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Assessment of matters pertaining to the renewal of the *Regional Forest Agreement for the South-West Forest Region of Western Australia*

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More information

Questions regarding the use of this material should be directed to:

Conservation and Ecosystem Management, Parks and Wildlife Service

Department of Biodiversity, Conservation and Attractions

Locked Bag 104

Bentley Delivery Centre WA 6983

Phone 08 9219 9000

Email: enquiries@dbca.wa.gov.au

www.wa.gov.au

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Australian Bureau of Agricultural and Resource Economics and Sciences (Australian Government)

Department of Agriculture and Water Resources (Australian Government)

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Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences (Cth)
ABS	Australian Bureau of Statistics (Cth)
AHA Act	*Aboriginal Heritage Act 1972 (WA)*
AHC Act	*Australian Heritage Commission Act 1975* (Cth)
AFS	Australian Forestry Standard
Alcoa	Alcoa of Australia Limited
ANZECC	Australian and New Zealand Environment and Conservation Council
BC Act	*Biodiversity Conservation Act 2016* (WA)
BDTA	Bindoon Defence Training Area
BICWA	Bee Industry Council of Western Australia
CALM Act	*Conservation and Land Management Act 1984* (WA)
CAM	Common Assessment Method
CAMBA	China-Australia Migratory Bird Agreement
CAPAD	Collaborative Australian Protected Area Database
CAR	Comprehensive, adequate and representative (reserve system)
CAWS Act	*Country Areas Water Supply Act 1947* (WA)
CO_2	Carbon dioxide
CPC	Conservation and Parks Commission (WA)
CRC	Cooperative Research Centres
CRA	Comprehensive regional assessment
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth (of Australia)
C&D	Construction and Demolition
DAWR	Department of Agriculture and Water Resources (Cth)
DBCA	Department of Biodiversity, Conservation and Attractions (WA)

DIWA	Directory of Important Wetlands
DoEE	Department of the Environment and Energy (Cth)
DPIRD	Department of Primary Industries and Regional Development (WA)
EC Act	*Export Control Act 1982* (Cth)
EMS	Environmental Management System
EPA	Environmental Protection Authority (WA)
EP Act	*Environmental Protection Act 1986* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ERF	Emissions Reduction Fund
ESFM	Ecologically sustainable forest management
ESP Act	Endangered Species Protection Act 1992 (Cth)
FHZ	Fauna habitat zone
FIFWA	Forest Industries Federation of Western Australia
FMP	Forest Management Plan
FMS	Forest Management System
FP Act	*Forest Products Act 2000* (WA)
FPC	Forest Products Commission
FTAs	Free Trade Agreements
FWPA	Forest and Wood Products Australia
GRP	Gross Regional Product
HWPs	Harvested wood products
ILUA	Indigenous land use agreements
IUCN	International Union for Conservation of Nature
ISGs	Investment security guarantees
JAMBA	Japan-Australia Migratory Bird Agreement
JANIS	Joint ANZECC/MCFFA National Forest Policy Implementation Sub-committee

KPI	Key Performance Indicator
LGA	Local Government Area
LiDAR	Light Detection and Ranging
MCFFA	Ministerial Council on Forestry, Fisheries and Aquaculture
MIG	Montréal Process Implementation Group for Australia
MNES	Matters of National Environmental Significance
MOU	Memorandum of Understanding
m^3	Cubic Metres
NFI	National Forest Inventory
NFPS	National Forest Policy Statement (1992)
NIFPI	National Institute for Forest Products Innovation
NWI	National Wilderness Index
pa	Per Annum
RFA	Regional Forest Agreement
RFA Act	*Regional Forest Agreements Act 2002* (Cth)
RNE	Register of the National Estate
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
R&D	Research and Development
SOC	State Owned Corporation
SOFR	Australia's State of the Forests Report
SWALSC	South West Aboriginal Land and Sea Council
SWNT Settlement	South West Native Title Settlement
SWWMP	South West Wetlands Monitoring Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
WA RFA	Regional Forest Agreement for the South-West Forest Region of Western Australia

WC Act	*Wildlife Conservation Act 1950* (WA)
WH	World Heritage
WHA	World Heritage Area

Introduction

The *Regional Forest Agreement for the South-West Forest Region of Western Australia* (WA RFA) was signed by the Australian and Western Australian (WA) governments on 4 May 1999. Prior to the signing of the WA RFA, Comprehensive Regional Assessments (CRAs) of environmental, heritage, social and economic uses and values of the forests were undertaken to inform the framework for the WA RFA process. The 1996 WA RFA scoping agreement described the process for the implementation and collection of data for the CRAs and covered the following values:

a. Biodiversity
b. Old-growth
c. Wilderness
d. Endangered species
e. National Estate values
f. World Heritage values
g. Indigenous Heritage
h. Social values
i. Economic values and industry development opportunities in forested areas
j. Ecologically sustainable management.

This document provides an assessment of how the various uses and values of the WA RFA have been monitored, maintained, implemented and addressed since the CRAs and signing of the WA RFA, to inform consideration of the WA RFA extension process.

Subsequently, the *Regional Forest Agreements Act 2002* (Cth) (RFA Act) adopted the following list of *matters* to be considered when developing RFAs:

i. environmental values, including old-growth, wilderness, endangered species, national estate values and world heritage values
ii. indigenous heritage values
iii. economic values of forested areas and forest industries
iv. social values (including community needs)
v. principles of ecologically sustainable management.

This document considers the applicability of the findings of the CRAs, the current status of the values and the likely impact of the extension of the RFA on those values

This document takes data from published sources and assimilates it to provide information, over time, about relevant WA RFA matters, including the state of environmental, economic, social and heritage values.

The assessment undertaken in this document demonstrates that the Australian and WA governments have, through a comprehensive and diverse range of processes, had ongoing regard to the listed matters in paragraph (a) of the definition of 'RFA' in the RFA Act relevant to the WA RFA region. There is a specific reference within paragraph (d) of the Recitals in the WA RFA which refers to the agreement being entered into having regard to "studies and projects carried out in relation to all of the following matters relevant to the region" and it lists exactly the matters referred to in paragraph (a) of the definition of 'RFA' in the RFA Act.

It is not a replacement for other reviews that have been completed for the WA RFA or which have included Montréal Process indicators. Rather it draws on these sources to illuminate the state of the matters and indicators as they have changed over the life of the WA RFA.

Background

The Australian and WA governments have recognised the need to manage the environmental, heritage, social and economic uses and values of the south west forests of WA and have done this through the WA RFA. These uses and values are derived from the National Forest Policy Statement (NFPS) and are formalised in the RFA Act.

The WA RFA is a bilateral agreement that provides for efficient forestry operations in the RFA area by obviating the need for approvals under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) and the Export Control Act 1982 (Cth) (EC Act). This is balanced by requirements under the WA RFAs for environmentally sustainable forestry operations, an ongoing Comprehensive, Adequate and Representative (CAR) reserve system, and appropriate periodic reporting. The WA RFA was established as a long-term 20-year bilateral agreement between the Australian and WA governments with an expiry date of 4 May 2019.

The WA RFA was signed following the CRA process, which provided an information base from projects commissioned by the Australian and WA governments to evaluate the economic, social, environmental, and heritage uses and values of the forests in the WA RFA region. The CRAs and the information provided through the assessments also formed the basis for negotiation of the WA RFA between the Australian and WA governments.

The CRA was a result of extensive scientific study, consultation and negotiation with a diverse range of stakeholders.

The WA RFA established an agreed framework for the ecologically sustainable forest management (ESFM) and use of forests in those regions. In particular, the WA RFA which:

- identifies areas required for the purposes of a CAR reserve system and provides for the conservation of those areas
- provides for the ecologically sustainable management and use of forested areas in those regions
- is for the purpose of providing long-term stability of forests and forest industries
- has regard to studies and projects carried out in relation to:
    - environmental values, including old-growth, wilderness, endangered species, National Estate values and World Heritage values
    - Aboriginal heritage values
    - economic values of forested areas and forest industries
    - social values (including community needs)
    - the principles of ESFM.

The Australian and Western Australian governments have stated their intention to renew and extend the existing WA RFA. To inform this process, the Assessment of Matters document has been developed as an update on matters considered during the CRA process.

WA RFA region

Figure 1 identifies the extent of the WA RFA region as well as the Comprehensive, Adequate and Representative (CAR) reserve system in the south-west region of Western Australia since its establishment in 1999. The RFA region is a subset of the Department of Biodiversity, Conservation and Attractions (DBCA) Swan, South West and Warren regions. On lands managed by DBCA the RFA commitments are given effect through the Forest Management Plans (FMPs) prepared under the CALM Act. As the WA RFA region is a subset of the area covered by the FMPs, some statistics presented in this assessment may differ to figures published in those Plans.

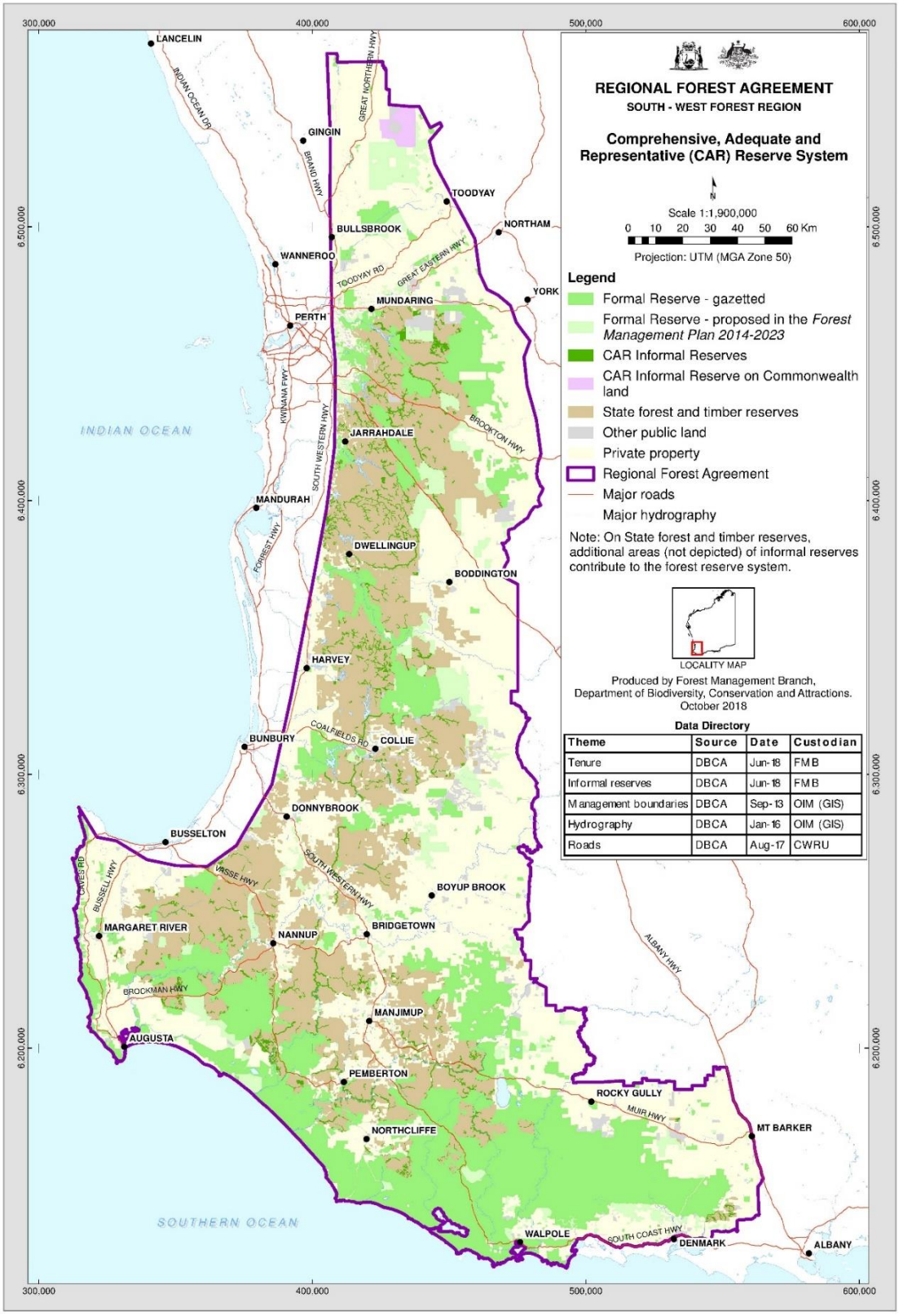

Figure 1: WA RFA region and extent of CAR reserve system in 2018

Method

This document collates information on the relevant values from a range of sources to demonstrate the accumulated changes arising, since the commencement of the WA RFA. This document used data from published sources and assimilates it to provide information, over time, about relevant WA RFA matters, including the state of environmental, economic, social and heritage values.

The principles of ESFM underpin the NFPS, the RFA Act, and the WA RFA itself. These principles are consistent with the criteria established in the Montréal Process (Table 1). The Australian and state governments have adopted the internationally-agreed Montréal Process Criteria and Indicators for reporting on sustainable forest management, reviewing and adapting them for Australian conditions. The indicators cover all the matters listed in para (a) of the definition of 'RFA' in the RFA Act and are the agreed framework for ESFM reporting in RFA regions. The Montréal Process indicators relating to these principles are used in a range of RFA and other reporting, and provide the framework upon which the laterFMP (2004-2013; 2014-2023) have been structured. The FMPs have a range of Key Performance Indicators (KPIs) and other reporting mechanisms that have been developed and monitored, and are aligned with the Montreal Indicators. Specific reporting requirements under the plans have been developed for the DBCA and the Forest Products Commission (FPC). WA has a comprehensive system in place for reporting on KPIs under the FMP (Wilkinson 2017).

Table 1: Comparison of Montréal Process Criteria with the principles of ESFM as described in the background of the WA FMP and section 19(2) of the CALM Act.

Montréal Process Criteria for Sustainable Forest Management	Principles of ESFM
Criterion 1. Conservation of biological diversity	Principle 1: Precautionary Principle Principle 3: Principle of Intergenerational Equity Principle 4: Conservation of Biological Diversity and Ecological Integrity
Criterion 2. Maintenance of productive capacity of forest ecosystems	Principle 2: Sustainability Principle Principle 3: Principle of Intergenerational Equity
Criterion 3. Maintenance of ecosystem health and vitality	Principle 1: Precautionary Principle Principle 3: Principle of Intergenerational equity Principle 5: Principles of improved valuation, pricing and incentive mechanisms
Criterion 4. Conservation and maintenance of soil and water resources	Principle 1: Precautionary Principle Principle 3: Principle of Intergenerational equity

Montréal Process Criteria for Sustainable Forest Management	**Principles of ESFM**
Criterion 5. Maintenance of forest contribution to global carbon cycles	Principle 1: Precautionary Principle Principle 3: Principle of Intergenerational equity Principle 5: Principles of improved valuation, pricing and incentive mechanisms
Criterion 6. Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies	Principle 2: Sustainability Principle Principle 3: Principle of Intergenerational equity
Criterion 7. Legal, institutional and economic framework for forest conservation and sustainable management	Principle 2: Sustainability principle Principle 3: Principle of Intergenerational Equity

Appendix A shows the relationship between individual indicators under the Montréal Process criteria, and RFA matters for consideration in the RFA Act.

Appendix 11 of the third five-year review of the WA RFA summarises the current WA reporting mechanisms for sustainability indicators, and their relationship to the national Montreal Process indicators. Data and information have been compiled or in some cases recaste to the RFA region (as a subset of the FMP area) for reporting. The information is assembled under five separate sections, each addressing a matter for consideration under the RFA Act.

This document provides relevant information on indicators over the life of the WA RFA within the region.

Linkages to other Processes

A number of processes have produced complementary information aimed at reporting on sustainable management of forest ecosystems. These include the reporting against Montréal Process Criteria and Indicators such as Australia's State of the Forests (SOFR) reporting, and WA FMP reporting.

The outcomes and findings of these processes have been considered through the formal, independent five-yearly reviews of the WA RFA undertaken jointly by the Australian and WA governments. The Australian and WA governments have duly taken account of the outcomes of these reviews and assessment processes, providing formal responses to each of the five-yearly reviews and by agreeing to implement further measures consistent with the adaptive management and continuous improvement commitments in the WA RFA and sustainable management principles.

In addition, the Australian Government, as a signatory to the Montréal Process, also reports under Montréal Process obligations.

Montréal Implementation Group (MIG) indicators

Under the RFA, reporting against criteria and indicators is carried out in accordance with *A Framework of Regional (Sub-national) Level Criteria and Indicators of Sustainable Forest Management in Australia* (Department of Primary Industries and Energy, 1998). The 1998 indicators current at the signing of the WA RFA were updated in *Australia's Sustainable Forest Management Framework of Criteria & Indicators 2008 – Policy Guidelines* (Department of Agriculture, Fisheries and Forestry 2008). This provided the seven criteria and 44 indicators currently in use. Mapping of these to the international criteria is shown in Appendix A.

Section 1: Environmental Values

The purpose of this Section is to report on the environmental values that are specifically listed in para (a)(i) of the definition of 'RFA' in the RFA Act: old-growth, wilderness, endangered species, national estate values and world heritage values. Biodiversity values and wetland values have also been included under the 'environmental values' heading.

This section includes the following Montréal Indicators:

- Indicator 1.1b – Area of forest by growth stage
- Indicator 1.2b – Status of forest dwelling species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment
- Indicator 6.4b – Registered places of non-Indigenous cultural value in forests that are formally managed to protect those values
- Indicator 1.1a – Area of forest by forest type and tenure
- Indicator 1.1c – Area of forest in protected area categories
- Indicator 1.2a – Forest dwelling species for which ecological information is available
- Indicator 1.2c – Representative species from a range of habitats monitored at scales relevant to regional forest management
- Indicator 1.3a – Forest associated species at risk from isolation and the loss of genetic variation, and conservation efforts for those species
- Indicator 4.1a – Area of forest land managed primarily for protective functions
- Indicator 4.1b – Management of the risk of soil erosion in forests.

Information is drawn from the original documentation produced as part of the CRA process, subsequent reports (including State of the Forest Reports, State of the Environment reports, statutory independent five-yearly reviews of WA RFA required under the RFA and other relevant data).

Old-Growth Values

Old-growth forest is defined in the NFPS as 'ecologically mature forest where the effects of disturbances are now negligible' [1](Commonwealth of Australia, 1992, 1995). Along with other environmental and heritage values, old-growth forest types were one of the values that were highly regarded in the design of a CAR reserve system under the WA RFA. The long-term protection of old-growth forest is important due to the biodiversity, aesthetic, and cultural attributes of these areas associated with the absence of anthropogenic disturbance.

The JANIS committee (Joint ANZECC/MCFFA National Forest Policy Implementation Sub-committee) recognised the need to adopt criteria for determining old growth forest extent which reflect the differences in ecological characteristics of the forests. This includes their growth stage, as old-growth forest is a subset of areas dominated by the mature and senescent growth stages. In WA, the concept of ecological maturity in fire tolerant dry sclerophyll forests, the potential to map stand growth stages in multi-species mixed-age jarrah forest based on structural characteristics, and the context of 'minimal disturbance'

[1] The full NFPS definition is *forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in the late mature to overmature growth phases*.

were all extensively examined during the CRA project for the WA RFA. The resulting criteria and their application by DBCA have continued (with some refinement of techniques) throughout each of the FMPs to the present.

Indicator 1.1b – Area of forest by growth stage

This indicator measures the change in area of forest by growth stage to reflect how ecological processes and species associated with those processes change as forests grow. The age and size of trees is important in maintaining forest biodiversity.

The CRA process in 1998 identified 347,082 hectares of old-growth forest on public lands in the WA RFA region, and the WA RFA included at least 60 per cent of the old-growth forest within each forest ecosystem in the CAR reserve system. Timber harvesting in areas containing old-growth forest outside the CAR reserves was permitted until 2001, when the then State government introduced the *Protecting our Old-growth Forests* policy.

Table 2 summarises the changes in old-growth forest extent and reservation for each forest ecosystem over the WA RFA period 1999-2018. Between 1999 and 2018 there has been a reduction in old-growth forest of 11,525 hectares within the WA RFA area. The reduction is due largely to the harvesting of old-growth forest prior to cessation in 2001, natural events such as bushfire and *Phytophthora* dieback disease, and improved mapping as presented in the case study reported in Indicator 1.1b in SOFR 2018.

In 2018, there were 335,557 hectares of old-growth forest recorded in public forests in the WA RFA region, located mostly in the southern half of the WA RFA region (Figure 2). Around 94 per cent of the extant old-growth forest is in the WA RFA CAR reserve system, with a further 6 per cent in other informal reserves on public land (Table 2). There has been an overall increase in reservation of old-growth forest of 89,167 hectares since the commencement of the RFA in 1999, largely due to the additional reserves introduced under the FMP 2004-2013 which implemented the then State government's *Protecting our Old-growth Forests* policy. The total reservation level of old-growth forest is 36 per cent above the area agreed in the WA RFA (Wilkinson 2017).

All old-growth forest on lands vested in the Conservation and Parks Commission (CPC) will continue to be protected from timber harvesting, either in formal reserves or through informal reserves under the FMP 2014-2023. Accordingly, the process for approving any disturbance operations (such as timber harvesting, road and infrastructure development) on lands managed by DBCA requires all proponents to check for the presence of unmapped old-growth forest. This has resulted in continuous refinement of mapping and the addition of areas to the old-growth forest datasets used for management and reporting on public lands. This process includes provision for the public to nominate areas to DBCA for assessment of their old-growth forest status. However, there has been no refinement since the 1998 CRA of the limited extent (275 hectares in 1998) of old-growth forest on private lands in the WA RFA region.

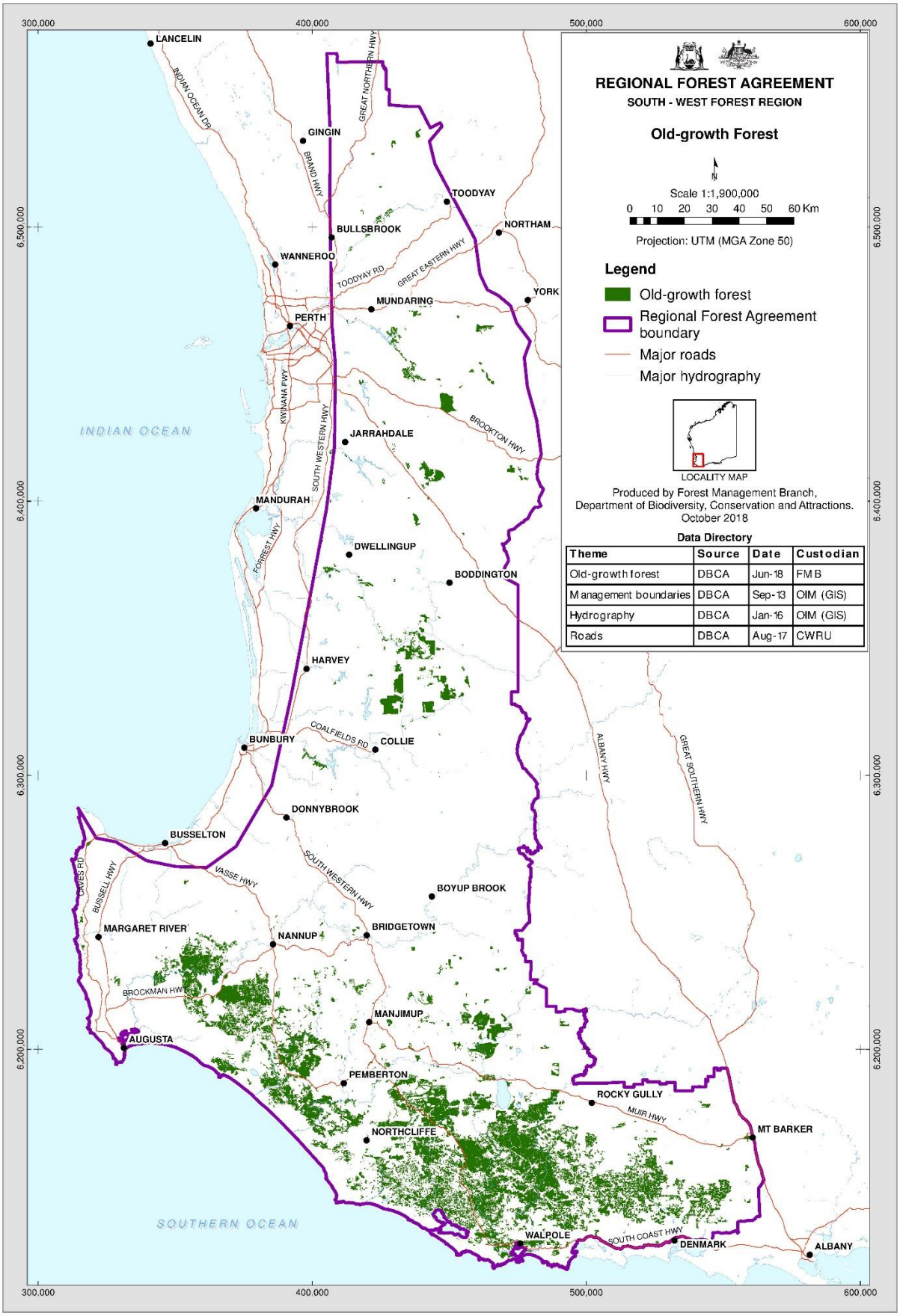

Figure 2: WA RFA region and the extent of old-growth forest in 2018

Table 2: Reservation levels of old-growth forest in CAR reserves and other informal reserves on public land from 1999 to 2018.

	WA RFA 1999				WA RFA Review 2009				WA RFA Review 2014				Current area to June 2018			
Forest Ecosystem	**Present area (ha)**	**Total CAR (ha)**	**Total CAR (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR (ha)**	**Total CAR (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR (ha)**	**Total CAR (%)**	**Other informal reserves (ha)**	**Present area *** (ha)**	**Total CAR (ha)**	**Total CAR (%)**	**Other informal reserves (ha)**
Darling Scarp"									151	104	68.7	7	151	144	95.4	7
Jarrah Blackwood	48,516	29,093	60.0	1,405	45,523	43,667	96	1,825	45,464	43,392	95.4	2,061	45,419	43,230	95.2	2,177
Jarrah Leeuwin *	477	477	100.0	0	489	489	100	0	484	484	100.0	0	481	481	100.0	0
Jarrah Mt Lindesay	14,005	11,123	79.4	36	12,456	12,145	98	27	12,464	12,164	97.6	300	12,472	12,168	97.6	304
Jarrah North East *	11,504	9,847	85.6	125	12,897	11,854	92	1,042	13,217	11,917	90.2	1,264	13,267	11,900	89.7	1,330
Jarrah North West *	8,069	7,887	97.7	7	7,927	7,733	98	164	8,003	7,729	96.6	214	7,739	7,438	96.1	248
Jarrah Rate's Tingle *	1,021	1,021	100.0	0	1,091	1,091	100	0	1,091	1,091	100.0	0	1,091	1,091	100.0	0
Jarrah Red Tingle *	214	214	100.0	0	214	214	100	0	214	214	100.0	0	214	214	100.0	0
Jarrah Sandy *	2,170	2,170	100.0	0	2,223	2,220	100	4	2,224	2,212	99.4	12	2,224	2,212	99.4	12
Jarrah South	159,713	100,347	62.8	5,235	151,267	143,312	95	7,956	151,307	142,392	94.1	8,915	151,446	142,167	93.9	9,069
Jarrah Unicup	4,739	2,916	91.5	89	4,251	4,230	100	21	4,517	4,241	93.9	21	4,552	4,277	94.0	20
Jarrah Woodland	13,215	11,602	87.8	1,440	12,037	11,876	99	113	12,216	12,090	99.0	126	12,178	12,047	98.9	125
Jarrah Yellow Tingle	7,249	4,395	60.6	236	7,074	7,074	100	0	7,074	7,074	100.0	0	7,065	7,065	100.0	0
Sub-total Jarrah dominant	**270,892**	**181,092**		**8,573**	**257,449**	**245,905**		**11,152**	**258,275**	**245,104**		**12,920**	**258,300**	**244,432**		**13,291**
Karri Main Belt	53,569	33,496	62.5	3,603	51,928	46,952	90	4,976	53,210	48,050	90.3	5,160	53,308	47,802	89.7	5,300
Karri Rate's Tingle *	674	674	100.0	0	731	731	100	0	731	731	100.0	0	731	731	100.0	0
Karri Red Tingle	3,283	3,283	100.0	0	3,288	3,288	100	0	3,288	3,288	100.0	0	3,287	3,287	100.0	0
Karri West Coast *	492	492	100.0	0	522	519	99	0	516	516	100.0	0	516	516	100.0	0
Karri Yellow Tingle	6,969	4,190	60.1	308	6,956	6,953	100	3	6,956	6,956	100.0	0	6,946	6,946	100.0	0
Karri South Coast ^	364	76	76.8	4	362	353	98	9	363	363	100.0	0	360	360	100.0	0
Sub-total Karri dominant	**65,351**	**42,211**		**3,915**	**63,787**	**58,796**		**4,988**	**65,064**	**59,904**		**5,160**	**65,146**	**59,641**		**5,300**
Western Wandoo forest *	7,832	6,810	87.0	137	8,804	7,950	90	847	8,923	7,956	89.2	922	8,931	7,939	88.9	948
Western Wandoo woodland *	3,007	2,788	92.7	26	3,246	3,114	96	129	3,192	3,043	95.3	149	3,179	3,018	94.9	150
Sub-total Wandoo dominant	**10,839**	**9,598**		**163**	**12,050**	**11,064**		**976**	**12,115**	**10,999**		**1,071**	**12,111**	**10,957**		**1,098**
GRAND TOTAL	**347,082**	**232,901**		**12,651**	**332,286**	**315,765**		**17,116**	**335,454**	**316,007**		**19,151**	**335,557**	**315,029**		**19,690**

* Rare or depleted ecosystem

** No current estimate of ecosystems on private land was available to contribute to a "total present area". The estimate produced for the WA RFA was out-dated.

*** Sum of area on private and public land. Ecosystems on private land derived from historic forest types.

^ Majority occurs outside the WA RFA region.

" Darling Scarp old-growth forest includes jarrah and wandoo dominant forest

Wilderness values

The NFPS/JANIS Criteria defines Wilderness as:

> *Land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement…*[2]

Delineated Wilderness was determined for the CRA by a desktop analysis of datasets relating to landscape factors (remoteness, naturalness, size etc.) that relate to the NFPS/JANIS wilderness definition. Delineated Wilderness was the layer used to determine the JANIS reservation targets (90%, or more if practicable) for wilderness in the development of the WA RFA.

Wilderness extent and protection in WA RFA region

There were no wilderness areas identified in the CRA as none met the combined thresholds for the wilderness indicators to be delineated.

Extensive areas with high wilderness quality and high biophysical naturalness were incorporated into the CAR reserve system. Table 3 summarises the reservation levels for the wilderness quality and biophysical naturalness identified during the CRA process in 1999 and as currently reserved at 30 June 2018. There has been a significant increase in the proportion for each value in the CAR reserve system due to the progressive additions to reserves over this period.

Table 3: Reservation levels of wilderness values in the CAR Reserve System from 1999 to 2018.

Value	Present area	CAR Reserve System				
		Formal Reserves			CAR Informal Reserves	Total CAR
		Gazetted	FMP Proposed	New		
	(ha)	(%)	(%)	(%)	(%)	(%)
Wilderness quality >= 12	214,392	44.6	18.4	17.4	4.6	85.0
Wilderness quality >= 10	558,261	37.4	17.2	15.1	6.8	76.5
Wilderness quality >= 8	1,107,504	28.3	14.6	11.4	7.1	61.5
Biophysical naturalness >= 5	666,640	31.7	18.6	16.5	10.2	77.0
Biophysical naturalness >= 4	732,451	36.5	17.4	15.4	9.3	78.5
Biophysical naturalness >= 3	789,432	35.1	16.5	14.7	9.7	76.1

[2] The full NFPS definition is *land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement or is capable of being restored to such a state; is of sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and self-reliant recreation*.

Value	Present area*	CAR Reserve System				Other Informal Reserves
		Formal Reserves		CAR Informal Reserves	Total CAR	
	(ha)	Gazetted (%)	Proposed (%)	(%)	(%)	(%)
Wilderness quality >= 12	214,392	89.1	5.5	1.2	95.8	0.7
Wilderness quality >= 10	558,261	80.6	6.1	2.3	89.0	1.6
Wilderness quality >= 8	1,107,504	61.3	7.7	3.6	72.5	2.9
Biophysical naturalness >= 5	653,918	82.7	6.6	3.1	92.5	3.9
Biophysical naturalness >= 4	719,349	83.2	6.9	2.9	92.9	3.6
Biophysical naturalness >= 3	780,953	80.5	6.6	3.5	90.6	4.0

Since the commencement of the WA RFA the State government undertook in the *Protecting our Old-growth Forests* policy to create a 'Walpole Wilderness' area (a conceptual name for a group of conservation reserves, see Figure 3). The DBCA (then DEC) developed Policy No. 62 – *Identification and Management of Wilderness and Surrounding Areas*, which incorporates the National Wilderness Index (NWI) criteria and defines a 'wilderness area' as an area that has a NWI wilderness quality rating of ≥12 and meets a minimum size threshold of 8,000 hectares in temperate areas. The CRA datasets were used to delineate two areas in the Walpole area of high Wilderness quality which also had practical boundaries for fire protection, strategic access control and were feasible to manage as wilderness.

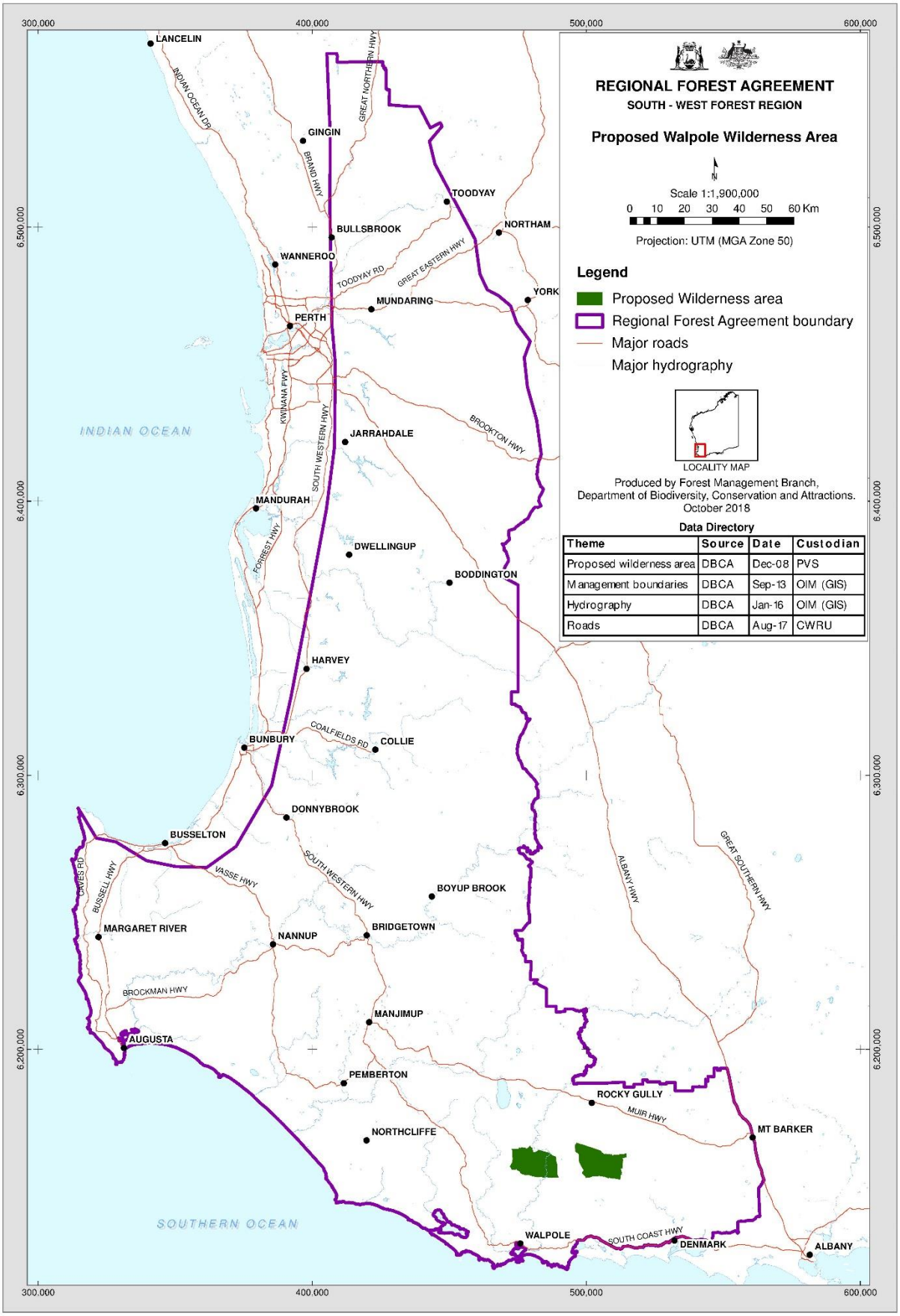

Figure 3: WA RFA region and the Proposed Walpole Wilderness Area in 2018.

Management of the Walpole Wilderness areas is in accordance with the *Walpole Wilderness Management Plan 2008* and Policy 62 which aims to maintain or enhance wilderness qualities within these areas through such actions as restricting access, limiting the use of mechanised transport, the placement of infrastructure (including closure and rehabilitation of legacy tracks and trails) and other measures. These areas are within a national park (part of the CAR reserve system) and will continue to be managed over the long-term to preserve their biophysical naturalness and wilderness attributes.

Other Wilderness definitions

The extent of formally reserved Delineated Wilderness, formally reserved Identified Wilderness, and the International Union for Conservation of Nature (IUCN) Protected Areas Wilderness Category, are each determined through mechanisms using differing definitions of wilderness. The IUCN Wilderness Area is derived from the Commonwealth Department of the Environment and Energy's Collaborative Australian Protected Area Database (CAPAD) so may include wilderness outside formal reserves but otherwise protected through mechanisms recorded in CAPAD, such as informal reserves. Declared Wilderness is a subset of Identified Wilderness.

International Union for Conservation of Nature wilderness

The IUCN defines Wilderness as:

> *Protected areas that are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition*.

The IUCN Protected Areas Category Ib: Wilderness Area is reported through the CAPAD. There are no IUCN Wilderness Areas within the WA RFA region.

Endangered species values

According to the *National Forest Policy Statement* (1992), endangered species are species of animals or plants that are at risk of extinction and whose survival is unlikely if the causal factors continue operating (Commonwealth of Australia 1992). Included are species whose numbers have been reduced to a critical level or whose habitats have been reduced so that the species are now deemed to be in danger of extinction. Also included are species that are possibly already extinct but have definitely been seen in the wild in the past fifty years and have not been subject to recent thorough searching.

Under the WA RFA, endangered species were included in the list of threatened flora and fauna. It is proposed that an extended WA RFA will have new terminology: 'Listed Species and Communities'. This is defined as species and communities listed in accordance with Part 13 of the EPBC Act, including threatened species, ecological communities, migratory species and other listed categories, or threatened species and communities listed under the *Wildlife Conservation Act 1950* (WA) (WC Act) or subsequent *Biodiversity Conservation Act 2016* (WA) (BC Act). Listed species (or threatened species) in this assessment will encompass 'endangered species', which are specifically referred to as part of 'environmental values' in para (a)(j) of the definition of 'RFA' in the RFA Act. However, the concept of 'listed species' is broader than the meaning of endangered species as defined in the *National Forest*

Policy Statement as it includes extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent categories. Listed threatened species and ecological communities are Matters of National Environmental Significance (MNES) under the EPBC Act.

National Legislation protecting Listed Species and Communities

The WA RFA was signed prior to the new Commonwealth environmental legislation that came into force and changed the definition and assessment of threatened species at the national level. The EPBC Act protects Australia's native species and ecological communities by providing for the:

- identification and listing of threatened species and ecological communities
- development of conservation advice and, where appropriate, recovery plans for listed species and ecological communities
- development of a register of critical habitat identification
- recognition of key threatening processes
- development of threat abatement plans where appropriate
- implementation of environmental impact assessment processes for proposed actions with significant impacts to listed threatened species and ecological communities.

Listing and protection processes

Listing species or ecological communities recognises their long–term survival is under threat. The national listing of species and ecological communities follows a rigorous scientific assessment process and involves consultation with stakeholders including scientific experts and the public. Advice on the eligibility of a species or ecological community for listing is provided to the Minister by the independent Threatened Species Scientific Committee.

