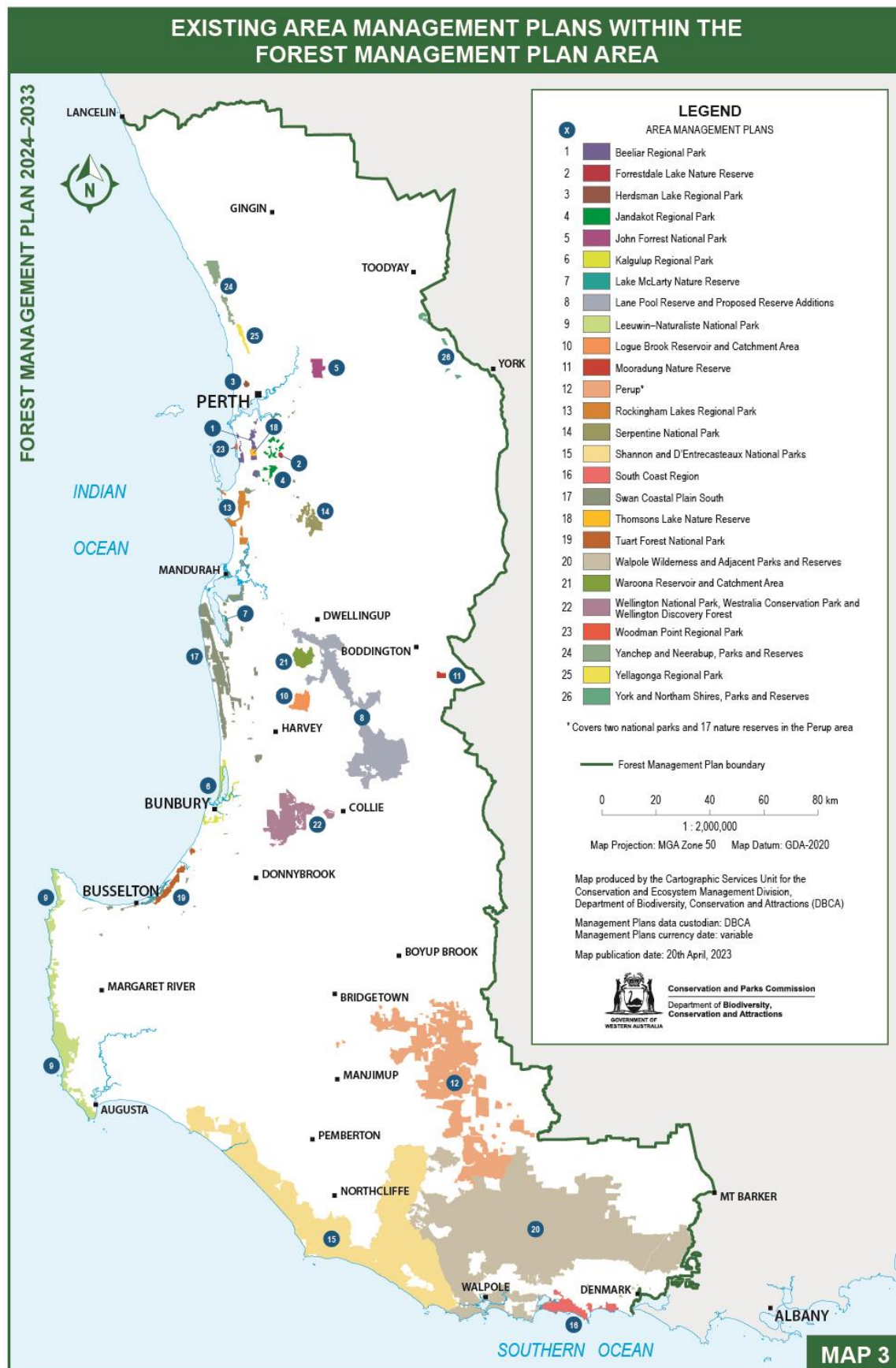
This plan will also function as a management plan for conservation reserves where no specific area management plan exists, including those on the Swan Coastal Plain. Management frameworks of existing area management plans (see Map 3) or those developed during the period of this plan which apply to specific parks and reserves and have precedence over this plan. Approved management plans are available on the Parks and Wildlife Service [website](#).⁵

Opposite Map 2 Existing land categories

⁵ dpaw.wa.gov.au/parks/management-plans/approved-management-plans

EXISTING LAND CATEGORIES





23 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.

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).

The *Draft Forest Management Plan 2024-2033* was released for public consultation from October to December 2022, in accordance with section 58 of the CALM Act. Public submissions resulted in modifications to the draft FMP, as detailed in the report Summary of public submissions on the Draft Forest Management Plan 2024-2033.

Outcomes of the pre-draft consultation process included acknowledgement that climate change poses a key risk to forest health and resilience; support for increased Noongar involvement in forest and fire management; advocating increased protection of the forests from mining; restoration, conservation and protection of biodiversity; ongoing engagement with the public and stakeholder groups, and measures to assess management effectiveness.

This plan outlines values of south-west forests consistent with sentiments voiced in the consultation process, seeks to protect these values and conserve biodiversity through a range of complementary management objectives, identifies climate mitigation strategies including carbon sequestration opportunities across the planning area, facilitates Noongar involvement in forest management, incorporates measures associated with assessing and reporting on forest health, and allows for public and stakeholder involvement in forest management activities where possible.

Further information and reports from these consultation and engagement processes are available on [the FMP website](#)⁶.

24 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; clearing for townsites, agriculture and infrastructure; the introduction and spread of exotic diseases, weeds and pest animals; and more recently the frequency and intensity of extreme summer bushfire events. 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.

⁶ dbca.wa.gov.au/forest-management-plan

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 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.

For this plan, a healthy native forest is one that continues to sustain the natural ecosystem components, including biodiversity and biophysical, ecological and evolutionary processes. Ecosystem components are not static, but interact at varying scales and rates over time. Where forests are subject to disturbance, whether natural or human, their resilience can be described as their capacity to maintain or regain a healthy condition over time.

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.



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.

25 Strategic goals

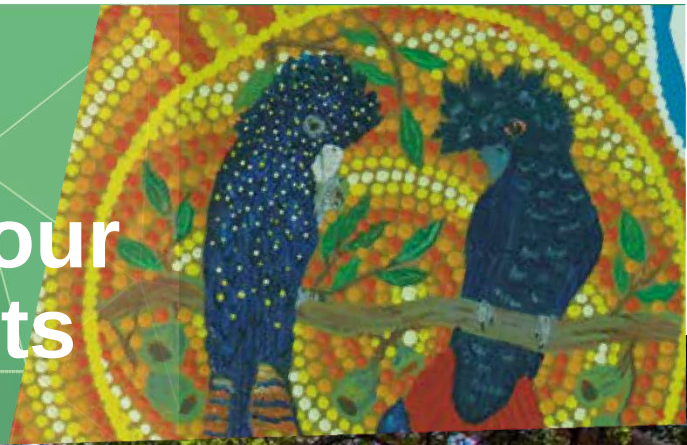
A set of strategic goals has been developed for the planning area that align with legislation, government policy, ESFM principles and the Montreal Process Criteria. The strategic goals are:

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, cultural 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, spiritual, recreational and socio-economic benefits that the forests provide (Subroy *et al.* 2021, 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.