Once listed a threatened species and ecological community is recognised as a matter of national environmental significance and must be considered in the EPBC Act's assessment and approval provisions.

Conservation advice and recovery plans

Since 2007, conservation advice is required at the time of listing a threatened species or ecological community. Conservation advices outline the eligibility for listing, and immediate priorities for conservation, research and recovery (Department of the Environment and Energy, 2018).

For some species and ecological communities, a more comprehensive recovery plan may also be developed to guide recovery action. Recovery plans set out the research and management actions that are necessary to stop the decline of, and support the recovery of, listed threatened species and ecological communities, (Department of the Environment and Energy, 2018a). The aim of a recovery plan is to assist the long-term survival in its natural environment of the species or ecological community.

Key threatening processes and threat abatement plans

The listing process for key threatening processes is similar to the listing of species and ecological communities. A listed key threatening process is not a matter of national environmental significance. Once a key threatening process is listed under the EPBC Act, a threat abatement plan is developed if it is shown to be a 'feasible, effective and efficient way'

to abate the threatening process. Threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.

As with recovery plans, a threat abatement plan can be made by the Minister alone or jointly with relevant states and territories, or the Minister can adopt a state or territory plan. Before a plan is made or adopted, there must be public consultation and advice from the Threatened Species Scientific Committee about the plan.

Interaction between the RFA and the EPBC Act

Consistent with the objectives of the EPBC Act, the RFA provides for protection of the environment; promotes ecologically sustainable development; promotes the conservation of biodiversity; and provides for the protection of heritage.

Section 38 of the EPBC Act streamlines forest planning processes by exempting forest operations in RFA areas from assessment and approval processes under the EPBC Act. This means forestry operations that are undertaken in accordance with a RFA do not require approval for the purposes of any provision in Part 3 of the EPBC Act (Commonwealth of Australia 1998). The rationale for this approach is that the EPBC Act recognises 'that in each RFA region a comprehensive assessment has been undertaken to address the environmental, economic and social impacts of forestry operations' (Commonwealth of Australia 1998). The exception is forestry operations within World Heritage properties or Ramsar wetlands sites, where assessment and approval is required.

WA Legislation protecting Listed Species and Communities

At the time the WA RFA was signed the WC Act and the *Environmental Protection Act 1986* (WA) (EP Act) were the key pieces of legislation providing protection for listed species in WA. The BC Act and supporting Biodiversity Conservation Regulations 2018 will replace the WC Act on 1 January 2019 and provide a modern and effective approach to biodiversity conservation and the ecologically sustainable use of biodiversity.

The BC Act and its associated regulations improves on the WC Act in a number of ways including:

- provisions for listing threatened species and threatened ecological communities that are based on the internationally accepted IUCN criteria,
- introducing provisions for listing key threatening processes, and critical habitats;
- providing incentives for private and community conservation initiatives, including conservation agreements and biodiversity conservation covenants;
- significantly increasing the protection for threatened species as well as threatened ecological communities with significantly increased maximum penalties for illegal taking of a threatened species, or modification of a threatened ecological community;
- provisions for approving, amending and adopting Recovery Plans and Interim Recovery Plans; and
- minimising superfluous regulation and avoiding regulation where non-regulatory processes are adequate.

Listed threatened species and ecological communities are also protected by a suite of planning and operational controls within WA's FMS that operate across a range of scales. The framework to guide planning and decision-making reflect both the scale and direct effects of operations locally, and as a component of an integrated management system linked into broader scales of strategic planning over longer timeframes. The document *the Forest Management System in Western Australia: An Overview* (2018) provides details on how WA's FMS manages and provides protection for threatened species and ecological communities.

Indicator 1.2b Status of forest dwelling species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment

This indicator measures the conservation status of nationally listed threatened forest dwelling species. Documentation of this information over time allows analysis of changes to species' conservation status indicating the extent to which forest species biodiversity is being maintained. Forest-dwelling species are species that occur in forest vegetation types, although they may also occur outside forests. Forest-dependent species are species that require a forest habitat for at least part of their lifecycles.

Threatened Flora and Fauna

When the WA RFA was signed in 1999, 12 threatened fauna species and 57 threatened flora species that occurred (or which had occurred) within the WA RFA region were declared as specially protected fauna or flora under the WC Act or listed in the Schedules to the then *Endangered Species Protection Act 1992* (ESP Act).

By 2018, 55 threatened fauna taxa and 146 threatened flora species declared as protected or rare under the WC Act or listed in the Schedules to the EPBC Act had (or were believed to have had) populations within the WA RFA region. Over 70 per cent of these threatened species were plants.

Appendix B details, as of 2018, all WA, WC Act listed threatened species, and EPBC Act listed species that had (or were believed to have had) populations within the WA RFA region as well as the status of relevant conservation advices and recovery plans.

A case study on the management of prescribed fire and threatened flora in the WA RFA region is presented in *The Forest Management System in Western Australia: An Overview (2018)*. The status of threatened species listings are reviewed annually and the WA Environment Minister considers recommendations on threatened categories (DBCA, n.d.).

Status of Listed Species recovery plans and conservation advice

All EPBC Act listed threatened species known or likely to occur within the WA RFA region (Appendix B) have either a conservation advice, recovery plan or both to guide their recovery. The 12 non-threatened EPBC Act listed migratory birds do not require a conservation advice or recovery plan. Of the 55 threatened fauna species, 24 have either a WA or National recovery plan in place. Of the 146 threatened flora species, 65 have either a WA or National recovery plan in place. WA Recovery plans are preferentially prepared for species listed as critically endangered. WA Recovery plans are also prepared for species listed

as endangered or vulnerable where resources are available and requirements for managing the species justify preparing such a plan. The Australian and WA governments continue to work collaboratively in prioritising the development of new recovery plans.

In addition to the specific species recovery planning for threatened flora, there are regional wildlife management programs (flora) covering DBCA's Swan, South West and Warren regions[3]. The RFA region is a subset of these DBCA regions. The regional wildlife management programs (flora) provide a brief description of the appearance, distribution, habitat and conservation status of flora species, subspecies or varieties which are declared as rare or listed as priority flora. These plans include recommendations for research and management actions to assist towards the continued survival of the species identified.

Case studies on the management of three nationally listed species, the Woylie, the Numbat and the Black Cockatoo are outlined in Appendix 4 of *The Forest Management System in Western Australia: An Overview (2018)*.

Threatened Ecological Communities

No Ecological communities were listed in WA until 2001. As of July 2018, there were 15 ecological communities listed as threatened under the EPBC Act that were known or likely to occur in the WA RFA region (Table 4). Ten threatened ecological communities were assessed under the predecessor to the EPBC Act, the ESP Act, and transferred to the EPBC Act in 2000. A further five were listed between 16 July 2000 and 16 September 2016, all after the WA RFA had been signed in 1999. Between 2001 and 2002, the WA Minister for Environment endorsed a list of ecological communities that were considered to be at threat of being destroyed. In 2018, 27 ecological communities were listed in this manner in the WA RFA area.

A list of ecological communities occurring in the WA RFA region is provided at Appendix B.

Table 4: Number of Threatened Ecological Communities listed under the EPBC Act in the WA RFA region.

	Critically endangered	Endangered	Vulnerable	Total
Total	2	12	1	15

Status of Listed Communities recovery plans and conservation advice

Of the 15 EPBC listed threatened ecological communities within WA RFA region (Table 4), all have either a conservation advice, recovery plan or both in place to guide their recovery.

Key threatening processes

There are 12 threatening processes listed under the EPBC Act potentially affecting threatened species in the WA RFA region (see Table 5). The Australian Government has

[3] Department of Biodiversity, Conservation and Attractions (n.d.). dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants?view=categories&id=108

developed threat abatement plans for most of the key threatening processes registered under the EPBC Act.

Table 5: EPBC listed key threatening processes potentially affecting threatened species in WA RFA region

EPBC listed key threatening process	Effective listing date	Threat abatement plan date of approval
Competition and land degradation by rabbits	16 July 2000	2016
Competition and land degradation by unmanaged goats	16 July 2000	2008
Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)	16 July 2000	2014
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	23 July 2002	2016
Land clearance	4 April 2001	Not applicable - threat abatement plan not considered a feasible, effective or efficient way to abate the process.
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	8 January 2010	Not applicable - threat abatement plan not considered a feasible, effective or efficient way to abate the process.
Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases	4 April 2001	Not applicable - threat abatement plan not considered a feasible, effective or efficient way to abate the process.
Novel biota and their impact on biodiversity	23 February 2013	Not applicable - threat abatement plan not considered a feasible, effective or efficient way to abate the process.
Predation by European red fox	16 July 2000	2008
Predation by feral cats	16 July 2000	2015
Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs	6 August 2001	2017
Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species	4 April 2001	2005 (ceased on 1 October 2015), however a non-statutory threat abatement advice is in place.

A risk-based approach is adopted by DBCA when setting priorities for management activities to address key threatening processes on public lands within the WA RFA region.

Throughout the period 1999 to 2018, DBCA (and its predecessors) has maintained major programs to address the spread of *Phytophthora* dieback disease in forest ecosystems. Since the RFA was signed there has been over 220,000 hectares of DBCA managed land within the WA RFA region intensively mapped for the presence of *Phytophthora* dieback. Dieback management plans are developed to minimise the risk of introducing or spreading *Phytophthora* dieback when undertaking disturbance activities such as timber harvesting, roading and building infrastructure. Where appropriate, DBCA also uses a biodegradable fungicide, 'phosphite' to protect plants against *Phytophthora* dieback.

Commencing in 1996, 'Western Shield' is one of the biggest wildlife recovery programs ever undertaken in Australia and aims to return the balance and mix of native animals to levels comparable to pre-European settlement. Working to protect WA's native wildlife though the broadscale control of introduced predators including foxes and feral cats, Western Shield monitoring has shown increases in the population size and distribution of priority native species including quokka, western brush wallaby and chuditch. Approximately 80 per cent of the annual baiting program occurs within the WA RFA region.

The RFA region has experienced a drying and warming trend which commenced prior to the signing of the RFA in 1999, and this change in climate is predicted to continue in future decades. In addition to an expansion of the CAR formal reserve system (providing enhanced protection to threatened species) the FMP 2004-2013 incorporated refined management practices, adjustments to the informal reserve network and reduced forest growth projections in response to climate change. These adaptation measures were built upon in the FMP 2014-2023 through a refinement of the fauna habitat zone (FHZ) network (outside the CAR reserve system), ongoing refinement of silviculture and prescribed fire practices, further reductions in the projection of timber yields, and provision for management of vegetation density to increase resilience of landscapes to reduced rainfall.

National Estate values

The term *National Estate* refers to places defined in section 4 of the repealed *Australian Heritage Commission Act 1975* (Cth) (AHC Act). After the signing of the WA RFA, the AHC Act was repealed and the Register of the National Estate was phased out. As a consequence, the RFAs do not reflect the current system of heritage protection under the EPBC Act through the National and Commonwealth Heritage Lists and the *Australian Heritage Council Act 2003 (Cth)*.

As part of the CRA process the Western Australia National Estate Aesthetic Value Identification and Assessment Project recommended 42 places could be included in the Register of the National Estate (ERM Mitchell McCotter, 1998).

There is one place on the National Heritage List and two places on the Commonwealth Heritage List within the WA RFA region (Table 6 and Table 7). All of these places have management plans that outline how the heritage values of the site are protected.

For the past 20 years, the WA Forest Management System (FMS) has provided for the protection of National Heritage Values of National Heritage Places in accordance with National Heritage Management Principles.

National Estate values in the RFA Act refer to the aesthetic, historic, scientific or social significance or other values of places that form part of the natural environment or cultural environment of Australia that make those places of significance or special value to current and future generations. National Estate values are protected and managed through implementation of the CAR reserve system and the application of the WA FMS.

Changes to National Legislation

Closure of the Register of the National Estate

After the WA RFA was signed in 1999, a new system of national heritage protection was introduced. The Register of the National Estate was a national list of places of natural, historic and Indigenous significance. Each site was identified under the repealed AHC Act and the EPBC Act. The Register was maintained by the Australian Heritage Commission and later the Australian Government between 1975 and 2007.

In 1997, the Council of Australian Governments agreed that it was more appropriate for heritage listing and protection to be the responsibility of the government agencies that were best placed to deliver agreed outcomes. As a result, the AHC Act was repealed and the Register of the National Estate was phased out as a statutory list.

The Register was frozen in 2007 and ceased to be a recognised statutory list in February 2012. The Register of the National Estate is maintained on a non-statutory basis as a publicly available archive of information on more than 13,000 places throughout Australia. This list can be publicly accessed on the Australian Heritage Database.

A new national heritage system

The expiration and repeal of parts of the EPBC Act and the *Australian Heritage Council Act 2003* (Cth) relating to the Register of National Estate did not diminish protection of Commonwealth heritage places. These parts were superseded by stronger ongoing heritage protection provisions under national environment law.

National Estate Values are now managed through a combination of formal and informal reserve systems, the National and Commonwealth Heritage Lists, WA heritage provisions, including the *Heritage of Western Australia Act 1990*, and the Heritage Codes of local planning schemes. The National Heritage List includes places of outstanding heritage value to the nation, and the Commonwealth Heritage List includes heritage places owned or controlled by the Commonwealth.

Commonwealth and National Heritage List assessment

Anyone can nominate a place with significant or outstanding heritage values for the Commonwealth or National Heritage List. The Australian Heritage Council assesses the values of nominated places against set criteria and makes recommendations to the Minister for the Environment about listing. There are two key tools used to assess Commonwealth and National Heritage List nominations: criteria and thresholds. To reach the threshold for the National Heritage List, a place must have 'outstanding' heritage value to the nation. This means that it must be important to the Australian community as a whole. The threshold for inclusion on the Commonwealth Heritage List is local heritage significance.

Indicator 6.4b Registered places of non-Indigenous cultural value in forests that are formally managed to protect those values

This indicator measures and monitors management regimes for non-Indigenous cultural values, such as historical, research, education, aesthetic, and social heritage values.

Within the WA RFA region there is one 'site' registered on the National Heritage List. The Goldfields Water Supply Scheme, an above ground pipeline stretching from Perth to Kalgoorlie, was opened in 1903 and registered as a listed feature in 2011. This pipeline is still in use today, providing a critical water supply to the Goldfields region. The pipeline corridor is recorded in DBCA spatial datasets referenced during planning and disturbance approval processes. Activities such as the construction and maintenance of adjacent fire breaks and regular fuel reduction burning adjacent to the pipeline and associated pumping stations are undertaken to protect this feature.

Within the WA RFA region there are two places on the Commonwealth Heritage List: the Bindoon Defence Training Area (BDTA) and the Cape Leeuwin Lighthouse. Figure 4 shows the location of the listed National and Commonwealth Heritage places in the WA RFA area.

The Department of Defence manages the natural values of the BDTA, as a CAR Informal Reserve for the protection of identified CAR values. The establishment of the reserve is based on the development of Defence management arrangements (i.e. Defence Environmental Plans) that prescribe the management regime for the reserve.

The Cape Leeuwin Lighthouse was listed in 2004 in recognition of its historical value, and is covered by a conservation plan. The lighthouse was built in 1896 from locally-quarried ashlar limestone, and is considered exceptionally important as its original lens array and rotation mechanism demonstrate the earliest use of the mercury bath system in Australia (Department of the Environment and Energy, n.d.) The lighthouse remains operational, and is actively managed as a popular tourist destination.

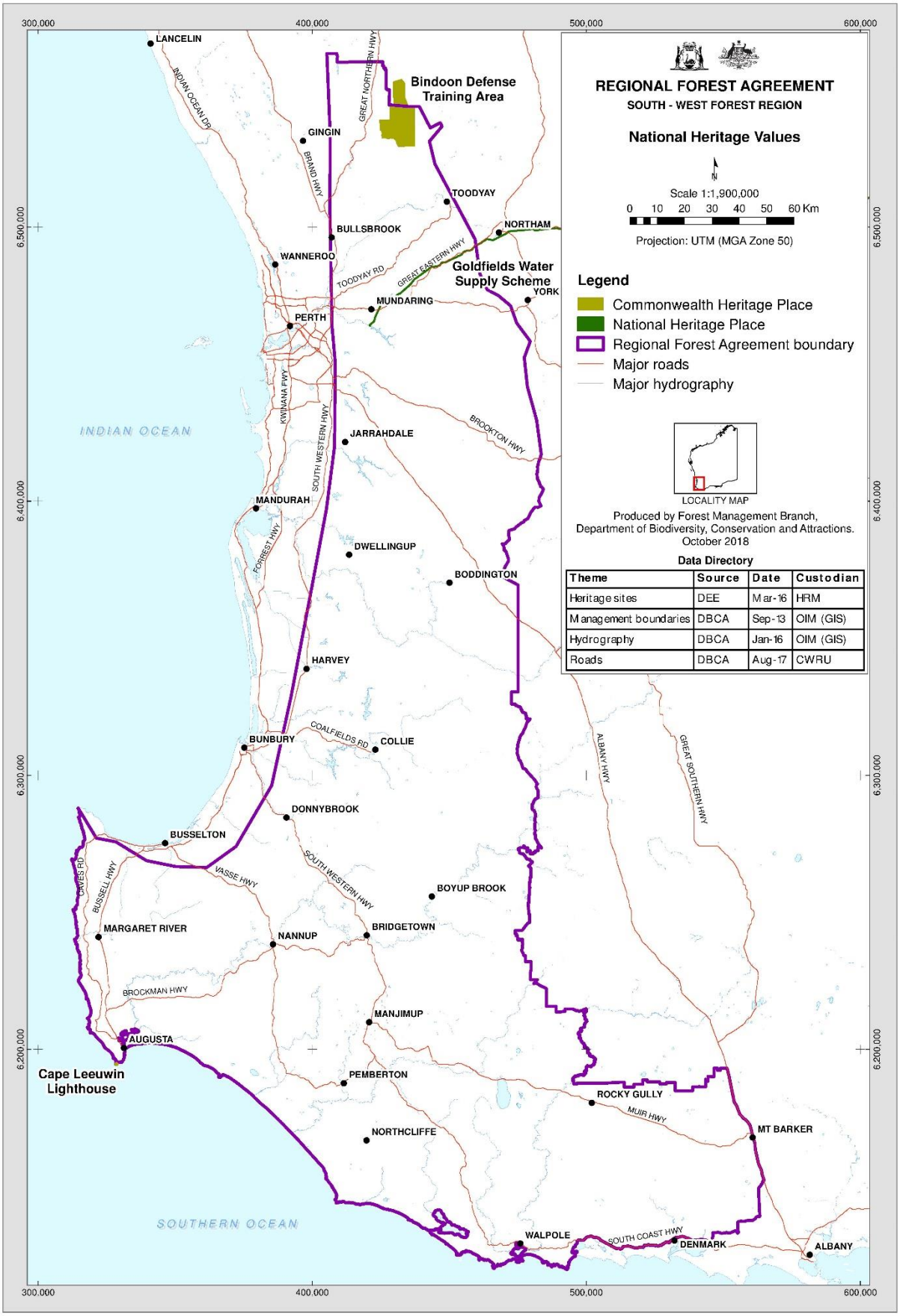

Figure 4: WA RFA region and the location of the places on the National and Commonwealth Heritage lists in 2018.

There are many local heritage sites listed on State and local shire inventories. The process for approving forestry operations and other ground disturbance activities on lands vested in the CPC requires a check for listed sites, and if present, appropriate measures for protection or modification of activities is required. The availability of the data improves over time as databases are enhanced.

For the past 20 years, the WA FMS has provided for the protection of National Heritage Values of National Heritage Places in accordance with National Heritage Management Principles.

Table 6: WA National Heritage List places

Name	Type	Listing date
The Goldfields Water Supply	Historic	23 June 2011

Table 7: WA Commonwealth Heritage List places

Place	Type	Listing date
Bindoon Defence Training Area	Natural	25 October 2004
Cape Leeuwin Lighthouse	Historic	22 June 2004

World Heritage values

There are four World Heritage properties in Western Australia, but none are located within the WA RFA region. The four are: Australian Convict Sites – Fremantle Prison (former); Purnululu National Park; Shark Bay; and The Ningaloo Coast.

If World Heritage properties were to be listed within the WA RFA region they would be managed separately from processes put in place by the WA RFA, and be protected by Part 3 of the EPBC Act. The Australian and WA governments will continue to participate in the assessment and protection of any future World Heritage places consistent with the Australian World Heritage Intergovernmental Agreement.

Natural and cultural heritage, which contribute to the concept of World Heritage Values, are protected and managed through the implementation of the CAR reserve system and application of the WA FMS.

Legislative protection of World Heritage values

The UNESCO World Heritage Convention 1972 establishes a list of places that have natural and/or cultural values of outstanding global significance. As a signatory to the convention, Australia has an obligation to identify, protect and conserve places on the World Heritage List (Department of the Environment and Energy, 2018b).

Under the EPBC Act, World Heritage properties are MNES. The EPBC Act therefore provides protection for World Heritage properties by ensuring that an assessment process is undertaken for proposed actions (including forestry operations) that will, or are likely to, have a significant impact on the World Heritage values of a declared world heritage property. This process allows the Commonwealth Minister for the Environment to grant or refuse approval to take an action, and to impose conditions on the taking of an action within a world heritage property. The EPBC Act also provides for the preparation of management plans which set out the significant heritage aspects of the place and how the values of the site will be managed.

The exemption of forestry operations in RFAs from Commonwealth assessment and approval requirements under section 38 of the EPBC Act does not apply to operations within World Heritage properties or Ramsar wetland sites[4].

World Heritage listing

To be inscribed on the World Heritage list, properties must demonstrate outstanding universal value and meet at least one of the ten selection criteria. These criteria are based on cultural heritage and natural heritage as defined in the World Heritage Convention.

Only the Australian Government can nominate Australian places for inclusion on the World Heritage List. The World Heritage Committee assesses nominated places against the set criteria and makes the final decision as to the places that are included on the World Heritage List.

[4] See section 42 of the EPBC Act.

Biodiversity Values

Biodiversity is the name given to the variety of living things, the different flora, fauna and organisms, the genetic information they contain and the ecosystems they form. The CRA process drew together extensive datasets on biodiversity values within the WA RFA region which were used to inform the design of the CAR reserve system. The comprehensiveness of biodiversity datasets has continued to grow throughout the period of the RFA through research and monitoring programs undertaken by DBCA, the WA Herbarium, WA Museum and universities. The WA FMS references these CRA and updated data to inform disturbance approval processes, refinement of the formal and informal reserve systems on public lands, and the protection of biodiversity values during management activities such as prescribed burning on public lands. Some of the CRA datasets (such as forest ecosystems) have annual update cycles as they provide the basis for annual reporting of KPIs under the WA FMP.

Indicators of biodiversity value within an area included the number and diversity of flora and fauna species, ecological communities and vegetation assemblages (forest ecosystems). The indicators below report on the range of flora and fauna species and communities, and the maintenance of reserves established to protect biodiversity.

Indicator 1.1a Area of forest by forest type and tenure

Area of forest, by forest type

Comprehensive Regional Assessment

The extent of forest ecosystems in the WA RFA region was mapped through the CRA process between 1995 and 2000[5]. Application of the JANIS criteria for defining forest ecosystems as a basis for reserve design and management resulted in the development of forest ecosystem categories which combined detailed vegetation mapping and forest associations data. The forest ecosystems dataset has been maintained and updated annually with minor changes to forest type arising from silvicultural regeneration operations, rehabilitation following mining, and approved refinements from ground surveys of informal reserve boundaries. Figure 5 shows the forest ecosystems within the WA RFA area.

[5] Further information on the CRA forest ecosystems classification and mapping projects for the WA RFA region can be found at http://www.agriculture.gov.au/forestry/policies/rfa/regions/wa

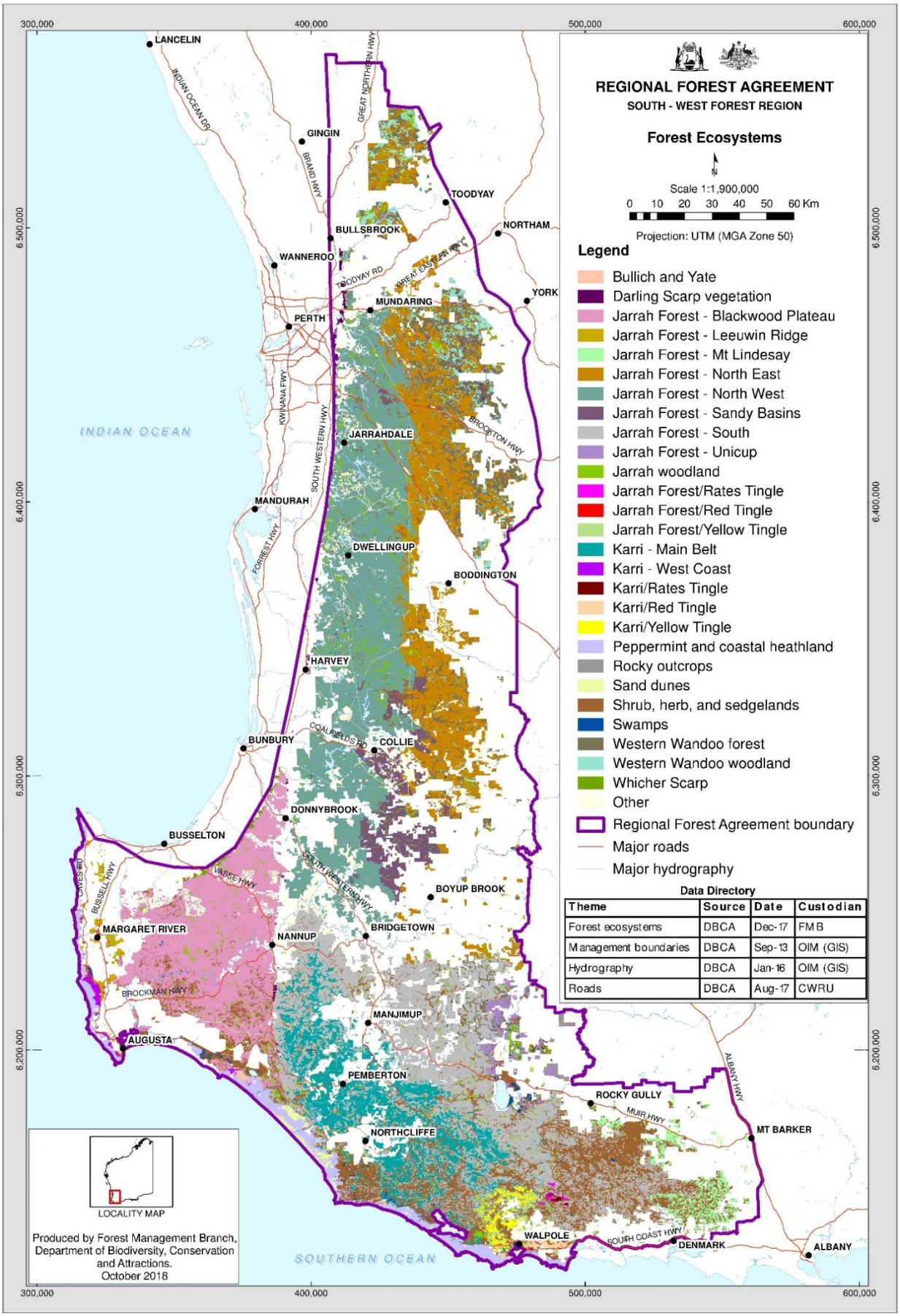

Figure 5: WA RFA region and forest ecosystems in 2018.

In 1999 there was a total of 2.6 million hectares of forest ecosystems recorded within the WA RFA region, of which 2.2 million hectares (85 per cent) were classified as forested. The total area of forest ecosystems had reduced to 2.5 million hectares at December 2017, of which 2.1 million hectares (84 per cent) was classified as forested. The reduced area arose from clearing for infrastructure, mining, and agriculture as well as data refinements.

Area of forest ecosystems by tenure

The 2.2 million hectares of forest ecosystems within the WA RFA region in 1999 comprised 1.94 million hectares (87 per cent) located on public lands and 295,050 hectares (13 per cent) on private and leasehold lands. At June 2018, there was a total of 2.1 million hectares of forested ecosystems in the WA RFA region, of which 1.98 million hectares (94 per cent) are on public land and 137,356 hectares (6 per cent) are on private and leasehold land.

Table 8 shows the area of forest ecosystems by land tenure in the WA RFA region at 1999 and 2018. Figure 6 shows the native vegetation remaining on private land within the WA RFA area.

Table 8: Forest ecosystem area, by tenure in the WA RFA region

	WA RFA 1999		Current area to June 2018	
Tenure	**Area ('000 hectares)**	**Proportion of total forest ecosystem area (%)**	**Area ('000 hectares)**	**Proportion of total forest ecosystem area (%)**
Public	1,940	87	1,980	94
Private and leasehold	295	13	137[a]	6
Total	2,235		2,117	

Note: Area derived from spatial data associated with the RFA data tables published in 1999-2001 and updated data at June 2018. Based on the best available data at signing of RFA.

[a]The decrease of forest ecosystems on Private and leasehold land is not from a reduction in remnant vegetation. The reported decrease is largely due to a difference in the basis of forest ecosystem mapping on private property from that undertaken in 1998, as well as a change to the categorisation of 'Other government freehold' tenure from private (1999) to public (2018).

Totals may not tally due to rounding

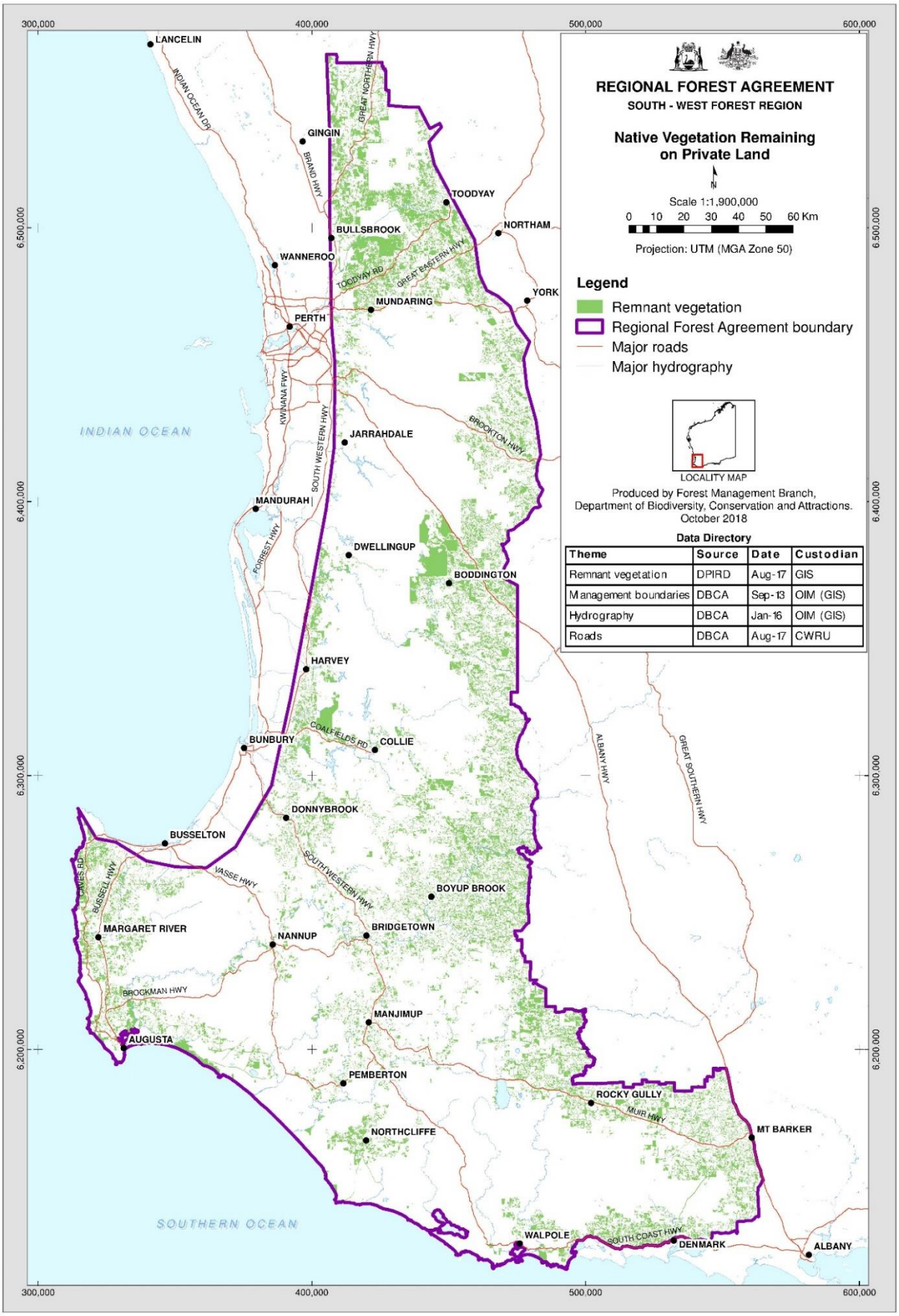

Figure 6: WA RFA region and native vegetation on private land in 2018.

Indicator 1.1c Area of forest in protected area categories

Extent of protected areas in RFA regions

The area and proportion of forest ecosystems reserved through formal and informal processes is a measure of the emphasis placed by society on the preservation of representative ecosystems as a strategy to conserve biodiversity.

The CRA process reported a total of 4.25 million hectares of land area within the boundaries of the WA RFA region. This comprised 1.87 million hectares on private lands and 2.38 million hectares on public lands. A total of 746,000 hectares (31 per cent) of the public land was protected as formal reserves, while a further 315,000 hectares (13 per cent of the public land) were included in informal reserves.

Table 9 summarises the representation of each forest ecosystem in the CAR reserve system over time from 1999 to 2018.

At the commencement of the RFA in 1999 the CAR Reserve System totalled 1.047million hectares, comprising 25 per cent of the total land within the RFA. By the end of 2009 the CAR reserve system had expanded by 203,000 hectares to 1.25 million hectares (30 per cent) of the total land in the RFA region. By mid-2018, a total of 1.29 million hectares (30 per cent) of the total land was protected under the CAR Reserve System. This constitutes an overall increase of 241,000 hectares added to CAR Reserves during the period 1999-2018.

Most of the CAR additions during the RFA period arose from government policy decisions, but there were also some additions arising from new information on the distribution of biodiversity within the RFA region. For example, consolidation of flora surveys and additional mapping of vegetation complexes on the Swan Coastal Plain resulted in the recognition of a separate Whicher Scarp forest ecosystem. The FMP 2014-2023 proposes this area to become a national park (formal reserve). The Whicher Scarp ecosystem was formerly part of the Jarrah – Blackwood forest ecosystem, and is therefore reported separately in Table 9.

Table 9: Forest ecosystems within the WA RFA region and the changes in area in the CAR reserve system over time

		WA RFA 1999				WA RFA Review 2009				WA RFA Review 2014				WA RFA Assessment of Matters 2018			
Forest Ecosystem	**Pre-1750 area (ha)**	**Present area (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves and FHZs (ha)**	**Present area *** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves and FHZs (ha)**
Darling Scarp`	29,000	9,938	2,767	9.5	16	4,960	4,062	14.0	19	5,710	4,565	15.7	273	11,010	4,496	15.5	295
Jarrah Blackwood	343,500	281,805	57,117	16.5	16,719	272,720	95,805	27.6	17,209	270,010	97,002	28.2	22,372	279,430	96,586	28.1	22,402
Jarrah Leeuwin	56,400	19,552	8,480	15.0	41	10,660	8,693	15.4	54	10,720	8,736	15.5	54	18,290	8,650	15.3	54
Jarrah Mt Lindesay	126,600	44,597	20,608	16.3	93	31,420	24,015	19.0	89	32,590	24,113	19.0	365	44,530	24,442	19.3	374
Jarrah North East	717,100	350,239	107,581	15.0	7,940	271,510	121,826	17.0	7,540	281,030	123,922	17.3	16,493	306,930	123,482	17.2	16,298
Jarrah North West	670,600	499,598	100,585	15.0	19,401	453,880	112,984	16.8	18,306	455,250	114,411	17.1	39,372	475,040	114,280	17.0	39,186
Jarrah Rate's Tingle *	1,500	1,246	1,069	85.8	0	1,160	1,156	99.6	0	1,160	1,156	99.6	0	1,160	1,156	99.6	0
Jarrah Red Tingle *	350	266	226	85.0	0	230	228	99.1	0	220	220	99.8	0	270	219	81.2	0
Jarrah Sandy	107,900	71,092	17,175	15.9	2,461	65,500	25,785	23.9	2,070	66,260	25,802	23.9	4,081	70,660	25,790	23.9	4,031
Jarrah South	557,300	438,918	157,311	28.2	22,197	422,650	242,304	43.5	25,205	423,580	241,351	43.3	30,142	439,720	240,947	43.2	30,164
Jarrah Unicup	81,000	29,459	13,290	16.4	134	17,710	16,653	20.6	43	21,290	18,790	23.2	35	32,080	18,760	23.2	34
Jarrah Woodland	106,400	67,220	44,210	41.6	11,542	53,200	43,875	41.2	7,857	54,450	44,806	42.1	7,941	54,170	44,430	41.8	7,896
Jarrah Yellow Tingle	11,600	9,669	4,799	41.4	304	8,270	8,266	71.3	0	8,380	8,299	71.5	0	8,900	8,289	71.5	0
Sub-total Jarrah dominant	**2,809,250**	**1,823,599**	**535,217**		**80,848**	**1,613,870**	**705,651**		**78,392**	**1,630,650**	**713,173**		**121,129**	**1,742,190**	**711,525**		**120,736**
Karri Main Belt	193,000	163,905	55,603	28.8	13,071	153,320	78,468	40.7	13,871	154,590	79,628	41.3	14,482	160,070	79,200	41.0	14,634
Karri Rate's Tingle *	1,100	860	736	85.6	0	790	788	99.7	0	790	788	99.7	0	790	788	99.7	0
Karri Red Tingle	7,200	5,858	5,103	70.9	0	5,230	5,228	72.6	0	5,220	5,214	72.4	0	5,600	5,208	72.3	0
Karri West Coast	14,500	6,274	4,384	30.2	33	4,890	4,552	31.4	15	4,920	4,683	32.3	15	5,670	4,599	31.7	15
Karri Yellow Tingle	15,800	13,264	5,277	33.4	557	11,770	11,742	74.3	3	11,800	11,747	74.3	0	12,620	11,733	74.3	0
Sub-total Karri dominant	**231,600**	**190,161**	**71,102**		**13,661**	**176,000**	**100,778**		**13,889**	**177,320**	**102,060**		**14,497**	**184,750**	**101,527**		**14,649**
Western Wandoo forest	363,200	146,597	57,137	15.7	4,609	111,300	70,574	19.4	4,577	115,200	70,660	19.5	5,987	127,470	70,495	19.4	5,980
Western Wandoo woodland	163,000	72,078	36,127	22.2	1,863	53,360	39,208	24.1	1,883	52,760	38,861	23.8	2,307	52,730	38,707	23.7	2,301
Sub-total Wandoo dominant	**526,200**	**218,674**	**93,264**		**6,472**	**164,660**	**109,782**		**6,460**	**167,960**	**109,521**		**8,294**	**180,200**	**109,202**		**8,281**
Peppermint and coastal heath	80,100	70,826	57,771	72.1	1	62,920	59,582	74.4	0	63,280	62,379	77.9	0	73,530	62,077	77.5	0

		WA RFA 1999				WA RFA Review 2009				WA RFA Review 2014				WA RFA Assessment of Matters 2018			
Forest Ecosystem	**Pre-1750 area (ha)**	**Present area (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves (ha)**	**Present area on public land** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves and FHZs (ha)**	**Present area *** (ha)**	**Total CAR reservation (ha)**	**Total CAR reservation (%)**	**Other informal reserves and FHZs (ha)**
Rocky outcrops	26,400	12,444	9,810	37.2	2,473	13,600	10,528	39.9	2,479	13,820	10,897	41.3	2,530	14,030	10,874	41.2	2,540
Sand Dunes	11,500	10,342	10,030	97.4	4	11,590	11,160	97.0	0	11,570	11,311	98.4	0	12,010	11,134	96.8	0
Shrub, herb, and sedgelands	429,900	296,950	236,302	55.0	14,949	262,160	244,580	56.9	11,329	265,430	246,644	57.4	11,313	285,890	245,123	57.0	11,548
Swamps	15,300	8,069	6,243	40.8	249	6,670	6,387	41.7	260	6,850	6,524	42.6	293	7,240	6,512	42.6	291
Whicher Scarp"	23,700	-	-	-	-	-	-	-	-	4,000	2,442	10.3	181	7,470	2,434	10.3	238
Bullich and Yate *	2,800	2,440	2,176	89.2	1	2,160	2,159	100.0	0	2,720	2,313	85.0	174	2,740	2,305	84.1	173
Other ~	n/a	n/a	25,284	n/a	3,240	n/a	n/a	n/a	n/a	n/a	24,510	n/a	1,690	n/a	25,827	n/a	1,843
Sub-total Other forest	**589,700**	**401,071**	**347,616**		**20,917**	**359,100**	**334,395**		**14,068**	**367,670**	**367,020**		**16,181**	**402,910**	**366,285**		**16,634**
GRAND TOTAL	**4,156,750**	**2,633,505**	**1,047,199**		**121,898**	**2,313,630**	**1,250,606**		**112,809**	**2,343,600**	**1,291,774**		**160,100**	**2,510,050**	**1,288,539**		**160,300**

* Rare ecosystem with 100% reservation target of current area

** No current estimate of ecosystems on private land was available to contribute to a "total present area". The estimate produced for the WA RFA was out-dated.