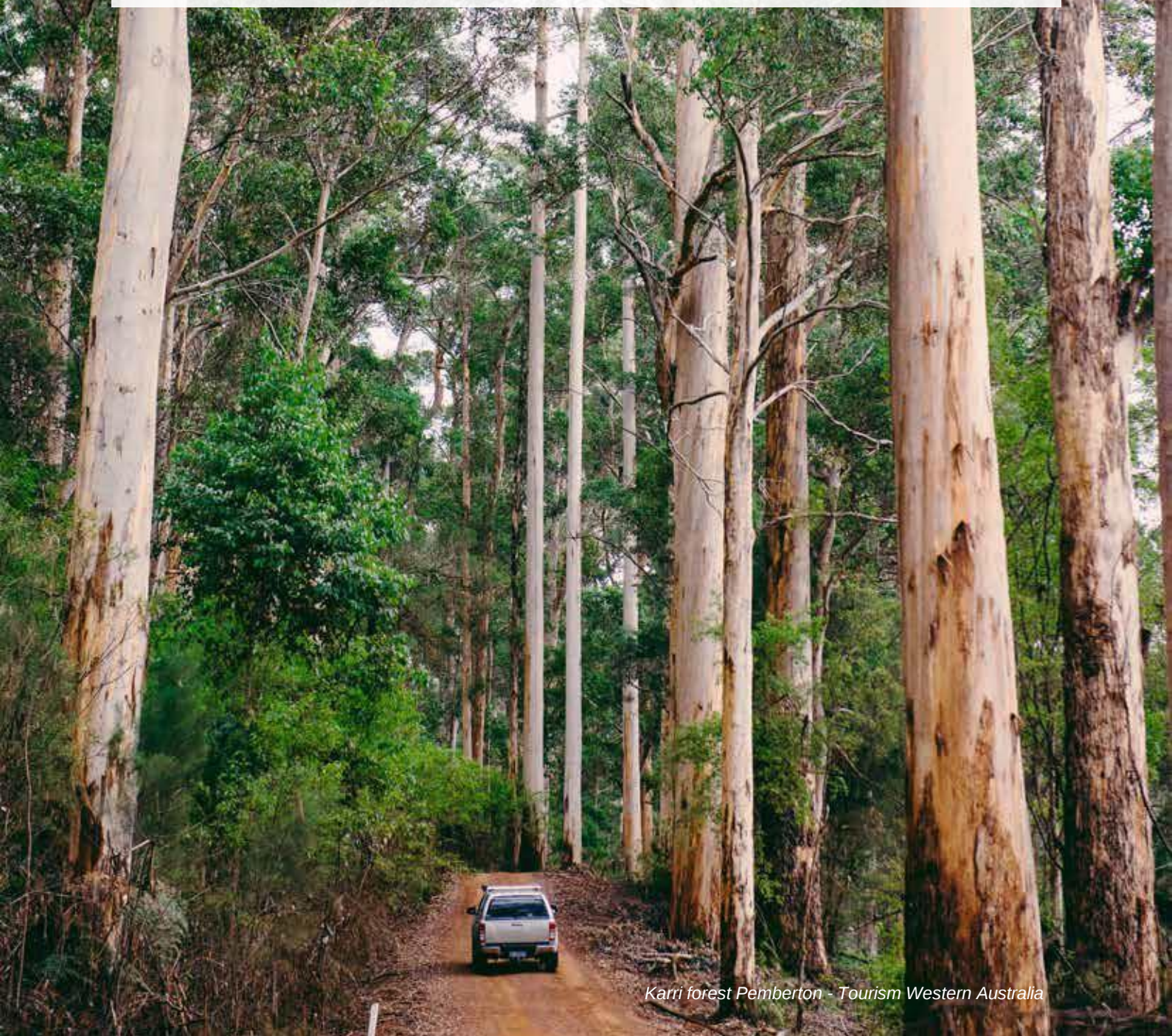
The south-west is also renowned as a hotspot for geographically isolated plants and animals with ancient genetic lineages, such as the Albany pitcher plant (*Cephalotus follicularis*), honey possum (*Tarsipes rostratus*), western swamp tortoise (*Pseudemydura umbrina*), sunset frog (*Spicospina flammocaerulea*) 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, fauna and fungi.

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). Timber was an important resource for European settlers and while timber harvesting was largely unregulated in the first century of settlement, after 1918 forests were managed primarily for the production of timber while accommodating other values and uses (Carron 1985).

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 the 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 Karrik (formerly South West Boorah) 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) 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 periods⁷ (Figure 1). 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.

⁷ noongarculture.org.au

Noongar Seasons

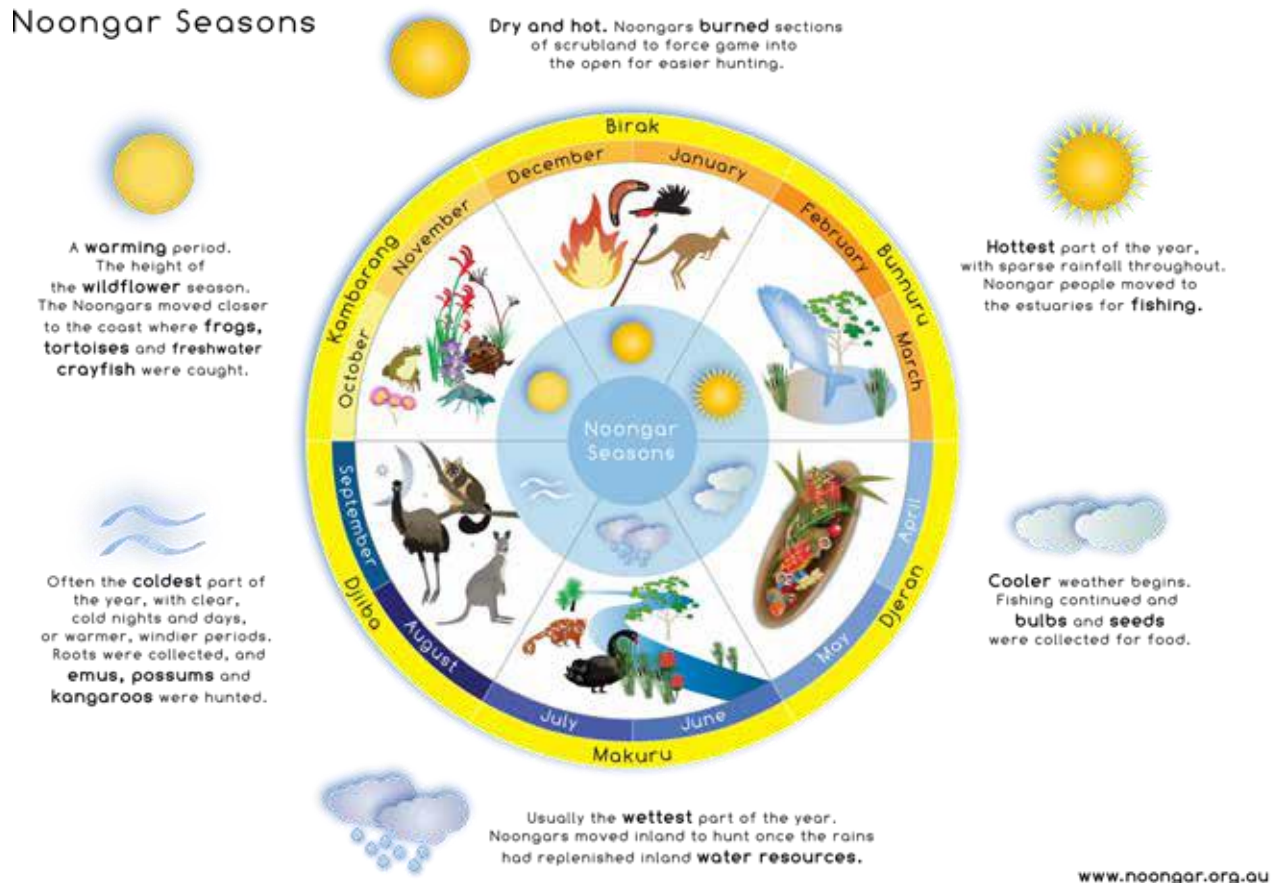


Figure 1. Noongar seasons calendar provided by South West Aboriginal Land and Sea Council (SWALSC)

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 kadjiny 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 (Gentili 1989). Rainfall in the northern part of the forest ranges from 500mm per annum at the eastern edge, to 1100mm 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 1300mm per annum at some locations (rainfall data Bureau of Meteorology, 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

FOREST MANAGEMENT PLAN 2024-2033

COOPERATIVE MANAGEMENT

For each Agreement (ILUA) area:

A Cooperative Management Agreement (CMA) will apply to the whole of the South West Conservation Estate within that ILUA area.

A Cooperative Management Committee (CMC) comprising 6 Noongar and 2-6 DBCA representatives will provide high-level advice on matters affecting the Conservation Estate. The CMC will also work to identify and prioritise specific parks and reserves to be jointly managed.

CMCs will meet at least 3 times a year.

LEGEND

- South West Native Title Settlement boundary
- Indigenous Land Use Agreement (ILUA) boundary
- Forest Management Plan boundary

Example of cooperatively managed area (for illustrative purposes only)

Example of jointly managed area (for illustrative purposes only)

0 20 40 60 80 100km

1:3,000,000

Map Projection: MGA Zone 50 Map Datum: GDA 2020



SOUTH WEST NATIVE TITLE
SETTLEMENT AREA

Map produced by the Cartographic Services Unit for the
Conservation and Ecosystem Management Division,
Department of Biodiversity, Conservation and Attractions (DBCA)

Native Title data custodian: National Native Title Tribunal (NNTT)

Native Title data currency date: April, 2022

Map publication date: 21st February, 2023



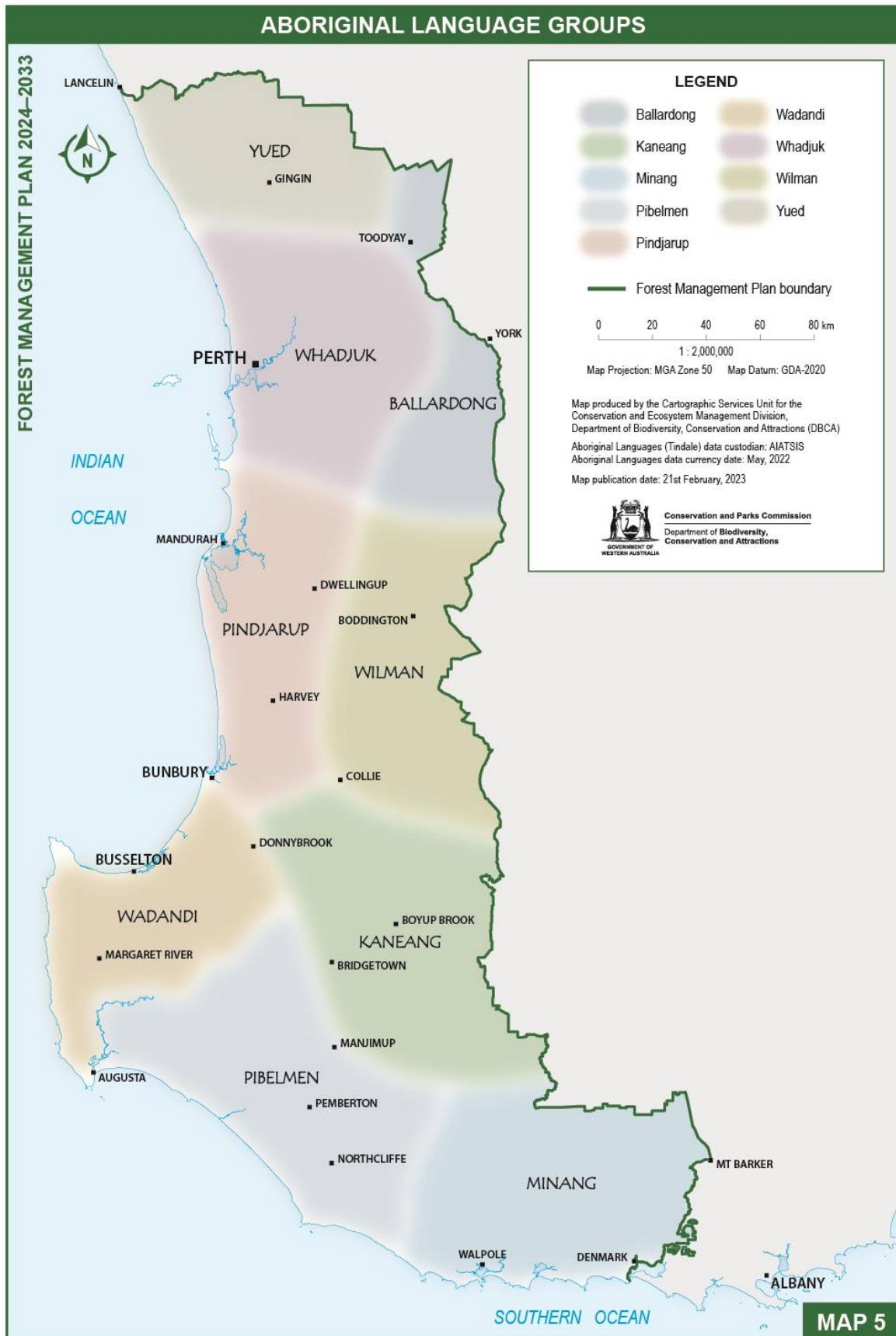
Conservation and Parks Commission
Department of Biodiversity,
Conservation and Attractions