*** Sum of area on private and public land. Ecosystems on private land derived from historic forest types.

~ Vegetation, the majority of which occurs outside the RFA region, water, exotics, cleared and unclassified land.

" Identification of the Whicher Scarp ecosystem has reduced the extent of the Jarrah Blackwood

` Darling Scarp includes both jarrah and wandoo forest types

Indicator 1.2a Forest dwelling species for which ecological information is available

This indicator reports the level of information available to manage forest dwelling species and tracks changes in this knowledge over time. The amount of habitat, disturbance and life history information available to make management decisions indicates the capacity to assess risk to species and to implement conservation strategies.

The national SOFR provides information on forest dwelling and forest dependent species on a five-yearly basis. Prior to the SOFR 2013 data was compiled for the area of south-west Western Australia covered by the RFA. Subsequent reports from 2013 onwards incorporate data for the entire state including woodlands and forests in the semi-arid and northern savanna regions of the state, resulting in a substantial increase in the numbers for some taxonomic groups. Data reported here refer to the RFA region only.

While the taxonomy and distribution of vertebrate fauna is generally well established, some changes in the number of species reported for the RFA region are to be expected in the future as a result of further survey, taxonomic revision and possibly the movement of more mobile species in response to changing climate and habitat availability. Similarly, the number of vascular plant species is likely to increase as a result of further survey, taxonomic revision and occasional discovery of new species.

Table 10: Number of forest-dwelling vertebrate species[1]

Taxonomic group [2]	WA RFA region	Australia [3]
Fish	10	459
Amphibians	22	229
Reptiles	59	789
Birds	112	668
Mammals	31	356
Total	234	2501

Table 11: Number of forest-dwelling vertebrate species, by year

Year	WA RFA region	Australia
1998	239	1,227 [4]
2001	226[5]	1,817
2006	226	—
2011	234	2,212

— = not available

[1] Forest-dwelling species are species that may use forest habitat for all or part of their lifecycles.

[2] Subspecies are included where they are managed by jurisdictions or nationally. Non-native species are not included.

[3] Numbers for Australia also include data from offshore forested islands—such as Torres Strait, Christmas, Lord Howe and Norfolk islands. SOFR (2018), Table 1.29

[4] SOFR 1998 reported a national minimum estimate of forest-dwelling native vertebrate fauna, based on an incomplete compilation of data from New South Wales, the Northern Territory, Tasmania and parts of Queensland.

[5] Changes to sampling methodology in SOFR 2003 changed, and so data from 2006 report is provided in this table

Source: SOFR 2018.

Table 12: Number of forest-dependent vertebrate species, by jurisdiction, 2011[1]

Taxonomic group [2]	WA	Australia [3]
Fish	5	109
Amphibians	12	91
Reptiles	77	350
Birds	76	371
Mammals	49	180
Total	219	1,101

Source: SOFR 2013

Notes:

[1] Forest-dependent species are species that must inhabit a forest habitat for all or part of their lifecycles.

[2] Subspecies are included where they are managed by jurisdictions or nationally. Non-native species are not included.

[3] Numbers for Australia also include data from offshore forested islands—such as Torres Strait, Christmas, Lord Howe and Norfolk islands.

Table 13: Number of forest-dwelling vascular plant species, by jurisdiction

Reporting date	WA	Australia
1998	2639	13,622
2001	3178	16,532
2006	3000	n.r.
2011	3320	16,836

Source: SOFR 2013

Notes:

— = not available.

n.r. = not reported

Indicator 1.2c Representative species from a range of habitats monitored at scales relevant to regional forest management

This indicator provides broad habitat, population and range information for representative forest dwelling flora and fauna. Evidence of changing ranges or densities of forest dwelling species can be used to guide forest management activities so that they are consistent with maintenance of forest biodiversity.

Scientific Studies

Knowledge of the distribution and abundance of a broad suite of plant and animal species has been enhanced during the period of the RFA by the *FORESTCHECK* integrated biodiversity monitoring project. *FORESTCHECK* is a long-term, landscape-scale monitoring project which began in 2001 to provide information for forest managers about changes and trends in biodiversity associated with timber harvesting and silvicultural treatments in jarrah forest (McCaw et al. 2011). The project was designed to support state, national and international reporting obligations to ensure that forests are managed in an ecologically sustainable manner.

The *FORESTCHECK* program samples a wide range of organisms at multiple sites across the jarrah forest and has highlighted the extraordinary biodiversity that exists in the jarrah forest ecosystems. Monitoring covers five RFA jarrah forest ecosystems (J South, J North West, J North east, J Blackwood, J Sandy Basins) and includes a range of stand structural attributes including stand density, litter and coarse woody debris to inform sampling of biodiversity elements. The network currently has 67 grids established on a standardised pattern, of which 48 have surveyed at least twice and some grids surveyed three times. The project has identified an abundance of relatively unknown species of invertebrates, fungi and lichens, many of which have been collected and recorded for the first time.

In 2011, a special issue of the Australian Forestry journal was devoted to the findings from *FORESTCHECK* monitoring from the first five years of data collection. A key finding was that timber harvesting in the jarrah forest does not have a major impact on the number of species present (Abbott and Williams 2011). While harvested forest areas can have a different composition of species to non-harvested forest for a period, the changes in species composition and abundance vary over time as a response to periodic disturbance. Natural disturbances such as storms, fire and drought also contribute to biological diversity at the local, regional and whole of forest scales. In addition to informing forest managers on the effects of timber harvesting on biodiversity, *FORESTCHECK* has shown that the pattern of occurrence of a broad range of biodiversity is strongly related to the vegetation systems and forest ecosystems mapped for the WA RFA region. This important finding supports the use of these vegetation categories as the original basis in the WA RFA for the design of the CAR reserve system.

FORESTCHECK has also provided a framework for monitoring the effect on flora and fauna of such unplanned events as the high intensity bushfires (e.g. the Lower Hotham bushfire in 2015). Comprehensive pre-fire datasets have provided a baseline against which the subsequent changes and recovery can be interpreted.

Additional biological surveys of the flora and vegetation complexes within the Whicher Scarp (near Busselton) identified the area as containing a diverse and rich flora including many rare species, endemic species, species at the end of their distribution range, restricted and rare wetland communities, and a diverse suite of woodland communities. The Whicher Scarp was subsequently defined as a separate forest ecosystem, and additional formal reserves were proposed in the FMP 2014–2023.

An analysis of relative effort for biodiversity surveys across the RFA region was undertaken by Chapman and McCaw (2017). Information gathered during 420 past surveys was collated into a metadata base linked to a spatial geodatabase, and multicriteria modelling then used to rank the relative survey effort in landscape conservation units. The results indicated that the western, particularly the south-western, parts of the study area were relatively well surveyed while eastern parts were relatively poorly surveyed. This is likely to reflect greater habitat loss and fragmentation of vegetation on the eastern margins of the forest estate where it adjoins the extensively cleared Western Australia wheatbelt. There was also an emphasis on monitoring biodiversity in forest habitats closer to the main population centres of the south-west. The results of this analysis provide a basis for assessing future survey needs for the region which should also consider: patterns of distribution in species richness; the extent, connectivity and conservation status of native vegetation; and the relative risks posed to biodiversity by infrastructure and industrial land uses.

Table 14 provides an overview (as at 2018) of the range of taxonomic groups for which representative species are monitored at scales relevant to forest management within the RFA region.

Table 14: Taxonomic groups for which representative species are monitored in the WA RFA region

Fauna species groups	**Number of representative species monitored**
Arboreal mammals	3
Ground-living mammals	14
Bats	No regular monitoring of bats.
Amphibians	13
Fish	No regular monitoring of fish.
Non-raptor birds	57
Raptor birds	Monitoring of Wedge-tailed eagle.
Reptiles	33
Invertebrates	More than 2000 species of terrestrial invertebrates sampled by FORESTCHECK monitoring. More than 100 species of aquatic invertebrates sampled through stream monitoring project.
Flora species groups	**Number of representative species monitored**
Vascular plants	500

Flora species groups	Number of representative species monitored
Non-vascular plants	263

Indicator 1.3a Forest associated species at risk from isolation and the loss of genetic variation, and conservation efforts for those species

This indicator assesses the risks to loss of forest genetic variation and describes the formal measures designed to mitigate this risk. A loss of genetic diversity in species can result in a decreased ability to adapt to future environmental change, and thus a higher risk of extinction.

Australia's Biodiversity Conservation Strategy 2010—2030 (Natural Resource Management Ministerial Council, 2010) is the national policy framework for conserving Australia's biodiversity, which includes genetic diversity. Formal measures are in place across WA to address the risk of loss of genetic variation in threatened species. These measures include recovery plans, conservation advices, habitat restoration, FHZs, engineered animal movement mechanisms, seed-collecting programs, and management of habitat and populations under forest management systems. Nominations for listing as 'threatened' include species with populations that are low in numbers, small in geographic extent or fragmented, and that have low genetic variability, hybridisation and fecundity issues.

FHZs are a measure introduced since the commencement of the RFA to (in part) complement the CAR reserve system in retaining genetic diversity across the forest ecosystems. Introduced at the commencement of FMP 2004-2013, FHZs were established across the geographic spread of State forests available for timber harvesting to provide fauna populations a place of refuge and for recolonization and recovery following displacement from timber harvesting activities. Each FHZ ranges in size from around 50 hectares to around 200 hectares in size, and 308 were located systematically across the area available for timber harvesting. The FHZs are separated by about 3 kilometres to existing areas of mature forest within formal reserves. Areas identified as FHZs can be rotated over time to maximise the biodiversity outcomes as the forest changes.

In developing the FMP 2014-2023 further refinement of the location of FHZs was undertaken, with improvements to biodiversity outcomes achieved by increasing the FHZs in those forest ecosystems with lower levels of representation in formal reserves, slightly increasing the amount of mature forest within FHZs, reducing the area of regrowth forest, and increasing the size range of individual FHZs to better reflect the landscape they were representing. The introduction of FHZs into routine forest management has resulted in an additional 48,000 hectares outside the CAR reserve system being set aside from timber harvesting.

Wetland values

Australia has international obligations under the Ramsar Convention to protect the ecological character of declared Ramsar wetlands. The one Ramsar Wetland of International Importance in the WA RFA region, the Muir-Byenup system, covers approximately 10,631 hectares. While the original WA RFA does not include clauses specifically on wetland values, they include the commitments from the WA Government to implement measures to improve catchment and

water management. These measures have largely been met as reported in the five-yearly reviews and in the Independent Reviews.

All Ramsar listed wetlands, including those in RFA regions, are protected by Part 3 of the EPBC Act. This means any action (including forestry operations) that has, will have, or is likely to have, a significant impact on the ecological character of a Ramsar wetland must be referred to the Minister and undergo an environmental assessment and approval process.

The primary responsibility for managing wetlands and their associated flora and fauna is vested in the respective landholder/land manager. Individual state and territory governments have the primary legislative and policy responsibility for natural resource management (Department of the Environment and Energy, 2018c).

Australia's obligations under the Ramsar Convention

The Ramsar Convention is an international agreement promoting the conservation and wise use of wetlands. It aims to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain.

As a signatory of this Convention, Australia has an obligation to manage and protect Ramsar wetlands. The EPBC Act establishes a process for identifying Ramsar wetlands and encourages best practice management through nationally consistent management principles. The EPBC Act provides automatic protection for Ramsar wetlands by ensuring an assessment process is undertaken for proposed actions (including forestry operations) that will, or are likely to, have a significant impact on the ecological character of a declared Ramsar wetland. This process allows the Commonwealth Minister for the Environment to grant or refuse approval to take an action, and to impose conditions on the taking of an action.

The exemption from Commonwealth assessment and approval requirements under section 38 of the EPBC Act for forestry operations in RFA areas does not apply to operations within Ramsar wetland sites.

Protecting WA Ramsar sites

Wetland sites are listed under the Ramsar Convention if they meet at least one of the nine Ramsar criteria. A wetland should be considered internationally important if it:

1. Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.
2. Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
3. Supports populations of plant and/or animal species important for maintaining the biological diversity of a biogeographic region.
4. Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
5. Regularly supports 20,000 or more waterbirds.
6. Regularly supports 1 per cent of the individuals in a population of one species or subspecies of waterbird.
7. Supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

8. Is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.
9. Regularly supports 1 per cent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species. Under the Ramsar Convention, the WA government is required to protect the ecological character of its Ramsar sites.

The WA Government is responsible for managing Ramsar wetlands in the WA RFA region and works collaboratively with a diverse range of stakeholders, including Ramsar Convention Secretariat, Commonwealth Government, local governments, landowners and community groups, to promote the conservation and wise use of wetlands and to implement the Ramsar Convention.

The DBCA is the lead agency for partnering with the Australian Department of Environment and Energy and other jurisdiction's environment agencies to develop national policies, guidelines and programs that provide for meeting Australia's obligations under the Convention. The CPC is the vesting agency for those Ramsar wetlands that are within the State's conservation reserves. DBCA also works collaboratively with a diverse range of stakeholders, including other State agencies and local governments who manage reserves within Ramsar wetlands and landowners and community groups, to promote the conservation and wise use of wetlands and to implement the Ramsar Convention.

Ramsar sites in the WA RFA region

As of September 2018, 66 Australian wetlands have been designated under the Ramsar Convention. Of the 12 Ramsar sites in WA, one is located in the WA RFA region and covers approximately 10,631 hectares (see Table 15). There are three Ramsar wetlands within 10 km of the WA RFA region whose catchment areas fall within the region. There are also three wetland sites within the WA RFA area that are considered as candidate for listing under the Ramsar Convention (Table 16).

Table 15: Ramsar Wetlands of International Importance in the WA RFA region

Wetland	Within WA RFA	Date of listing	Area (hectares)
Muir – Byenup System	Yes	5 January 2001	10,631
Forrestdale and Thompsons Lakes	No – catchment area only	7 June 1990	784
Peel – Yalgorup System	No – catchment area only	7 June 1990	26,530
Vasse – Wonnerup System	No – catchment area only	7 June 1990	1,115

Table 16: Details of candidate Ramsar wetlands within the WA RFA region

Candidate Ramsar Wetland	Area (hectares)	Tenure/Vesting
Tributaries of the Lower Blackwood River	838	Conservation Reserve vested with the WA CPC
Ellen Brook Swamps	193	Conservation Reserve vested with the WA CPC
Owingup Swamp System (Upper portion)	1,369 (35 ha inside WA RFA region)	Timber Reserve vested with the WA CPC

Muir-Byenup System

The Muir-Byenup System Ramsar site was designated in 2001 and is located 55 km south-east of the town of Manjimup in South-West Coast Australian Drainage Division of Western Australia. The Ramsar site comprises a suite of partly inter-connected lakes and swamps in an internally draining catchment. The wetlands are varied in size (up to 4,600 hectares), salinity (saline to fresh), permanence (seasonal to permanent) and substrate (peat and inorganic). The site includes Lake Muir, Byenup Lagoon, Tordit-Gurrup Lagoon, Poorginup Swamp, Neeranup Swamp, Coorimup Swamp and Wimbalup Swamp and reserves in the surrounding area.

The peat based wetlands are rare in WA (Department of Environment and Conservation 2008). The open lakes are used for moulting by thousands of Australian Shelduck (*Tadorna tadornoides*) and for drought refuge by tens of thousands of other waterbirds. More than 50 waterbird species have been recorded and Lake Muir is a migration stop-over site for shorebirds such as the Red-necked Stint. The sedge/shrub dominated swamps support an important population of Australasian Bittern (Botaurus poiciloptilus) and threatened orchids (*Caladenia harringtoniae, Caladenia christineae* and *Diuris drummondii*). Key fauna at the Ramsar site includes, six of the eight endemic south-western Australian freshwater fish species and seven native fish species, including the nationally vulnerable Balston's Pygmy Perch, and 32 endemic macroinvertebrate species. Vegetation communities of the wet flats are among the few remaining in non-coastal parts of south-western Australia and the Ramsar site has some of the largest natural sedgelands in WA. The vegetation of the Ramsar site is highly diverse; a total of 649 indigenous flora have been recorded in Nature Reserve 31880, with at least 600 within the Ramsar site (Gibson and Keighery 1999).

Lake Muir is fringed by sedgelands, low samphire shrubland and *Melaleuca*-dominated wetland scrub. The rest of the wetlands on the site are fringed by sedgelands, and *Melaleuca*, *Astartea* and *Agonis* shrublands. Eucalypts, such as Jarrah and Yate dominate higher elevations. A bird observatory on Muir Highway provides facilities for nature-based recreation such as bird watching. The wetlands are spiritually significant for the Noongar people.

The Muir-Byenup System is recognised as meeting six criteria for listing under the Ramsar Convention (Department of Environment and Conservation 2009). A review of the ecological character of the system in 2009 (Farrell, C. and Cook, B. 2009) noted that some changes to wetland values in the system had occurred since its listing in 2001. These changes related to the composition of aquatic invertebrate communities, distribution of some fish species and

condition of fringing vegetation which could assumed to be within natural variation. Threatening activities, processes and impacts were identified as:

- Secondary salinity
- Disturbance of potential acid sulfate soils
- Eutrophication
- Grazing
- Introduced species
- Pathogens and pests
- Inappropriate fire regimes
- Illegal vehicle access.

A review of the wetland values for the draft mid-term performance review of the FMP 2014-2023 (CPC, 2018) found that significant pressure is being exerted on the hydrological and related geochemical processes within the system as a result of reduced rainfall in the catchment over the last 20 years. This had resulted in severe acidification processes as acid sulphate forming compounds in the sediments became exposed in Tordit-Gurrup Lagoon as the wetland dried out in the summer of 2013. The acidification was reported to the Australian Government as a Preliminary Assessment of change in ecological character report (DEC 2016).

The acidification of Tordit-Gurrup Lagoon is largely the result of anthropogenic climate change, particularly declining rainfall reducing both surface water and groundwater levels. Water supplementation to Tordit-Gurrup Lagoon has been considered but determined to not be feasible due to the lack of a sustainable water source. Surface water level data collected in 2015-2016 show summer levels in all wetlands within the Muir-Byenup System Ramsar site were at a record long term low. Therefore, under the current climate, all water bodies within wetlands with peat substrates are at risk of becoming acidic.

Aerial application of lime has also been considered, however, advice from peat researchers at the University of Western Australia suggests that lime delivered to Tordit-Gurrup Lagoon's acidic water body via an aircraft is likely to fall-out over a broader area and may affect the health of peat and vegetation which comprise a significant area of the wetland. This could result in deleterious changes to the vegetation, peat and biota that has adapted to inhabit these areas.

The potential effectiveness of alternative methods such as targeted application of lime to central locations on the lake and the use of a carbon source to buffer the acid forming process are yet to be fully assessed.

In accordance with Principle 6 in *National guidance on notifying change in ecological character of Australia's Ramsar Wetlands (Article 3.2)* (Department of Environment, Water, Heritage and the Arts 2009) a notification of change will not be made where climate change is the principal cause of identified ecological character change. As the changes at the Muir-Byenup System Ramsar site have been attributed primarily to climate change, a formal assessment is not required at this stage. Monitoring of changes will inform future management. The monitoring at Tordit-Gurrup Lagoon may include:

- Monthly surface water levels and basic water chemistry
- Biannual groundwater levels
- Monthly waterbird surveys
- Weed and feral animal monitoring and control.

The Directory of Important Wetlands (DIWA) was first published in hard copy in 1993 as an inventory of ecologically important wetlands in the Oceania region and to identify potential sites that met the nomination criteria under the Ramsar Convention.

The DIWA was updated in 1996, 2001 and released as a digital dataset in 2005. There are 120 wetlands in WA that are listed under DIWA, covering an area of 2.58 million hectares. In March 2016 the boundaries of the DIWA listed wetlands were updated using the latest available spatial information including digital elevation models, hydrography, current aerial imagery, historical aerial imagery, named locations and the distribution of wetland dependent flora and fauna. Boundaries were mapped at a scale of 1:10,000 for wetland types requiring finer detail (such as rivers) and at a scale 1:40,000 for broader wetland types such as floodplains.

Table 17 lists those DIWA wetlands wholly or partially within the RFA region. Almost all the areas are within exiting or proposed formal reserves under the FMP 2014-2023, and therefore within the RFA CAR reserve system.

Table 17: Details of Directory of Important Wetlands in Australia within the WA RFA region

DIWA Wetland	Total area	Area within RFA	Formal reserves		State forest, timber reserves and miscall-aneous reserves	Other public land
			Gaz-etted	Pro-posed		
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Avon River Valley	363	357	135	6	0	98
Benger Swamp*	653	65	65	0	0	0
Blackwood River and Tributaries System^	841	718	278	14	0	18
Broke Inlet System	27,056	27,056	22,453	0	117	30
Byenup Lagoon System"	10,449	10,449	7,459	1,569	0	3
Cape Leeuwin System	30	30	28	0	0	2
Chittering-Needonga Lakes	255	255	223	0	0	0
Doggerup Creek System	13,059	13,059	12,546	0	0	7
Ellen Brook Swamp System^	193	131	129	0	0	0

DIWA Wetland	Total area	Area within RFA	Formal reserves		State forest, timber reserves and miscall-aneous reserves	Other public land
			Gaz-etted	Pro-posed		
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Gingilup - Jasper Wetland System	3,281	3,281	2,781	99	19	99
Lake Muir"	4,141	4,141	4,137	0	0	0
Maringup Lake	604	604	604	0	0	0
Mt. Soho Swamps	330	330	330	0	0	0
Owingup Swamp System*	1,367	21	0	16	0	5
Wannamal Lake System	827	669	202	0	0	9
TOTAL	**63,448**	**61,165**	**51,369**	**1,704**	**136**	**273**

" Partly contained within a registered Ramsar wetland
^ Partly contained within a candidate Ramsar wetland
* Majority is outside RFA region

Non-Ramsar wetland areas in RFA regions and the extent in terrestrial ecosystems, and in the CAR Reserve system

The extent of other wetland areas in the RFA area is depicted in the following map (Figure 7).

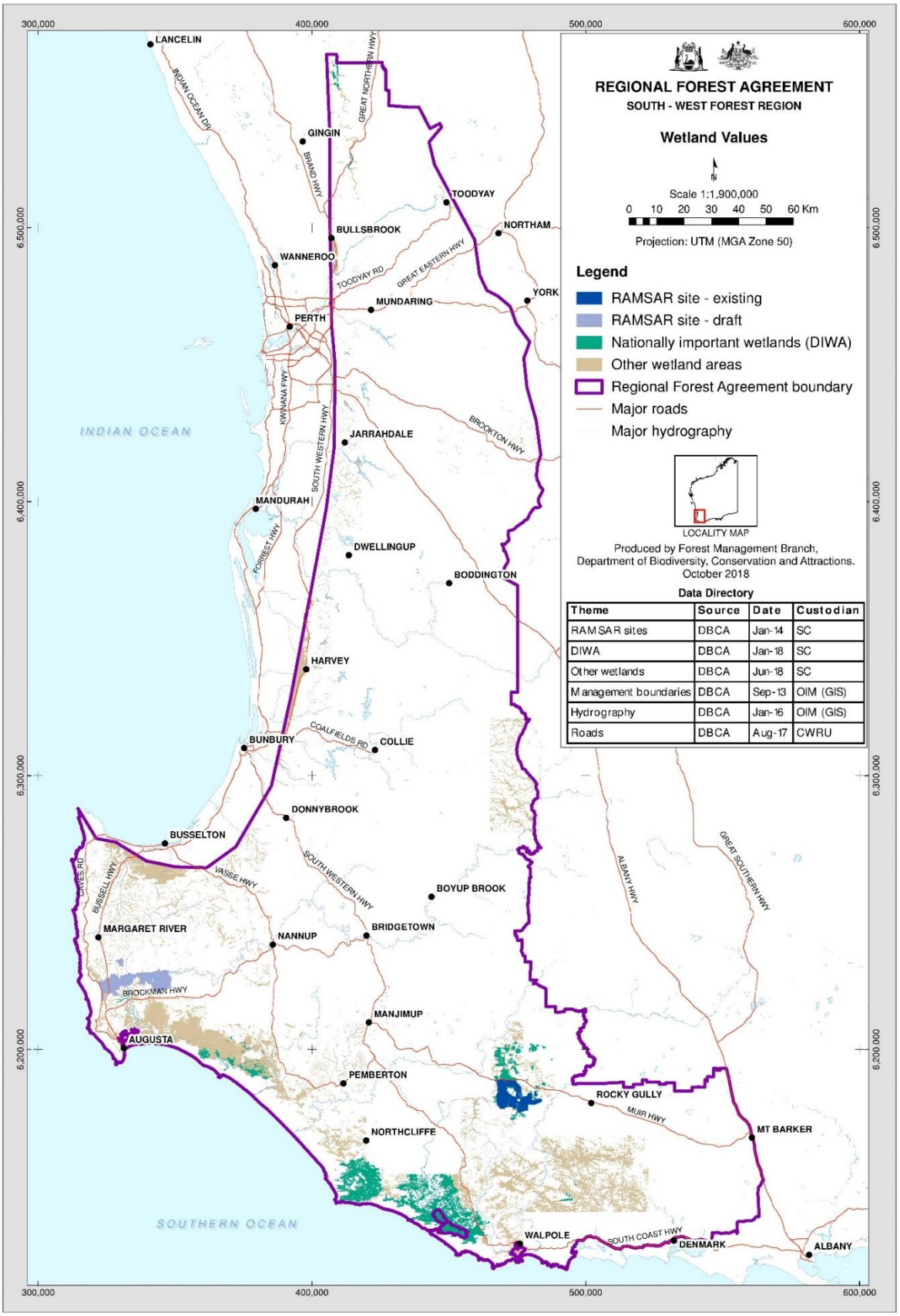

Figure 7: WA RFA region and wetlands in 2018

Note: Wetland mapping is complete across over 85% of the area, with variable attributes contributing to delineation of boundaries and classification of wetland type. 'RAMSAR site – draft' represents 'Candidate Ramsar Wetland' in Table 16.

Monitoring of wetlands within the WA RFA region is targeted on those listed under the Ramsar Convention, or which have records of migratory bird species listed under Australia's international migratory bird agreements (JAMBA (Japan-Australia Migratory Bird Agreement), CAMBA (China-Australia Migratory Bird Agreement), ROKAMBA (Republic of Korea-Australia Migratory Bird Agreement)) or other migratory species, threatened species and ecological communities listed under the EPBC Act. The South West Wetlands Monitoring Program (SWWMP) has been monitoring depth, salinity and pH in up to 50–200 wetlands continuously since 1978.

Indicator 4.1a Area of forest land managed primarily for protective functions

Public land

The area of forest land where priority is given to protecting soil and hydrological functions provides an indication of the emphasis being placed by society on the conservation of these values. This indicator includes areas managed to protect soil and water by excluding incompatible activities.

Throughout the WA RFA region, soil and water resources are protected through the allocation of land for conservation and maintenance purposes. The area of forest land where priority is given to protecting soil and hydrological functions provides an indication of the emphasis being placed by society on the conservation of these values. This indicator includes areas managed to protect soil and water by excluding incompatible activities.

In WA the area managed for protective functions comprises all public nature conservation reserves; catchments managed specifically for water supply; and those parts of multiple-use public forests in which wood harvesting and road construction are not permitted.

Forested catchments are highly valued as sources of drinking water because forest vegetation, soil and litter serve as natural filters, and the quality of water flowing from such catchments is therefore usually very high. In the WA RFA region approximately 48,040 hectares of forest are managed specifically for water supply in closed catchments from which human disturbance activities are excluded. Another 204,130 hectares of forest in closed water catchments are available for timber harvesting, subject to control measures to protect soil and water values.

Private land

Forest composition, condition and structure on private land is not well recorded in Western Australia, however clearing of any native vegetation is strictly regulated via the *Environmental Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations). Clearing of native vegetation is authorised only under a clearing permit issued by the Department of Water and Environmental Regulation (DWER) or if an exemption applies. Exemptions may be requirements of other written law or statutory process (Schedule 6 of the EP Act) or are routine land management practices as prescribed in the Clearing Regulations. Exemptions do not apply to environmentally sensitive areas (ESAs) as determined by the Minister for the Environment in accordance with section 51B of the EP Act.

Approval under the *Country Areas Water Supply Act 1947* (WA) (CAWS Act) may also be required to clear native vegetation within a controlled catchment. There are six controlled

catchments in WA, identified to protect water supply catchments from salinization that might be caused by the clearing of native vegetation. If a clearing permit is issued under the EP Act, then a CAWS Act licence is generally not required. If an EP Act exemption applies to a clearing application, a CAWS Act licence will still be required (unless there is an exemption under the CAWS Act).

The state of Western Australia and the Australian Government have entered into a bilateral agreement that allows the State to assess, on behalf of the Commonwealth, whether or not applications for clearing native vegetation under the EP Act also require assessment under the EPBC Act. This agreement ensures that if a clearing activity has, or is going to have a significant impact on a matter of national environmental significance, DWER can ensure the clearing activity is also compliant with the requirements of the EPBC Act (DER 2014).

Managing a private native forest for sustainable wood production is subject to the same legislation as clearing and requires a clearing permit under the EP Act. To sell products from private native forests a Commercial Producers Licence issued by DBCA under the WC Act (being replaced by a Flora Supply Licence under the BC Act) is required. The publication *Managing private native forests and woodlands in the south-west of Western Australia: combining wood production and conservation* was developed by the National Heritage Trust, CALM (a predecessor of DBCA) and the FPC to assist landowners manage private native forests. The booklet provided information on how wood production could be undertaken in a way that protected conservation values as well as assisting landowners develop management plans to manage their private native forest.

The Forest Industries Federation of Western Australia (FIFWA) and the Australian Forest Growers encourage private plantation growers to apply the *Code of Practice for Timber Plantations in Western Australia*. This code assists landowners with the development of plantation management plans and is based upon the principles in *Forest Practices Related to Wood Production in Plantations: National Principles*.

Indicator 4.1b Management of the risk to soil and water values in forests

The conservation of soil and water is intimately linked to the conservation of biodiversity, sustaining the productive capacity, health and vitality of ecosystems, and the value of the land to the culture and heritage of the Noongar. Since commencement of the WA RFA, the system for managing soil and water values established through the FMP 2004-2013 and FMP 2014-2023 has been updated and continually improved in response to factors such as the increased mechanisation of timber harvesting and changes in forest hydrology, groundwater and streamflow that have resulted from declining rainfall. The approach has been applied in an adaptive management framework which is supported by long term research programs, scientific and operational monitoring and developed in consultation with practitioners and stakeholders. A brief synopsis of past, present and future management of soil and water values is presented below in four key areas: soil physical properties, soil erosion, water quality and water quantity.

Soil Physical Properties

The FMP 2004-2013 aimed to significantly reduce the extent and severity of soil disturbance associated with timber harvesting in native forests. The FMP 2004-2013 and supporting guidance documents provided improved definition of the severity of soil damage, introduced soil disturbance limits and a precautionary approach to planning harvest operations. A risk-

based approach was developed to control access for harvesting under moist soil conditions, based on a soil trafficability index. The Trafficability Index is based on the water balance method described by Mount (1972) for the 'Soil Dryness Index' and adapted by the Bureau of Meteorology for conditions in the south-west. The index is calculated daily for every coupe using forest type, daily rainfall and temperature data and informs decisions on access by DBCA, FPC and harvest contractors. The system was further refined in 2006 (following a review of factors affecting disturbance of soil (Rab *et. al*, 2005)) to focus on soil types with the greatest capacity to sustain heavy vehicle traffic during winter. Approval to harvest during moist soil conditions is governed by a two-stage approvals process, and approval to harvest at all times of year is supported by requirements to conduct monitoring and manage each harvest cell within allowable limits of soil disturbance.

The collective suite of requirements including templates for monitoring and approvals are prescribed in the *Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests* (Department of Parks and Wildlife, 2015) which was first published in 2004 and has undergone continual review and improvement, being revised in 2005, 2006 (June and September), 2007, 2009, 2010 and 2015. The manual is supported at a policy level by the *Soil and Water Conservation Guideline* (Department of Environment and Conservation 2009) and at the operational level by various procedures and Advisory Notes for monitoring and compliance management (such as Department of Parks and Wildlife, 2016). The substantial investment by both the then DEC and the FPC into planning and managing operations to reduce soil damage resulted in clear improvements in the protection of soil under the FMP 2004-2013 as reported in both the mid-term and end-of-term audit of performance reports (Conservation Commission 2008, 2012).

The FMP 2014-2023 carried forward the measures for the protection of soil in FMP 2004-2013 and they have undergone further refinement and improvement through to 2018. While the highly visual forms of soil disturbance such as rutting, puddling and soil mixing are now rarely seen in WA, the focus on continuous improvement has resulted in refinements to minimise soil compaction. The review of performance under FMP 2004-2013 identified that tracks created by harvest vehicles were the major cause of soil disturbance limits being exceeded. In response, the method of assessment of soil disturbance was refined (from using line transect surveys of visual indicators of soil disturbance to a method that maps the pattern of extraction tracks created by heavy vehicles) and reporting altered to better inform the FPC and their contractors. Future refinements will apply refined planning of extraction tracks for varied machine and operation types.

Soil Erosion

Limits on the permissible soil erosion from machine operations were introduced under the FMP 2004-2013. These are specified in the *Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests* and include both onsite (sheet, rill and gully erosion) and offsite (deposition and turbid runoff) forms. In 2008, an independent expert was commissioned to conduct a review of DBCA's process for surface water management including guidance documents and operational practice. Subsequently, in 2009 recommendations from the review were incorporated into FEM Manual No. 3 *Manual for the Management of Surface Water*, (Department of Environment and Conservation, 2009). The manual is complimented by a field guide *Tables and formulae for the management of surface water* (Department of Environment and Conservation, 2010) and spreadsheet tool to guide the planning, installation and management of structures for the management of surface

water including aspects of road design, culverts, drains, spreaders and sediment control. To facilitate implementation of the new manual, training courses were developed to Certificate II (machine operators) and Certificate III (field officer) level and conducted for FPC and then DEC staff in the WA RFA region.

The guidance documents include a requirement for surface water management structures to be installed prior to the completion of harvest operations.

Water quality and quantity

The issues of water quality and quantity are interlinked, and their management has been informed by a program of hydrological research that has been in place within DBCA and its predecessor agencies for over 40 years. The research is supported by other government agencies, research institutions and private companies. Long-term data sets on the response of streamflow, stream salinity and groundwater to timber harvesting have informed silvicultural specifications, stream zone dimensions, mining and rehabilitation practices. Since commencement of the WA RFA, forest management policy and practices have responded to fundamental changes in hydrology resulting from decreased rainfall within the WA RFA region. Declining groundwater has resulted in a shift in management response from salinity being a key risk to (water quality) towards declining groundwater and reduced streamflow being a key risk to forest values (water quantity).

The FMP 2004-2013 prescribed a range of precautionary salinity management practices guided by hydrology research which commenced in the 1970s and 1980s. These practices aimed to retain a minimum vegetation density, or unharvested area, in space and time, during timber harvesting, silvicultural operations and subsequent regeneration, to minimise the potential rise in groundwater levels and ensure a low potential salinity impact. By the end of the FMP 2004-2013 it was clear that the decline in annual rainfall had resulted in declining groundwater levels and stream salinity across much of the WA RFA region. At this time, groundwater levels that were near the surface in the 1970s and 1980s had become deeper than 5 m in the northern half of the WA RFA region. With annual rainfall and groundwater levels projected to decline further for several decades, the FMP 2014-2023 introduced revised settings that recognised the declining risk of stream salinity and increased risk of reduced streamflow and potential impacts on aquatic and groundwater dependent ecosystems. The FMP 2014-2023 provides for silvicultural treatment to address threats to ecosystem health and vitality (referred to as 'silviculture for ecosystem health'). The FMP 2014-2023 also provides for 'silviculture for water production', which involves silvicultural treatment to maintain or enhance water supply, with ancillary benefits for ecosystem health and vitality.

At an operational level, management practices are guided by the *Soil and Water Conservation Guideline* (Department of Environment and Conservation, 2009). This guideline outlines physical and chemical aspects of water quality and a series of guiding principles for protection and management of these values. Key subsidiary documents to the guideline prescribe operational practices for the management and protection of water values including demarcation and protection of stream reserves, spills management for pesticides and/or hydrocarbons, the location, design and drainage of roads, identification and management within acid sulphate soil risk zones and operational controls associated with public drinking water source areas.

Summary and future management of environmental values

Old-Growth Forest Values

Old-growth forest attributes were a key factor in the design of the CAR reserve system under the WA RFA. The long-term protection of old-growth forest is important due to biodiversity, aesthetic and cultural attributes associated with the absence of anthropogenic disturbance.

The Western Australian Government ceased harvesting in old-growth forests in 2001, through the *Protecting our Old-growth Forests* policy.

All old-growth forest on lands vested in the CPC has been protected since 2001. Any disturbance operations on lands managed by DBCA requires checks for the presence of unmapped old-growth forest. This practice will be continued in the future, with any refinements included in the old-growth forest dataset, and to ensure ongoing protection of the old-growth forest estate.

In 2018, there were 335,557 hectares of old-growth forest on public land in the WA RFA region. There has been an overall increase in reservation of old-growth forest of 89,167 hectares since the commencement of the WA RFA in 1999. While the dataset of old-growth forest on private land has not been updated since the CRA, DBCA will continue to work with private landowners to identify, conserve and protect old-growth forest on private land where the opportunity arises, and acknowledging the fact that private landowners are governed by different policy and legislation to old-growth forest on public land.

The extended WA RFA will continue to protect old-growth forest values through the implementation of the CAR reserve system and Western Australia's FMP process. The FMP 2014-2023 includes measures for the protection of old-growth forest, including the permanent prohibition of harvesting the old-growth forests outside the CAR reserve system.

Wilderness Values

There is a growing awareness that wilderness areas support values that should be protected from anthropogenic disturbance. While the CRA assessments did not identify any areas that met the combined thresholds for the wilderness indicators to be delineated, areas with high quality wilderness were incorporated into the CAR reserve system. Since the signing of the RFA, the amount of wilderness protected in reserves has increased significantly, including the creation of the Walpole Wilderness areas. Management of the Walpole Wilderness areas is in accordance with the *Walpole Wilderness Management Plan 2008* and DBCA Policy 62 which aim to maintain or enhance wilderness qualities within these areas through such actions as restricting access, limiting the use of mechanised transport, the placement of infrastructure (including closure and rehabilitation of legacy tracks and trails) and other measures. These areas are within a national park (part of the CAR reserve system) and will continue to be managed over the long-term, under an extended WA RFA, to preserve their biophysical naturalness and wilderness attributes.

Under the extended WA RFA, Western Australia will continue to protect wilderness values by identifying and assessing wilderness values on land vested in the CPC. Actions will be taken to maintain natural processes and communities by protecting them from unnatural disturbances and maintaining ecological processes. Management actions will be subject to ongoing monitoring to ensure the effectiveness of the protection on these values.

Endangered Species Values

Protection of endangered species values was one of the key considerations of the CRA process, which identified 12 threatened fauna species and 57 threatened flora species listed under the WC Act and ESP Act that occurred (or which had occurred) within the WA RFA region. By 2018, 55 threatened fauna and 146 threatened flora species declared as protected or rare under the WC Act or listed in the Schedules to the EPBC Act had (or were believed to have had) populations within the WA RFA region (Appendix B).

The WA RFA protects endangered species by providing a system of conservation reserves, maintaining a permanent native forest estate, and management of habitat in areas outside the reserve system. Endangered species are further protected under the EPBC Act and the WC Act. In January 2019, endangered species values will also be considered under the BC Act which is a modern and effective approach to biodiversity conservation and the ecologically sustainable use of biodiversity.