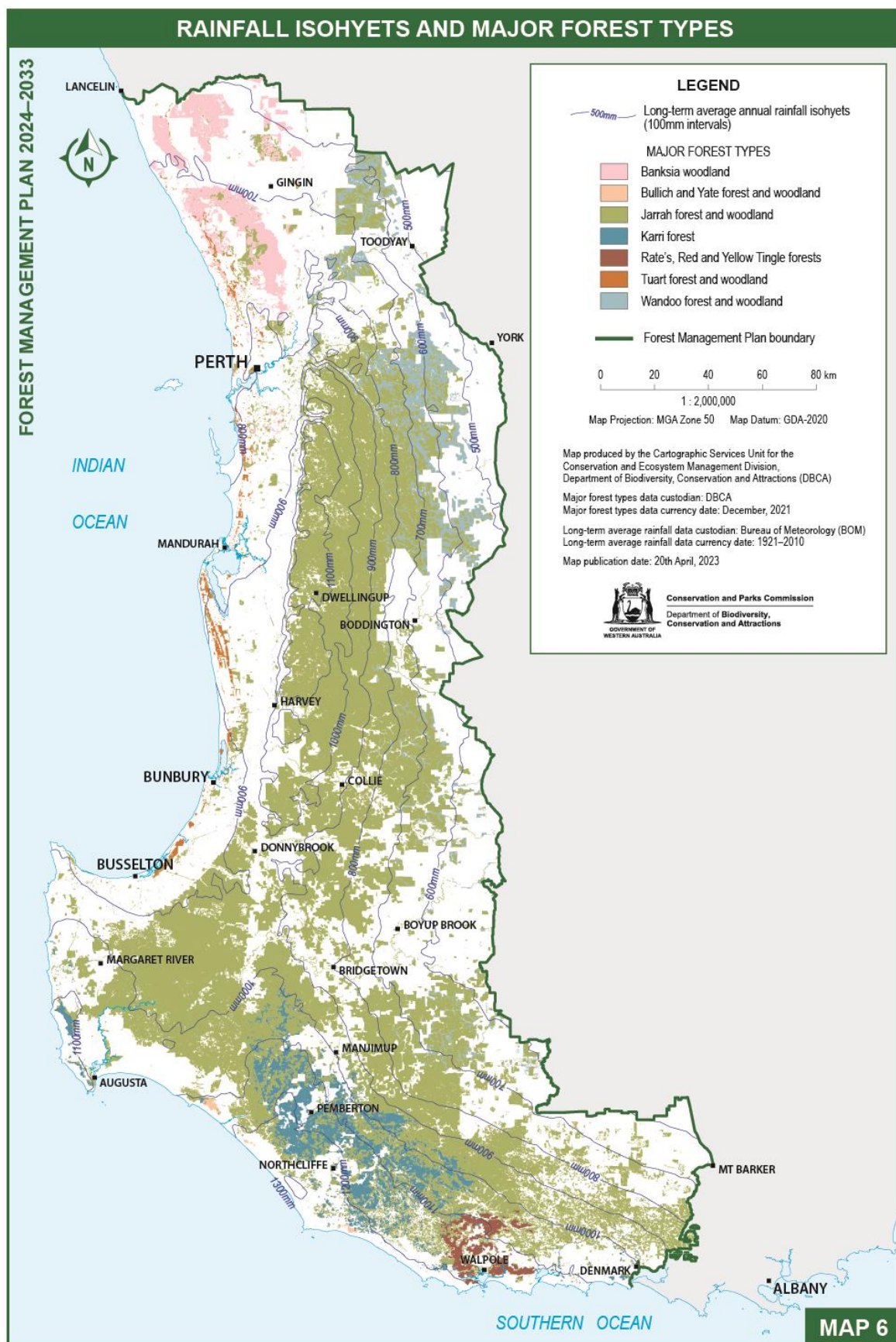
JOINT MANAGEMENT

For each Agreement (ILUA) area:

A Joint Management Agreement (JMA) will be signed for specific priority parks and reserves.

A Joint Management Body (JMB) of up to 6 Noongar and up to 6 DBCA representatives will make decisions consistent with the relevant management plan.





3.3.2 Geology

The geology of the south-west is dominated by granite and greenstones of the Yilgarn Craton, a large block of ancient crust that has been relatively tectonically stable for much of the last billion years. There are two major geological units that occupy the coastal areas of the region, the Perth Basin to the west and the Albany Fraser Orogen to the south.

The bedrock in the south-west has been unearthed and exposed to weathering since either the Permian glaciation (about 299 million years ago (mya)) or uplift following Early Cretaceous sedimentation (about 145 mya) (Cornelius *et al.* 2008; Cockbain 2014). This has resulted in relatively flat terrain with deeply weathered zones (Cornelius *et al.* 2007). The Western Australian climate has continually changed from humid in the Cretaceous to increasingly arid since the end of the Miocene (about 5.3 mya) (Cockbain 2014). Lateritic soil profiles common in the Yilgarn Craton required several million years of weathering in the Miocene to Pleistocene (about 20 – 2.6 mya) under humid temperate to tropical climates and tectonic stability to form (Cockbain 2014). The present-day drier climate of the south-west mainly favours lesser chemical weathering. Ironstones, lateritic duricrusts, and lateritic gravels rich in gibbsite (an aluminium hydroxide mineral) and hematite (an iron oxide mineral) have formed in a period between the Miocene to late Pliocene, (about 10 mya to 2.6 mya), at a time when the climate in the south-west Yilgarn Craton was believed to be temperate with warmer temperatures and higher rainfall than present day (Anand and Paine 2002; Cockbain 2014).

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. The south-west Yilgarn Craton also contains potential for nickel, copper, cobalt and platinum-group elements.

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 south-west the major aquifers, ordered from shallow to deep are the Superficial, Leederville and Yarragadee aquifers. All three aquifers are used to provide water for industry, horticulture and green space. Garden bores generally access water from the Superficial aquifers, while the Leederville and Yarragadee aquifers are used by the Water Corporation, Bunbury Water Board (Aqwest) and the Busselton Water Board 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

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, other 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 Fungi

Forest fungal communities are extremely diverse and play critical roles in the ecology and health of forest ecosystems. It is estimated that there are at least 50,000 species of fungi in Australia, representing about 9% of estimated Australian biodiversity (Chapman 2009); most species are yet to be described or even discovered, and this would be the case in the south-west forests. The jarrah forest alone supports at least 670 species of macrofungi (Robinson et al. 2023). There are also species that do not produce above-ground fruiting bodies and are therefore not as well known, including mycorrhizal

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species, pathogens of animal and plants, and species that breakdown organic matter and thus contribute to soil processes and health. Some fungi are important food resources for animals, such as kwenda whose digging for subterranean fungi has numerous beneficial effects on soil properties, including water infiltration and burying of litter, and helps to distribute mycorrhizal species (Ryan et al. 2020; Valentine et al. 2018).

3.4.3 Old-growth forest

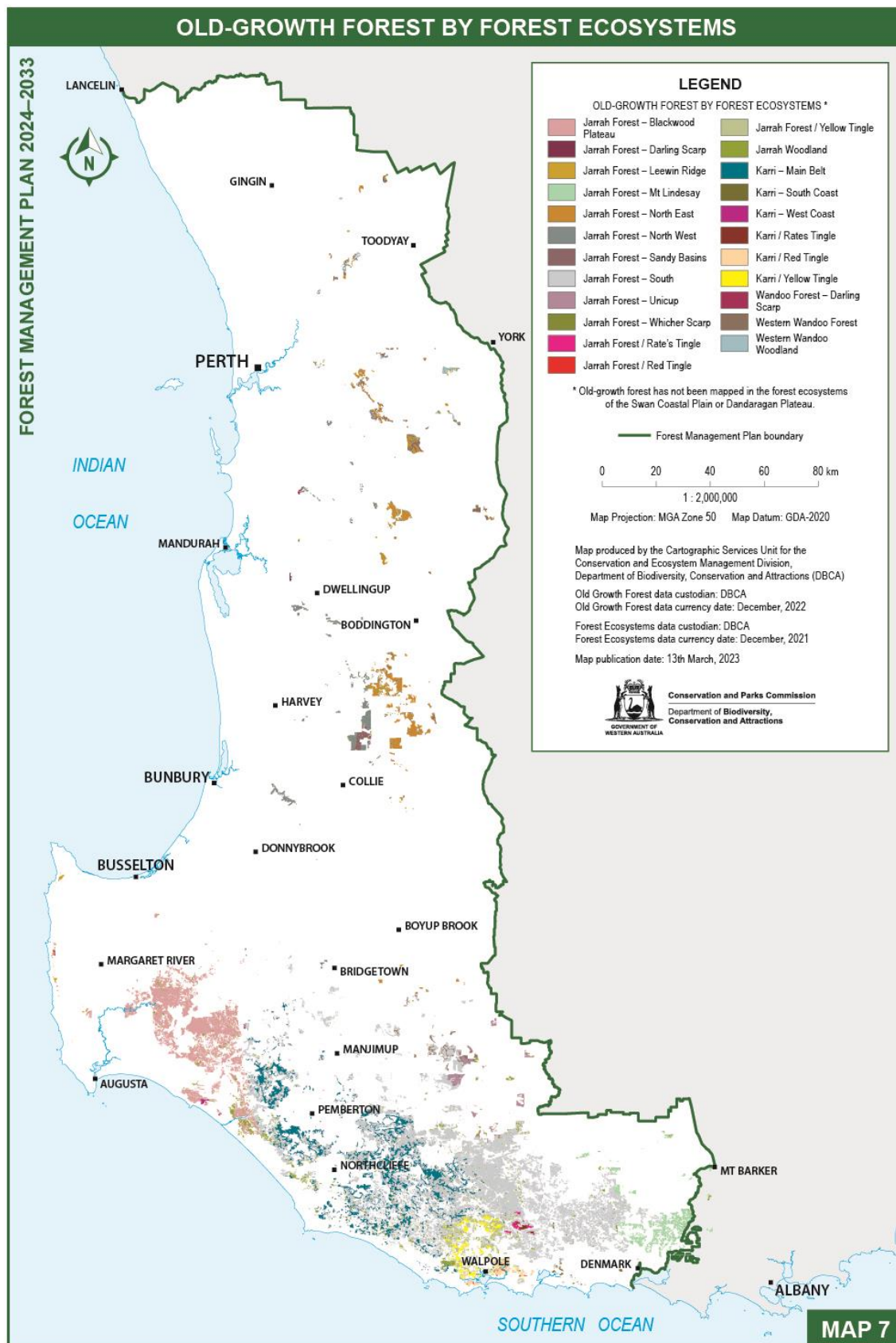
Old-growth forest is defined in the National Forest Policy Statement (1992) as “*Ecologically mature forest where the effects of unnatural disturbance are now negligible. The definition focuses on forest in which the upper stratum or overstorey is in a late mature to senescent growth stage*” (Commonwealth of Australia 1992). Criteria that reflect the different forest types and disturbance histories were developed through the Regional Forest Agreement process and procedures to map the extent of jarrah, karri (*Eucalyptus diversicolor*) and wandoo (*Eucalyptus wandoo*) old-growth forests, and are described in the DBCA *Procedures for the assessment, identification and demarcation of old-growth forest FEM075* (Department of Parks and Wildlife 2017). 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 2022, a total of 337,620 hectares of old-growth forest has been identified within the plan area, comprising 259,840 hectares of jarrah, 65,440 hectares of karri and 12,340 hectares of wandoo forest and woodland (see Map 7). A further 490 hectares of jarrah old-growth forest has been identified within the Regional Forest Agreement area not covered by this plan.

Opposite Map 7 Old-growth forest by forest ecosystems





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,

3.4.4 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/walyo⁸ (*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 – *Isodon fusciventer*), koomal (common brushtail possum – *Trichosurus vulpecula*), and yongka (western grey kangaroo – *Macropus fuliginosus*).

⁸ Noongar plant and animal names are used throughout the plan where possible.



Tjooditj - 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 naso*) - vulnerable; ngoolyanak (Baudin's – *Zanda⁹ baudinii*), and ngoolyak (Carnaby's – *Zanda¹⁰ 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 alba¹¹* – 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.

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



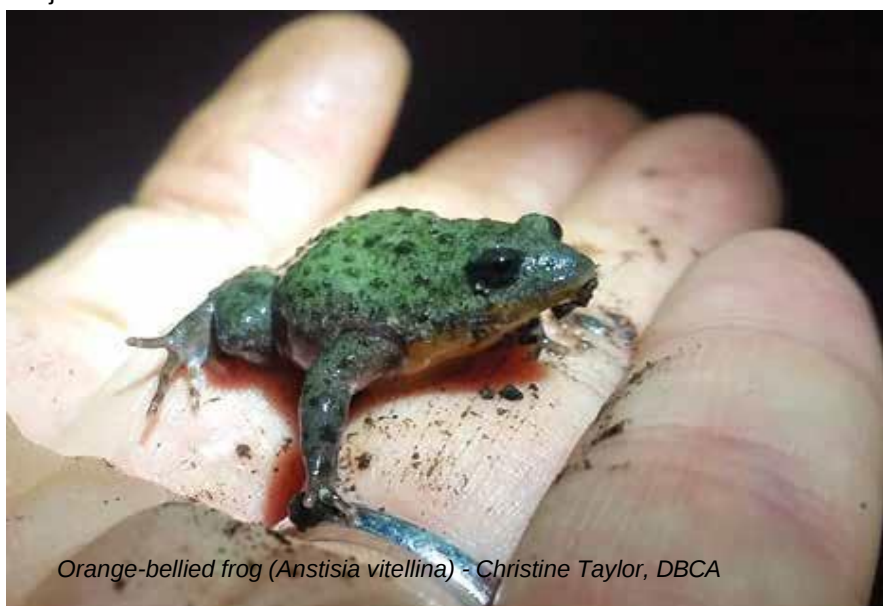
Karak - Doug Coughran

9 Prior to 2023 *Zanda baudinii* were classified as *Calyptorhynchus baudinii*

10 Prior to 2023 *Zanda latirostris* were classified as *Calyptorhynchus latirostris*

11 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 – *Bettongia lesueur*), and dalgite (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*).

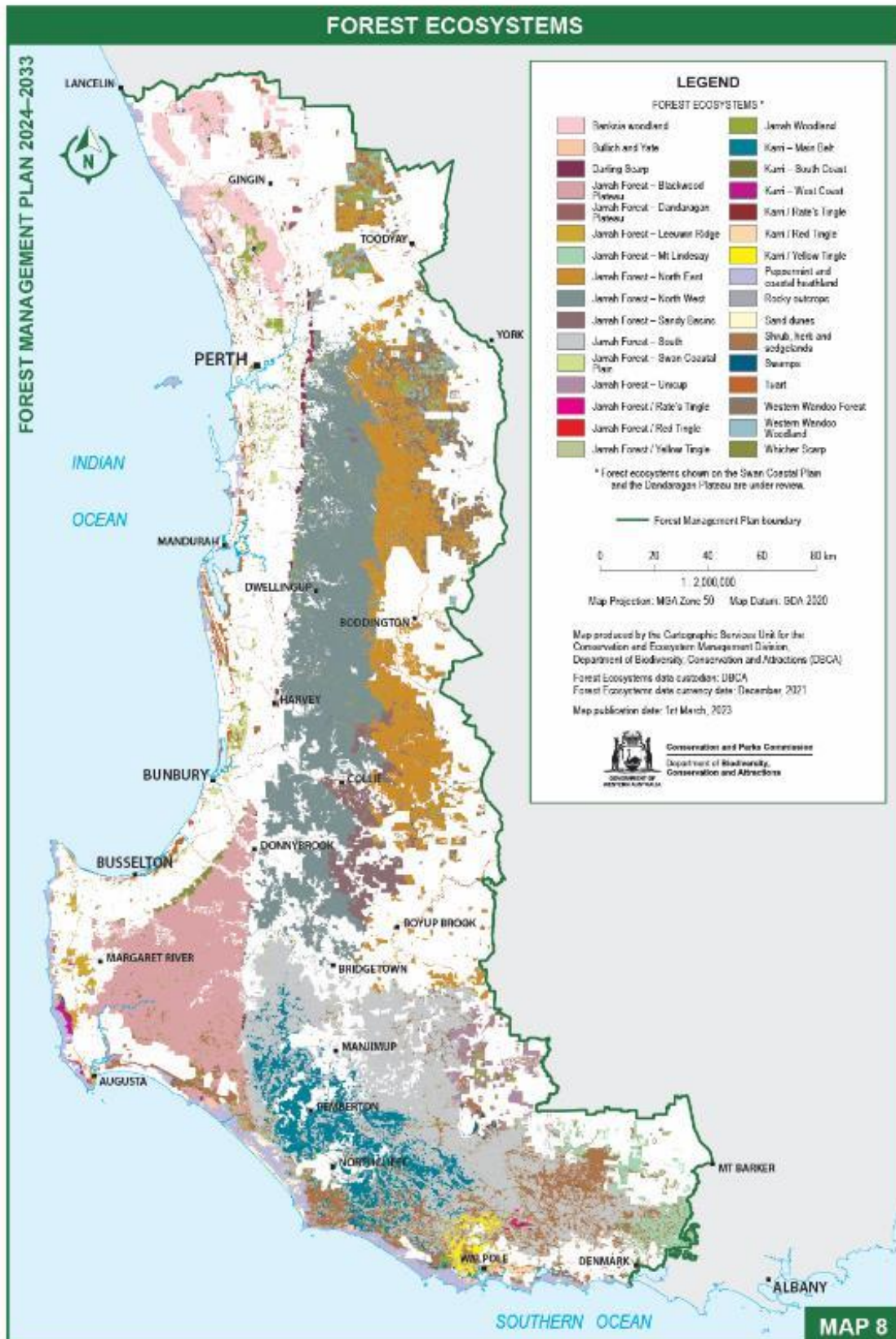
There are five invertebrate TECs that occur in water-filled caves, and one in a very rare mound spring habitat in permanently damp peat. Three TECs and four PECs are microbialites (limestone-like structures formed by microbes in wet habitats).