Either a WA recovery plan or National recovery plan is in place for 89 of the 201 threatened fauna and flora declared as protected or rare under the WC Act or listed in the Schedules to the EPBC Act. In the WA RFA region, there are 15 EPBC Act listed ecological communities and 27 ecological communities considered at threat by the WA Minister for the Environment (Appendix B). All EPBC Act listed ecological communities have a conservation advice, recovery plan or both in place to guide their recovery.

There are 12 threatening processes listed under the EPBC Act potentially affecting threatened species in the WA RFA region. Western Australia applies a risk based approach to set priorities for management activities to address key threatening processes on public land in the WA RFA region.

A measure to reduce the impact of at least two of these threatening processes, 'Western Shield' is working to protect WA's native wildlife though the broadscale control of introduced predators including foxes and feral cats. Western Shield monitoring has shown increases in the population size and distribution of priority native species including quokka, western brush wallaby and chuditch. Approximately 80 per cent of the annual baiting program occurs within the WA RFA region. This program will continue under the extended WA RFA to minimise the impact to threatened fauna.

Threatened species and ecological communities are protected by a suite of planning and operational controls within WA's FMS that operate across a range of scales. The document *The Forest Management System in Western Australia: An Overview (2018)* provides details on how WA's FMS manages and provides protection of threatened species and ecological communities.

Listed threatened species and ecological communities are MNES under the EPBC Act. These listed species and communities include endangered species values. The extended WA RFA will include specific clauses on MNES, including that Western Australia will use best endeavours to ensure that its FMS provides for the protection of MNES.

Under an extended WA RFA, the governments will continue to consult on the priorities on listed species and communities, forest ecosystems, and threatening processes, and research on these, recognising that priorities can change in light of new information. To improve transparency the governments have also agreed in the extension to update in the five-yearly review progress reports the threat status of flora and fauna listed in Attachment 8.

In extending the WA RFA the governments will agree that the primary function of the CAR reserve system is to ensure the long-term conservation and protection of environment and heritage values, including listed species and communities. Western Australia will also agree to implement, manage and conserve the CAR reserve system.

An extended WA RFA will continue to provide for the protection of endangered species values through the CAR reserve system and the ecologically sustainable management and use of forests outside of the reserves, with adaptive management and continuous improvement.

National Estate Values

The term *National Estate* refers to places defined in section 4 of the repealed AHC Act. After the signing of the WA RFA, the AHC Act was repealed and the Register of the National Estate was phased out. As a consequence, presently the RFAs do not reflect the current system of heritage protection under the EPBC Act through the National and Commonwealth Heritage Lists and *the Australian Heritage Council Act 2003*.

There is one place on the National Heritage List and two places on the Commonwealth Heritage List within the WA RFA region. The heritage values of these sites are protected when conducting management activities in the vicinity.

National Estate Values have been, and will continue to be protected by the WA FMS in accordance with National Heritage Management Principles.

An extended WA RFA will reflect current heritage concepts and definitions consistent with the EPBC Act.

An extended WA RFA will continue the protection of heritage values through the provision of the CAR reserve system and the application of WA FMS. Places of aesthetic, historic, scientific and social significance in the WA RFA Region will be comprehensively managed for current and future generations.

World Heritage Values

There are no World Heritage properties located within the WA RFA region. If present, properties would be managed separately from processes put in place by the WA RFA and be protected by Part 3 of the EPBC Act. The Australian and WA Governments will continue to participate in the assessment and protection of any future World Heritage places consistent with the Australian World Heritage Intergovernmental Agreement, as reflected in the extended WA RFA.

While there are no World Heritage properties in the WA RFA region, natural and cultural heritage will be protected and managed through the provision of the CAR reserve system and the application of WA FMS under an extended RFA.

Biodiversity Values

Biodiversity Values were fundamental in establishing the CAR reserve system and were a focus of the CRAs. Indicators of biodiversity value can include the number and diversity of flora and fauna species, ecological communities and forest types. These attributes reflect the range of flora and fauna species and communities, and the representativeness of reserves established to protect biodiversity.

In 1999 there was a total of 2.6 million hectares of forest ecosystems recorded within the WA RFA region, of which 2.2 million hectares (85 per cent) were classified as forested. The total area of forest ecosystems was reduced to 2.5 million hectares at December 2017, of which 2.1 million hectares (84 per cent) was classified as forested. The reduced area arose from clearing for infrastructure, mining, and agriculture as well as data refinements.

Australia's Biodiversity Conservation Strategy 2010-2030 is a guiding policy framework for conserving Australia's biodiversity, which includes genetic diversity. Formal measures are in place across WA to address the risk of loss of genetic variation in threatened species. These measures include recovery plans, conservation advices, habitat restoration, wildlife corridors, translocations, seed-collecting programs, and management of habitat and populations under forest management systems.

At the commencement of the RFA in 1999 the CAR Reserve System totalled 1.047 million hectares, representing 25 per cent of the total land within the RFA. By the end of 2009 the CAR reserve system had expanded by 203,000 hectares to 1.25 million hectares (30 per cent) of the total land in the RFA region. By mid-2018, a total of 1.29 million hectares (30 per cent) of the total land was protected under the CAR Reserve System. This constitutes an overall increase of 241,000 hectares added to CAR Reserves during the period 1999-2018.

Most of the CAR additions during the RFA period arose from government policy decisions, but there were also some additions arising from new information on the distribution of biodiversity within the RFA region.

FHZs were established in 2004 across the area of forest on public land available for timber harvesting. These FHZs are set aside from timber harvesting to provide fauna populations a place of refuge and for recolonization and recovery following displacement, as well as maintain less disturbed areas with connectivity at the landscape scale. FHZs range in size, typically from around 50 hectares to around 200 hectares and are systematically located across the landscape. Refinements over time have been undertaken to maximise biodiversity outcomes, and resulted in an additional 48,000 hectares of forest being set aside from timber harvesting. While future FMPs may be adjusted based on new information and monitoring, an ongoing network of FHZs is seen as a key component of delivering ESFM in the WA RFA region.

Knowledge of the distribution and abundance of a broad suite of plant and animal species has been enhanced during the period of the RFA by the *FORESTCHECK* integrated biodiversity monitoring project. *FORESTCHECK* is a long-term, landscape-scale monitoring project which began in 2001 (with a sample frame informed by the CRA) to provide information for forest managers about changes and trends in biodiversity associated with timber harvesting and silvicultural treatments in jarrah forest (McCaw *et al.* 2011). *FORESTCHECK* will continue under the extended WA RFA and provide valuable knowledge on biodiversity that can be used to inform forest management across the jarrah forests in the WA RFA region.

Future five-yearly reviews of the WA RFA will be outcomes focused, with streamlined monitoring and reporting requirements that where possible indicate the impact of management procedures on biodiversity to demonstrate the maintenance of protections for biodiversity values.

An extended WA RFA will continue to provide for the protection of biodiversity values through the CAR reserve system and the ecologically sustainable management and use of forests outside of the reserves, under the FMS, with adaptive management and continuous improvement.

Wetland values

Australia has international obligations under the Ramsar Convention to protect the ecological character of declared Ramsar wetlands. The WA Government is responsible for managing Ramsar wetlands in the WA RFA region and works collaboratively with a diverse range of stakeholders, including Ramsar Convention Secretariat, Commonwealth Government, local governments, landowners and community groups, to promote the conservation and wise use of wetlands and to implement the Ramsar Convention.

While the 1999 WA RFA does not include clauses specifically on wetland values, it includes commitments from the WA Government to implement measures to improve catchment and water management. These measures have largely been met as reported in the five-yearly reviews and in the Independent Reviews.

If extended, the WA RFA will include a clause that acknowledges that the FMS provides for the protection of the ecological character of Ramsar Wetlands, including that Part 3 of the EPBC Act applies to forestry operations that may impact Ramsar Wetlands.

The one Ramsar Wetland of International Importance in the WA RFA region covers approximately 10,631 hectares. The Muir-Byenup System is recognised as meeting six criteria for listing under the Ramsar Convention (Department of Environment and Conservation 2009). The WA Government regularly reviews the ecological values of this wetland and will continue to implement commitments to international agreements relating to the conservation of wetlands and migratory birds.

Additionally, there are 120 wetlands in Western Australia, including 15 wetlands wholly or partially in the WA RFA region, listed in the Directory of Important Wetlands, a directory of ecologically important wetlands in the Oceania region.

Under the extended WA RFA, Western Australia will continue to monitor and manage wetlands to maintain and improve the values within them. This includes having mechanisms in place under the FMS to maintain wetland characteristics that may be impacted by prescribed burning and to minimise the impact of forestry operations on soil erosion, water quality and quantity in the broader catchments.

Section 2: Indigenous Heritage Values

Indigenous heritage values[6] are the values of a place which are of significance as part of Indigenous practices, observances, customs, traditions, beliefs or history. The extent to which Indigenous people participate in forest management reflects their connection with the land, and the integration of Indigenous values into forest management practice, policy and decision-making.

This section includes the following Montréal Indicators:

- Indicator 6.4 a – Area of forest to which Indigenous people have use and rights that protect their special values and are recognised through formal and informal management regimes
- Indicator 6.4.c – The extent to which Indigenous values are protected, maintained and enhanced through Indigenous participation in forest management
- Indicator 6.5.d – Resilience of forest dependent Indigenous communities to changing social and economic conditions

Access, management and ownership are key parts of the relationship of Indigenous people with land. The Indigenous estate can be broadly divided into land tenure and management categories based on the degree of Indigenous ownership, management and other rights over the land. Effective Indigenous participation can occur through a variety of direct or consultative mechanisms.

Indicator 6.4a Area of forest to which Indigenous people have use and rights that protect their special values and are recognised through formal and informal management regimes

This indicator monitors the degree to which land is placed under appropriate tenure classifications or management regimes to protect Indigenous peoples' values in forests. An acceptable level of accountability for the protection of Indigenous peoples' cultural, religious, social and spiritual needs and values is an essential part of forest management.

For the purposes of this indicator 'Formally managed' includes management required by legislation, or protection of places through management zones, prescriptions and/or codes of practice where these lead to relevant sites being actively managed or protected on the ground. The four broad categories used to identify Indigenous land are shown in Table 18.

Table 18: Categories of Indigenous land

Indigenous land category	Description
Indigenous owned and managed	Freehold lands that are both owned and managed by Indigenous communities

[6] The Term *Indigenous* is used in the national context and in relation to the relevant international Montréal Indicators. In a specifically WA context the term *Aboriginal* is generally preferred and used, although both terms have been used in this document.

Indigenous land category	Description
Indigenous managed	Lands that are managed but not owned by Indigenous communities (e.g. Crown reserves and leases); and lands that are owned by Indigenous people, but have formal shared management agreements with Australian and state and territory government agencies (e.g. leased-back nature conservation reserves)
Indigenous co-managed	Lands that are owned and managed by other parties, but have formal, legally binding agreements in place to include input from Indigenous people in the process of developing and implementing a management plan (e.g. nature conservation reserve memoranda of understanding)
Other special rights	Lands subject to native title determinations and active Indigenous land use agreements (ILUA). These are independent of tenure and, in most cases, do not grant ownership or management rights of land to Indigenous communities. They can provide for the right to access areas of cultural significance, or a legal requirement for consultation with the local Indigenous community before any major development activities take place

Source: *Australia's State of the Forests Report 2013*

The primary piece of legislation which protects Aboriginal cultural heritage in Western Australia is the *Aboriginal Heritage Act 1972* (WA) (AHA Act). The Department of Planning Lands and Heritage (DPLH) is responsible for the administration of the AHA Act. The AHA Act provides automatic protection for all places and objects in Western Australia that are important to Aboriginal people because of connections to their culture. These places and objects are referred to as Aboriginal sites (Department of Planning, Lands and Heritage 2018).

The CALM Act also includes provisions which provide significant protection for Indigenous cultural heritage values including:

- a management objective to conserve and protect the value of the land to the culture and heritage of Aboriginal people;
- facilitation of the conduct of Aboriginal customary activities (such as visiting country to care for and protect Aboriginal sites and values, obtaining food, medicines, or conducting ceremonies); and
- a framework for the joint management of CALM Act lands.

The provisions of section 103A of the CALM Act confer upon Indigenous people rights to access and use CALM Act lands within the scope of the 'Other special rights' category of land. Similarly, the provisions of section 56A of the CALM Act provide a statutory framework for formal Indigenous co-management of selected CALM Act land within the scope of the 'Indigenous co-managed' category of land.

The processes to identify and protect Indigenous heritage places and values within the WA RFA region are being further strengthened through the South West Native Title Settlement (SWNT Settlement) process. This is a comprehensive native title agreement, comprising the

full and final resolution of all native title claims in the south-west of WA in exchange for a comprehensive settlement package. Identical ILUAs have been executed across the South West by the WA Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip and Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC). The SWNT Settlement ILUAs were registered with the National Native Title Tribunal on 17 October 2018 which, subject to the outcome of any judicial review, will enable the implementation of the agreement.

In addition to protections provided under the AHA Act, in 1999 the WA RFA recognised a need to improve the protection and management of Aboriginal heritage and cultural values within the region. The RFA included a suite of actions (Attachment 10 of the 1999 WA RFA) for the State to progress, including actions to enhance consultation with Aboriginal people on the identification and protection of sites, facilitate access to CALM Act lands for cultural activities, and improve assessment and monitoring of disturbance activities that might pose a threat to sites (such as road construction).

The *Review of the Implementation of the Regional Forest Agreement for the South-West Forest Region of Western Australia for the Period 2009-2014* reported that all actions had been achieved in full or modified form by 2014. In relation to the protection of Aboriginal heritage and cultural values RFA recommendations have been significantly addressed by:

- The SWNT Settlement, which provides a standard heritage agreement and assessment process to be followed by all Government departments.
- The establishment of Cooperative Management Committees between Noongar Regional Corporations and DBCA for all CALM Act land within the SWNT Settlement area. These Cooperative Management Committees will, among other things, provide advice to DBCA on the value of the land to the culture and heritage of Indigenous people from the relevant areas and on management of the conservation estate more generally.
- The CALM Act amendments in 2012 to provide:
    - a statutory management objective to conserve and protect the value of the land to the culture and heritage of Aboriginal persons;
    - Indigenous people with 'Other special rights' on CALM Act land and provide statutory protections for Indigenous people to access CALM Act land; and
    - a statutory framework for the co-management of CALM Act land.
- A specialist Aboriginal Heritage Unit was established within DEC (now DBCA) whose role includes the provision of cultural heritage advice and information into planning processes, training in heritage and cultural awareness, and site identification.

The protection of Aboriginal heritage and cultural values within the RFA region was further strengthened through the SWNT Settlement process, which incorporates the development of a Noongar Standard Heritage Agreement to ensure compliance with the AHA. These Agreements require proponents of activities that may impact sites to refer the proposed operations to the SWALSC for determination of heritage survey and consultation requirements with Noongar representatives during the planning phase. Depending on the assessment and advice from the traditional owners and custodians the operations may require on-site monitoring during ground disturbance activities.

The register of Aboriginal sites within the RFA region will continue to be added to as an outcome of the Noongar Standard Heritage Agreements. Figure 8 depicts the registered and lodged sites within the region as at April 2018, which total 423 sites.

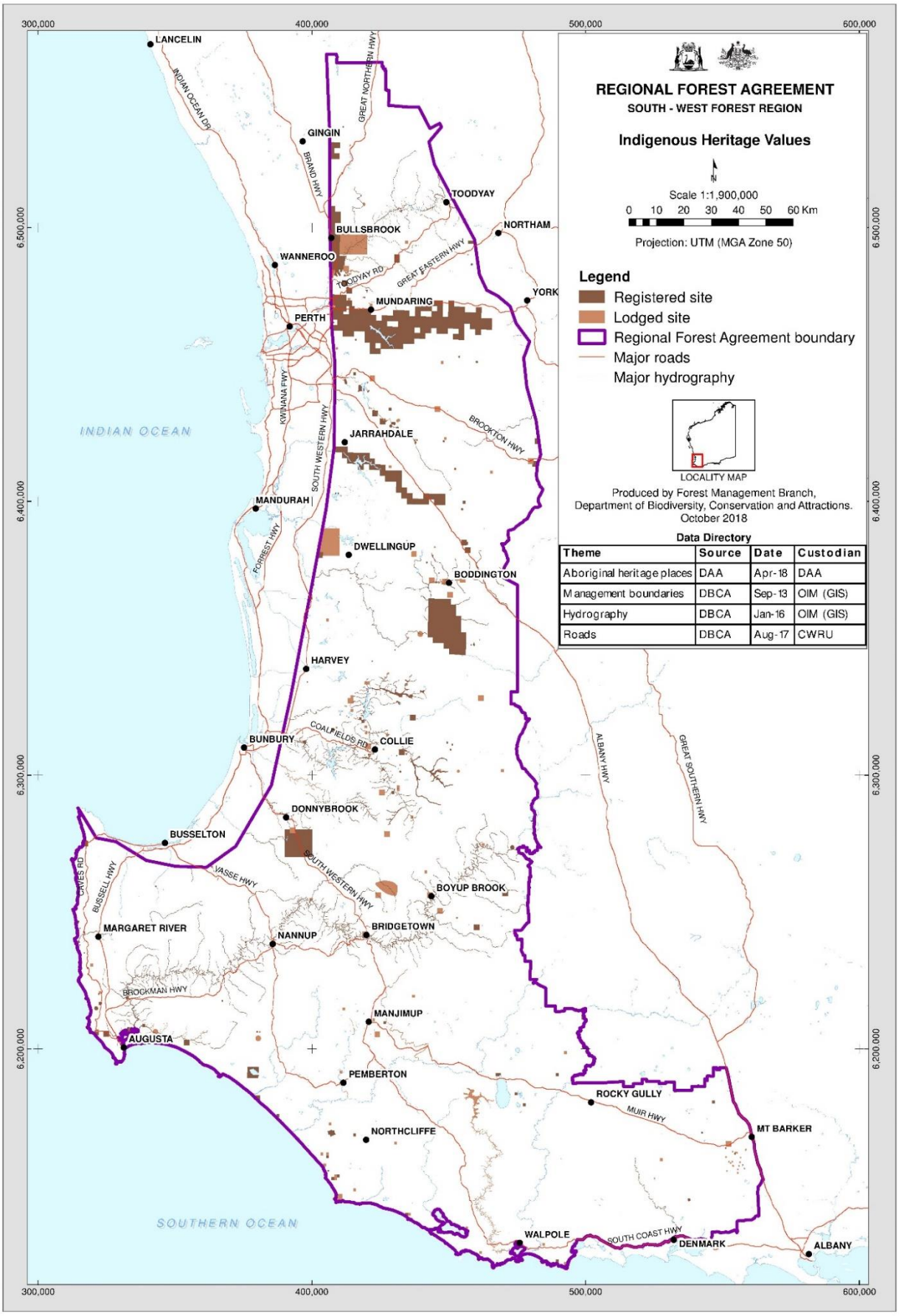

Figure 8: WA RFA region and Indigenous Heritage sites in 2018.

Comprehensive Regional Assessment

The RFA noted that identification and assessment of National Estate Values for the CRA were complete except for Indigenous heritage values. The identification and assessment of Indigenous heritage values was intended to be, and continues to be, an ongoing effort through the period of implementation of the RFAs.

Register of the National Estate (archive)

Records of Indigenous sites were maintained by the Australian Government in the Register of the National Estate (RNE) between 1975 until it was closed in 2007 (Department of the Environment and Energy, n.d.). The RNE was recognised at the time the RFA came into effect.

Indicator 6.4c The extent to which Indigenous values are protected, maintained and enhanced through Indigenous participation in forest management

This indicator measures the extent to which Indigenous people participate in forest management. Active participation in forest management reflects the relationship between people and the land, and the integration of Indigenous peoples' values with forest management practise, policy and decision making.

Since 1999 there has been considerable development of legislation, policy and processes to enhance the recognition and participation of Aboriginal people in forest management.

Amendments to the CALM Act in 2011 (effective from 2012) provide for the joint management of lands and waters between DBCA and other parties (including traditional owners), the undertaking of customary activities and cultural practices on CALM Act lands, and a requirement that all management plans prepared for CALM Act lands must include the objective of protecting and conserving the value of the land to the culture and heritage of Aboriginal persons.

Consideration of joint management arrangements between DBCA and traditional owners for some conservation areas within the RFA region may progress following finalisation of the SWNT Settlement process.

Corporate policies for *Acknowledgement of Aboriginal traditional custodians* and *Aboriginal customary activities* were introduced by DBCA, while the FPC developed a framework for *Engagement with Noongar Peoples in the South West of Western Australia*. The development of the FMP 2013-2023 included significant engagement with Noongar people and includes performance targets to establish joint management arrangements, develop local area protocols for customary activities in each DBCA district, and Noongar input to all management plans.

The WA Government introduced an Aboriginal Ranger Program during 2017 aimed at training and employing Aboriginal rangers to undertake a range of land and marine management activities including:

- biodiversity monitoring and research
- traditional knowledge transfer
- fire management
- cultural site management

- feral animal and weed management
- cultural awareness and immersion experiences
- tourism management
- education programs and mentoring.

This program will enable the South West Aboriginal Land and Sea Council Aboriginal Corporation, for the Noongar Boodja Mentored Employment and Training Partnership, to employ 12 Aboriginal rangers for the area covered by the WA RFA region.

Collectively, these initiatives will continue to enhance the direct involvement of Aboriginal people in the management and use of forests on public lands in the WA RFA region.

Indicator 6.5d Resilience of forest dependent Indigenous communities to changing social and economic conditions

This indicator provides a measure of the extent to which forest dependent Indigenous communities can respond and adapt to change successfully. Resilient forest dependent Indigenous communities will adapt to changing social and economic conditions, ensuring they prosper into the future**.**

Beyond their immediate economic value, most Aboriginal people, even those living significant distances away, are likely to have some cultural dependence on forests, particularly where the forest is part of the traditional country for which a particular group has customary responsibility. Native forests are places where new generations of Aboriginal people can learn about cultural practices and laws. Access to the forests is critical for the continuation and maintenance of cultural values; conversely, loss of access to or use of forests and their products may lead to a diminution of culture and therefore of resilience.

It is recognised that resilience is a complex indicator to quantify, and no single measure of resilience is possible. It is believed, however, that successful Indigenous forest-sector projects can deliver both social and economic benefits, strengthening the resilience of Indigenous communities in the face of social and economic change.

The registration of the SWNT Settlement ILUAs, amendments to the CALM Act and the establishment of Cooperative Management Committees between Noongar Regional Corporations and DBCA for all CALM Act land within the SWNT Settlement area (see Indicator 6.4a) will provide ongoing commitment and opportunities to Aboriginal communities based within the WA RFA region.

Summary and future management of Indigenous heritage values

The extent to which Aboriginal people participate in forest management reflects their connection with the land, and the integration of Indigenous values into forest management practice, policy and decision-making.

The primary piece of legislation which protects Aboriginal cultural heritage in WA is the *Aboriginal Heritage Act 1972* (WA) (AHA Act). The CALM Act also includes provisions which provide significant protection for Indigenous cultural heritage values.

Since 1999 there has been considerable development of legislation, policy and processes to enhance the recognition and participation of Aboriginal people in forest management. This is

expected to develop further under the extended WA RFA, with WA's commitment to provide opportunities for Aboriginal communities to be involved in forest management.

Amendments to the CALM Act in 2011 (effective from 2012) provide for the joint management of lands and waters between DBCA and other parties (including traditional owners), the undertaking of customary activities and cultural practices on CALM Act lands, and a requirement that all management plans prepared for CALM Act lands must include the objective of protecting and conserving the value of the land to the culture and heritage of Aboriginal persons. The development of the FMP also involves significant engagement with Aboriginal people and includes performance targets to establish joint management arrangements, develop local area protocols for customary activities in each DBCA district, and Noongar input to all management plans.

In 1999, the WA RFA recognised a need to improve the protection and management of Aboriginal heritage and cultural values within the region, and included a suite of actions for increased consultation, identification and protection of sites, facilitate access to CALM Act lands for cultural activities and monitoring of disturbance activities. The five-yearly reviews of the WA RFA reported that all actions had been achieved by 2014.

Aboriginal heritage has been further enhanced through the SWNT Settlement process. This is a comprehensive native title agreement, comprising the full and final resolution of all native title claims in the south-west of Western Australia in exchange for a comprehensive settlement package.

The commitment to protection and acknowledgement of Aboriginal heritage is reflected in legislation, WA Government policy, procedures and guidelines. The processes described in this chapter provide the framework to continue to enhance the consideration and direct involvement of Aboriginal people in the management and use of forests on public land in the RFA region. DBCA are committed to providing ongoing opportunities for involvement in forest management to Aboriginal communities in the WA RFA region and to continue adapting and improving the WA FMS to provide these opportunities, including through commitments under an extended WA RFA.

Section 3: Economic Values

Ecologically Sustainable Forest Management requires that decision making processes effectively integrate both the long-term and short-term economic, social and equitable considerations, and that the health, diversity and productivity of the forest is maintained or enhanced.

The primary economic values from the forests in the south west forest region of WA are derived from timber harvesting, mineral extraction and intra-state and overseas tourism. Other economic activities include honey production, seed collection and wildflower collection.

Consistent with the Montreal Criteria, the FMP seeks to sustain social and economic benefits through the provision of a range of goods and services valued by the community.

Criterions 2 and 6 of the Montréal Process Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests provide for the maintenance and enhancement of economic values.

Criterion 2, Maintenance of Productive Capacity of Forest Ecosystems measures the ongoing productive capacity of forests by monitoring the area of native forests and plantations available for producing timber and other forest products. Maintaining the productive capacity of forests involves maintaining the land base, and from areas of State forest and timber reserves where timber harvesting is permitted, providing for timber production on a sustained yield basis.

Criterion 6 Maintenance and Enhancement of Long-term Multiple Socio-economic benefits, monitors and reports across five sub-criteria relevant to how the forest sector provides multiple socio-economic benefits to society. This chapter includes measures of the production and consumption of forest products, investment in the forest sector and forest-related employment and community needs.

This section includes the following Montréal Indicators:

- Indicator 2.1a – Native forest available for wood production, area harvested, and growing stock of merchantable and non-merchantable tree species
- Indicator 2.1b – Age class and growing stock of plantations
- Indicator 2.1c – Annual removal of wood products compared to the volume determined to be sustainable for native forests and future yields for plantations
- Indicator 2.1d – Annual removal of non-wood forest products compared to the level determined to be sustainable
- Indicator 2.1e – The area of native forest harvested and the proportion of that effectively regenerated, and the area of plantation harvested and the proportion of that effectively re-established
- Indicator 6.1a – Value and volume of wood and wood products
- Indicator 6.1b – Values, quantities and use of non-wood forest products
- Indicator 6.1c – Value of forest based services
- Indicator 6.1d – Production and consumption and import/export of wood, wood products and non-wood products
- Indicator 6.1e – Degree of recycling of forest products
- Indicator 6.2a – Investment and expenditure in forest management

- Indicator 6.2b – Investment in research, development, extension and use of new and improved technologies.

Indicator 2.1a Native forest available for wood production, area harvested, and growing stock of merchantable and non-merchantable tree species

This indicator reports the capacity of forests to sustainably produce wood to meet society's needs into the future. The area of native forest available for wood production, the nature of the growing stock, and the area harvested over time are measures of the sustainability of forest management.
The main factors which affect the sustained yield of forests include:

- the net area available for the activity
- attributes of the forest – including species, age and size classes, growth and mortality rates, which are in turn affected by soils, climate, natural disturbance, pests, diseases and management history
- the silviculture applied.

Net harvestable area

The net area available for timber harvesting is an important component of the sustained yield calculation process, as it the area basis upon which current growing stock is measured and future yields are modelled. Within state forest and timber reserves in the WA RFA region, informal reserves, FHZs and areas of unproductive or degraded forest (such as those mapped as drought affected, areas too steep to harvest safely or areas used for roads and landings) are excluded from the net area used to calculate the sustained yield. The areas of jarrah dominant forest rehabilitated following bauxite mining are also included in the net area available for timber harvesting.

The net harvestable area of public forest has declined since 1999 as a result of policy decisions made by the WA government including:

- the introduction of the *Protecting our Old-growth Forests* policy, which resulted in additional national parks, conservation parks and nature reserves being added to the CAR reserve system
- the introduction of FHZs in the FMP 2004-2013. FHZs contributed to a reduction in the net harvestable area of 52 thousand hectares in FMP 2004-2013, which was refined to 48 thousand hectares in FMP 2014-2023
- the establishment of further national parks in the FMP 2014-2023, such as the proposed Whicher Scarp national park.

These decisions have contributed to an overall reduction from 1.15 million hectares of forest available for timber production at the commencement of the WA RFA to 0.9 million hectares by 2009 (Table 19). The net harvestable area of public forest has remained largely unchanged since the 2009 review, and currently equates to 21 per cent of the total RFA area (down from 27 per cent in 1999).

Table 19: Net area of State forest and timber reserves available for wood production within the WA RFA region at each of the RFA reporting periods.

RFA reporting period	Area available for wood production (ha)	Proportion of total RFA area (%)
WA RFA 1999	1,147,200	27.0
RFA review 2009	901,190	21.1
RFA review 2014	902,940	21.2
Current area to June 2018	903,430	21.2

Source: DBCA

Area harvested

The area of native forest harvested on public land in the WA RFA region varies from year to year, influenced by a range of factors including forest type and structure being harvested, market conditions and the silviculture objectives being applied. The area harvested is reported annually in the FPC and DBCA annual reports.

The annual area of public native forest harvested dropped significantly after the introduction of the *Protecting our Old-growth Forests* policy (Table 20) and has continued to contract as the net available area and sustained yield levels have been revised to accommodate additions to the conservation estate. Throughout the period of the WA RFA the area harvested each year has always remained below 1.5 per cent of the area available for wood production.

Table 20: Native forest average annual area harvested within the WA RFA region at each of the reporting periods.

Years of harvest	Average annual area harvested (ha)	Proportion of area available for wood production (%)
1999-2003	15,337	1.3
2004-2008	8,473	0.9
2009-2013	7,780	0.9
2014-2017	6,652	0.7

Source: DBCA

Growing stock of merchantable and non-merchantable tree species

Strategic inventory to estimate the growing stock of native forests is maintained by DBCA, and informs the calculation of sustained yields for each FMP. The calculations include consideration of standing wood inventory, forest stratification and extent, future growth, past and future disease, pest and bushfire impacts (and related effects on tree mortality).

The proportion of the total standing volume that is harvested each year also provides a broad indicator of the maintenance of the forest productive capacity. For example, DBCA's

sustained yield projections for the FMP 2014-2023 indicated that the removal of the annual levels of sawlog determined to be sustainable would constitute around 1.1 per cent for jarrah, and 1.8 per cent for karri, of the estimated standing sawlog volumes at 2014. The sustainable harvest volumes for other non-sawlog volume would constitute around 0.6 per cent for jarrah, and 1.6 per cent for karri, of the estimated standing other non-sawlog volumes at 2014.

Given limited inventory for the private native forests in WA, their variable grower intent and condition, and the restrictions under the native vegetation clearing regulations, the private native forests have not been a significant consideration for industry supply projections to date.

Indicator 2.1b Age class and growing stock of plantations

This indicator uses the area, age class and growing stock of native and exotic species plantations to assess the volume of timber that Australia's plantation forests can supply now and into the future.

This indicator provides a state-wide summary of the progress of plantation establishment of native and exotic species over time. An increase in the size and quality of the plantation estate is a significant element in longer-term sustainability, wood supply security, and the growth of the forest industry in Western Australia.

The State monitors and reports on plantation areas through the FMP and the FPC's annual reports. The FMP area differs from the RFA area, and the FPC annual reports are at a state-wide level. However, they provide a good indication of the area and volume available to the industry as a significant proportion of the publicly owned pine plantations are located within the WA RFA region.

Since 1999, areas of plantation on State forests have been added or excised because of land tenure changes. These arose from road and utility corridor construction, and the establishment of basic raw material quarries. Bushfires have impacted the McLarty, Myalup and Thomson Brook plantations within the WA RFA region, affecting the net plantation area and wood supply. The FPC has a policy to salvage harvest and replant plantations damaged by fire in order to reduce the impact of the fire on the long-term sustainable productivity of the plantations.

During the period 1999 to 2018 the total area of plantations available to, or managed by, the FPC increased from 37,540 hectares to 47,690 hectares (Table 21). Through this period investment in new plantation establishment has fluctuated in response to various federal and state government initiatives including Managed (Sharefarm) Investment Schemes, National Action Plan for Salinity and Water Quality, the Infinitree initiative to promote plantations on farm lands, and the Strategic Treefarming Project.

The State government has made significant recent investment in softwood plantations, with the development of the *Softwood Industry Strategy for Western Australia* (FPC 2016) and the commitment of $21 million to plant additional softwood plantation areas over five years.

The area of plantations providing resource to the industry is forecast to increase over the next decade. The FPC and industry are working together to secure additional plantation areas consistent with the *Softwood Industry Strategy for Western Australia* (2016).

Table 21: Plantation areas within the WA RFA region owned or managed by the Forest Products Commission from 1999 to 2018

	December 1998			December 2003			December 2008			December 2014			December 2017		
Plantation type	State	Share farm	Total	State	Share farm	Total	State	Share farm	Total	State	Share farm	Total	State	Share farm	Total
Hardwood	560	0	560	460	2,810	3,270	380	3,270	3,650	1,260	1,650	2,910	870	1,720	2,590
Softwood	32,250	4,730	36,980	32,220	7,050	39,270	31,370	7,410	38,780	33,140	7,050	40,190	35,090	7,800	42,890
Sandalwood	n/a	n/a	n/a	n/a	n/a	n/a	0	120	120	10	160	170	10	160	170
Fallow	n/a	n/a	n/a	1,970	0	1,970	3,550	90	3,640	1,920	440	2,360	1,570	470	2,040
Total	32,810	4,730	37,540	34,650	9,860	44,510	35,300	10,890	46,190	36,330	9,300	45,630	37,540	10,150	47,690

Indicator 2.1c Annual removal of wood products compared to the volume determined to be sustainable for native forests and future yields for plantations

This indicator measures the harvest levels of wood products in relation to sustainable and predicted yields. These products can represent a significant asset base supporting the livelihoods of regional communities. The capacity to implement strategies to deal with changing demand for forest products based on predicted yields from both native and plantation forests is an integral part of sustainable forest management.

Sustainable yield from native forests

Calculated sustainable yield is the estimated volume of wood that can be removed each year while ensuring maintenance of functions within native forest systems as a whole. Sustainable yield volumes vary over time according to changing management strategies and utilisation standards, improved resource data, and changes in the net area of native forest available for wood harvesting.

The sustained yield for the period pre-dating the RFA was calculated in 1993 for the period of the FMP 1994-2003. The sustained yield figure of 704,000 cubic metres consisted of 214,000 cubic metres of first grade karri sawlogs and 490,000 cubic metres of jarrah first and second grade sawlogs.

The WA RFA reduced the sustained yield level for the period 1999-2003 to 186,000 cubic metres of first and second grade karri and 324,000 cubic metres of first and second grade jarrah sawlogs per annum. For the period 2004-2018, the WA RFA set sustained yield levels of 178,000 cubic metres per annum of karri first and second grade sawlogs and 286,000 cubic metres of jarrah first and second grade sawlogs.

A further, more significant reduction in the sustained yield figure took effect with the release of the FMP 2004-2013. The revised figures during this period allowed for up to 54,000 and 131,000 cubic metres per annum of karri and jarrah first and second grade sawlogs. This reduction (and deviation from the levels expected for this period under the RFA) was largely

due to the implementation of the *Protecting our Old-growth Forests* policy, and the consequent reduction in forest area available for timber production.

Table 22 below shows the actual annual volume removed compared to the allowable harvest levels over the RFA period. The volume of sawlogs harvested from public native forests has remained within sustained levels over the entire period of the RFA.

Table 22: Annual sustained yield and volume removed from public native forests in WA

Public native forest	Volume (cubic metres)	1996-97[a]	2001-02[b]	2006[c]	2010[c]	2016-17[d]
Sustained yield	'000 m3	704	510	185	185	191
Actual harvest	'000 m3	568	336	181	150	150

[a] Sourced from SOFR2003. Figures include jarrah first and second grade sawlogs, karri first grade sawlogs.
[b] 2001/02 Annual Report of the Forest Products Commission
[c] 2012 Forest Management Plan 2004-2013: End-of-term Audit of Performance Report, CCWA Perth
[d] 2016/17 Annual Report of the Forest Products Commission. 'Sustained yield' figure reported is actually the 'allowable cut' volume. The calculated 'sustained yield' figure is 216,000m3 (12% higher), the allowable cut has been reduced to include a safety margin for unforeseen bushfire and disease impacts, as per a recommendation by an independent review panel.

Removal of wood products from plantations

The annual supply of plantation wood to industry fluctuates due to a broad range of supply and demand issues.

The State government's contracts of sale for plantation products typically include a maximum amount that the FPC is required to supply. The contracts also include provisions for customers to request a lesser amount in any year depending on market demand and alternative sources of supply. This negotiated volume is reported as budgeted demand in the FPC's annual reports and has fluctuated over the RFA period. Budgeted demand continues to be met annually (Table 23).

Short-term variations in supply or demand may also arise due to machinery breakdowns, market cycles or the need to respond to salvage areas following bushfire or storm events. Short-term opportunities also arise to meet plantation management objectives by supplying export markets when prices are favourable.

The State continues to demonstrate support for the plantation industry, with industry highlights including the development of State Agreements with major processors including Wespine (2008), Wesbeam (2002) and Laminex.

The RFA period has also seen the closure of Wesfi MDF plant in 2009.

Table 23: Annual demand and supply of sawlog volumes from WA plantations owned or managed by the Forest Products Commission for the past five years (Source, FPC, 2017)

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Actual supply	444,392	536,123	594,106	538,253	488,360
Budgeted demand	435,500	473,500	542,200	546,900	441,000

Within WA there is no formal process for reporting on the removal of wood products from private native forests or private plantations in the WA RFA region. This information is unable to be included in this Indicator.

Indicator 2.1d Annual removal of non-wood forest products compared to the level determined to be sustainable

This indicator is used to assess the sustainability of removals of non-wood forest products. These products can represent a significant asset base supporting the livelihoods of remote communities.

While there are some state-wide data for this indicator available on removal of non-wood forest products, the data on sustainable yields of these products are very limited. The different levels of available data reflect market driven responses where demand for particular non-wood forest products determines what, if any, monitoring systems are developed.

Continued access to floral resources on Crown land has remained important to the beekeeping industry throughout the period of the RFA. Access to Crown land for apiary is regulated by the DBCA in accordance with the *Conservation and Land Management Act 1984* (WA) (CALM Act) and Conservation and Land Management Regulations 2002 and consistent with the BC Act and Biodiversity Conservation Regulations 2018. Beekeeping on Crown land is facilitated when it is compatible with the primary purpose of the land and consistent with the CALM Act management plan for the land. DBCA maintains a distance of three kilometres between apiary sites held by different beekeepers in order to minimise the potential for disease spread. Applications for apiary sites are assessed against environmental and management criteria. The General Conditions for Apiary Authorities on Crown land require beekeepers to ensure appropriate risk management systems, strategies and procedures to minimise foreseeable risks to the environment, the values of the land, the beekeeper and their employees, agents or contractors and to members of the public.

Table 24: Number of registered beekeepers in Western Australia (Source, DPIRD)

Year	No. of beekeepers
2006	430
2007	406
2008	425
2009	488
2010	542
2011	582

Year	No. of beekeepers
2012	643
2013	753
2014	850
2015	1127
2016	1508
2017	2007
2018	2550

Beekeepers are also registered with the Department of Primary Industries and Regional Development (DPIRD) to maintain high biosecurity standards (Table 24). Honey, pollen, beeswax, honeycomb or any other product of bees are animal products covered by the *Biosecurity and Agriculture Management Act 2007*. DPIRD undertakes surveillance and sampling for exotic bee pests and diseases.

There are no data available on indigenous resources collected or used for cultural activities.

Indicator 2.1e The area of native forest harvested and the proportion of that effectively regenerated, and the area of plantation harvested and the proportion of that effectively re-established

This indicator reports on the extent of native forest harvested and the success of re-establishing regeneration on harvested sites. It also compares the area of plantation clearfelled with the area effectively replanted, and gives an indication of the success of the planting effort. This indicator is used to assess the success of the re-establishment of forests after harvesting. Re-establishment is critical to the maintenance of the productive capacity of the forest.