3.4.5 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 2015a). 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 forest ecosystem types in the planning area (Bradshaw 2015a, b). 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.



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 CO₂-equivalents (Conservation Commission of Western Australia 2013). Applying a similar calculation method but using revised forest stratification, updated timber inventory datasets and refined yield models suggests the total forest carbon stock (excluding soil carbon) in 2020 was likely closer to 1,000 million tonnes CO₂-equivalents. This apparent large increase is due to more comprehensive data and methods, highlighting the importance of improving the relative precision and reliability of estimates of forest carbon stores.

3.4.6 Forest habitats

Forest ecosystems contain a vast array of habitat types for plants, animals, fungi and other 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 and mesic areas. Non-forested areas such as rock outcrops and wetlands 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. The typical minimum tree size for the formation of useable hollows in jarrah and marri is approximately 50cm in diameter at chest height. Large hollows used by cockatoo species are more likely to be found in senescent trees with diameters above 70cm at chest height (Abbott and Whitford 2001).

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 other 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

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).

In the early years there were many small, makeshift timber operations scattered throughout the south-west with saw-pits producing timber for local consumption. With the emergence of timber companies and export markets, the saw-pits were replaced by steam-driven machines with railways bringing logs to the mills. Settlements around the mills attracted other services such as pubs, churches and shops, to form towns. Many south-west towns, including Jarrahdale and Manjimup, developed as a result of the timber industry and the forestry crews managing the forests. A decline in the timber industry after World War I and the Great Depression saw many mills close, with some now tourism venues. (Prause 1991). The Donnelly River mill town is 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. Many of these were constructed using timber from south-west forests.

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](#)¹², the [National Heritage list](#)¹³ and the [Commonwealth Heritage List](#)¹⁴.

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), safe drinking water and forest-based produce and resources. Intangible benefits relate to the inherent value of the natural environment and the wellbeing, health, spiritual and quality of life benefits to people from connecting with nature, with increasing numbers of people seeking to live in the towns of the south-west forests for these reasons.

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. State forests and timber reserves provided for the sustained yield of native timber from land that may otherwise have been cleared for agriculture (Carron 1985). In the 1970s and 1980s forest management supported a range of values under the multiple use approach, moving to an ecologically sustainable forest management framework from the 1990's.

The *Djarlma Plan for the Western Australian Forestry Industry (2019-2030)* sets out the strategic directions for that industry and includes the native forests and plantations within the planning area (FPC 2019). Elements of the *Djarlma Plan* will continue to be implemented by the FPC.

From 2024, large-scale commercial timber harvesting in native State forests will cease. Limited native forest timber, including for craft and high quality furniture making industries, 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 are 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 50,200 hectares of State forests and timber reserves classified as plantation within the planning area. Of this, 32,600 hectares is softwood (pine) plantations managed for sawn timber and engineered wood products which are a critical resource for Western Australia's building and construction industries. Plantations 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

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 some limitations on activities exist in water catchment areas and 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 and cooking, 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 neither the demand for, nor quantity of firewood collected from public firewood areas is known.

Apiculture 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 economic value including honey, wax, pollen, propolis, royal jelly, venom, and live export of queens, packaged bees and nucleus hives. The value of Western Australian honey and honeybee products has increased as the State is free of pests and diseases that impact the industry in other parts of Australia and the world.

Commercial apiary sites in the planning area underpin the honey products industry in Western Australia. At the date of publication the planning area represents approximately 25 percent of the State's hives. This access is permitted under strict conditions when suitable species are flowering and producing nectar and/or pollen.

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. The north-western jarrah forest contains 15 drinking water dams supplying the Integrated Water Supply Scheme, delivering drinking water to 2.5 million people. These dams receive flow from the surrounding forest and are also used to store water from Perth and south-west desalination plants and provide safe drinking water to the majority of the Perth, Peel and south-west regions. 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, motorcycle 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, tourism and outdoor education is expected to remain high given the popularity of nature-based activities, and development of new adventure-based visitor experiences such as Lake Kewpaw near Collie, Collie Adventure Trails, and Dwellingup Adventure Trails.

Forests and reserves close to Perth are important for public recreation due to their proximity to a large percentage of the State's population. These areas provide an escape from urban living and an opportunity for outdoor activities such as hiking, camping, cycling, and spending time in nature. Being located near a major city also makes these forests and reserves easily accessible to a wide range of people, allowing for increased participation in outdoor recreation and promoting a connection to nature. This proximity to nature helps to improve the physical and mental health of those who visit, and the conservation and protection of these areas is important for maintaining their value to the community as recreational spaces.

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. There were approximately 900,000 more visitors to the planning area in 2020-2021 than in 2018-2019, possibly a result of international travel restrictions in place at that time due to Covid-19. 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.

Vehicle driving and riding of motorcycles continue to be popular recreational activities in the planning area. The demand for sanctioned or organised trails and driving/riding areas is currently largely unmet with limited provision for trails and other facilities for 'off-road' driving or riding activities. Off-road activities (i.e. operating vehicles off sanctioned vehicular roads and tracks), particularly using unlicensed motorcycles and other off-road vehicles, is regularly reported as an unauthorised activity in parks and reserves (see 4.7 Unauthorised activities).

Permitted areas for off-road registered vehicles including motorcycles on department-managed lands currently exist in former pine plantation areas at Gnangara and Pinjar. Designated trails specific to road-registered vehicles and motorcycles include the Captain Fawcett Track. Further areas may need to be identified to meet the demand for recreational and tourism related activities using these vehicles and to counter unauthorised use, with a variety of options (both on and outside CALM Act lands) requiring consideration.

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.

3.6.4 Land use planning

Amendments to tenure may be required to meet land use planning commitments, for the provision of services, or to rationalise and upgrade road networks. These amendments are typically in the form of an excision from State forest or timber reserves, and occur under provisions in the CALM Act.

Where an excision from State forest or timber reserve is required to enable alternative land uses, an amendment will also be required to the relevant region scheme and/or local planning scheme in accordance with the *Planning and Development Act 2005*.

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 vegetation clearing for mining and other developments)
- 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 human activities, in particular 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). The IPCC notes the south-west forests as an Australian ecosystem at risk due to climate change. 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° 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.