The areas re-established and replanted are reported annually in the annual reports of the FPC and DBCA.

Native forest

Effective regeneration of native forest after wood harvesting is a fundamental component of sustainable forest management, since the standard of regeneration determines the long-term productivity, growth, dynamics and composition of forest stands. In this context, regeneration is considered the establishment of a new tree cohort from natural seed fall, planted seedlings, lignotubers or coppice following the harvesting event.

This indicator is relevant to the public forest estate as there are no statistics for regeneration on harvested private property. For native forests, annual information is provided on the total area harvested, the area harvested where regeneration is a targeted outcome and the proportion of area effectively regenerated.

Regeneration activities aim to re-establish the species representation within the disturbed area, using propagules, on-site seed, on-site seedlings and other established growth that has been retained, or seedlings developed from seed from the same landscape zone. The FMP 2014-2023 requires proponents harvesting native forest to undertake regeneration and tending operations in accordance with DBCA's silviculture guidelines, and sets timelines and

targets for effective regeneration to occur. As Table 25 below indicates, during the period of the WA RFA the proportion of harvested area being effectively regenerated has been within 1 per cent of required targets.

The release of the *Draft mid-term review of performance of the Forest Management Plan 2014-2023* noted that for areas of jarrah forest where the release of regeneration was an objective, around half of the areas had not been treated within the specified timeframe. This shortfall has been largely due to delays in achieving DBCA's scheduled silvicultural burning program. The commencement of the 'Enhanced Prescribed Burning Program' in 2015-16 has enabled more silvicultural burns to completed and substantially reduce the backlog of areas requiring regeneration.

Table 25: Area of multiple-use public native forest effectively regenerated, Western Australia, 2001–02 to 2015–16

Reporting year	Total area harvested (hectares)	Proportion of harvested area effectively regenerated (%)[a]
2001–02	16,630	100.00
2002–03	13,950	100.00
2003–04	9,725	100.00
2004–05	9,610	99.94
2005–06	7,440	99.94
2006–07	9,670	99.98
2007–08	8,820	99.90
2008–09	7,640	100.00
2009–10	10,660	99.65
2010–11	6,140	n.r.
2011–12	7,490	n.r.
2012–13	7,780	n.r.
2013–14	6,730	n.r.
2014–15	5,480	n.r.
2015–16	6,360	n.r.
Annual averages for SOFR reporting periods		
2001–02 to 2005–06	11,471	100.0
2006–07 to 2010–11	8,586	99.9
2011–12 to 2015–16	6,768	n.r.

Total forest area harvested is the gross harvested area and includes jarrah forest harvested to a range of silvicultural objectives, but excludes areas cleared for mining.
[a] Proportion of harvested area effectively regenerated, based on harvested areas where the silvicultural objectives of the silvicultural systems require regeneration establishment in the harvested area and follow-up assessment for effectiveness, and calculated as the weighted average of regeneration success reported for karri and jarrah regeneration for that year. Regeneration success can relate to areas harvested 18–30 months previously.
n.r., not reported in this format, but adequate regeneration achieved for karri and jarrah areas across the years.
Source: CCWA (2012), Western Australian Department of Environment and Conservation, Western Australian Department of Biodiversity, Conservation and Attractions.

Plantation

Effective establishment of a plantation either on land not previously under plantation (afforestation) or as re-establishment of a previous plantation after clearfell harvesting

(reforestation) is a fundamental component of sustainable plantation management to provide for long term and consistent wood volumes required by wood-processing industries.

In terms of monitoring plantation establishment on public forests, the planted area includes both new plantation establishment and plantation re-establishment. Establishment is measured one year after planting; the seedling survival rate applies to the planted area in the previous year. Monitoring the effectiveness of the establishment of newly planted forest is undertaken by surveys of seedling survival in the first year after planting. If survival rates are generally low or low in specific locations, the failed areas are replanted. Secondary survival counts are sometimes undertaken if plant health, disease or adverse weather conditions warrant further examination.

During the period 2001 to 2017 the annual area of softwood plantation established by the FPC fluctuated between years, but averaged 1,649 hectares per annum (Table 26).

Table 26: Annual area of public softwood plantation re-established (Source: FPC)

Reporting year	Target Area (ha)	Area Established (ha)
2001 - 02	1,229	943
2002 – 03	914	721
2003 – 04	1,309	1,013
2004 – 05	1,500	1,391
2005 - 06	1,500	1,425
2006 – 07	1,500	1,425
2007 – 08	1,500	1,506
2008 – 09	2,000	1,644
2009 – 10	2,000	2,112
2010 - 11	600	636
2011 – 12	2,000	2,252
2012 – 13	2,500	2,083
2013 – 14	2,000	2,002
2014 – 15	2,000	2,133
2015 – 16	2,400	2,605
2016 - 17	2,400	2,378
2017 - 18	n.r.	1,768

Note: Target area refers to 2nd and 3rd rotation areas planted with softwood species.
n.r. not reported

Indicator 6.1a Value and volume of wood and wood products

This indicator presents information on the value and volume of wood and wood products that are directly generated by the forest and wood products industries and enables socio-economic benefits to be monitored by ascertaining trends in value and volume of wood production.

State Summary

A detailed study of the socio-economic impacts of the forestry industry (Schirmer *et al.* 2017) found that in 2015-16, the direct value of output generated by the WA forestry industry at

the point of sale of primary processed products was $649 million, increasing to $1,405 million when flow-on effects generated in other industries is included. The study covered the South West, Wheatbelt, Great Southern and Esperance regions and does not specifically address the WA RFA region, though the native forests and the much of the softwood plantations are located within this area.

Both the volume and value of hardwood logs sourced from native forests in WA has declined over the last decade and now stabilised, while the softwood (pine) volume and value have remained relatively constant (Tables 27 and 28). The volume of plantation hardwood removals (mostly bluegums managed on short rotations for export as woodchips) has increased in recent years to be almost nine times the volume of native forest production. The majority of the bluegum plantations are located outside the WA RFA region.

The volume of saw log wood products extracted is anticipated to remain relatively constant into the future. The volume of other bole volume is expected to increase, as higher value markets are found for this material. Removal of other bole volume will enhance regeneration and provide forest health benefits. Greater removal of other bole volume is a key recommendation of the draft FMP 2014-2023 mid-term review.

Log volume

Table 27: Volume of logs harvested in Western Australia ('000m3) (Australian forest and wood products statistics: September and December quarters 2017)

Forest type	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Hardwood native	528	545	495	437	468	499	451	343	331	355	395
Hardwood plantation	2,498	2,255	2,590	2,639	3,060	2,543	2,772	2,911	3,376	3,700	3,620
Softwood	980	997	1,009	901	924	843	801	856	969	912	930
Total	4,007	3,796	4,093	3,977	4,452	3,885	4,024	4,110	4,676	4,967	4,945

Log value

Table 28: Value of logs harvested in Western Australia ($m) (Australian forest and wood products statistics: September and December quarters 2017)

Forest type	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Hardwood native	46	49	48	40	40	43	37	28	26	28	31
Hardwood plantation	179	183	215	219	255	188	183	195	240	262	248
Softwood	58	59	51	52	54	51	50	54	61	59	58
Total	284	291	314	310	348	282	270	277	327	350	336

Indicator 6.1b Values, quantities and use of non-wood forest products

This indicator enables socio-economic benefits to be monitored by ascertaining trends in quantities, values and usage of non-wood forest products against management objectives.

Monitoring the supply and sale of specific non-wood forest products from forests helps forest managers understand the extent to which forests remain an important multiple-use resource, supplying products sought by the community.

Discussion

For the purpose of measurement against this indicator, non-wood forest products in State forests have been determined to be those products that are not supplied to sawmills or wood-based processing plants. Non-wood forest products may be for personal use or as part of a commercial enterprise.

Within the WA RFA region the major non-wood product from the native forests is potable water from managed catchments. Other important products are mining enterprises, apiculture, floriculture (seed), gravel, sand and rock. Other activities and infrastructure within the RFA region include, communication sites, powerlines/pipelines/cables and other infrastructure sites. Less common non-wood forest products which are utilised for specific commercial purposes include eucalypt leaf/oil, bark and native (protected) plants and wildflowers. There are other non-wood forest products that are collected for personal use and usually without cost e.g. wild berries and mushrooms, with no statistics maintained of these collections.

Mining

Within the RFA region there are substantial mining enterprises operating in forest areas, including mining for bauxite (Darling Range), gold (Boddington), lithium / tantalum (Greenbushes) and coal (Collie). Aside from the direct economic contribution the industry underpins employment for many regional communities within the RFA region. The WA Department of Jobs, Tourism, Science and Innovation reported the following information:

- Alcoa of Australia Limited (Alcoa) owns two mines and three refineries operating within the WA RFA area under three State Agreements - *Alumina Refinery Agreement Act 1961, Alumina Refinery (Pinjarra) Agreement Act 1969* & *Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978*. These operations produce almost 45 per cent of Australia's alumina. Alcoa mines approximately 35 million tonnes per annum of bauxite and produces approximately 9 million tonnes per annum of alumina from the refineries. Alcoa employs more than 3, 730 people in WA, and spends $654 million annually in wages and benefits in WA whilst investing $1.39 billion in operating and capital expenditure annually in WA. Alcoa pays $400 million in State and Federal taxes annually. More than 75 per cent of Alcoa's total revenue stays in Australia through wages, local purchasing, taxes, royalties, capital investment and dividends to Australian shareholders.
- South32 is the major shareholder and operates Worsley Alumina, a bauxite mine and a refinery within the WA RFA area under the *Alumina Refinery (Worsley) Agreement Act 1973*. Worsley Alumina mines approximately 16-17 million tonnes per annum of bauxite and the refinery has the capacity to produce 4.7 million tonnes per annum of

alumina. In the 2017-18 financial year, Worsley Alumina recorded revenue of $1.4 billion and capital expenditure of over $50 million. The company employs over 2,000 employees and contractors in WA, and has an annual procurement expenditure of $500 million in WA.

Honey and other bee products

As at June 2018 there were 1,585 apiary sites located within the RFA area, of which 539 are located within the CAR reserve system, 981 are located within the area available for timber harvesting and 65 are on lands not managed by the DBCA. Sites are occupied seasonally following the flowering of selected species.

Honey is the major commercial product of the honey bee industry. There are several other products which can add to the income of honey bee businesses, including paid pollination services, beeswax production, queen bee and packaged bee sales.

Western Australian honey is reputed to be amongst the best in the world. The industry is notable for the absence of bee diseases, and it exports bees to other countries each year. The only European honey bee available in Western Australia is *Apis mellifera* (European honey bee).

Jarrah honey has one of the highest levels of anti-microbial activity of any honey, similar to Manuka honey from New Zealand, but using a different mechanism.

Recent increases in the export price of honey, driven by strong demand from China, has increased the value of sites and led to a consolidation and further professionalisation of the industry in Western Australia. Competition for sites among apiarists has intensified during the term of the RFA. The finalisation of management plans in reserves with high biodiversity has required the cancellation of some sites in the south coast and other south west forest locations. These planning decisions have in turn improved site efficiency and use and helped addressed site latency issues.

DPIRD reported that in the 2016-17 financial year the bee product value in WA was $11 million, coming from 2,664 registered beekeepers within the state (152 commercial, 2,512 non-commercial). The Bee Industry Council of Western Australia (BICWA) estimates the value of bees and beekeeping to the WA economy is as much as $1.2 billion for pollination and $30-50 million for honey and associated products. BICWA also estimates there are 1,500 people directly employed in the industry, as well as another 2,000 in associated pollination services. BICWA's strategic plan forecasts that during the next 10 years the industry will continue to expand. It is not known what proportion of the above figures are relevant to the WA RFA region as this level of reporting is not available.

Floriculture

DBCA manages seed collection and flower harvesting operations within the WA RFA region though provisions in the WC Act (BC Act from January 2019). The commercial harvesting of flora is conducted in accordance with the department's *Management of Commercial Harvesting of Protected Flora in Western Australia 1 July 2018 – 30 June 2023*. A system of licensing, area and species-specific management and monitoring has been developed to ensure the conservation of the target flora. Figures 9 and 10 below show the trends in harvesting within the WA RFA area over the period of the WA RFA for native flowers and

seed. The number of native wildflowers has declined during the period of the WA RFA as the consumer demand for dried native plants has contracted.

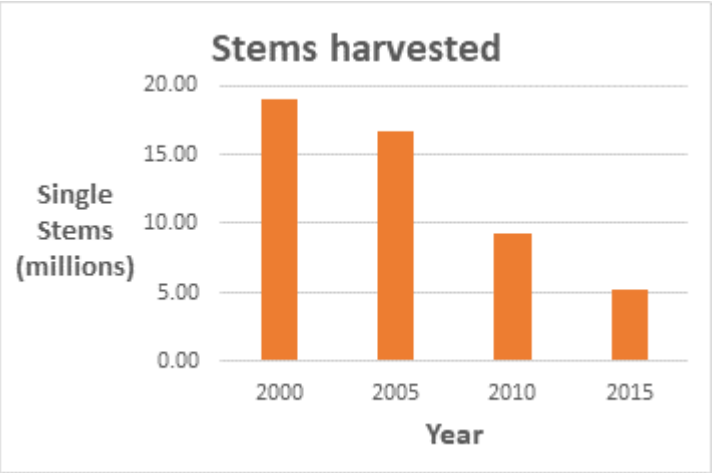

Figure 9: Trend in number of native plants harvested 2000-2015 within the WA RFA area

The amount of seed harvested during the period of the WA RFA has increased substantially, largely as a result of the requirements for revegetation and rehabilitation works, particularly in the mining sector.

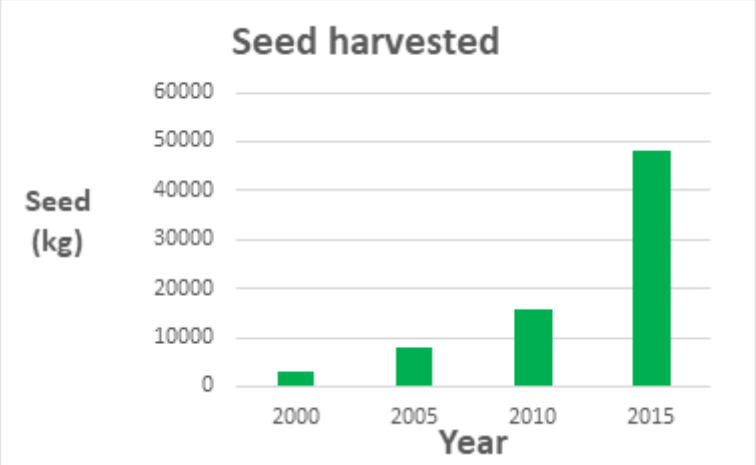

Figure 10: Trend in the amount of seed harvested 2000-2015 from native plants within the WA RFA area.

Telecommunication facilities

There are over 40 leases and licences for telecommunication facilities within the RFA region. These enable access, use and maintenance of key infrastructure. DBCA administers the licences and leases in accordance with the CALM Act. Most of these facilities are owned by the major telecommunication carriers while others include broadcasters, local government, community groups and government agencies, including those providing fire and emergency services.

General Leases

The RFA area accommodates 216 general leases and nine licences for land access for a range of purposes including grazing, recreation, tourism, dam sites, rubbish disposal, sawmills and basic raw materials.

Indicator 6.1c Value of forest based services

This indicator measures forest-based services such as ecosystem services, carbon credits, salinity mitigation and ecotourism. Forest-based services provide economic values and contribute to the sustainability of forests by providing significant social and environmental benefits.

In general, there is limited data on the value of forest-based services (ABARES, 2013). Section 4: Social Values contains further information on this Indicator.

Indicator 6.1d Production and consumption and import/export of wood, wood products and non-wood products

This indicator measures the consumption of forest-based products in Australia. Consumption trends over time provide a measure of the ability of Australian forest and timber industries, through both domestic production and importation, to meet Australian society's demand for forest-based products and the industries contribution to the economy.

This indicator provides a measure of the trends in the production and consumption of wood and wood related products in Australia (including imports), and the export of those products from Australia. Within WA, ongoing access to interstate and international markets is fundamental in ensuring the viability of the forestry and forest-based industries sector.

Information on the production, consumption and trade of non-wood forest products is often difficult to obtain because of the generally small size of industries based on these products and their dispersed nature. Non-wood forest products can include honey, flowers, water, minerals and bark.

Australian consumption data

SOFR 2013 states that Australia is a net importer of wood and wood products. The trade deficit in wood products increased slightly from $1.91 billion in 2006-07 to $1.93 billion in 2010-11. This was attributed to an increase in sawn wood and wood-based panel imports, linked to the strong Australian dollar, and an international oversupply of wood products, because of a slowdown in the United States housing market.

In 2010-11, the highest proportion of imported wood products into Australia, by value, was printing and writing paper at 30.6 per cent. The production of paper products in Australia declined in 2010-11 by 1.4 per cent compared to 2006-07 production. The consumption of paper products still exceeded Australia's production of paper products, despite this consumption declining by 4.3 per cent over the 2006-07 to 2010-11 period.

Woodchips were the highest value export category for wood products in 2010 11, at $884.4 million. Most export woodchips went to Japan over the 2006-07 to 2010-11 period, but in recent years exports to China have increased.

Sawn wood consumption in Australia decreased by 6 per cent from 5.3 million cubic metres in 2006-07 to 5.0 million cubic metres in 2010-11. This was due to a downturn in hardwood sawn wood consumption from 1.23 million cubic metres to 748 thousand cubic metres over the period. Consumption of softwood sawn wood increased, from 4.1 million cubic metres to 4.3 million cubic metres.[7]

Uses of Western Australian forest products

Native forest timbers from WA's forests are used for a variety of applications. A survey of forest industry businesses in 2017 showed that the primary processors, such as sawmills and woodchip mills produce green and dry sawn timber, veneers, poles, piles and posts, and woodchips. The non-sawlog products include charcoal for high quality silicon production, commercial firewood, woodchips for export, and sawdust and bark residues for garden and agricultural purposes. Secondary processors produce flooring and decking, wooden furniture, joinery, pallet and containers, laminates, recycled timber and truss and frames.

Non-wood forest products sourced from WA State forest include seeds, flowers, and honey. The values and quantities of these non-wood forest products are reported in Indicator 6.1b.

Indicator 6.1e Degree of recycling of forest products

This indicator measures the extent to which recycling or reuse of forest products occurs. As global demand for forest products increase, there is a growing need to meet societal demands for recycling of forest products.

Background

Information on the levels of recycling or reuse of forest products in Australia and in WA is limited, and depends on the type of product i.e. solid, processed or paper/paperboard. Data is not available for the WA RFA region, and therefore the data quoted in this report is for the whole of WA. Assigning recycling levels to one region is problematic because forest products produced in one region often end up in many different areas of the State, interstate or exported to other countries. Recovery options include direct recycling into other wood products, indirect recycling into non-wood products (e.g. mulch), reuse and energy generation (FWPA 2008). In this section "wood" includes wood and wood products such as engineered wood products.

The Hazelmere Recycling Centre (managed by the Eastern Metropolitan Regional Council) is the major timber recycling facility in the Perth and Peel regions (Figure 11). The centre accepts untreated timbers which are sorted, ground and screened to produce bedding for the poultry industry, particle board, compost, wood chips and mulch. There are also smaller-scale businesses that salvage and reuse timber (e.g. reclaiming timber for floor boards and decking, reuse of wooden pallets) (WAWA 2014).

[7] Data in this section sourced from ABARES – State of the forest report 2013

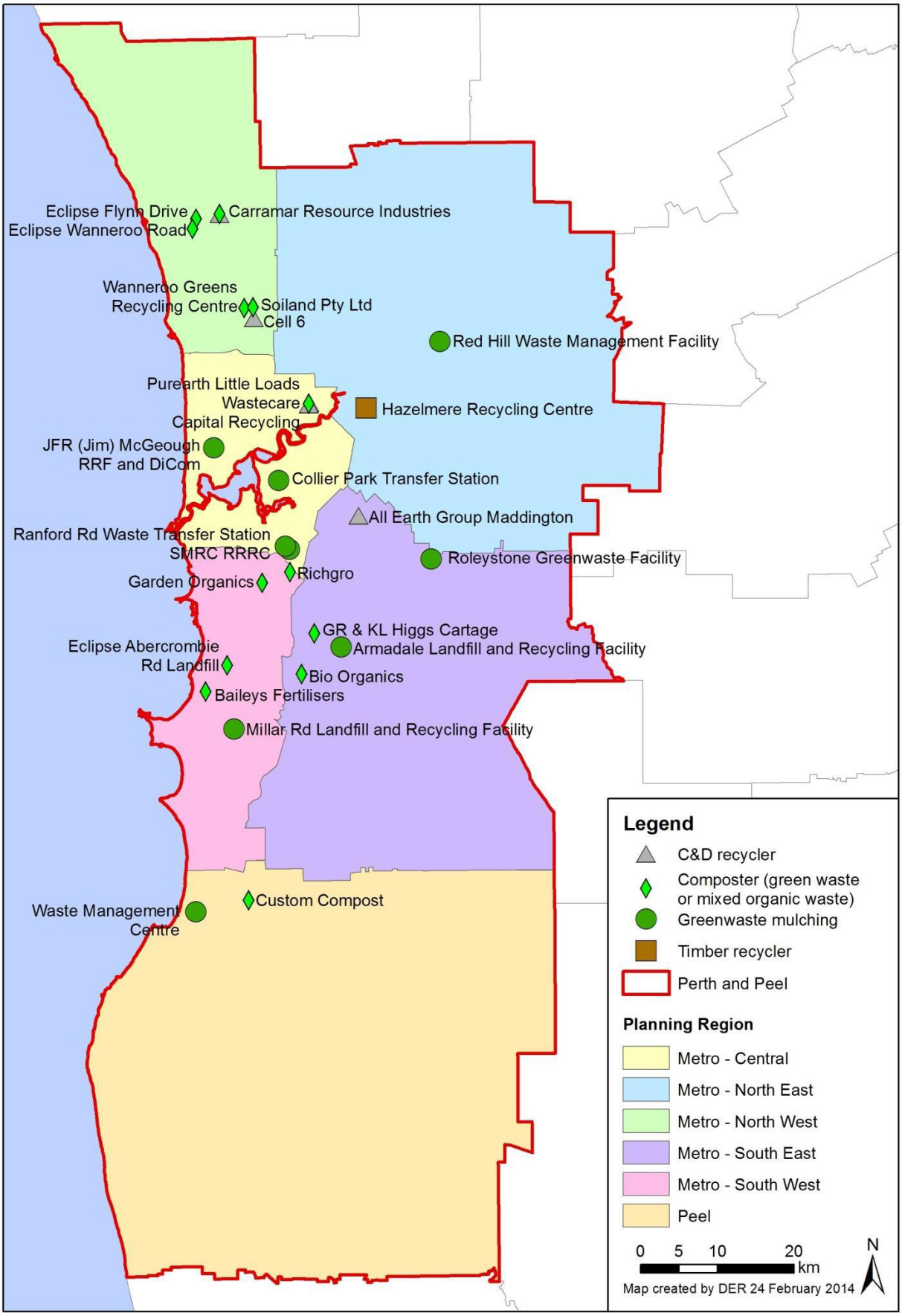

Figure 11: Major construction and demolition materials recyclers, timber recyclers and organic waste recyclers in the Perth metropolitan regions (WAWA 2014)

Statistics on recycling of wood in WA

In 2006-07 it was estimated that approximately 10,000 tonnes of construction and demolition (C&D) wood was recycled in WA (NTPSG 2008). C&D waste makes up around half the total waste stream in WA and improving landfill diversion rates for this waste stream is a focus of the WA Government. Local markets for recycled C&D products are still in development (ANWR 2016).

Wood/timber waste is a significant contributor to the total organic waste for WA, contributing to 14.9 per cent of total recovered organics (Figure 12).

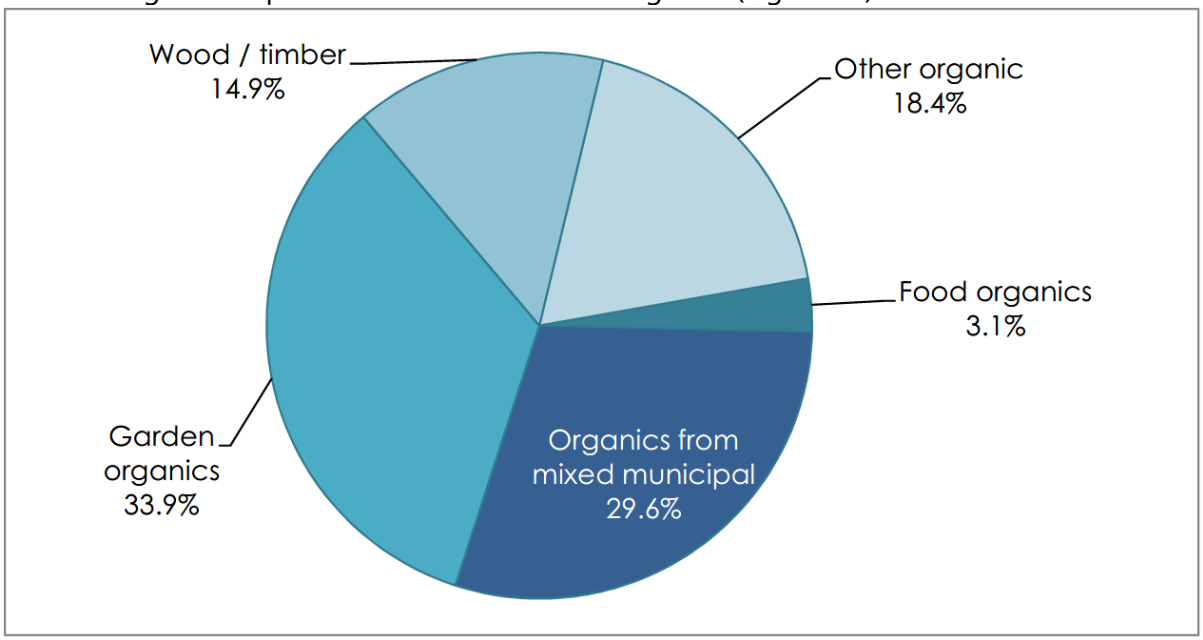

Figure 12: Western Australian 2014-15 composition of recycled organics, by weight (WAWA 2016)

Challenges in increasing recycling levels of wood in WA

Figures on wood recycling levels in WA are difficult to produce, and for reporting purposes wood is categorised as an organic material in WA. Wood and timber make up 57,830 tonnes or 15 per cent of total organic waste recycled in 2014-15 (WAWA 2016).

The main barrier to organics recycling according to processors is local government regulation of composting facilities. Issues raised by the organics sector include:

- A perception that a standardised regulatory approach was not being applied across the sector.
- An overly complicated planning and environmental approvals process.
- Prescriptive regulations and conditions that require significant capital investment.
- Underdeveloped markets for recycled organics and a lack of customer awareness of the benefits of utilising recycled organics.

The reported strength of the recycled organics market varies across the sector, but there is wide recognition that the industry needs to work collaboratively on market development and customer education to realise its full potential (WAWA 2016).

Statistics on recycling of paper and paper products in WA

Over 225,000 tonnes of paper and cardboard was recovered in during 2014-15 (Figure 13). This comprised cardboard and paper packaging (76 per cent or 171,290t), old newsprint (20 per cent or 44,990t) and white office paper (4 per cent or 8,640t) (WAWA 2016).

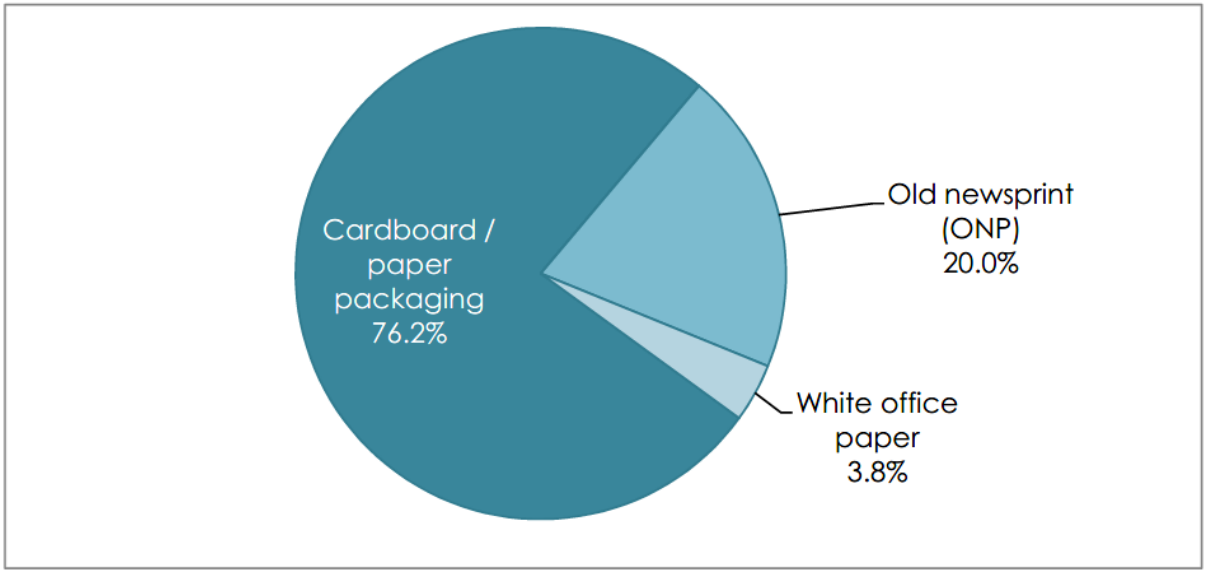

Figure 13: Western Australian 2014-15 composition of recycled paper and cardboard, by weight (WAWA 2016)

The paper and cardboard recycling industry report poor separation of materials, contamination and relatively high transport costs (particularly outside the metropolitan area) are barriers to increased recycling (WAWA 2016).

Challenges in increasing recycling levels for paper in WA

The proportion of paper recovered in Australia and in WA that has been exported to Chinahas grown substantially in the last ten years (ABS, 2013). Approximately 1.5 million tonnes of scrap paper and paperboard were exported in the 2017 calendar year (Australian Packaging Covenant Organisation, 2018). However, a recent ban by China on imports of low-grade waste has had an impact on export volumes to that country – during the first half of 2017, China and Hong Kong were the dominant markets for Australian exports of paper or paperboard (62.8 per cent by weight); during the second half of 2017 this fell to 45.3 per cent of paper or paperboard. This shortfall has been largely absorbed by other countries, though with substantial drops in prices (Australian Packaging Covenant Organisation, 2018). In the long-term industry analysts forecast that waste paper exports will again trend upward as more processing is undertaken in Australia before export (Pash, C. 2018).

WA recycling strategy

In November 2009, the environment ministers of the Australian, state and territory governments endorsed the National Waste Policy (Department of the Environment and Energy, 2010), which aims to reduce the amount of waste that is generated and disposed of

by industry and households. The policy includes strategies to increase the recycling of waste products.

The WA *Waste Strategy* contains five strategic objectives, one of which identifies a need to initiate and maintain long-term planning for recycling processing (WAWA 2018).

Indicator 6.2a Investment and expenditure in forest management

This indicator quantifies investment and expenditure in developing, maintaining, and obtaining goods and services from forests. It provides an indication of the long-term and short-term commitment to forest management, further processing and other forest uses.

Sustainable forest management is an evolving process and the manner in which it is conducted changes over time based on scientific information, policy and the needs and aspirations of the community. The NFPS provided a framework that integrated environmental, social and commercial objectives to seek a balanced outcome for all forest uses. This facilitates a cooperative vision for sustainable management of Australia's forests. The NFPS laid the foundation for the creation of the RFAs. The CRA of the environment, heritage, social and economic uses and values of the forests informed how the forests were to be managed, based on their respective values within the RFA region.

Ecologically sustainable forest management in WA seeks to provide social and economic benefits to the community from the use of forests, including recreation, while considering the impact on the biological diversity and health of these forests. For the purposes of this indicator the description of forest management will be largely confined to the public forest estate.

Expenditure in forest management

Expenditure in forest management is predominantly undertaken by two state government agencies.

The DBCA[8] works to ensure that WA's plants and animals and the lands (including State forests, conservation parks and nature reserves) and water under its care are managed appropriately for a range of environmental and economic values, including those derived from recreation, tourism, water and wood production.

The FPC is the government trading enterprise responsible for the sale of forest products and development of Western Australia's forest products industry, derived from native forest, plantation and sandalwood products on land owned or leased by the state.

Table 29: Expenditure on forest management, Western Australia, 2011-12 to 2015-16 ($ million) provides an indication of the annual expenditure on forest management for a recent five-year period, by DEC, DPaW and the FPC. Total expenditure by DEC increased to $56 million in 2012–13, and by DPaW increased to $62.7 million in 2014–15. The total expenditure on forest management by FPC, including the sustainable management of timber resources, was about $73 million annually over this five-year period.

[8] Before 1 July 2013, DBCA was the Department of Environment and Conservation (DEC). For the period 1 July 2013 – June 30 2017 DBCA was the Department of Parks and Wildlife (DPaW).

Table 29: Expenditure on forest management, Western Australia, 2011-12 to 2015-16 ($ million)

Activity	2011–12	2012–13	2013–14	2014–15	2015–16
Forest management (DEC)	53.6	55.9	n.a.	n.a.	n.a.
Forest management (DPaW)[a]	n.a.	n.a.	58.2	62.7	8.9
Forest management (FPC)	73.9	74.0	70.9	72.2	73.1

n.a., not applicable

[a] Values for 2013-14 and 2014-15 relate to expenditure by the agency's 'Forest Management Service'. The value for 2015-16 relates only to expenditure by the agency's 'Forest Management Plan Implementation Service' and cannot be compared with previous years.

Note: Changes in operational service areas between 2012–13 (DEC) and 2013-14 (DPaW) means that forest management expenditure between these agencies may not be comparable.

Source: DEC 2012, 2013; DPaW 2014, 2015, 2016; FPC 2012, 2013, 2014, 2015, 2016.

Indicator 6.2b Investment in research, development, extension and use of new and improved technologies

Table 30: Business R&D expenditure in the forest and wood products sector, and proportion of total business R&D expenditure, 2005-06 to 2010-11

Sector / Parameter	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2013-14	2015-16
Forestry and logging ($ million)	15.6	20.1	22.0	26.0	37.6	33.2	25.8	21.8	12.9
Wood product manufacturing ($ million)	76.3	55.2	51.3	57.1	57.5	62.4	38.2	20.8[a]	—
Pulp, paper and converted paper product manufacturing ($ million)	72.2	70.7	71.1	53.8	—	—	48.3	43.3	70.1
Total research expenditure in forestry ($ million)	164	146	144	137	—	—	112.3	85.9	—
Total business expenditure in Australia ($ million)	10,434	12,639	15,047	17,264	16,685	17,880	—	—	—
Proportion of expenditure that is forestry expenditure (%)	1.6	1.2	1.0	0.8	—	—	—	—	—

— = not available

Note: Totals may not tally due to rounding.

Data from the ABS 'Survey of R&D, Businesses' as compiled for *Australia's State of the Forests Report 2018* (in preparation).and ABARES, 2013

The ABS survey is a biennial survey, with the change to the collection frequency from annual to biennial being made after the 2011–12 survey. Data on research and development on wood product manufacturing is not requested in every survey, and only partial data on R&D expenditure are available from the ABS for some years.

[a] This value is reported by ABS to have a relative standard error of 25–50% and thus to be used with caution.

National trends in research and development expenditure for the forest and wood product sectors are presented in Table 30. The FPC continues to seek investment and access to markets for other bole volume, new technologies and processes to reduce production costs, and undertake trials of suitability for various engineered wood products.

In recent years there has been significant local industry investment to improve efficiency and introduce new technologies, including the 2016 consolidation of Auswest's sawmills at the Greenbushes site. Auswest recommissed the small log line, built a new large log line and installed a multi-sensor log scanner to improve sawn recovery rates, processing speed and value. This technology, while commonplace in the softwood industry, is reported to be the first of its kind to be used in native forest timber mills in Australia.

Harvesting contractors continued to invest by updating harvesting and transport equipment to ensure efficiency and state-of-the-art optimising technology. With each piece of equipment estimated to cost on average $500,000-$600,000 the industry annually spends ~$3-4 million on equipment purchases and maintenance.

The FPC and DBCA continue to support and encourage private forestry initiatives through participation in workshops and field days, and providing information and practical, on-ground assistance to farmers on integrated farm planning, species selection, plantation establishment and silviculture.

Trends in Research and Development

A significant amount of forest ecology research was undertaken prior to the signing of the WA RFA as part of the CRA process, covering specific forest flora, fauna and impacts on forest condition of fire and climate change.

The WA RFA (Appendix 11) identified that the major priorities at that time for future research in WA would be:

- description and documentation of biological diversity
- protection and conservation of biodiversity
- sustainable utilisation of natural resources
- the development of tree crops as integral, multiple purpose components of sustainable land management systems.

Research priorities since the signing of the WA RFA have been articulated for native forests in FMPs 2004-13 and 2014-23, and have remained broadly consistent with the priorities identified in the RFA. Priority research areas have included monitoring of the effects of timber harvesting and silvicultural treatments on fauna and flora, description and documentation of biological diversity through survey and monitoring programs, research into the behaviour and ecological effects of fire, and hydrological studies to quantify changes in streamflow and groundwater associated with timber harvesting and a drying climate.

Research has been managed through a series of science strategic plans that have been updated periodically to reflect changes in agency structural arrangements and resourcing levels. Accountability is provided through annual reporting of activities and outcomes at the

individual project level[9]. Incorporation of tree crops as integral, multiple purpose components of sustainable land management systems was addressed through the WA Government State Salinity Strategy (2000) which directed research and management actions in targeted natural diversity recovery catchments and water resource recovery catchments.

Forest and Wood Products Australia (FWPA) was established in 2007 as a not-for-profit industry services company (rural development company) that provides national, integrated research and development services to the Australian forest and wood products industry. It replaced the Forest and Wood Products Research and Development Corporation. FWPA promotes joint research and development (R&D) projects, which continue to be a feature of R&D activity. The forest and wood products forum in 2014–15 initiated a process of strategy development designed to ensure that R&D meets the future needs of the forest and wood products sector and the Australian public. WA was a core partner in the development of many of these strategies. They were compiled on the basis of extensive stakeholder consultation with representatives of the forest and wood products sector, government, and the providers and funders of forest and wood product R&D. Industry levies are matched by a Commonwealth contribution and are allocated by FWPA to R&D priorities for industry development.

In addition to these developments, the Cooperative Research Centres (CRC) for Forestry began operating in late 2005, following the conclusion of operations of the CRC for Sustainable Production Forestry (1997-2005).

Resource allocation for conservation forest science research priorities is generally funded by state-based agencies with specific and targeted interests

There were investments in new processing technologies and consolidation of operations to improve operational efficiencies of the wood products industry, and employment and social benefits that flow from this.

The genetics program undertaken by the FPC, in collaboration with the Southern Tree Breeding Association, is the major breeding program for radiata pine (*Pinus radiata*). The FPC's commercial nursery at Manjimup comprises 226 hectares and is capable of producing approximately 45 million seedlings and cuttings each year. The nursery manages the:

- genetic improvement program for radiata pine
- deployment of improved genetics for the FPC's plantations program
- commercial production and sale of tree seedlings for native and plantation forests
- sale and deployment of native and genetically improved seed (dieback resistant, salt tolerant, low rainfall dependency).

Investment by the FPC and industry

Existing businesses have invested in upgrading facilities to improve operational efficiencies. This includes investment in chipping technology to recover lower grade timber and improve sawing technology for logs with sweep. Trials into peeling of regrowth karri and jarrah have also been conducted, resulting in one customer routinely using karri in laminated veneer lumber.

[9] Annual Research Activity Reports can be found at https://www.dpaw.wa.gov.au/about-us/science-and-research/76-publications-and-resources/105-plans-and-reports

The FPC continues to work on enhancing opportunities for further growth and development of wood-based industries and regional communities. The focus with industry groups is to achieve greater value from the wood available through optimising harvesting and primary conversion processes. A reduction in the size and quality of logs sourced from some native forest areas has stimulated work on maximising the recovery of products within logs through improved selection and segregation in the field, distribution logistics and enhancements to harvest planning processes.

The FPC has also contributed to associations involved with research across Australia such as FWPA including programs to optimise transport, assess wood quality and utilise lower grade resource. The FPC is also a member of the Forest Industry Federation of Western Australia, FWPA and the Australian Forest Products Association.

Summary and future management of economic values

The WA RFA has and will continue to support the WA forest industry so that it has a strong and sustainable future and to provide additional certainty to industry and the community into the future. The WA RFA seeks to maintain a stable regulatory and investment environment, that will assist in providing for socio-economic stability and opportunities for additional competition, productivity increase and market growth.

Native forest available for wood production

The net area available for harvesting has decreased by 243,770 hectares since the commencement of the WA RFA (from 27 to 22 percent of the RFA area). A large part of this reduction was a result of the *Protecting our Old-growth Forests* policy and the introduction of further informal reserves and FHZs. The area of native forest harvested each year has also been declining since the establishment of the RFA due to changing policy settings and the contraction of the net available area (which has contributed to lower sustained yields). For the duration of the WA RFA the annual area harvested has always remained below 1.5 per cent of the area available for wood production.

While the sustained yield of sawlogs has remained comparatively stable for each of the FMPs (2004-2013; 2014-2023) there has been a progressive reduction in the availability of larger log sizes and an increase in the proportion of regrowth forests contributing to supply. These factors have impacted on the annual area cutover and the costs of production, with corresponding adjustments by industry during the period of the RFA.

Age class and growing stock of plantations

Since 1999, significant areas of plantation have been replaced with other land uses such as basic raw material quarries and roads. Bushfires have also impacted plantations. The WA Government has made recent significant investment in softwood plantations on public and private lands to support regional development and consolidate future resource security.

Annual removal of wood products compared to the level determined to be sustainable

The sustained yield is the estimated volume of wood that can be removed each year while ensuring the overall maintenance of functions within native forest systems. The sustained yield in the WA RFA region has declined from 704,000 cubic metres per year prior to the RFA, to 510,000 cubic metres per year at the time of the RFA and 185,000 cubic metres in 2004. Reductions since the RFA was established were largely due to the implementation of the

Protecting our Old-growth Forests policy and the consequent reduction in high yielding forest areas available for timber production. WA will continue to review and determine sustained yields, and will report on harvest levels against the determined sustained yields through agency Annual Reports, the FMP and five-yearly RFA reviews.

The supply of plantation wood fluctuates due to a range of supply and demand issues. These fluctuations can be due to customers requesting lower amounts than contracted, market cycles, the need to respond to salvage areas after storms or bushfires, export market demand and even machinery breakdowns. WA will continue to implement measures to expand the plantation estate to ensure stable long-term supply of products.

Annual removal of non-wood products compared to the level determined to be sustainable

There is limited data on the production of non-wood forest products. One of the important non-wood products fromnative forest areas in the RFA region is honey, and continued availability of apiary sites (in line with DBCA policies) is considered in the proposed extension of the WA RFA. The bauxite mining industry is also heavily reliant on access to forest areas within the RFA region for mining of bauxite and other minerals, and leases under State Agreement Acts ensure access will be maintained. The WA Government will continue to facilitate access to forests for non-wood products, where these are compatible with the FMP and RFA framework.

The area of native forest and plantation harvested and regenerated

Effective regeneration of harvested native forest is an essential element of sustainable forest management. The FMP requires proponents harvesting native forest to undertake regeneration operations (where regeneration is the silvicultural objective) and sets timelines and targets for regeneration effectiveness. Since 2001, virtually allnative forests have been successfully regenerated. However, delays in the scheduled silvicultural burning program have meant that some areas of jarrah forest were not treated within target timeframes. The 'Enhanced Prescribed Burning Program' commenced by DBCA in 2015-16 has substantially reduced the backlog of areas requiring regeneration. Western Australia will continue to monitor and report on the success of regeneration in native forests on public land, and take remedial action where deficiencies are identified in line with the silviculture guidelines and procedures.

Re-establishment of plantation forests following final harvest is important to ensure an ongoing supply of plantation wood. Replanting and expansion of plantation areas within the RFA region will continue, with routine monitoring of establishment success one year after planting. If survival rates are low, failed areas will be replanted to ensure the site is fully stocked.

Value and volume of wood and wood products

In 1998 the estimated annual gross value of production of the combined hardwood and softwood sectors of timber and wood based products valued up to the point of first sale was estimated to be around $400 million (Commonwealth of Australia and the State of Western Australia, 1998a). The total value of logs harvested from native forests has decreased over time, primarily due to decreased volumes being harvested, while the value of logs from hardwood plantation has increased in line with harvest volume increases. The value of logs harvested from softwood plantation has remained relatively stable. The value and volume of

native forest production is likely to continue as larger volumes of regrowth karri become available over time, and the softwood plantation estate expands.

A detailed study of the socio-economic impacts of the forestry industry (Schirmer *et al.* 2017) found that in 2015-16, the direct value of outputs generated by the WA forestry industry at the point of sale of primary processed products was $649 million, increasing to $1.4 billion when flow-on effects generated in other industries is included

This total included $220 million dependent on native forests, $617 million dependent on softwood plantation and $568 million dependent on hardwood plantations. In 2015-16, the forestry industry directly contributed around $257 million to Gross Regional Product (GRP) in WA, and a total of $643 million once flow-on effects through the entire economy were included. This total included $104 million dependent on native forests, $274 million dependent on softwood plantation and $265 million dependent on hardwood plantations. The contributions to total GRP by region were $162 million in the Great Southern and Esperance, $327 million in the South West and $26 million in the Wheatbelt, with the remainder in Perth or other parts of WA. (Schirmer *et al.* 2017).

The volume of wood products harvested from native forests in Western Australia has decreased significantly since the signing of the WA RFA. Between 1999 and 2009, additions to the reserve system reduced the available sawlog volume by 54 per cent for jarrah and 70 per cent for karri relative to the original agreed figures in Clause 75 of the WA RFA. Between 2006 and 2016, volumes of logs harvested remained relatively stable, however the log volumes produced from native forest has decreased while production from hardwood plantations has increased. Wood production from softwood plantations has remained stable.

The volume of sawlog products extracted is anticipated to remain relatively constant into the future. The volume of other bole volume is expected to increase, as higher value markets are found for this material. Removal of other bole volume will enhance regeneration and provide forest health benefits. Greater removal of other bole volume is a key recommendation of the draft FMP 2014-2023 mid-term review.

It is expected that the long-term productive capacity of the forests in the RFA region will be affected by higher atmospheric carbon dioxide concentrations and associated drier and warmer conditions as a result of climate change. DBCA have incorporated consideration of climate change into sustained yield calculations by modelling a high severity climate change scenario in calculations. WA will seek to sustain the productive capacity of forest ecosystems and plantations as they adapt to climate change.

Values, quantities and use of non-wood forest products

Monitoring the supply and sale of non-wood products from forests helps forest managers understand the extent to which forests remain an important multiple-use resource, supplying products sought by the community.

Within the RFA region potable water from managed catchments, and water supplies for irrigation and industrial uses are a major product from the native forests. There are also substantial mining enterprises operating in the forest areas, including mining for bauxite, gold, lithium/ tantalum and coal. Throughout the period of the RFA the mining industry has been a major contributor to the economic wealth and prosperity of the south-west, and this is expected to continue, due to the range and high demand for minerals extracted in the region.

Honey and bee products are an expanding industry in WA. Bee products from the region are reputed to be among the best in the world, with the RFA region noted for the absence of bee diseases. Jarrah honey also has one of the highest levels of anti-microbial activity, and recent increases in the export price of honey has increased the value of apiary sites. The high level of export demand is expected to continue in the future.

The RFA area also accommodates over 40 leases and licences for telecommunication facilities, plus 216 general leases and licences for purposes including grazing, recreation, tourism, dam sites, rubbish disposal, sawmills and basic raw materials. The issuing of licences will continue to be considered on a case by case basis and assessed in line with relevant legislation, policies and agreements, including the WA RFA.

Value of forest based services

Forest based services include ecosystem services, carbon credits, salinity mitigation and ecotourism. Forest based services provide economic value and contribute to forest sustainability by providing social and environmental benefit.

The level of understanding about the role of forests in carbon storage is high and increasing, with surveys indicating 71 per cent of people acknowledge that carbon is stored in wood even after the tree is harvested. The provision and importance of forest based services is expected to grow as these benefits become better measured and more highly valued.

Production and consumption and import/export of wood, wood products and non-wood products

Australia is a net importer of wood and wood products, and is expected to remain so under current policy and market conditions. Changes in the future to export markets may change the value and volume of wood exported or imported from overseas. The expansion of the plantation estate is planned to ensure that there is a continuing softwood resource and that industries dependent on this resource are not solely exposed to imports and market fluctuations.

Information on the production, consumption and trade of non-wood forest products is often difficult to obtain because of the generally small size of industries based on these products and their dispersed nature. Non-wood forest products can include honey, flowers, minerals, and bark.

It is expected that the long-term productive capacity of the forests in the RFA region will be affected by higher atmospheric carbon dioxide concentrations and associated drier and warmer conditions as a result of climate change. DBCA have incorporated consideration of climate change into sustained yield calculations by modelling a high severity climate change scenario in calculations. Western Australia seek to sustain the productive capacity of forest ecosystems and plantations as they adapt to climate change.

The projected increase in bushfire frequency, intensity and scale and prolonged droughts will also influence the productive capacity of forests into the future. It is likely that the comparative mix of products from forests in the WA RFA region will also change overtime. The size and quality of sawlogs produced has already changed significantly as a result of the level of reservation introduced since 1999, with a greater and ongoing shift to reliance on regrowth forests and a higher proportion of smaller, lower quality stems.

Degree of recycling of forest products

As global demand for forest products increase, there is a growing need to meet societal demands for recycling of forest products. The Hazelmere Recycling Centre which is managed by the Eastern Metropolitan Regional Council is the major timber recycling facility in the Perth and Peel regions. The centre accepts untreated timbers which are sorted, ground and screened to produce bedding for the poultry industry, particle board, compost, wood chips and mulch. There are also smaller-scale businesses that salvage and reuse timber (e.g. reclaiming timber for floor boards and decking, reuse of wooden pallets). Wood/timber waste is a significant contributor to the total organic waste for Western Australia, contributing to 14.9 per cent of total recovered organics. In excess of 225,000 tonnes of paper and cardboard was recovered in Western Australia during 2014-15. There are opportunities for recycling of forest products to play a large role in the future of waste and forest management in the state, including in energy generated from biomass. Western Australia have endorsed the National Waste Policy to increase the recycling of waste products.

Investment and expenditure in forest management

DBCA works to ensure that Western Australia's plants and animals and the lands and water under its care are managed appropriately for tourism, water and wood production. FPC is a statutory authority responsible for the sustainable management and development of Western Australia's forest products industry, using native forest, plantation and sandalwood products on land owned or leased by the state.

Investment in research, development, extension and use of new and improved technologies

A significant amount of forest ecology research was undertaken prior to the signing of the WA RFA as part of the CRA process, covering specific forest flora, fauna and impacts on forest ecology such as fire and climate change. Research priorities since the signing of the WA RFA have been articulated in the FMP and remained broadly consistent with the priorities identified in the RFA.

DBCA priority research areas include monitoring of the effects of timber harvesting and silvicultural treatments on fauna and flora, description and documentation of biological diversity through survey and monitoring programs, research into the behaviour and ecological effects of fire, and hydrological studies to quantify changes in streamflow and groundwater associated with timber harvesting and a drying climate. FPC focus on seeking investment and access to markets for other bole volume, new technologies and processes to reduce production costs, and undertake trials of suitability for various engineered wood products. Industry have invested in improving efficiency and new technology to improve recovery rates, processing speed and value. FPC and DBCA support and encourage private forestry initiatives through a range of measures. Western Australia has also partnered in research conducted by FWPA and the CRC for Forestry.

Section 4: Social Values

Indicators in this section illustrate the extent to which Western Australian forests contribute to local and state economies, benefit personal and community wellbeing, and support cultural values. Socio-economic data are important measures of the monetary and non-monetary value and benefits of forests to society. In addition, local communities, especially Indigenous communities, have strong social, spiritual and cultural attachments to forests, whether for traditional needs, provision of wood and non-wood forest products and other benefits, direct and indirect employment, or active and passive recreation.

Social values include:

- Production and consumption
- Investment
- Tourism and recreation
- Cultural, spiritual and social values
- Employment, worker welfare, and community resilience.

This section includes analysis of the following Montréal Indicators:

- Indicator 6.3.a – Area of forest available for general recreation/tourism
- Indicator 6.3.b – Range and use of recreational/tourism activities available
- Indicator 6.4.b – Registered places of non-indigenous cultural values in forests that are formally managed to protect those values
- Indicator 6.4.d – The importance of forests to people
- Indicator 6.5.a – Direct and indirect employment in the forest sector
- Indicator 6.5.b – Wage rates and injury rates within the forest sector
- Indicator 6.5.c – Resilience of forest dependent communities to changing social and economic conditions.

Indicator 6.3a Area of forest available for public recreation and tourism

This indicator measures the area of forest available for use by the community for recreation and tourism purposes. This provides an indication of the emphasis placed by society on the management of forest for recreation and tourism.

Analysing the area and proportion of forests available for recreation and tourism assists in understanding the emphasis placed by society on managing forests for recreation and tourism uses, and the extent to which forest management is providing for the recreational needs of local and regional communities. An area of forest is considered to be available for recreation and tourism if there is no formal prohibition on access for recreation and tourism activities.

At June 2018, a total of 1.39 million hectares of forested ecosystems in multiple-use forest (State forests) and conservation reserves were available for recreation and tourism within the RFA region. This is an increase of approximately 56,900 hectares since the signing of the WA RFA in 1999. There is a perception among some stakeholders that State forests do not provide adequate support for recreation (Wilkinson 2017).

Indicator 6.3b Range and use of recreation/ tourism activities available

This indicator assesses the range and number of recreation and tourism facilities provided in forests, their level of use and their contribution to the broader tourism sector. Appropriate and well managed facilities help to optimise visitor satisfaction as well as minimising environmental impacts associated with recreation and tourism.

A range of recreation and tourism activities and facilities may be made available in public forests, and the frequency of their use may vary widely. Activities may be provided for at a specific location or localities, such as campgrounds or self-guided forest drives, or be generally allowed without being related to a specific site, including scenic touring and swimming. Likewise, facilities may be provided to directly meet the needs of tourists and visitors (i.e. picnic facilities, toilets, BBQs, walking and riding tracks), or indirectly support recreational uses alongside other management value (i.e. roads).

WA continues to provide significant funding for tourism and recreation, much of which has been invested in programs and facilities to support the use of national parks created under the FMP 2004–2013 (Wilkinson, 2017). There has been $53 million capital investment over the past 10 years in visitor experiences and recreation assets. Working closely with Aboriginal partners and stakeholders, DBCA has ensured that visitors and local community enjoy parks safely whilst protecting conservation and heritage values. New and improved recreation facilities have included campgrounds, day-use areas, walking trails and mountain bike trail networks. Investment in these facilities to a high quality enables DBCA to protect the environment and enrich visitor experiences by providing opportunities to learn, explore and interact with the natural and cultural environment. There has been a focus on caravan and camping over the past 5 years which has significantly improved visitor experience in forest areas. This included major new and improved campgrounds at Jarrahdene near Margaret River, Potters Gorge near Collie and Shannon near Pemberton.

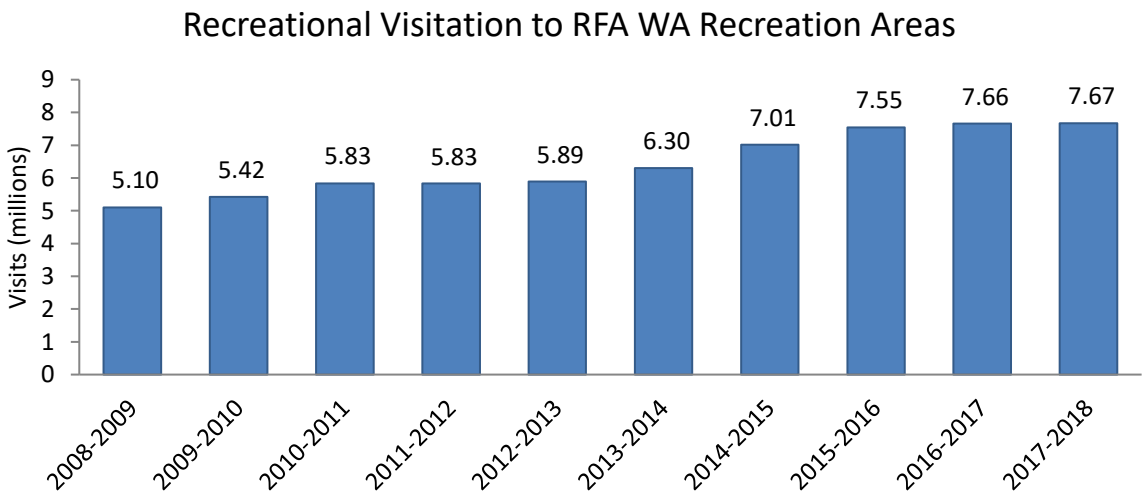

Figure 14: Recreational visitation to WA RFA recreation areas, 2008-2018

Recreational visitation to the managed area has increased on a trend similar to population growth over the last 10 years from 5.1 million visits in 2008 to 7.67 million in 2018 (Figure 14). However, a proportion of the change demonstrated has been due to improvements in monitoring over time and cannot be solely attributed to actual visitation change. Demand for

the use of land for recreation and tourism is expected to grow in line with population growth in the south-west and the need to balance enjoyable visitor experience with conservation and other values will remain an important management challenge.

Figure 15: Average visitor satisfaction in WA RFA recreation areas 2013-2018

Average visitor satisfaction has experienced a significant improvement over the last five years (Figure 15). The timing appears to coincide with the completion of a suite of recreational infrastructure improvements (Figures 16-18).

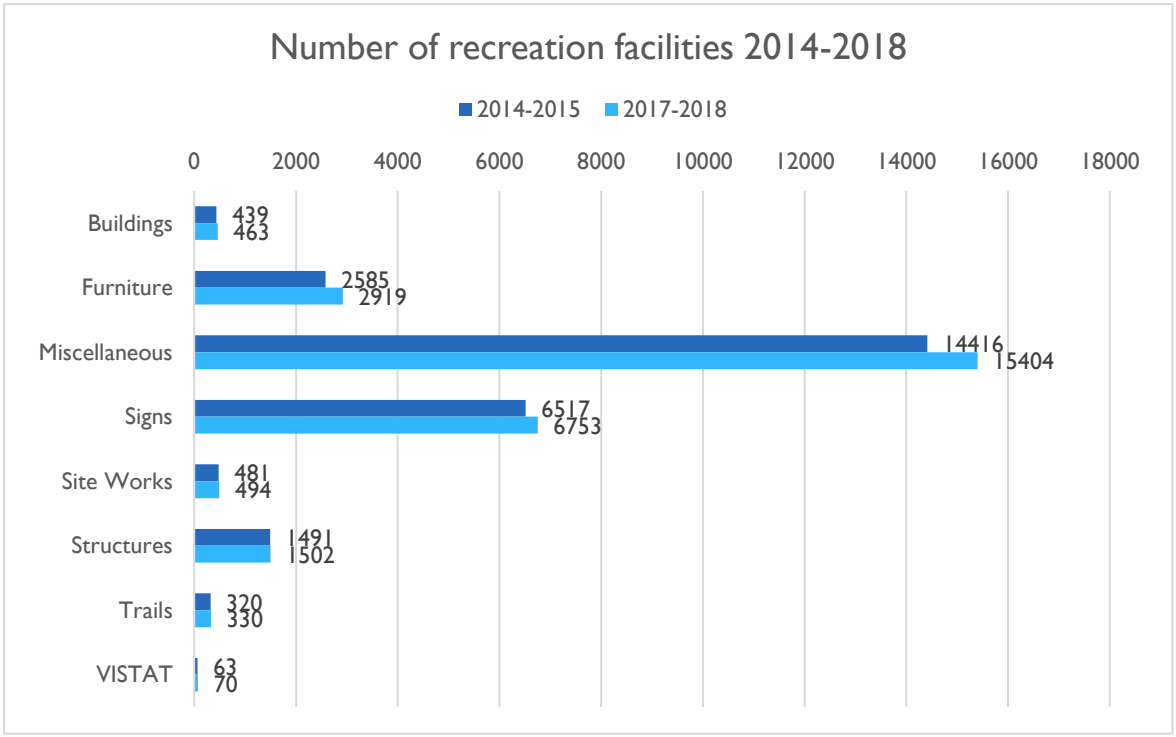

Figure 16: Number of recreation facilities 2014-2018

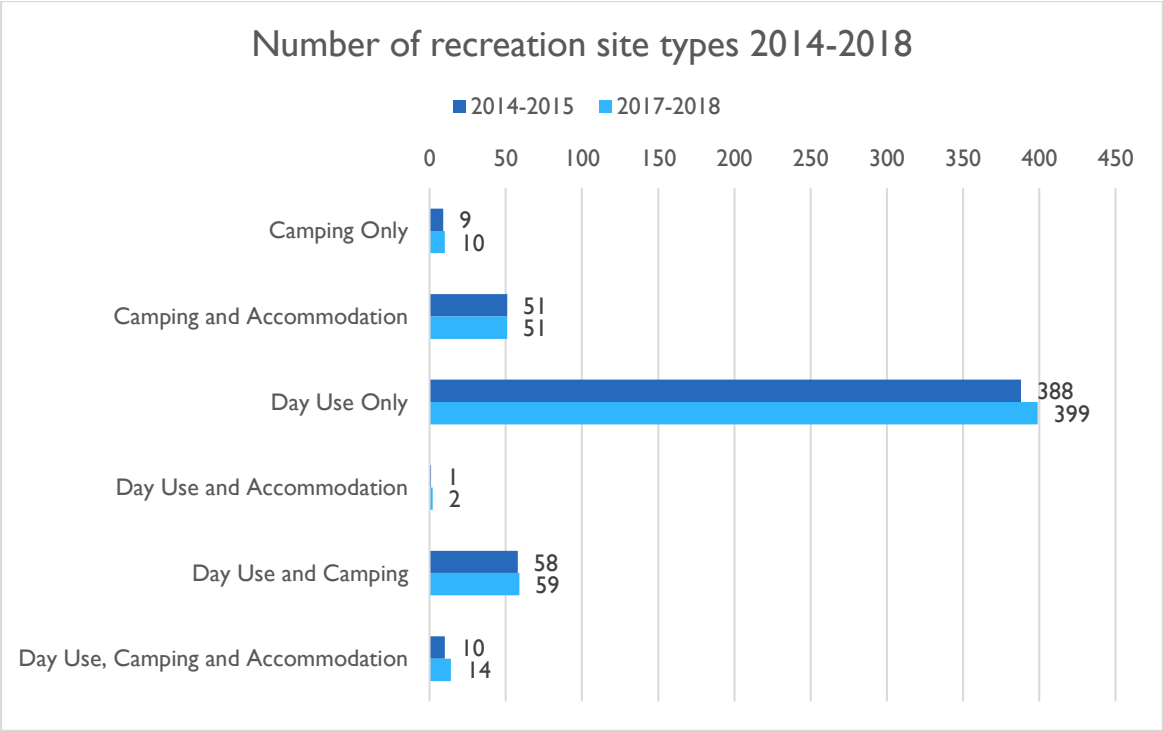

Figure 17: Number of recreation site types 2014-2018

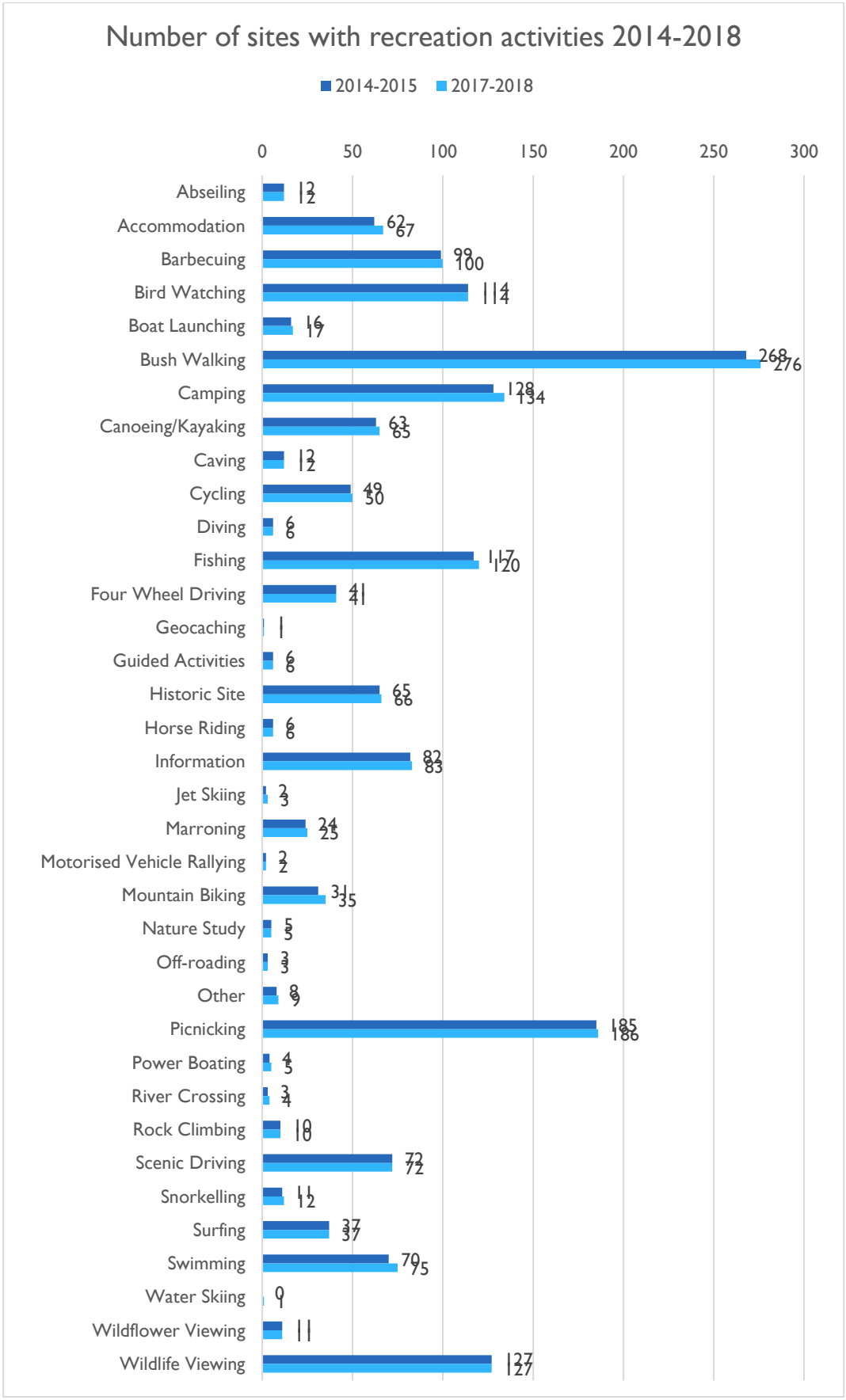

Figure 18: Number of sites with a range of recreational activities 2014-2018

Reporting methodologies used for recreation infrastructure have changed over the last few years. For small items such as park furniture, signs and miscellaneous assets, the quantity of assets are now reported rather than the numbers of rows in the database table which previously grouped these items. Assets considered to be non-recreation assets, such as work sheds, residences and other management utilities, have been excluded from the report.

The data presented above are for recreation sites within the forest regions, including regional parks in the Perth Hills.

Western Australia is seeking to protect and maintain the range and quality of recreation and nature based tourism opportunities and experiences over time, and the associated physical and mental health benefits. Threats to these values include:

- Degradation of natural areas, assets and facilities that support recreation and tourism
- Inadequate planning, leading to conflicts with other land uses or activities and/or recreation and tourism opportunities not matched to community demand.
- Poor design of assets and facilities leading to user dissatisfaction or safety risks.
- Inappropriate behaviour affecting the enjoyment of others, and inappropriate use of and/or wilful damage to facilities provided.
- Inappropriate fire regimes, including uncontrolled bushfires (Conservation Commission of Western Australia 2013).

DBCA manages the increasing demand for recreational activities on land managed by the Department through the issuing of leases, licences and permits for commercial tourism uses.

Studies of tourism activity in the south west indicates that there is no direct relationship between forest harvesting activities and tourism use. Recreation is not necessarily incompatible with timber harvesting, and in some cases facilitates it (e.g. firewood collection, 4WD use). The main impact of forestry activities is on tourism operators who access specific areas of forest on a regular basis.

On 7 December 2011 the WA ministers for Environment and Tourism announced the implementation of recommendations from a Nature Based Tourism Review. Outcomes include longer term leases and tourism licences in addition to communication, education and marketing initiatives with changes designed to provide greater certainty and flexibility while increasing accountability and delivering conservation and tourism outcomes (Tourism Western Australia, 2011).

Increasing populations in Perth and Bunbury are likely to increase demand for nature-based recreation in the RFA area. The WA Government continues to upgrade recreation facilities, including walking tracks, camp grounds and off-road vehicle areas. The government will also develop new and innovative ways to manage increases in visitation and meet the expectations of forest users.

Indicator 6.4d The importance of forests to people

Communities value the forests we depend on for the air we breathe and wood that we use in every day life. This indicator measures the range of attitudinal values that communities and individuals place on their forests. The importance of forests to society is exemplified through the value that people place on biodiversity, clean air and water, social equity or simply the knowledge that Australia's forests exist.

Management of WA's forest estate provides a range of benefits to society, based on the environmental, social and economic values within the forest estate. The current management approach reflects changes in community priorities and values over time, including a greater emphasis on conservation, while also developing a robust forest practices system to ensure sustainable supply of wood and non-wood forest products.

Forests are valued in the community for a range of attributes, from a source of inputs to processing facilities income and job security to broader values encompassing renewable resources, biodiversity, climate change mitigation, clean air and water.

In the wider Australian community, more than 40 per cent of the respondents to an Australia-wide series of surveys agreed with a survey statement that Australia's native forests were being managed sustainably (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee, 2013). The proportion of respondents who agreed that 'we should not be cutting down any trees for wood products' decreased between 2009 and 2012, and the proportion of respondents who agreed that 'we should use more wood because it is more environmentally friendly than alternative materials' increased.

The level of understanding about the role of forests in carbon storage is high and increasing. In 2012, more than 90 per cent of respondents to the same series of Australia-wide surveys agreed that trees absorb carbon dioxide (CO_2), and 71 per cent (up from 52 per cent in 2008) agreed that 'carbon is stored in wood, even after the tree is harvested'.

Volunteers make a strong connection and contribution to projects in the RFA area, providing 40,000 hours of work per year. Additionally, Eco Education opportunities attract 10,000-15,000 participants each year (Conservation Commission of Western Australia, 2012).

Studies on Social attitudes to forests

Within the WA RFA region there is a comprehensive system in place to take account of the competing demands on the forest estate. In particular, the planning process goes to considerable effort to ensure that timber harvesting operations are conducted in a manner that contributes to the maintenance of biodiversity values; both at the individual coupe scale and at the landscape level (as part of the mosaic of structural diversity, created by both anthropogenic impacts and natural disturbance regimes/ ecological processes) (Wilkinson 2017).

A detailed study of the socio-economic impacts of the forestry industry (Schirmer *et al.* 2017), published by the FWPA, was conducted by a team from the University of Canberra and Econsearch and provides evidence of the importance of the forest industry to the WA economy and regional communities. As well as research into the economic value, employment, workforce diversity and industry diversity and sustainability, the report addressed broader socio-economic effects of the forest industry in the communities in which it operates.

As part of the 2016 Regional Wellbeing Survey (University of Canberra 2017), residents living in communities across WA, including the South West, Great Southern and Esperance, and Wheatbelt regions, were asked about (i) their overall views about quality of life and liveability of their community, and (ii) the extent to which they felt the different industries that operated in their region affected different social and economic aspects of their lives. The report identified that that those living in regions with higher dependence on the forest industry are

just as or more likely to rate their community as highly liveable, friendly, safe and aesthetically pleasant as those living in nearby communities with less dependence on the forest industry.

The report (p9) also identified that plantations and native forests provide a base for other socio-economic activities that are valued by forest users including:

- bee keeping.
- livestock grazing,
- mountain biking
- bush walking
- four-wheel driving and dirt bike riding
- horse riding
- hunting
- conservation.

The report recognises that these activities generate important social and economic benefits, however does not attempt to quantify these benefits.

Public consultation

DBCA works with, and on behalf of, the people of Western Australia to protect and conserve the state's parks, wildlife, forests and other natural assets. Community participation is an important to the work and DBCA offers the public the chance to give feedback on many conservation and management issues. This feedback ensures that the DBCA is aware of community expectations and reflects and respond appropriately to this where it is consistent with desired management directions and outcomes.

Community participation and feedback is accepted through a range of opportunities, including formal legislated processes or liaising and partnering at regional and local levels.

In context of the WA RFA, the five-yearly reporting process involves public consultation on the implementation of the WA RFA. The public consultation provides an opportunity for the public to have their say and ask questions on the implementation of the WA RFA, and to liaise directly with government officials from the Australian and WA governments.

The CALM Act requires preparation of area management plans for conservation reserves, including the development of a FMP covering State forest and timber reserves. A crucial part of the preparation process for area management plans is the statutory public comment phase, which is set at a minimum of 2 months.

Preparation of FMPs involves wide-ranging public consultation. For example, the FMP 2014-2023 including consulting within government and across industry, conservation groups, local government and with Noongar representatives. The community could comment on the plan during a 12-week review period in accordance with the CALM Act and the EP Act. The environmental impact assessment of the plan also included an appeals process. Key milestones in the preparation of the plan were:

- An Environmental Scoping Document released as a part of the Environmental Protection Authority (EPA) environmental impact assessment process. The scoping document provided the community with an opportunity to comment on the key environmental issues that should be addressed in the plan.

- A 12-week statutory public comment period on the *Draft Forest Management Plan 2014-2023*, during which approximately 5,100 submissions were received.
- Consultation with Noongar people, which included: DBCA representatives attending meetings of the native title working parties representing the registered native title claim groups in the area of the plan; an intensive workshop for representatives of the native title groups to discuss the content of the *Draft Forest Management Plan 2014-2023* and prepare a submission; and a meeting to discuss appropriate mechanisms for ongoing consultation to conserve and protect Noongar cultural and heritage value.
- Assessment of the *Proposed Forest Management Plan 2014-2023* by the EPA.

The FMP 2014-2023 also required preparation of a mid-term performance review which was released by the CPC for a 6-week public comment period.

Input on species recovery plans is sought from key stakeholders who will be involved in implementing these plans, and the public is able to nominate species to be considered for protection. The new BC Act introduces a broader consultation process for species recovery plans, which will complement the process outlined in the EPBC Act. The Act also introduced biodiversity management programmes meant to provide a strategic framework, linking legislated and policy instruments to best achieve the desired outcome of conservation or sustainable use of biodiversity. While preparing a BMP consultation may be carried out with any other person or organisation likely to be affected in a material way by the programme.

In undertaking it management responsibilities in invasive species control or prescribed burning DBCA will carry out work with consideration to its Good Neighbour policy. Also, acknowledging that the conduct of prescribing burning can have a material effect on the lucrative wine industry in the State's south-west, DBCA consults with WA wine growers in planning the prescribed burn plan. This consultation will be extended to the bee industry.

The FPC releases the annual timber harvest plan for six-week public comment. As part of coupe level planning, the FPC carries out consultation with neighbouring land manager neighbouring proposed harvest operations.

Western Australia intends to maintain this degree of public consultation and participation, either through formal legislation/statutory requirements, policy initiative or in response to community expectations.

Indicator 6.5b Wage rates and injury rates within the forest sector

This indicator measures the level of wage and injury rates in the forest sector. A sustainable industry will ensure high levels of workforce health and welfare and wage rates comparable with national averages for other occupations.

Wage rates

Individuals aged 65 and under typically receive the majority of their income from a salary or wages earned from a job. Information on wage rates in the forest sector contributes to an understanding of employment opportunities in the sector and the contribution it makes to the economy.

Knowing about industry wage rates is also important to employers including those who run commercial businesses. Earnings paid to employees typically represent a significant component of operating costs. Changes in wages can impact on the productivity of a business and its competitiveness in a global market. Changes in average earnings can also reflect the impact of the economic cycle on the labour market, or sectors within the labour market (Australian Bureau of Statistics, 2016).

How much an individual earns from wages and salaries and other sources (personal income) affects their well-being.

The national minimum wage is set at $719.20 per 38-hour week or $37,398.40 per year before tax (Fair Work Commission, 2018). Wage levels above the minimum wage provide individuals with more economic discretion. Individuals on higher wages have greater life choices than those on lower wages, including the opportunity to become financially secure more quickly.

WA forest industry workers in 2015-16 earned higher than average incomes than others employed in other industries, in the same regions (Schirmer *et al.* 2017). However, this was attributed to a higher portion of forest industry workers being employed full-time, and when full-time work was compared, forest industry workers are paid wages similar to the rest of the workforce (Schirmer *et al.* 2017).

In the WA forest industry, the largest direct expenditure is wages and salaries, with a total spend of $135.2 million in 2015-16 (Schirmer *et al.* 2017). Schirmer *et al.* (2017) found that the native forest sector in WA spends relatively more on wages ($1 in every $3.40 total expenditure) compared to the softwood plantation ($1 in every $3.80) and the hardwood plantation ($1 in every $4.80) sectors. Schirmer *et al.* (2017) also reported however that the native forest sector had the lowest total direct spending on wages, around $25 million, followed by hardwood ($46 million) and softwood ($65 million) sectors.

Injury rates

Work-related injuries have a wide-ranging impact at both an individual and macro-economic level. WA workers compensation injury statistics allow employers, workers, regulators and insurance and service providers to better understand and manage workplace health and safety risks. The FPC has a commitment to staff and contractor safety and conduct safety audits, review the occupational health and safety committee, safety training, quarterly contractor safety meetings and skills verification system.

Table 31: Forest Products Commission WA injury reporting from Annual Reports 2011-2017

Indicator	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Number of Fatalities	0	0	0	0	0	0^	0*
Lost time injury/ disease incident rate	6.25	3.95	3.55	0	1.27	0.59	0.56
Lost time injury severity rate	0	0	0	0	0	0	100

^Whilst there were no FPC employee fatalities to report for the 2016-17 year, there was a fatality of an FPC contractor's employee.
**While there were no FPC employee fatalities in the 2017-18 financial year, there was one fatality of an FPC contractor's employee. There was one lost time injury in 2017-18 but it was classified as severe.*
Sources: FPC 2017, 2015, 2013

Table 32: Forest Products Commission WA injury rate reporting from Annual Reports 2001-2010

Measure	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Number of Lost Time Injuries (LTIs)	7	3	2	2	5	6	8	3	4
Frequency rate (number of LTIs per 1 million hours worked)	NR	NR	NR	NR	NR	NR	14	5	8
Minor Treatment Incidents (MTIs)	NR	NR	NR	16	13	9	NR	NR	NR

Note: no safety/incident rates were recorded by FPC prior to 2001-02. The FPC Annual Reports reported on safety differently in different years.

Sources: FPC 2010, 2007, 2006, 2005, 2004, 2003

Indicator 6.5a Direct and indirect employment in the forest sector

This indicator measures the level of direct and indirect employment in the forest sector. Employment is an important measure of the contribution of forests to viable communities and the national economy.

The CRA process prior to the WA RFA identified that the regional economy in the south-west region of WA is becoming increasingly diverse and less dependent on the forest industry than traditionally. However, some towns in the WA RFA area are heavily dependent on the forest industry for employment. Key drivers to these changes are increasing centralisation, changes in attitudes to the environment (and consequently the forest industry), tourism, agriculture, mining and technological advancement.

Direct employment

The forestry and wood products industry

A detailed study of the socio-economic impacts of the forestry industry (Schirmer *et al.* 2017) showed that the industry generated 2,114 direct jobs up to the point of primary processing; the estimated flow-on employment generated was an additional 2,456 jobs. Secondary processing of timber provided a further 1,495 jobs meaning that the industry supports the employment of around 6,000 people, showing the importance of local processing facilities to generating regional economic activity from the industry.

The Schirmer report found that, 'overall, the number of jobs generated by the industry has declined significantly since 2006, although employment generated by hardwood plantations has grown. The majority of jobs generated by the industry are generated by the processing sector, as is the majority of the flow-on economic impact of the industry. This highlights the importance of local processing of wood and fibre for generation of jobs from the industry; fewer jobs are created if logs are harvested and exported with no or little processing'.

Non-wood forests products and services

As indicated previously, the forest sector produces many products and services other than forestry and wood products. These include; apiary, grazing, sand, rock and gravel extraction, telecommunication sites, and forest based tourism. Employment associated with the collection, processing and sale of these other products and services is classified by ABS in non-forestry categories that cannot be isolated.