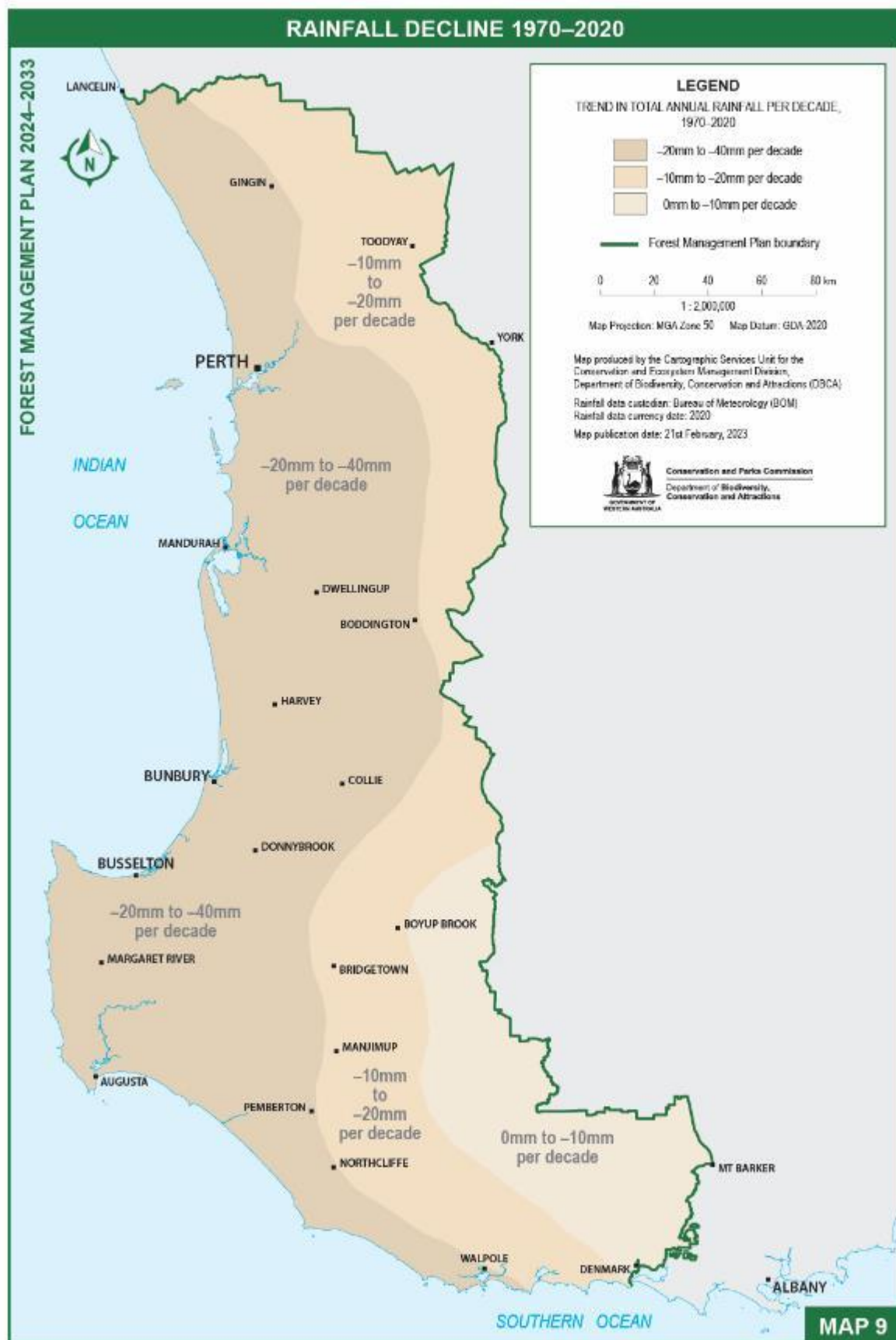


Table 1 Projected climate changes in south-west Western Australia

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 <i>et al.</i> 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° 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 <i>et al.</i> 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 <i>et al.</i> 2015), along with potentially large fluctuations in the number and intensity of summer rainfall events (Andrys <i>et al.</i> 2017).	There are likely to be fewer frost events across the region (Hope <i>et al.</i> 2015), but they may increase at a local scale (Matusick <i>et al.</i> 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, including feedback processes, 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 (Silberstein *et al.* 2011; Macfarlane *et al.* 2010).
- 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 (Silberstein *et al.* 2012; 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).
- There have been vegetation community shifts away from species that prefer seasonally moist soils (Mattiske 2012).
- 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; Maher *et al.* 2010).
- Modelling of climate change impacts on key plant species and fauna habitat has predicted range contractions and shifts towards higher rainfall areas (Molloy *et al.* 2014).
- 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 (Matusick *et al.* 2013; Brouwers *et al.* 2013a).
- 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 (Macfarlane *et al.* 2018).
- Studies of marri have shown that plants from warmer, drier areas have a greater capacity to cope with water deficit than those from cool, wet areas (Challis *et al.* 2022).
- Jarrah has a lower optimal seed germination temperature and a narrower range for germination compared to marri (Filipe *et al.* 2023).
- There is a higher prevalence of canker disease in marri in regions with higher rainfall (Paap *et al.* 2017), and drought conditions may increase the development of canker disease, particularly when followed by wetter conditions conducive to pathogen growth (Hossain *et al.* 2019). Provenances from cooler wetter regions showed higher resistance to leaf blight (Duong *et al.* 2022).
- 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.* 2013b; 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 (Steffen *et al.* 2009; 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 Gibson *et al.* 2010; Edwards and Roberts 2011; Mitchell *et al.* 2013; Molloy *et al.* 2014; Hoffman *et al.* 2021; 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 will lead to changes in fauna ranges, foraging and community dynamics, habitat, and soil microbial communities (Gibson *et al.* 2010; Molloy *et al.* 2014; Hopkins *et al.* 2018; Angel *et al.* 2021; Dundas *et al.* 2021; Smithies 2022).
- 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).
- 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).
- Drier 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 directly cleared for mining purposes (excluding BRM) to June 2022 is estimated by the department at approximately 50,000 hectares noting that mining may also have indirect impacts on forest ecosystems in a landscape setting (see Map 10). Petroleum exploration and development activities such as drilling and seismic surveys have also occurred historically in the south-west forests but have had limited long-term effects, particularly in regard to vegetation clearing and disturbance.

While mining for a variety of minerals has occurred, the commodities being extracted influence the level of direct and indirect impacts 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 directly and indirectly affecting more substantial areas of forest than open cut mining, these operations more readily permit progressive rehabilitation. In areas affected by these operations it may also be possible to establish post-mining landform and soil conditions that enable establishment of vegetation and fauna habitat elements with similarities to those occurring in natural forests. Despite intensive rehabilitation efforts, full return of the pre-existing soils, landforms vegetation and ecosystem functions after major disturbances may take hundreds of years or may never occur.

Mineral and petroleum exploration, extraction, and rehabilitation activities currently occur in the planning area and these are primarily approved and governed by processes managed by other government agencies under legislation such as the *Environmental Protection Act 1986* (EP Act), *Mining Act 1978* (Mining Act), *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) and various State Agreement Acts that take precedence over the provisions of the CALM Act (see Appendix 6). This legislation includes requirements for resource tenure and consent for activities in reserves as well as assessment, approval, management of environmental and other impacts, and rehabilitation and closure. 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).