Indirect employment

Like any economic activity, the forest sector creates indirect ('flow on') employment as a result of spending by forest sector businesses and workers.

Schirmer *et al.* (2017) calculated that 2,456 indirect jobs were generated in WA by the forest industry, primarily through the demand from the spending of wages and salaries by workers, plus the plantation industry demand for supplies, fuel and mechanical servicing. Up to the point of primary processing, modelling suggests that every direct job in the industry generates 2.2 indirect jobs in the region.

Many input–output studies have been undertaken to identify downstream impacts of the industry as a whole for a defined region, but this has still resulted in reasonably limited

coverage of different regions, and has rarely examined the downstream impacts of native forest and plantation related activities separately (Schirmer *et al.* 2008).

Census employment data for the accommodation and food and beverage service sector shows consistent growth within the RFA region, highlighting that opportunities may exist to create more employment in forest-based tourism and recreation.

Indicator 6.5c Resilience of forest dependent communities to changing social and economic conditions

This indicator provides a measure of the extent to which forest dependent communities are able to respond and adapt to change successfully. Resilient forest dependent communities will adapt to changing social and economic conditions, ensuring they remain viable into the future.

This indicator considers only the dependence of communities on the forest and wood products industries, and not on other forest activities or services such as tourism or grazing.

Community resilience in the WA RFA region

The WA forest industry has been a traditional driver for regional communities. WA's forest dependent communities faced a broad variety of change events during the WA RFA period, including local industry restructures, natural disasters, social conflict changing economic conditions and the impacts of policy decisions. Schirmer et al. (2017) found that those living in communities where the industry operates view these communities just as, or slightly more, liveable than those living in communities with little industry activity. Within the RFA area, there is a range of community dependence on the forest industries.

State-wide policy supports the local communities dependent on the FPC and forest industry through its buy local policies, the *Softwood Industry Strategy for Western Australia* (FPC 2016) and conditions of the contracts of sale of forest products.

The positive figures regarding the employment and social benefits from the forest industry are a combined result of industry confidence and investment in new processing technologies and consolidation of operations to improve operational efficiencies.

The FPC continues to work proactively with industry and the community facilitating a vibrant industry that makes a positive contribution to regional communities by:

- adopting policy settings that support increased value-adding and local processing of high value timber and other bole volume
- building on the strength of the industry as a manufacturer of locally grown timber;
- improving engagement with the community to promote greater understanding of the benefits brought by the industry to local communities
- ensuring that monitoring of the socio-economic impacts of the forest industry is continued.

The WA forest industry has undergone significant change since the implementation of the RFA as a result of the *Protecting our Old-growth Forests* policy that had the effect of reduced resource availability and a decrease in log size and quality. In response to these changes, and through improvements in manufacturing efficiency, there has been consolidation of processing infrastructure with the number of sawmills decreasing from 40 in 2001 to 17 in

2012. The sawmills that remain in the industry, particularly the larger mills, have invested in new equipment and value-adding technology to maximise value from the logs they receive. During the implementation of the *Protecting our Old-growth Forests* policy, a $161 million compensation and assistance program was developed, including a workers' assistance program of $27.3 million to assist workers made redundant as a result of the policy. There was delivery on initiatives to retool for value-adding at the Pemberton karri mill and a laminated veneer lumber plant in Donnybrook plus promotion of greater value adding (URS 2012)

Training/ skills development.

Most of the jobs in the WA forest industry are in only a few local government areas, namely Albany, Bunbury and Manjimup. The local government areas with the highest proportion of forest industry employment are Nannup, Manjimup and Bridgetown-Greenbushes where employment is highly dependent on the native forest sector, with fewer jobs generated by plantations.

It has been recognised that the development of skills and training to specifically support the forest industry is required in the south west. This was recognised as part of the *Protecting our Old-growth Forests* election commitment which promised to create 100 new jobs in forest management, 30 new jobs in a jarrah and karri regrowth thinning program and 850 new direct jobs in the plantation industry. URS in 2012 reported that these commitments were not delivered.

The policy recognised the potential benefits of establishing a TAFE course in Forest Management and Silviculture in Manjimup, an Environmental Science degree at ECU Bunbury to include forest management, silviculture and wood technology and Dwellingup and Harvey centres for tertiary units value adding, kiln drying and fine wood preparation.

FPC in partnership with FIFWA will begin to implement a specialised skills verification system in 2018-19, which will allow them, and FPC contractors, to manage and assess staff and employee competency and training for their individual roles. This is one example of how the industry identifies and addresses the training needs of its workforce.

WA RFA extension consultation

Stakeholders were provided with two opportunities to comment on the extension of the WA RFA.

The first opportunity was provided as part of the public comment period of the third five yearly review of the WA RFA. During a 6-week period between 1 November 2016 and 13 January 2017, stakeholders and the public were invited to have their say on issues relevant to the ongoing implementation and potential extension of the WA RFA. 12 submissions were received and considered by the Independent reviewer in his report to the Parties.

Stakeholders were provided with a second opportunity to provide feedback on the RFA extension in October 2018. Key stakeholders were contacted and invited to participate in a series of targeted stakeholder engagement meetings run over four days from 17 to 19 October 2018 and on 7 November 2018.

Summary and future management of social values

Since the signing of the WA RFA in 1999 there has been an increase of 59,600 hectares of area available for recreation and tourism in the WA RFA region, to be 1.39 million hectares in State forests and reserves. This access will be maintained or enhanced under an extended WA RFA.

WA continues to provide significant funding for tourism and recreation, much of which has been invested in programs and facilities to support the use of national parks created under the FMP 2004-2013 (Wilkinson 2017). There has been significant investment of $53 million in capital funds to develop visitor experiences and recreation assets over the past 10 years. This has included new and improved campgrounds, walking and mountain bike trails, and day use areas. The investment over the past five years has coincided with an increase in visitation to native forest sites within the RFA region and improvements in visitor experience.

A management challenge expected to continue in the WA RFA region into the future is balancing conservation and other values with the expected growth in demand for an enjoyable visitor experience, particularly as the populations of Perth and Bunbury grow. The WA Government will continue to upgrade recreation facilities, as well as develop new and innovative ways to manage increases in visitation and meet the expectations of forest users.

Importance of forests to people

Both regional and urban communities value forests for their biodiversity, cultural values, wood products and water. Communities also benefit from employment and economic activity in the forests through the forestry industry and other compatible industries such as forest-based tourism, recreation and beekeeping businesses. The importance of forests to the heritage and culture of the Noongar community has been recognised in the CALM Act and the SWNT Settlement process. This recognition is expected to expand during an extended RFA as joint management of some conservation reserves and increased opportunities for economic development are realised. The WA FMS and WA RFA include opportunities for ongoing public consultation that will allow people to continue to communicate the relative importance of different forest values and the preferred balance between those values.

The capacity for forests and forest products to store carbon is increasingly valuedby the community, particularly as the impacts of a warmer, drier climate increasingly affects the south west forests.

The FPC has recently developed a Stakeholder Engagement Strategy to provide for ongoing improvement in the way that community views are integrated into policy and operational decision making in the forestry industry.

Employment, wage and injury rates

The forest industry in WA supports employment of around 6,000 people (including areas outside the RFA region). Secondary processing is an important value adding sector, generating 1,495 jobs. The forestry sector also supports a number of other industries including apiary, sand, rock and gravel extraction, mineral extraction, telecommunication sites and forest-based tourism. While it is difficult to quantify employment in these industries, approximately 1,500 people are estimated by the BICWA to be directly employed in the apiary industry, and this may increase as export demand for WA honey products increases.

Forestry workers have comparatively higher incomes compared to other industries in 2015-16 (Schirmer *et al.* 2017), due to comparatively higher rates of full time employment. There is limited information available on how employment in the forest industry is changing over time. Employment in the industry fell between 2006 and 2011 for most parts of the industry, however this is varied by area and industry sector. It is difficult to predict the wage rates of forestry workers compared to other industries into the future. The industry implements a range of policies and practices aiming to reduce injury rates. Improving safety and reducing injury will continue to be an industry target focus into the future.

Community resilience

While the forest industry in the south-west of WA has traditionally been a key economic driver in regional communities, there has been a range of changes to the industry in the last 20 years which have reduced dependence of some communities on forestry. However, communities with a high dependence on the forest industry remain just as liveable as those with little dependence on the forest industry. There has been significant loss of employment in some regional communities, particularly with the closure of mills following the introduction of the *Protecting our Old-growth Forest*s policy, which decreased community resilience. The expectation by the WA Government at the time to deliver jobs in other parts of the forest industry were not realised, while anticipated levels of employment and activity in alternative industries such as tourism has been variable.

WA has recognised the challenges of a changing forest industry, and is implementing policies such as the *Softwood Industry Strategy for Western Australia* to expand the economic base of some communities. The recent positive figures regarding the employment and social benefits from the forest industry are a combined result of recent industry confidence and investment in new processing technologies, and consolidation of operations to improve operational efficiencies. The FPC will continue to work with the forest industries and communities to expand the economic and social benefits arising from forestry.

Section 5: Principles of Ecologically Sustainable Management

As a party to the NFPS, WA is committed to the principles of ecologically sustainable development. The WA RFA defines ESFM as 'forest management and use in accordance with the specific objectives and policies for ecologically sustainable development as detailed in the NFPS. This includes "*three requirements for sustainable forest use: maintaining the ecological processes within forests (the formation of soil, energy flows and the carbon, nutrient and water cycles); maintaining the biological diversity of forests; and optimising the benefits to the community from all uses of forests within ecological constraints.*

For the purposes of this report, 'ecologically sustainable management' in para (a) of the definition of 'RFA' in the RFA Act is taken to be synonymous with Ecologically Sustainable Forest Management as used in the WA RFA. In Australia, the internationally-agreed Montréal Process Criteria and Indicators for reporting on sustainable forest management are used. The Montréal Process Criteria and Indicators were agreed to be the framework for reporting on sustainability (refer to clause 51 of the current WA RFA, as an example). The framework for Ecologically Sustainable Forest Management covers all of the matters listed in para (a) of the definition of 'RFA' in the RFA Act, and therefore provides the performance criteria for the assessment in this report.

The Parties agree in the WA RFA that ESFM is an objective which requires a long-term commitment to continuous improvement and that the key elements for achieving it are:

1. the establishment and maintenance of a CAR Reserve system
2. sustainable Forest-based industries
3. an integrated and strategic FMS capable of responding to new information.

This section includes analysis of the following Montréal Indicators:

- Indicator 7.1a – Extent to which the legal framework supports the conservation and sustainable management of forests
- Indicator 7.1b – Extent to which the institutional framework supports the conservation and sustainable management of forests
- Indicator 7.1c – Extent to which the economic framework supports the conservation and sustainable management of forests
- Indicator 7.1d – Capacity to measure and monitor changes in the conservation and sustainable management of forests
- Indicator 7.1e – Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services
- Indicator 3.1.a: – Scale and impact of agents and processes affecting forest health and vitality
- Indicator 5.1a – Contribution of forest ecosystems and forest industries to the global greenhouse gas balance.

Indicator 7.1a Extent to which the legal framework supports the conservation and sustainable management of forests

This indicator outlines the support that the legal system gives to the sustainable management of forests. A legal system that ensures transparency and public participation in

policy and decision-making processes supports the continuous improvements in sustainable forest management.
The WA RFA provides the framework and context for the protection and management of forests in WA's south-west, at the Commonwealth level. The key principles of the agreement are supported by legislation (both State and commonwealth) which sets applicable legal requirements, establishes roles and responsibilities and ensure transparency and public participation in policy and decision-making.

Commonwealth Legislation

The primary Commonwealth legislation guiding the conservation and sustainable management of forests includes:

- The EPBC Act – administered by the Department of the Environment and Energy, encapsulates and promotes the principles of ecologically sustainable development, and protects and manages MNES.
- The RFA Act – administered by the Department of Agriculture and Water Resources, legislates for the creation and operation of RFAs. The Act gives effect to the CAR reserve system and WA's FMS.

Western Australian State Legislation

Western Australia has a suite of legislation supporting the conservation and sustainable management of forests. The core regulatory framework is guided by the following Acts:

CALM Act, administered by the DBCA, makes provision for the use, protection and management of certain public lands and waters and the flora and fauna thereof.

Since signing the WA RFA the CALM Act has been amended to acknowledge Aboriginal connection to lands, enabling Aboriginal people to become more involved in managing land and using parks and reserves for customary activities. This will help the DBCA build strong relationships with Aboriginal people and provide opportunities to resolve native title.

EP Act, administered by the Department of Water and Environmental Regulation, established the EPA to provide for the prevention, control and abatement of pollution and environmental harm, the conservation, preservation, protection, enhancement and management of the environment, and for matters incidental to or connected with the foregoing.

Since 2004, clearing of native vegetation requires a clearing permit issued under the EP Act, except where exemptions were granted in accordance with the legislation. Schedule 5 of the EP Act, *Principles for clearing native vegetation*, provides the framework to apply the native vegetation clearing regulations and advice to external agencies and proponents.

Forest Products Act (WA) (FP Act) established the FPC to perform commercial functions of growing, harvesting and selling forest products; supporting industry development. The Commission seeks to encourage sustainable harvesting and regeneration of the state's plantation and native forest resources

The WC Act administered by the DBCA provides for conservation and legal protection of flora and fauna. The WC Act will be replaced by the BC Act from 1 January 2019. The BC Act is a modern and effective approach to biodiversity conservation and the ecologically sustainable use of biodiversity, designed to enhance the achievement of biodiversity conservation State-

wide through mechanisms covering promotion, encouragement, assistance, negotiation and completely revised penalty and defence provisions.

There is also a tranche of major secondary legislation influencing the delivery of ESFM, including protecting biodiversity, management of MNES (such as Ramsar wetlands, National Heritage places, threatened species and communities, or migratory species); the need to provide for multiple or specific benefits from the forests (such as provision for water, mining access, tourism or other); and recognition of Aboriginal connection and traditional ownership of lands and country. At a wider level the conduct, responsibilities and competencies of staff undertaking work, monitoring and regulating is also captured through these Acts.

- *Aboriginal Heritage Act 1972*
- *Agriculture and Related Resources Protection Act 1976*
- *Agricultural and Veterinary Chemicals (Western Australia) Act 1995*
- *Biosecurity and Agriculture Management Act 2007*
- *Bush Fires Act 1954*
- *Carbon Rights Act 2003*
- *Contaminated Sites Act 2003*
- *Country Areas Water Supply Act 1947*
- *Emergency Management Act 2005*
- *Fire and Emergency Services Act 1998*
- *Health Act 1911*
- *Heritage Act 2018*
- *Land Administration Act 1997*
- *Land Administration (South West Native Title Settlement) Act 2016*
- *Metropolitan Water Supply, Sewerage, and Drainage Act 1909*
- *Mining Act 1978*
- *The Noongar (Koorah, Nitja, Boordahwan) (Past, Present and Future) Recognition Act 2016*
- *Petroleum and Geothermal Energy Resources Act 1967*
- *Petroleum Pipelines Act 1969*
- *Rights in Water and Irrigation Act 1914*
- *Soil and Land Conservation Act 1945*
- *State Records Act 2000*
- *Water Agencies (Powers) Act 1984*
- *Waterways Conservation Act 1976*

In addition to the formal legislation, WA has the FMP 2014-2023 prepared in accordance with the CALM Act. The basis of the approach to forest management in the plan stems from the principles of EFSM, described in Section 19(2) of the CALM Act, it sets goals and proposed operations in line with these principles.

Indicator 7.1b Extent to which the institutional framework supports the conservation and sustainable management of forests

This indicator examines the institutional frameworks that support sustainable forest management. Institutional frameworks provide mechanisms for engagement of the wider community in the process of continuous improvement and sustainable forest management.

This includes institutional and administrative arrangements that have been put in place for enforcement and compliance with the legal regulatory framework, decision-making in

relation to forestry resource management, and community engagement in the broader process of sustainable forest management.

The information outlines WA Government's overarching vision and strategic plan for sustainable forest management, the roles and responsibilities of relevant WA agencies and their respective policy mechanisms that contribute towards achieving this vision.

The Australian and WA governments are committed to maintaining an institutional framework which supports ESFM. This includes delineation of the role and responsibilities of agencies and setting administrative arrangements for monitoring and regulating conformance within the legal regulatory framework. Recognising the community's regard for forests, community engagement in the broader process of sustainable forest management is established at the legislative and policy level.

Western Australia's CAR reserves system meets nationally agreed criteria to ensure the long-term conservation and protection of forest ecosystems, their biodiversity, old-growth forest and wilderness values. Areas proposed for reservation are adopted in FMPs, prepared by the CPC in accordance with the CALM Act. Preparation of area management plans includes a legislated public comment period of 10 weeks. The (current) FMP 2014-2023 (FMP 2014-2023) was also subject to environmental impact assessment by the EPA in accordance with the EP Act.

Preparation of the FMP 2014-2023 incorporates scientific knowledge acquired from implementing the previous plan (FMP 2004-2013) and findings from reviews carried out by suitably qualified experts. These included an expert panel review of silviculture guidelines and the sustained yield calculations of wood resources (as required under the WA RFA). The plan provides for an allowable harvest of various products from native forests on State forest and timber reserves, and outlines the conditions applicable to timber harvesting from native forests and plantations, so that forest products are taken in a manner that protects other forest values and uses.

The CPC is an independent authority that oversees the administration of Western Australia's national and marine parks, conservation parks, nature reserves, State forests and timber reserves managed by DBCA. The commission has the capacity to advise the Minister for Environment on the application of the principles of ESFM, management of State forest and timber reserves and forest produce throughout the State (section 19(2) CALM Act). The commission will conduct periodic assessments of the implementation of the FMP 2014-2023, and in meeting the requirements of the plan has prepared a mid-term performance review.

DBCA has lead responsibility for protecting and conserving the State's environment on behalf of the people of Western Australia. This responsibility includes monitoring activities which may disturb the environment, including timber harvesting. DBCA's regulation of the forest products industry is defined in a corporate policy. The policy provides for a cooperative compliance approach when developing and implementing strategies and regulating the FPC and industry activities. This policy is supported by working arrangements between DBCA and the FPC and a timber harvesting approvals process to comply with the requirements of the FMP 2014 2023. DBCA also facilitates access to forests on public lands for the conduct of other activities relating to honey production, commercial tourism operators and recreation or scientific activities.

The FPC is responsible for harvesting and regenerating native forest and plantations in State forests and timber reserves, and for the sale of forest products and providing advice to the Minister on industry matters. The FPC has a role in promoting innovation in forest management and local value adding for timber resources. Certain FPC operations are independently certified as meeting international standards of bodies such as the Australian Forestry Standard (AFS). A policy and practices framework guide the operation and conduct of the FPC.

At a strategic level, the EPA conducts environmental impact assessments, prepares statutory policies for environmental protection, and provides strategic advice to the Minister for Environment.

Indicator 7.1c Extent to which the economic framework supports the conservation and sustainable management of forests[10]

This indicator examines the extent to which government policies support the conservation and sustainable management of forests. Government policies on investment, taxation and trade influence the level of investment in forest conservation, forest establishment and timber processing.

Many of the factors that affect the economic framework in relation to sustainable management of forests occur at the state or national level. These factors have been actively reported on over the life of the WA RFA in five yearly SOFRs, as well as in WA reporting.

Through legislation and policy, the Australian and WA governments establish the economic framework which details taxation, business regulation, competition policy, foreign investment and consumer regulation.

The NFPS and WA RFA continue to provide the basis at the national level to manage the States' forest to achieve social and environmental outcomes.

The NFPS sets out a nationally shared vison for the delivery of sustainable forest management. Three of the key objectives articulated in the statement are to:

1. maintain a permanent forest estate to retain the full suite of forest values over time
2. set aside parts of the forest estate in formal reserves to safeguard special environmental and social values according to the principles of comprehensiveness, adequacy and representativeness
3. manage forests outside reserves in a manner that contributes to sustainable environmental, social and economic outcomes.

At the State level the FMP 2014-2023 provides for a native forest products industry and sets the availability of wood resources for the next 10 years. The plan is developed to account for the principles of ESFM as outlined in the CALM Act, including that 'the decision-making process should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations'. The FMP 2014-2023 also provides for an upper limit of

[10] Prior to 2005 effects of the economic framework on sustainable forest management was reported under indicators which were then enumerated as 7.3a and 7.3b.

other bole volume that can be approached should new markets arise during the time of the plan.

Investment

Australia has stringent controls over land use changes and industrial development that aim to protect environmental cultural and amenity values. These controls generally apply equally to all land use change and developments. Provided those values are protected, private investment in the forest and forest products industries in Australia is generally free from industry-specific legal and regulatory constraints. Australia's foreign investment policy aims to encourage foreign investment that is consistent with community and economic interests. Foreign investment in Australia is regulated primarily through a regime established under the *Foreign Acquisitions and Takeovers Act 1975* (Cth).

To allow for a stable investment environment for the wood products industry, Western Australia has investment security guarantees (ISGs) with native hardwood log buyers to enable them to better raise capital for timber processing. ISGs deliver increased certainty for investments by allowing compensation should access to specified volumes of wood not eventuate. They are provided for under the *Industry and Technology Development Act 1998* (WA).

ISGs do not pre-empt future decision-making in regard to allowable cuts for the new FMP nor determine the volume of native sawlogs that will be available under a FMP.

Competition

Australia's National Competition Policy has led to several reforms that affect the competitive climate for Australian forest-based industries, including that commercial state-owned forest entities be competitively neutral with the private sector.

The FPC was established with the commercial function to promote the sale of wood products from the State's public land. The FPC has a responsibility to use a valuable public resource and provide for the continuation of a viable timber industry. It has a role with respect to employment in and development of the forest resources industry, and sustainable use of indigenous forest resources consistent with FMPs for State forest and timber reserves. Part 8 of the FP Act requires that all sales processes are transparent, fair and equitable, and observe and apply relevant State Government policies and public sector guidelines. For the State Agreement Acts and long-term contracts, pricing reviews are undertaken in accordance with the requirements specified in each contract and the log sales process is adjusted accordingly.

FPC's *The Utilisation of Forest Products from Native Forests* corporate policy outlines implementation strategies to ensure that products from native forests will be marketed, prepared and delivered in processes which are consistent with the functions and strategic objectives of FPC as well as satisfying environmental performance criteria set in the FMP. The FPC also reports against a range of annual key effectiveness indicators which measure the performance of economic return to the State from the wood products industry.

Taxation

Prior to 2002, the tax treatment of forestry activities as primary production created unintended inequities for small scale private investments in forestry due to the seasonal and long-term nature of forestry, and its associated irregular cash flows. Key issues were:

- Inability to offset upfront establishment payments in managed schemes in the payment year.
- Immediate tax liability created by forward contracts for timber harvesting rights.
- Tax bracket creep with no mechanism to average large harvest incomes over the plantation lifecycle.

In 2002, a 12-month prepayment rule was introduced to address the offset issue for investors in prospectus based forestry schemes. This was the only significant tax treatment for forestry investments in managed schemes that was different to investment in other sectors at that time.

Managed Investment Schemes

In July 2007, new taxation arrangements for investment in forestry managed investment schemes came into effect. The arrangements encourage further expansion of the plantation estate and support investment in long rotation plantations by allowing trading of MIS investments, including existing MIS plantations

Following the Global Financial Crisis and collapse of several large managed investment schemes in 2009 and 2010, these schemes have become a less important financial mechanism for plantation expansion.

Adjustment programs

Under Clause 98 of the WA RFA, a commitment of $59 million was initially made by the Parties to industry assistance. The Commonwealth provided up to $20 million for the Western Australia Forest Industry Structural Adjustment Program (WAFISAP) with $5 million allocated to the then Australian Government Department of Transport and Regional Services for the Timber Industry Road Evaluation Study (TIRES) and $15 million allocated to the Department of Agriculture, Fisheries and Forestry (DAFF). Between 2004 and 2006, the DAFF component of WAFISAP was administered through allocations of $12.5 million for the Forestry Assistance Program for Western Australia (FAPWA) and $2.5 million for the Grants for Forest Communities.

A State Government package worth $161 million was allocated to a number of government agencies to implement the then Labor Government's *Protecting our Old-growth Forests* policy, which included a number of industry assistance programs.

Trade policies

Throughout the RFA period, Australian trade policy has continued to support trade liberalisation to improve access for Australian exports in global markets, as well as Australian access to imports. Improved market access has been facilitated through global and multilateral efforts and through the use of free trade agreements (FTAs). Australia is a member of the World Trade Organization, which facilitates multilateral trade negotiations

and ensures that the rules of international trade are correctly applied and enforced. FTAs are increasingly important to the forest-based industries.

Investment in environmental services

The Australian Government's Emissions Reduction Fund (ERF), established under the *Carbon Credits (Carbon Farming Initiative) Act 2011 (Cth)*, allows businesses to earn carbon credits for storing carbon or reducing greenhouse gas emissions. The ERF project participants have an opportunity to sell their emissions reductions to the Government through competitive reverse auctions.

Effectiveness of the economic framework

The effectiveness of the economic framework was not explicitly assessed on a holistic basis prior to SOFR 2011. The inclusion of these metrics with data from 2006 provided a baseline for future analysis of the effectiveness of the economic framework in relation to production forests, management of conservation reserves, bushfires and Indigenous managed lands.

Most measures remained consistent between 2006 and 2016 with the exception of understanding and processes relating to indigenous managed land, and conservation reserve processes which showed decline. Notably no items were ranked below partially effective, and no items showed significant improvement in ranking over the period.

Indicator 7.1d Capacity to measure and monitor changes in the conservation and sustainable management of forests

This indicator examines the capacity of forest owners and agencies to measure and monitor changes in the forest and the impact of forest activities. A comprehensive measurement and monitoring programme provides the basis for forest planning to support sustainable management.

Biodiversity is measured in terms of genetics, species and ecosystems. The FPC manages its softwood plantation estate primarily for wood production. There are often important opportunities for biodiversity conservation within plantations.

Forest Products Commission

FPC is the State Statutory Authority that carries out forestry operations in WA state forests and other Crown-timber lands. It has a Forest Management policy (Policy 9), which outlines its commitments to conserving and advancing a range of forest values such as biodiversity, forest productivity and carbon sequestration in keeping with the principles of sustainable forest management. The policy is delivered through the FPC's commitment to maintaining a FMS that is externally certified to ISO 14001 and the Australian Forestry Standard (AS4708). Policy 9 also commits the FPC to 'maintaining, planning, implementation, monitoring and audit systems, supported by regular reviews and an effective reporting system'. The FPC also commits to 'setting objectives and targets to ensure a continuous improvement approach to both management performance and managing environmental, economic, social and cultural impacts and outcomes, including the prevention of pollution'.

Department of Biodiversity, Conservation and Attractions

Public native forests in the WA RFA region are managed in accordance with FMPs, with the current plan (FMP 2014-2023) effective from 2014 to 2023. This plan requires a number of monitoring and auditing actions based on key performance indicators and associated management actions required by DBCA, the FPC and other parties. The CPC also undertakes mid-term and end-of-term performance assessments as a means of ensuring the plan is being implemented as intended. The plan is based upon the principles of ESFM and adopts the Montreal Criteria as the framework within which the goals and management activities are structured.

Further monitoring is undertaken within the WA RFA region through processes associated with planned disturbance activities, *Phytophthora cinnamomi* (dieback) mapping and forest health monitoring, post-burn evaluation, on-ground forest inventories and monitoring associated with operational activities. One of DBCA's key forest monitoring programs, FORESTCHECK, has been monitoring a range of taxa and attributes in the jarrah forest since 2001. Likewise, DBCA's major fauna recovery program, Western Shield, requires ongoing monitoring of key indicators associated with determining the success and application of the program.

DBCA routinely undertakes monitoring across a range of forest indicators using a variety of techniques. Whilst field-based monitoring and data collection practices have been well developed over a period of time, more recently methods are being developed utilising remote sensing advances in satellite sensors, aviation camera systems, remote piloted aircraft (drones), computer processing and software capabilities to undertake monitoring. Incorporating advances in technology has enabled improved monitoring programs to be established, in some instances moving away from sampling populations to obtaining complete information for an entire population. For example, DBCA uses LANDSAT imagery to periodically monitor the health and condition of the entire forest within the WA RFA area.

Indicator 7.1e Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services

This indicator reports on the scientific understanding of Australian forest ecosystem characteristics and functions needed to underpin sustainable forest management. Research, inventory and the development of assessment methodologies provide the basis for sustainable forest management.

For this Indicator, forestry R&D covers research in relation to commercial management and protection of forests, including environmental and ecological considerations. It also includes forest products R&D such as production runs in mills, but not work on final product development (e.g. furniture production). This Indicator is closely aligned to 6.2b which monitors the investment in, and the adoption of, new or improved technologies in forest management and in forest-based industries.

National capacity for Australian forestry R&D

While research is fundamental to supporting development and improvement in all aspects of forest management, production and sustainability, several recent publications have

highlighted the significant decline in national forestry R&D capacity and capability (Kile *et al.* 2014; Turner & Lambert 2015, 2016). Reasons for the reduction in funding for R&D associated with commercial forestry include the declining relative contribution of the forest industry to the national economy, reduced government involvement in the forestry industry, corporate restructuring, and increased international ownership.

Resource allocation for research priorities in nature conservation reserves is generally funded by state-based agencies or through universities that have received project grants, with specific and targeted interests focused on biodiversity and conservation issues. State conservation agencies are frequently being restructured and required to expand reliance on competitive external funding.

Forest products research is broadly considered in terms of utilisation of products from forests (i.e. primary processing, pulp and paper, engineered wood products, bioenergy). National R&D capacity in this area has also declined, notably with the demise of CSIRO's contribution to wood products research. While there has been a decline in forestry R&D by government agencies, a small number of new university-based forestry and/or forest products research centres have recently been established, e.g. the Forest Industries Research Centre at the University of Sunshine Coast, or by the National Centre for Future Forest Industries at the University of Tasmania established under the National Institute for Forest Products Innovation.

Nationally, the number of staff (scientists, technicians, support staff and graduate students) involved in forestry and products research was about 276 in 2013 compared with 794 in the mid-1980s (Turner & Lambert 2016).

WA capacity for forestry R&D

The DBCA through its Biodiversity and Conservation Science group delivers a significant proportion of the research for State forests, national parks and reserves aligned with actions identified in the FMP 2014-23, as described for Indicator 6.2 b. Research spans a broad range of topics including biodiversity conservation, entomology, fire science, hydrology, silviculture and plant genetics. DBCA staff resources engaged in forest related research have declined by half since 2012 due to targeted voluntary severance schemes implemented by the WA government to reduce the size of the public service, and the retirement of staff. Expenditure on staff salaries and operating funds has also reduced commensurately over this period.

WA Government agencies were partners in the Bushfire Cooperative Research Centre from 2003-13 and in the subsequent Bushfire and Natural Hazards Cooperative Research Centre, both of which have delivered important research that has led to improved management of forest fires and prescribed burning programs.

Forestry R&D Capacity within WA Universities

There are five universities in Western Australia all of which offer undergraduate and postgraduate studies in the broad field of natural resource management, biodiversity and environmental science. None of the universities offers a full undergraduate course focussed on forest science, although Edith Cowan University does offer a third-year elective unit of silviculture. Focal areas for postgraduate research relevant to forests include climate change and forest health, forest pathology, and wildlife ecology. Postgraduate research has also been

undertaken on a variety of topics related to fire management including economic analysis of prescribed burning programs, computer simulation of bushfires, and ecological responses to forest fires.

Forest Products Industry

Forest products industry priority projects include:

- carbon stocks and flows in native forests and HWPs
- operational deployment of LiDAR derived information into softwood resource systems
- herbicide screening trials to ensure industry best practice and seek to reduce the use of chemicals
- analysis and deployment of a genetic improvement program for radiata pine;
- improved harvest and haul logistics
- wood quality initiative that uses information about site, management regime and daily weather data to predict variation in wood density and stiffness
- biosecurity initiatives.

Indicator 3.1.a: Scale and impact of agents and processes affecting forest health and vitality

This indicator identifies the scale and impact on forest health of a variety of processes and agents, both natural and human-induced. Through the regular collection of this information, significant changes to the health and vitality of forest ecosystems can be monitored and measured.

Operational aspects of this indicator involve maintaining Western Australia's forest ecosystem health and vitality through pest and weed monitoring and control, including insect pests, invertebrate pests, and fungal diseases. It follows the principles of ESFM, which requires that forests are managed in an environmentally appropriate, socially beneficial, and economically viable manner, and meet the needs of the present without compromising the needs of future generations (Holvert & Muys, 2004; Washburn & Miller, 2003).

Native forest programs

Monitoring of the scale and impact of agents affecting ecosystem health and vitality

Dieback mapping and interpretation is discussed in detail in indicator 7.1d.

Monitoring undertaken as part of the FORESTCHECK project includes routine assessment of the presence, abundance and impact of potential forest insect pests including jarrah leafminer, gumleaf skeletoniser and bullseye borer. This information has proved useful in identifying the build-up of pest populations prior to outbreak. Cost-effective population monitoring techniques using pheromone lures have been developed and implemented operationally for the gumleaf skeletoniser (Farr and Wills 2012). Satellite remote sensing techniques were employed to map the extent of the severe outbreak of gumleaf skeletoniser in the Warren region during 2010-12.

Detailed post-fire mapping of the severity of crown damage has been undertaken following extensive bushfires in the karri forests of the Warren region in 2012 and 2015, and following large fires in the jarrah forest in 2015 and 2016. Mapping techniques have employed satellite imagery, high resolution aerial photography, and limited use of Light Detection and Ranging

(LiDAR). Ground-based measurements of tree characteristics, fire severity and crown recovery have been used to validate classifications derived from remotely sensed imagery. A case study documenting the effects of the 2016 Waroona bushfire on ESFM values has been included in the 2018 SOFR.

Management of agents affecting ecosystem health and vitality

There was good evidence of active management — following ESFM principles — of a range of agents that affect ecosystem health and vitality over the period of the RFA. This includes active on-ground management (e.g. mapping, monitoring, and chemical control of invasive weeds), development of management plans and strategies, and involvement in research to improve management of invasive species. A selection of these activities, as reported in the WA RFA Implementation Reports and elsewhere, includes:

- Predation by introduced pest animals is a key barrier to the recovery of native mammal populations. An initial recovery of threatened mammal populations following fox (*Vulpes vulpes*) control through broadscale baiting under the Western Shield program was not sustained, and mammal populations began to decline. After confirming that the fox-baits were still effective, research investigated whether fox baiting had resulted in 'mesopredator release', whereby the control of the dominant, larger predator (foxes) had led to an increase in the number of smaller predators (such as feral cats, *Felis catus*). Comparing cat abundance at sites that had been baited for foxes with those that were not baited, it was confirmed that the fox control undertaken in the northern jarrah forest over the past 15 years had led to an increase in the numbers of feral cats. The severe decline in woylie (*Bettongia penicillata ogilbyi*) numbers after their initial recovery following earlier fox-baiting programs has also been attributed to predation by increased numbers of feral cats. In order to control feral cats, Parks and Wildlife developed and trialled the Eradicat® feral cat bait. Eradicat® has now been registered for operational use in WA, and broad scale deployment of both cat and fox baits is occurring at selected sites through the Western Shield program, with ongoing monitoring of the impacts on fox and cat populations and recovery of mammal populations.
- Collaborative research with the Bushfire CRC was conducted to evaluate the resilience of plants, vertebrates, invertebrates and fungi to different fire interval sequences over the past 35 years in the Warren bioregion of the south-west forests. This research informs the management of fire interval regimes for biodiversity conservation. Accurate fire history information was used to determine the impact of different fire interval sequences over the past 35 years on the composition and abundance of vascular plants, ground-dwelling invertebrates, vertebrates and macrofungi in the forests and shrublands of the bioregion. The research found that the forests and shrublands investigated were more resilient to the effects of burning than may have been expected. The study found that none of the groups displayed significant differences in species composition as a result of contrasting fire interval sequences in either forest or shrubland. Varying fire intervals had no persistent effect on the richness and composition of biota associated with open forests and shrublands of the Warren bioregion, and demonstrated that these ecosystems are highly resilient to fire. The study suggested that the periodic occurrence of fire in these ecosystems from pre-human to more recent times is likely to have pre-conditioned the biota to persist across

a range of fire intervals varying from long (at least 30 years) to short (less than five years) fire intervals. This suggests that the variability that has occurred at the study sites makes an important contribution to observed resilience, whereas repeated short intervals over the longer term would likely lead to substantial ecological change.

Change in the scale and impact of agents affecting ecosystem health and vitality

For areas where consistent, long-term management actions have been applied, the condition of key conservation values under pressure from weeds has generally improved and the area and density of priority weeds have generally decreased. Where priority weeds have been managed to protect key conservation values, the condition of the conservation value has improved, and adjacent areas were protected from weeds. In the absence of consistent management actions, the density of weed species has generally increased and condition of key conservation values has declined. New infestations and/or species are being recorded across the FMP area each year.

Data from *FORESTCHECK* grids located in State forest indicates that weed numbers are generally low and weeds tend to be herbaceous annuals which increase immediately after harvesting and burning then decrease as the native vegetation regenerates. However, within small forest blocks surrounded by agriculture and adjacent to roads weed infestation is observed.

Indicator 5.1a Contribution of forest ecosystems and forest industries to the global greenhouse gas balance

Forest ecosystems and forest industries can contribute in a number of positive ways to the global greenhouse balance. When forests are managed sustainably, the harvested wood products (HWPs) generated can play a role in the global greenhouse balance, primarily via carbon storage in long-lived products, both in use and in landfills; and by displacing the use of more greenhouse-intensive materials.

However, these interactions between forest ecosystems and/or forest industries and the global greenhouse balance were not as well understood twenty years ago when the RFA was signed. The original RFA document highlighted a number of areas of research to be targeted to improve knowledge. Since then a number of studies have addressed many of the gaps originally identified, including a strong focus on the life cycle of carbon in HWPs. The majority of the forest-based studies have been conducted in production forests (both native and plantations).

The estimation of forest biomass and carbon has improved with the development of species-specific and generic allometric relationships for a number of important tree species (e.g. Keith *et al.* 2000; Paul *et al.* 2013, 2014 and 2016; Montagu *et al.* 2005; Ximenes *et al.* 2005, 2005b, 2008, 2018). Modelling of the carbon dynamics of forest and agricultural land ecosystems, for example the advanced Full Carbon Accounting Model (FullCAM) used to prepare land-based estimates of human induced greenhouse gas emissions (e.g. Australian Department of Environment and Energy 2018), has progressed substantially and ongoing enhancements are informed by the latest empirical scientific research (e.g. Paul and Roxburgh 2017; Roxburgh *et al.* 2017). There is a better understanding also of the longevity of biomass in root systems following tree harvest (Ximenes *et al.* 2006). Carbon dynamics in forest ecosystems are affected by the impacts of climate change. These may include more frequent and more

severe droughts and bushfires, increased incidence of pests and diseases and also changes in growth dynamics due to increased CO_2 levels in the atmosphere. The impact of natural disturbances such as bushfires to the greenhouse balance of forest ecosystems in WA may lead to large emission pulses for a particular year. However, these emissions are typically offset over time by the carbon sequestered when the burnt forests regrow.

The FMP 2014-2023 states 'that at the whole of forest scale, the quantity of carbon stored in live trees in the forests would increase by between three and five per cent during the plan's 10-year period'. Considering the sustained yield figure of this plan, and the large areas of the forest set aside in reserves and relatively small area available for timber harvesting, it is believed that the carbon stock at a whole of forest level will be comparatively stable. Whilst these statements were based on analyses with noted limitations, management activities proposed through the plan seek to minimise unnecessary emissions and maximise biosequestration wherever possible.

Plantations can also contribute significantly to the global greenhouse balance via additional carbon sequestration, especially if planted in previously cleared lands. Currently the national ERF presents an opportunity for plantations to obtain credits for carbon abatement. Projects can generate carbon credits by establishing plantations on non-forest land or by converting existing short-rotation plantations to long rotations.

Summary of future management of the Principles of Ecologically Sustainable Forest Management

This report has provided an updated assessment of the principles of ecologically sustainable management and use of forests in the WA RFA region, not only in this chapter but also by reporting in the other chapters on the Montréal Indicators.

The WA RFA is underpinned by comprehensive legislative and institutional frameworks governing the ecologically sustainable management of the South West forests. The Independent Reviewer for the third five-yearly review of the WA RFA found that WA has a very comprehensive system in place to monitor forestry operations.

These frameworks are continually adapting and improving through new legislation, regulations and reviews of plans and the WA RFA. This is demonstrated by the BC Act set to come into force from 1 January 2019. The BC Act is a modern and effective approach to biodiversity conservation and the ecologically sustainable use of biodiversity.