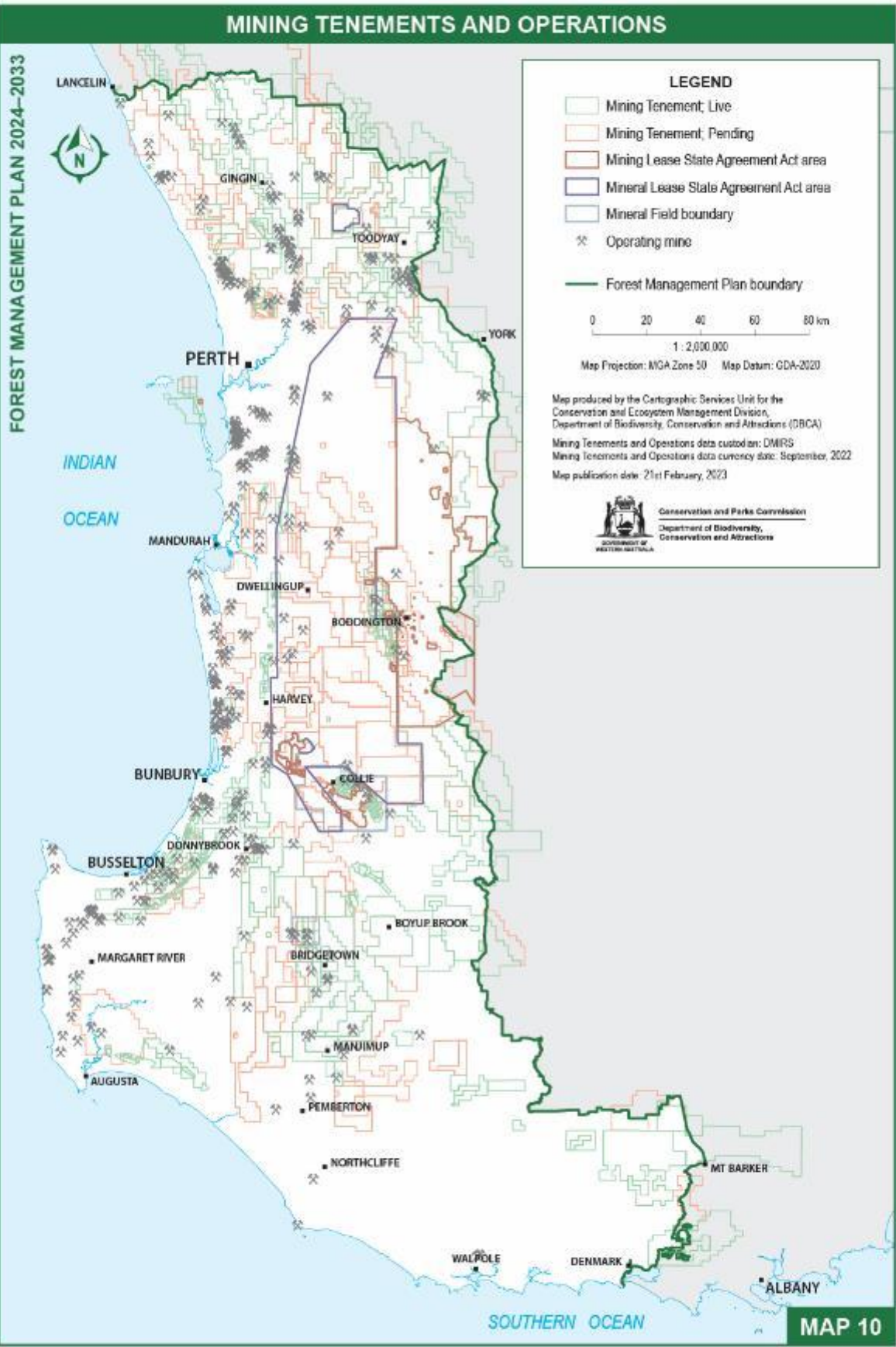
Each year, approximately 1000 hectares of State forests and timber reserves are subject to mining and petroleum operations, principally for extraction of bauxite (Darling Scarp north and east from Collie), coal (east of Collie) and gold (near Boddington). This could increase in the future with the expansion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

While many areas affected by resource development activities are rehabilitated following disturbance, there may be enduring impacts on landform, habitat and biodiversity, ecosystem connectivity, 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. The productive capacity of pine plantation areas on the Swan Coastal Plain may also be affected by large scale mining of sand and limestone through changes to landform, soil profile and hydrology.

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.

Where mining that is subject to environmental approval results in significant residual impacts on significant conservation values, including where these values occur within reserves, there is generally a requirement for proponents to provide environmental offsets to address these (DWER 2011). Environmental offsets may include undertaking activities on CALM Act lands, including State forest, provided the land is being managed for conservation purposes and the proposed activities are regarded by regulatory approval agencies as complementary and additional to standard management activities by the managing agency.

Opposite Map 10 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, and loss of refugia for wildlife and habitat features, such as tree hollows. Fauna recolonisation and vegetation recovery times, including replacement of tree crowns, may be relatively delayed in areas affected by high severity fire, while increased 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 sometimes not 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 67 high priority weed species identified in the planning area (as of April 2023). Of these, six species are common – bridal creeper (*Asparagus asparagoides*), gladioli (*Gladiolous sp.*), narrowleaf cottonbush (*Gomphocarpus fruticosis*), 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 priority weed species where possible.



Periwinkle weed (*Vinca major*), 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).

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.



Fox captured on remote camera - DBCA

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,

Feral goats and horses have established across the Western Australian landscape, although populations are restricted to specific locations within the planning area. Feral goats and horses are known to occur around Lake Muir in the Warren Region impacting the natural environment by spreading disease, weeds and degrading waterways.

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

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 birds and other species such as feral bees may limit their availability for native species. Feral bee colonies can also occupy recreation infrastructure and aggregate at water sources, disrupting their amenity for recreation and tourism.

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 the '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). A drying climate is likely to increase pressures on ecosystems, which could increase the impact *Phytophthora* and other plant diseases have on the vegetation assemblages.

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. These effects are likely to be exacerbated with a drying climate.

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 detected in northern Western Australia in 2022. 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. It is unknown what the impact of Myrtle rust will be as the climate changes.

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 predis



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.



The most common unauthorised activities in south-west forests are illegal dumping, illegal or inappropriate use of motorised vehicles (including motorcycles), construction and use of unsanctioned tracks and trails, and collection of firewood in unsanctioned areas. Unlawful vegetation clearing, illegal campfires, and 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 also 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.

Unauthorised and illegal activities in natural areas close to Perth are more prevalent due to the proximity to major population centres, as larger populations often lead to increased demand for access, facilities and services. This leads to a greater likelihood of unauthorised activity in parks, reserves and forest areas close to Perth.

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, and 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.

Whilst 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](#)¹⁵ and [DBCA policies](#)^{16,13} 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).

¹⁵ conservation.wa.gov.au/publications/position-statement

¹⁶ 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.

Multiple agencies, land managers and proponents conduct activities or have responsibilities in the planning area; the department works cooperatively with these parties in the interests of effective management.

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. Six Cooperative Management Agreements, one for each of the six Noongar Agreement Areas, will be signed by the department and the relevant Noongar Regional Corporation. The agreements will apply to the whole of the South West Conservation Estate within that Agreement Area. 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 (JMA). See Map 4 and Appendix 5 for further details.

Under the CALM Act land can be vested jointly in the Commission and an Aboriginal body corporate. The Settlement provides a comprehensive and wholistic governance framework for the management of the South West Conservation Estate.

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 in a respectful way. These partnerships also highlight opportunities to integrate traditional knowledge with contemporary science, to inform forest management outcomes. They will also provide awareness and understanding about mutual benefits of current and future practices that may 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 Noongar people across boodjar, and align closely with whole-of-government initiatives such as [Closing the Gap](#)¹⁷, the [Aboriginal Empowerment Strategy](#)¹⁸, and the [Aboriginal Procurement Policy](#)¹⁹. Opportunities may arise to manage forest-based resources, including activities such as weed management or seed collection.

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* replaces the AH Act and offers 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.

¹⁷ closingthegap.gov.au

¹⁸ wa.gov.au/organisation/departments-of-the-premier-and-cabinet/aboriginal-empowerment-strategy-western-australia-2021-2029

¹⁹ 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
- Partner with Noongar Traditional Owners through Cooperative Management Committees to protect Noongar cultural heritage values in the planning area. - Support Noongar Traditional Owners to carry out customary activities in the planning area. - Support Noongar employment and economic development opportunities 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.
	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 enable and support Noongar customary activities.
	Through cooperative and joint management arrangements, seek to develop approaches for two-way sharing knowledge of Noongar kadidjiny and western science into forest management.
	Endeavour to increase employment and training of Noong

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