The WA FMPs, produced in accordance with the CALM Act, are based on the principles of ESFM, and sets goals and proposed operations in line with the principles of ESFM. The ten-year WA FMPs are reviewed every five years, and are developed in consultation with the community. The FMPs incorporate scientific information to improve forest management, such as an expert panel review of silvicultural prescriptions and sustained yield calculations. Forest management on private land is governed by the EP Act and a range of guidelines, and licences issued by DBCA are required for the sale of products from private land. This ensures that forest operations on private land are also based on the principles of ESFM.

The WA FMS is the State's suite of legislation, policies, codes of practice, plans and management processes for forest management. It is designed to achieve ESFM across both public and private land tenures within the State's south-west. The WA FMS incorporates adaptive management and continuous improvement processes to respond to evolving

environmental, social and economic factors. Research findings, feedback from monitoring, compliance, certification and enforcement systems, and stakeholder engagement are used to inform periodic review processes.

The WA RFA implements an extensive CAR reserve system for the conservation of forest and non-forest vegetation communities in perpetuity. The WA RFA also provides for ESFM on the public and private forest estate to provide for wood and non-wood products for industry development, as well as ecosystem services and other societal benefits.

Research and development capacity in forestry has reduced over the past few decades across Australia, as indicated by the number of staff involved in forestry research (ABARES, 2013 and Turner and Lambert, 2016). The Australian Government continues to fund forestry research through contributions to the FWPA and the National Institute for Forest Products Innovation (NIFPI).

The WA FMS includes research and monitoring of forest ecosystem health and vitality, which has led to, and will continue to lead to, adaptive improvements in the management of the WA RFA regions forests. Examples of research and monitoring that has led to forest management improvements include:

- The Western Shield program expansion from fox baiting to both fox and feral cat baiting to improve the recovery of native mammal populations from predation by introduced pest animals.
- Collaborative research with the Bushfire CRC to inform the management of fire interval regimes for biodiversity conservation.

The WA RFA also has led to improved monitoring and research through the establishment of *FORESTCHECK*. Begun in 2002, *FORESTCHECK* is an integrated monitoring project, designed to provide information to forest managers about changes and trends in biodiversity associated with forest activities in Jarrah forests (Department of Biodiversity, Conservation and Attractions, 2014).

Research on carbon dynamics in forest ecosystems has greatly improved our understanding of its contribution to the global carbon cycle and climate change since the signing of the WA RFA. The WA RFA regions forests will be impacted by climate change into the future, which may include more frequent and more severe droughts and bushfires, increased incidence of pests and diseases, as well as changes to growth dynamics.

The FMP 2014-2023 takes into account the impacts of climate change, seeking to minimise unnecessary emissions and maximise biosequestration wherever possible.

Plantations can also contribute significantly to the global greenhouse balance via additional carbon sequestration, especially if planted in previously cleared lands or by converting existing short-rotation plantations to long rotations. There are also opportunities for ERF payments for these actions into the future.

ESFM is an objective which requires a long-term commitment to continuous improvement. The extended WA RFA with five year rolling extensions will continue to provide for ESFM in the WA RFA region. The WA RFA will continue to commit the Parties to the key elements of ESFM, including the maintenance of the CAR reserve system and an integrated, complementary and strategic FMS capable of responding to new information.

Section 6: Conclusion

The Regional Forest Agreement for the South-West Forest Region of Western Australia provides an efficient and effective and sustainable long-term solution for access and use of WA's forests.

The WA RFA establishes a framework for forest management, which:

- identifies a CAR reserve system and provides for the conservation of those areas
- provides for the ecologically sustainable management and use of forests
- provides long-term stability of forests and forest-based industries.

Environmental Values

Since the WA CRA process, the area of protected old-growth forest has increased by 89,167 hectares or 26 per cent, with the CAR reserve system and the ecologically sustainable management of State forests providing for the ongoing protection of old-growth forests. While the CRA assessments did not identify any areas that met the combined thresholds for the wilderness indicators to be delineated, since the signing of the RFA, the amount of wilderness protected in reserves has increased significantly, including the creation of the Walpole Wilderness areas.

The WA RFA addresses the conservation of endangered species through providing a system of conservation reserves and the management of habitat in areas outside the reserve system. Threatened species are protected through Australian and WA environmental legislation and the WA FMS. Case studies demonstrating how the WA FMS has responded to new information and threats are included in the *The Forest Management System in Western Australia: An Overview (2018)*. The WA FMS will be continually reviewed and updated in response to new information.

The register of the National Estate has been phased out, however the values of those places continue to be managed through a range of new management structures including the National Heritage List, the Commonwealth Heritage List, and the WA State Register of Heritage Places. These values include components of the natural or cultural environment in Australia that have been assessed and recognised for their aesthetic, historic, scientific or social significance or other special value for future generations as well as for the present community by the Australian or WA governments.

World Heritage values are catered for by the Australian and WA governments in accordance with the Australian World Heritage Intergovernmental Agreement. There are no World Heritage properties located within the WA RFA region. If present, properties would be managed separately from processes put in place by the WA RFA and be protected by Part 3 of the EPBC Act. The Australian and WA governments will continue to participate in the assessment and protection of any future World Heritage places consistent with the Australian World Heritage Intergovernmental Agreement. While there are no World Heritage properties in the WA RFA region, natural and cultural heritage will be protected and managed through the through the provision of the CAR reserve system and the application of WA FMS under an extended RFA.

The WA FMS protects the ecological character of Ramsar Wetlands, in accordance with the Ramsar Convention. Any potential indirect or offsite impacts to Ramsar wetlands are managed through the soil and water provisions of the system.

The WA RFA with a five-year rolling extension provides for the continued protection of biodiversity, old-growth forests and wilderness values through the CAR reserve system and the ecologically sustainable management of forests as described in *The Forest Management System in Western Australia: An Overview (2018)*. The conservation reserve estate is interconnected and will continue to adapt to climate induced changes into the future.

Indigenous Cultural Heritage

Western Australia is committed to the protection of Aboriginal heritage, the involvement of Aboriginal people in the management and use of forests on public land, increasing consultation with Aboriginal people, and the adaptation and improvement of their forest management system where the need is identified. Aboriginal involvement in forest management reflects their connection with the land, and the integration of Indigenous values into forest management practice, policy and decision-making.

There has been considerable development of legislation, policy and processes to enhance the recognition and participation of Aboriginal people in forest management since the signing of the WA RFA. This includes amendments of the CALM Act, WA's FMP processes and the SWNT Settlement which will provide ongoing commitment and opportunities to Aboriginal communities based within the WA RFA region. Successful involvement of Aboriginal people and forest-sector projects can deliver social and economic benefits, strengthening the resilience of Indigenous communities in the face of social and economic change.

Economic Values

A key goal of ecologically sustainable forest management is to maintain the productive capacity of native and plantation forests. To fully consider the economic values relating to forests, both quantitative resource volume and value metrics are required. Together, these illuminate the complex interactions affecting environmentally and economically sustainable forest management.

The WA RFA has and will continue to support the WA forest industry so that it has a strong and sustainable future and to provide additional certainty to industry and the community into the future. The extended WA RFA will seek to maintain a stable regulatory and investment environment, which will assist in providing for socio-economic stability and opportunities for additional competition, productivity increase and market growth.

The net area available for harvesting has decreased by 243,770 hectares since the commencement of the WA RFA (from 27 to 22 per cent of the RFA area). A large part of this reduction was due to the *Protecting our Old-growth Forests* policy and the introduction of FHZs. For the duration of the WA RFA harvested area has always remained below 1.5 per cent of the area available for wood production.

Since 1999, significant areas of plantation have been replaced with other land uses, including basic raw material quarries and roads. Bushfires have also impacted plantations. The WA Government has made recent significant investment in softwood plantations on public and private lands.

The sustained yield in the WA RFA region has declined over the period of the WA RFA, largely due to the implementation of the *Protecting our Old-growth Forests* policy and the consequent reduction in forest area available for timber production. WA will continue to determine sustained yields and undertake reviews through an independent panel, and will report on harvest levels against the determined sustained yield through the FMP and five-yearly RFA reviews.

DBCA have incorporated consideration of climate change into sustained yield calculations by modelling a high severity climate change scenario in calculations. WA seeks to sustain the productive capacity of forest ecosystems and plantations as they adapt to climate change.

The WA Government will continue to work with apiarists and other forest users involved in removal of non-wood forest products to encourage alternative uses of forests in the WA RFA region and to manage these uses in balance with the range of forest uses.

As global demand for forest products increase, there is a growing need to meet societal demands for recycling of forest products. There are opportunities for recycling of forest products to play a large role in the future of waste and forest management in the state, including in energy generated from biomass. WA have endorsed the National Waste Policy to increase the recycling of waste products.

Social Values

WA RFA forests contribute to local and State economies, benefit personal and community wellbeing, and support cultural values for local communities, including Aboriginal communities.

The forest industry in WA supports employment of around 6,000 people (including areas outside the RFA region). Secondary processing is an important value adding sector, generating 1,495 jobs. The forests also support a number of other industries including apiary, grazing, sand, rock and gravel extraction, mineral extraction, telecommunication sites and forest based tourism.

There is limited information available on employment trends in the forest industry over time. Future changes in employment will depend on a range of factors, including government policy decisions and state population growth. Forecasts of the wage rates of forestry workers compared to other industries in the future are not available. Improving safety and reducing injury will continue to be an industry focus in the future.

Western Australia's forest dependent communities faced a broad variety of change events during the WA RFA period, including local industry restructures, natural disasters, social conflict, changing economic conditions and the impacts of policy decisions.

Western Australia has recognised the challenges of a changing forest industry, and is implementing policies such as the Softwood Industry Strategy for Western Australia to expand plantation resources and provide further opportunities for local communities dependent on the forest industry. The FPC will continue to work with the industry and community to enhance the contribution of the forest products industry to regional communities.

Since the signing of the WA RFA in 1999 there has been an increase of 59,600 hectares of area available for recreation and tourism in the RFA region, and this level of access is expected to continue under an extended WA RFA.

Forests are important to people for a variety of reasons, and this will continue to be the case in the future. The capacity of forests to store carbon is likely to increase the importance of forests in the future.

An extended WA RFA will continue to ensure WA forests remain accessible for a range of uses, and support and deliver social benefits. An extended WA RFA will continue to provide an adaptive framework that can incorporate new information and changes in community attitudes and circumstances, which will maintain and enhance social values into the future.

Principles of Ecologically Sustainable Management

Ecologically sustainable management of forests is an objective that requires a long-term commitment to continuous improvement and adaptive management. An extended WA RFA will continue to provide for the ecologically sustainable management and use of forests in the WA RFA region, and commit the Australian and WA governments to its key elements, including the maintenance of the CAR reserve system and an integrated, complementary and strategic Forest Management System capable of responding to new information.

The WA RFA is underpinned by comprehensive legislative and institutional frameworks governing the ecologically sustainable management of the region's forests. These frameworks are continually adapting and improving through new legislation, regulations and reviews of plans and the RFA.

The WA FMS includes research and monitoring of forest ecosystem health and vitality, which has led to, and will continue to lead to, adaptive improvements in the management of the WA RFA regions forests. The Australian Government continues to fund forestry research through contributions to the FWPA and the NIFPI.

The FMPs incorporate scientific information to improve forest management, such as an expert panel review of silvicultural prescriptions and sustained yield calculations. Forest operations on private land are also based on the principles of ecologically sustainable management.

The WA RFA region forests will be impacted by climate change into the future. The FMP takes into account the impact on climate change, seeking to minimise unnecessary emissions and maximise biosequestration wherever possible. Plantations can also contribute significantly to the global greenhouse balance via additional carbon sequestration into the future.

Summary

Over the past 20 years there have been improvements to forest management within the WA RFA region. WA has a comprehensive forest management system to implement the WA RFA (Wilkinson 2017). The improvements and comprehensive FMS have been described in this document and are also described in the document: *The Forest Management System in Western Australia: An Overview (2018)*. The FMS in Western Australia is a comprehensive system for delivering ESFM across all land tenures. The system comprises an overarching legislative and policy framework, and associated planning and operational systems. It is complemented by an adaptive management and continuous improvement process

incorporating research findings and feedback processes associated with compliance and enforcement systems, stakeholder engagement and monitoring and review mechanisms.

The implementation of the WA RFA and the process of adaptive management and continuous improvement built into WA's FMS deliver sustainable forest management. As processes and knowledge evolve, the structure and delivery mechanisms within WA's FMS will continue to evolve to meet community expectations. As a framework agreement, the WA RFA can accommodate this continuous improvement and adaptive management, without requiring continual updates to the WA RFA itself. Improvements to WA forest management over the past 20 years are described in *The Forest Management System in Western Australia: An Overview (2018)* and include:

- Forest Management Plan (FMP): Is a 10-year plan developed in consultation with the community. It is the key policy framework for managing forests as these plans identify goals and performance targets and propose management activities to achieve these goals. The WA Government are currently reviewing their FMP 2014-2023, after accepting public submissions. This review will inform the implementation of the plan, and management of WA's South West forests for the next five years, as well as contribute information to the development of the next FMP.
- FORESTCHECK: is a key monitoring project that operates in the WA RFA region. It is an integrated monitoring project, designed to provide information to forest managers about changes and trends in biodiversity associated with forest activities. FORESTCHECK was commenced in 2002, with input from scientists and managers within the DBCA, and from universities and other government agencies. FORESTCHECK:
  - makes a significant contribution to forest science
  - informs forest managers on changes and trends in key elements of forest biodiversity
  - provides a framework for meaningful public participation in forest management
  - provides relevant information to allow DBCA to comply with reporting requirements associated with sustainable forest management
  - contributes to global-scale studies on impacts on biodiversity.

The independent five-yearly reviews of the WA RFA, report on the matters listed in para (a) of the definition of 'RFA' in the RFA Act. Independent reviewers consider environmental values, indigenous heritage values, economic values of forested areas and forest industries, social values and the principles of ecologically sustainable management within the WA RFA region. Review reports are tabled in the Parliament of Australia and the Australian and WA governments respond to any recommendations through joint government responses. Should the WA RFA be varied, subsequent five-yearly extensions would be contingent on successful completion of these independent five-yearly reviews.

This report has demonstrated that the Australian and WA governments have, through a comprehensive and diverse range of processes, formally had ongoing regard to the matters listed in para (a) of the definition of 'RFA' in the RFA Act relevant to the WA RFA region. Given the commitments of both governments to continue implementing the ongoing obligations and commitments of the WA RFA, while allowing for the FMS and implementation mechanisms to be responsive to new information consistent with adaptive management and continual improvement principles, it could be expected that the management of forests in the WA RFA region would continue within this framework.

Appendices

Appendix A: Relationship between listed Matters in the RFA Act and Montréal Process indicators

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
1.1 Ecosystem diversity					
1.1a Area of forest by forest type and tenure	■				■
1.1b Area of forest by growth stage	■				■
1.1c Area of forest in protected area categories	■				■
1.1d Fragmentation of forest cover	■				■
1.2 Species diversity					
1.2a Forest-dwelling species for which ecological information is available	■				■
1.2b The status of forest-dwelling species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment	■				■

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
1.2c Representative species from a range of habitats monitored at scales relevant to regional forest management					
1.3 Genetic diversity					
1.3a Forest associated species at risk from isolation and the loss of genetic variation, and conservation efforts for those species					
1.3b Native forest and plantations of indigenous species which have genetic resource conservation mechanisms in place					
2 Maintenance of productive capacity of forest ecosystems					
2.1a Native forest available for wood production, area harvested and growing stock of merchantable and non-merchantable tree species					

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
2.1b Age class and growing stock of plantations					
2.1c Annual removal of wood products compared to the volume determined to be sustainable for native forests and future yields for plantations					
2.1d Annual removal of non-wood products compared to the level determined to be sustainable					
2.1e The area of native forest harvested and the proportion of that effectively regenerated and the area of plantation clear-fell harvested and the proportion of that effectively					
3 Maintenance of ecosystem health and vitality					
3.1a Scale and impact of agents and processes affecting forest health and vitality					

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
3.1b Area of forest burnt by planned and unplanned fire					
4 Conservation and maintenance of soil and water resources					
4.1a Area of forest land managed primarily for protective function					
4.1b Management of the risks of soil erosion and the risks to soil physical properties, water quantity and water quality in forests					
5 Maintenance of forests' contribution to global carbon cycles					
5.1a Total forest ecosystem biomass and carbon pool					
6.1 Production and consumption					
6.1a Value and volume of wood and wood products					

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
6.1b Values, quantities and use of non-wood forest products					
6.1c Value of forest based services					
6.1d Production and consumption and import/export of wood, wood products and non-wood products					
6.1e Degree of recycling of forest products					
6.2 Investment in the forest sector					
6.2a Investment and expenditure in forest management					
6.2b Investment in extension and use of new and improved technologies					
6.3 Recreation and tourism					

Montréal Process Indicator	**Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)**				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii indigenous heritage values**	**4(a)iii economic values of forested areas and forest industries**	**4(a)iv social values (including community needs)**	**4(a)v principles of ecologically sustainable management**
6.3a Area of forest available for general recreation/tourism					
6.3b Range and use of recreational/tourism activities available					
6.4 Cultural, social and spiritual needs and values					
6.4a Area of forest to which Indigenous people have use rights that protect their special values and are recognized through formal and informal management regimes					
6.4b Registered places of non-indigenous cultural values in forests that are formally managed to protect those values					

Montréal Process Indicator	Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii** indigenous heritage values	**4(a)iii** economic values of forested areas and forest industries	**4(a)iv** social values (including community needs)	**4(a)v** principles of ecologically sustainable management
6.4c The extent to which indigenous values are protected, maintained and enhanced through indigenous participation in forest management					
6.4d The importance of forests to people					
6.5 Employment and community needs					
6.5a Direct and indirect employment in the forest sector					
6.5b Wage rates and injury rates within the forest sector					
6.5c Resilience of forest dependent communities to changing social and economic conditions					
6.5d Resilience of forest dependent indigenous communities to changing social and economic conditions					
7 Legal, institutional and economic framework for forest conservation and sustainable management					

Montréal Process Indicator	**Relevant matter in para (a) of the definition of 'RFA' in the *Regional Forest Agreements Act 2002* (Cth) (best match(es) shown as shaded boxes)**				
	4(a)i environmental values, (including old-growth, wilderness, endangered species, national estate values and world heritage values)	**4(a)ii indigenous heritage values**	**4(a)iii economic values of forested areas and forest industries**	**4(a)iv social values (including community needs)**	**4(a)v principles of ecologically sustainable management**
7.1a Extent to which the legal and policy framework supports the conservation and sustainable management of forests					
7.1b Extent to which the institutional framework supports the conservation and sustainable management of forests					
7.1c Extent to which the economic framework supports the conservation and sustainable management of forests					
7.1d Capacity to measure and monitor changes in the conservation and sustainable management of forests					
7.1e Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services					

Alignment of the international Montréal Process indicators with Australia's national indicators used in SOFR since 2005

Source: ABARES State of the Forests Report 2013

Criterion 1 Conservation of biological diversity

International Montréal Process criteria and indicators Indicator number	**International Montréal Process criteria and indicators Indicator name**	**Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment**	**Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment**
1.1	Ecosystem diversity	—	—
1.1a	Area and per cent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure	1.1a	1.1b
1.1b	Area and per cent of forest in protected areas by forest ecosystem type, and by age class or successional stage	1.1c	1.1b
1.1.c	Fragmentation of forests	1.1d	—
1.2	Species diversity	—	—
1.2a	Number of native forest associated species	—	1.2a
1.2.b	Number and status of native forest associated species at risk, as determined by legislation or scientific assessment	1.2b	—
1.2.c	Status of on site and off-site efforts focused on conservation of species diversity	—	—
1.3	Genetic diversity	—	—
1.3a	Number and geographic distribution of forest associated species at risk of losing genetic variation and locally adapted genotypes	1.3a	—

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
1.3b	Population levels of selected representative forest associated species to describe genetic diversity	—	1.2c
1.3c	Status of on site and off-site efforts focused on conservation of genetic	—	1.3a 1.3b

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
1.1	Ecosystem diversity	—	—
1.1a	Area of forest by forest type and tenure	1.1a	—
1.1b	Area of forest by growth stage	—	1.1a 1.1b
1.1c	Area of forest in protected area categories	1.1b	—
1.1d	Fragmentation of forest cover	1.1c	—
1.2	Species diversity	—	—
1.2a	Forest dwelling species for which ecological information is available	—	1.2a

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
1.2b	The status of forest dwelling species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment	1.2b	—
1.2c	Representative species from a range of habitats monitored at scales relevant to regional forest management	—	1.3b
1.3	Genetic diversity	—	—
1.3a	Forest associated species at risk from isolation and the loss of genetic variation, and conservation efforts for those species	1.3a	1.3.c
1.3b	Native forest and plantations of indigenous timber species which have genetic resource conservation mechanisms in place	—	1.3.c

Criterion 2 Maintenance of productive capacity of forest ecosystems

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
2.a	Area and per cent of forest land and net areas of forest land available for wood production	2.1a	—

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
2.b	Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production	2.1a	—
2.c	Area, per cent, and growing stock of plantations of native and exotic species	2.1b	—
2.d	Annual harvest of wood products by volume and as a per centage of net growth or sustained yield	2.1c	—
2.e	Annual harvest of non-wood forest products	2.1d	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
2.1a	Native forest available for wood production, area harvested, and growing stock of merchantable and non-merchantable tree species	2.a 2.b	—
2.1b	Age class and growing stock of plantations	2.c	—
2.1c	Annual removal of wood products compared to the volume determined to be sustainable for native forests and future yields for plantations	2.d	—
2.1d	Annual removal of non-wood forest products compared to the level determined to be sustainable	2.e	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
2.1e	The area of native forest harvested and the proportion of that effectively regenerated, and the area of plantation harvested and the proportion of that effectively re-established	—	—

Criterion 3 Maintenance of ecosystem health and vitality

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
3.a	Area and per cent of forest affected by biotic processes and agents (e.g. disease, insects, invasive species) beyond reference conditions	3.1a	—
3.b	Area and per cent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions	3.1a 3.1b	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
3.1a	Scale and impact of agents and processes affecting forest health and vitality	3.a 3.b	—
3.1b	Area of forest burnt by planned and unplanned fire	3.b	—

Criterion 4 Conservation and maintenance of soil and water resources

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
4.1	**Protective function**	—	—
4.1a	Area and per cent of forest whose designation or land management focus is the protection of soil or water resources	4.1a	—
4.2	**Soil**	—	—
4.2a	Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources	4.1b 4.1c	—
4.2b	Area and per cent of forest land with significant soil degradation	—	—
4.3	**Water**	—	—
4.3a	Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources	4.1d 4.1e	—

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
4.3b	Area and per cent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions	—	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
4.1a	Area of forest land managed primarily for protective functions	4.1.a	—
4.1b	Management of the risk of soil erosion in forests	4.2.a	—
4.1c	Management of the risks to soil physical properties in forests	4.2.a	—
4.1d	Management of the risks to water quantity from forests	4.3.a	—
4.1e	Management of the risks to water quality in forests	4.3.a	—

Criterion 5 Maintenance of forest contribution to global carbon cycles

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
5.a	Total forest ecosystem carbon pools and fluxes	5.1a	—
5.b	Total forest product carbon pools and fluxes	5.1a	—
5.c	Avoided fossil fuel carbon emissions	—	5.1a

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
5.1a	Contribution of forest ecosystems and forest industries to the global greenhouse gas balance	5.a 5.b	5.c

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

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
6.1	**Production and consumption**	—	—
6.1a	Value and volume of wood and wood products production, including primary and secondary processing	6.1a	—
6.1b	Value of non-wood forest products produced or collected	6.1b	—
6.1c	Revenue from forest based environmental services	6.1c	—
6.1d	Total and per capita consumption of wood and wood products in round wood equivalents	6.1d	—
6.1e	Total and per capita consumption of non-wood products	6.1d	—
6.1f	Value and volume in round wood equivalents of exports and imports of wood products	6.1d	—
6.1g	Value of exports and imports of non-wood products	6.1d	—
6.1h	Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption	—	6.1d
6.1i	Recovery or recycling of forest products as a per cent of total forest products consumption	6.1e	—
6.2	**Investment in the forest sector**	—	—
6.2a	Value of capital investment and annual expenditure in forest management, wood and non-wood product industries, forest-based environmental services, recreation and tourism	6.2a	—

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
6.2b	Annual investment and expenditure in forest-related research, extension and development, and education	6.2b	—
6.3	**Employment and community needs**	—	—
6.3a	Employment in the forest sector	6.5a	—
6.3b	Average wage rates, annual average income and annual injury rates in major forest employment categories	6.5b	—
6.3.c	Resilience of forest-dependent communities	6.5c	—
6.3d	Area and per cent of forests used for subsistence purposes	—	6.5d
6.3e	Distribution of revenues derived from forest management	—	—
6.4	**Recreation and tourism**	—	—
6.4a	Area and per cent of forests available and/or managed for public recreation and tourism	6.3a	—
6.4b	Number, type, and geographic distribution of visits attributed to	6.3b	—
6.5	**Cultural, social and spiritual needs and values**	—	—
6.5a	Area and per cent of forests managed primarily to protect the range of cultural, social and spiritual needs and values	6.4a 6.4b 6.4c	—
6.5b	The importance of forests to people	6.4d	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
6.1	**Production and consumption**	—	—
6.1a	Value and volume of wood and wood products	6.1a	—
6.1b	Values, quantities and use of non-wood forest products	6.1b	—
6.1c	Value of forest based services	6.1c	—
6.1d	Production and consumption and import/export of wood, wood products and non-wood products	6.1d 6.1e 6.1f 6.1g	6.1h
6.1e	Degree of recycling of forest products	6.1i	—
6.2	**Investment in the forest sector**	—	—
6.2a	Investment and expenditure in forest management	6.2a	—
6.2b	Investment in research, development, extension and use of new and improved technologies	6.2b	—
6.5	**Employment and community needs**	—	—
6.5a	Direct and indirect employment in the forest sector	6.3a	—
6.5b	Wage rates and injury rates within the forest sector	6.3b	—
6.5c	Resilience of forest dependent communities to changing social and economic conditions	6.3.c	—
6.5d	Resilience of forest dependent Indigenous communities to changing social and economic conditions	—	6.3d
6.3	**Recreation and tourism**	—	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
6.3a	Area of forest available for public recreation/ tourism	6.4a	—
6.3b	Range and use of recreation/ tourism activities available	6.4b	—
6.4	**Cultural, social and spiritual needs and values**	—	—
6.4a	Area of forest to which Indigenous people have use and rights that protect their special values and are recognised through formal and informal management regimes	6.5a	—
6.4b	Registered places of non-Indigenous cultural value in forests that are formally managed to protect those values	6.5a	—
6.4c	The extent to which Indigenous values are protected, maintained and enhanced through Indigenous participation in forest management	6.5a	—
6.4d	The importance of forests to people	6.5b	—

Criterion 7 Legal, institutional and economic framework for forest conservation and sustainable management

International Montréal Process criteria and indicators Indicator number	International Montréal Process criteria and indicators Indicator name	Australian indicator(s) with which each Montréal Process indicator aligns Strong alignment	Australian indicator(s) with which each Montréal Process indicator aligns Partial alignment
7.1a	Legislation and policies supporting the sustainable management of forests	7.1a	7.1b
7.1b	Cross-sectoral policy and programme coordination	—	7.1a 7.1b
7.2a	Taxation and other economic strategies that affect the sustainable management of forests	7.1c	—
7.3a	Clarity and security of land and resource tenure and property rights	—	7.1a
7.3b	Enforcement of laws related to forests	—	7.1a
7.4a	Programmes, services and other resources supporting the sustainable management of forests	—	7.1b
7.4b	Development and application of research and technologies for the sustainable management of forests	7.1e	—
7.5a	Partnerships to support the sustainable management of forests	—	—
7.5b	Public participation and conflict resolution in forest-related decision making	—	7.1b
7.5c	Monitoring, assessment and reporting on progress towards sustainable management of forests	7.1d	—

Australia's criteria and indicators Indicator number	Australia's criteria and indicators Indicator name	Montréal Process indicator(s) with which each Australian indicator aligns Strong alignment	Montréal Process indicator(s) with which each Australian indicator aligns Partial alignment
7.1a	Extent to which the legal framework supports the conservation and sustainable management of forests	7.1a	7.3.a 7.3b
7.1b	Extent to which the institutional framework supports the conservation and sustainable management of forests	—	7.1a 7.4a 7.5b
7.1c	Extent to which the economic framework supports the conservation and sustainable management of forests	7.2a	—
7.1d	Capacity to measure and monitor changes in the conservation and sustainable management of forests	7.5c	—
7.1e	Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services	7.4b	—

— = no such alignment

Appendix B: Threatened species and ecological communities in the WA RFA region

Threatened fauna

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
Taxa with recovery plan published and being implemented						
Bettongia penicillata ogilbyi	Woylie		Critically endangered		Endangered	WA recovery plan in place Endorsed as national recovery plan
Botaurus poiciloptilus	Australasian bittern	Vulnerable	Endangered		Endangered	WA recovery plan in place National recovery plan being prepared Conservation advice approved 01/02/2011
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo		Vulnerable		Vulnerable	WA recovery plan in place Endorsed as national recovery plan
Calyptorhynchus baudinii	Baudin's cockatoo or forest black cockatoo	Vulnerable	Endangered		Endangered	WA recovery plan in place Endorsed as national recovery plan
Calyptorhynchus latirostris	Carnaby's black cockatoo	Vulnerable	Endangered		Endangered	WA recovery plan in place Endorsed as national recovery plan
Dasyurus geoffroii	Chuditch	Vulnerable	Vulnerable	Endangered	Vulnerable	WA recovery plan in place Endorsed as national recovery plan
Dasyornis longirostris	Western Bristlebird[1]		Vulnerable	Endangered	Endangered	WA recovery plan in place Endorsed as national recovery plan
Engaewa pseudoreducta	Margaret River burrowing crayfish		Critically endangered		Critically endangered	WA recovery plan in place National recovery plan not required

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
						Conservation advice approved 14/04/2009
Engaewa reducta	Dunsborough burrowing crayfish		Endangered		Critically endangered	WA recovery plan in place National recovery plan not required Conservation advice approved 14/04/2009
Engaewa walpolea	Walpole burrowing crayfish		Endangered		Endangered	WA recovery Plan in place National recovery plan not required Conservation advice approved 14/04/2009
Galaxias truttaceus hesperius	Western trout minnow		Endangered		Critically endangered	WA recovery plan in place National recovery plan not required Conservation advice approved 03/07/2008
Geocrinia alba	White-bellied frog	Endangered	Critically endangered	Endangered	Endangered	WA recovery plan in place Endorsed as national recovery plan
Geocrinia vitellina	Orange-bellied frog	Vulnerable	Vulnerable	Vulnerable	Vulnerable	WA recovery plan in place Endorsed as national recovery plan
Myrmecobius fasciatus	Numbat	Vulnerable	Endangered	Endangered	Endangered	WA recovery plan in place.

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
						Endorsed as national recovery plan Conservation advice approved 11/04/2014
Pezoporus wallicus flaviventris	Western ground parrot	Critically endangered	Critically endangered		Critically endangered	WA recovery plan in place Endorsed as national recovery plan
Potorous gilbertii	Gilbert's potoroo	Critically endangered	Critically endangered		Critically endangered	WA recovery plan in place
Pseudemydura umbrina	Western swamp tortoise	Critically endangered	Critically endangered		Critically endangered	WA recovery plan in place Endorsed as national recovery plan
Pseudocheirus occidentalis	Western ringtail possum	Vulnerable	Critically endangered	Vulnerable	Critically endangered	WA recovery plan in place Endorsed as national recovery plan
Psophodes nigrogularis nigrogularis	Western whipbird	Endangered	Endangered		Endangered	WA recovery plan in place. Endorsed as national recovery plan
Setonix brachyurus	Quokka	Vulnerable	Vulnerable		Vulnerable	WA recovery plan in place Endorsed as national recovery plan
Spicospina flammocaerulea	Sunset frog	Vulnerable	Vulnerable		Endangered	WA recovery plan in place. National recovery plan not required Conservation advice approved 29/04/2014
Recovery plan being prepared, recovery action being identified						
Cherax tenuimanus	Margaret River hairy marron		Critically endangered		Critically endangered	WA recovery plan in preparation

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
Pachyptila turtur subantarctica	Fairy Prion (southern)[1]			Vulnerable	Vulnerable	Conservation advice approved 1/10/2015 National recovery plan required.
Parantechinus apicalis	Dibbler[1]		Endangered		Endangered	Conservation advice approved 1/10/2015 National recovery plan required.
Phascogale calura	Red-tailed phascogale[1]	Endangered	Other specially protected	Endangered	Vulnerable	Conservation advice approved 7/12/2016 National recovery plan required.
Sternula nereis nereis	Australian Fairy Tern[1]		Vulnerable		Vulnerable	Conservation advice approved 3/3/2011 National recovery plan required.
No recovery plan in place or in preparation						
Actitis hypoleucos	Common Sandpiper[1]				Migratory	No conservation advice or recovery plan required
Ardenna caneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater[1]				Migratory	No conservation advice or recovery plan required
Austroassiminea letha	Cape Leeuwin freshwater snail		Vulnerable		Not listed	
Bertmainius tingle	Tingle pygmy trapdoor spider		Endangered		Endangered	No recovery plan required Conservation advice approved 11/5/2018
Calidris canutus	Red Knot, Knot[1]		Vulnerable		Endangered; Migratory	No recovery plan required Conservation advice approved 5/5/2016
Calidris ferruginea	Curlew Sandpiper[1]		Vulnerable		Critically Endangered; Migratory	No recovery plan required Conservation advice approved 26/5/2016

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
Calidris melanotos	Pectoral Sandpiper[1]				Migratory	No conservation advice or recovery plan required
Caldris subminuta	Long-toed Stint[1]				Migratory	No conservation advice or recovery plan required
Cynotelopus notabilis	Western Australian pill millipede		Endangered		Not listed	
Galaxiella munda	mud minnow, western dwarf galaxias		Vulnerable		Not listed	
Galaxiella nigrostriata	black-stripe minnow, black-striped dwarf galaxias		Endangered		Endangered	No recovery plan required Conservation advice approved 11/5/2018
Gallinago stenura	Pin-tailed Snipe[1]				Migratory	No conservation advice or recovery plan required
Lepidogalaxias salamandroides	salamanderfish		Endangered		Not listed	
Glareola maldivarum	Oriental Pratincole[1]				Migratory	No conservation advice or recovery plan required
Hydroprogne caspia	Caspian Tern[1]				Migratory	No conservation advice or recovery plan required
Limosa lapponica	Bar-tailed Godwit[1]		Vulnerable		Migratory	No conservation advice or recovery plan required
Motacilla cinerea	Grey Wagtail[1]				Migratory	No conservation advice or recovery plan required
Nannatherina balstoni	Balston's pygmy perch		Vulnerable		Vulnerable	No recovery plan required Conservation advice approved 3/7/2008
Nannoperca pygmaea	Little pygmy perch		Endangered		Not listed	

Taxon	Common name	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under EPBC Act or WA State plan
Onychoprion anaethetus	Bridled Tern[1]				Migratory	No conservation advice or recovery plan required
Pandion cristatus	Eastern Osprey[1]				Migratory	No conservation advice or recovery plan required
Tringa nebularia	Common Greenshank, Greenshank[1]				Migratory	No conservation advice or recovery plan
Westralunio carteri	Carter's freshwater mussel		Vulnerable		Vulnerable	No recovery plan required Conservation advice approved 15/2/2018
Zephyrarchaea mainae	Main's assassin spider		Vulnerable		Not listed	
Taxa with distribution principally outside the RFA region, research program undertaken						
Leipoa ocellata	Malleefowl	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan in place
Petrogale lateralis lateralis (and four other rock wallaby taxa)	Black-flanked rock-wallaby	Vulnerable	Endangered	Endangered	Endangered	WA recovery plan in place Endorsed as national recovery plan
Taxa requiring no further action						
Rallus pectoralis clelandi	Lewin's water rail	Presumed extinct	Presumed extinct	Presumed extinct	Extinct	
Taxa removed from the Western Australian list and the Schedules to the *Endangered Species Protection Act* **						
Cacatua pastinator pastinator	Muir's corella		Other specially protected		Not listed	WA recovery plan in place
Phascogale tapoatafa subsp (WAM M434)	Brushtail phascogale		Other specially protected		Not listed	

Notes:

1) Species has less than 20 per cent chance of being present in suitable habitat within the RFA region. Many of the migratory birds are coastal shorebirds. Source: Department of the Environment and Energy, Environmental Resources Information Network Species Profile and Threats (SPRaT) Database, July 2018. Note: WA records indicate the Western Bristlebird and Dibbler no longer occur in the RFA region.

2) Source: Department of the Environment and Energy, Environmental Resources Information Network Species Profile and Threats (SPRaT) Database, July 2018.
Commonwealth Endangered category also includes species listed by WA and the IUCN as Critically Endangered.
** This Act ceased on 16 July 2000 as it was repealed by the *Environment Reform (Consequential Provisions) Act 1999*. It was replaced by the EPBC Act 1999.

Threatened Flora

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Taxa with recovery plan published and being implemented					
Acacia chapmanii subsp. *australis*	Not listed	Endangered		Endangered	WA recovery plan in place 2015 National recovery plan not required Conservation advice approved 03/07/2008
Adenanthos pungens subsp. effuses[1]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan
Andersonia annelsii		Critically endangered		Critically endangered	WA recovery plan in place 2012 National recovery plan not required Conservation advice approved 11/05/2018
Andersonia gracilis[1]		Vulnerable		Endangered	WA recovery plan endorsed as national recovery plan 2008
Banksia brownii[1]		Critically endangered	Vulnerable	Endangered	WA recovery plan endorsed as national recovery plan 2008
Banksia (previously *Dryandra*) *nivea* subsp. *uliginosa*	Endangered	Endangered	Endangered	Endangered	WA recovery plan in place 2010 Endorsed as national recovery plan
Banksia oligantha[1]		Endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2008
Banksia (previously *Dryandra*) *squarrosa* subsp. *argillacea*		Vulnerable		Vulnerable	WA recovery plan in place 2005 National recovery plan required

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Banksia verticillata *	Vulnerable	Critically endangered	Vulnerable	Vulnerable	WA recovery plan in place 2017 National recovery plan not required Conservation advice approved 26/03/2008
Boronia exilis	Critically endangered	Endangered		Endangered	WA recovery plan in place 2004 National recovery plan required
Brachyscias verecundus		Critically endangered		Critically endangered	WA recovery plan in place 2004 National recovery plan not required Conservation advice approved 01/10/2008
Caladenia bryceana subsp. *bryceana*	Endangered	Endangered	Endangered	Endangered	WA recovery plan in place 2009 National recovery required
Caladenia busselliana	Critically endangered	Critically endangered	Endangered	Endangered	WA recovery plan in place 2008 Naitonal recovery required
Caladenia caesarea subsp. maritima[2]		Critically endangered		Endangered	WA recovery plan andorsed as national recovery plan 2010
Caladenia hopperiana		Critically endangered		Endangered	WA recovery plan in place 2013 National recovery plan not required Conservation advice approved 15/2/2018
Caladenia huegelii	Endangered	Critically endangered	Vulnerable	Endangered	WA recovery plan in place 2009 National recovery required
Caladenia leucochila		Endangered		Endangered	WA recovery plan in place 2017 National recovery plan not required

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
					Conservation advice approved 11/5/2018
Caladenia lodgeana		Critically endangered		Critically endangered	WA recovery plan in place 2014 National recovery plan not required Conservation advice approved 30/01/2013
Caladenia procera		Critically endangered		Critically endangered	WA recovery plan in place 2012 National recovery required
Caladenia viridescens	Critically endangered	Critically endangered	Endangered	Endangered	WA recovery plan in place 2008 Endorsed as national recovery plan
Caladenia winfieldii	Critically endangered	Endangered	Endangered	Endangered	WA recovery plan in place 2009 Endorsed as national recovery plan
Calectasia cyanea[2]		Critically endangered		Critically endangered	WA recovery plan endorsed as national recovery plan 2010
Chamelaucium sp. Gingin (N.G.Marchant 6)[1]		Vulnerable	Vulnerable	Endangered	WA recovery plan endorsed as national recovery plan 2004
Commersonia apella		Critically endangered		Critically endangered	WA recovery plan in place 2016 National recovery plan not required Conservation advice approved 15/2/2018
Commersonia erythrogyna (previously *Rulingia* sp. Trigwell Bridge)	Critically endangered	Critically endangered	Endangered	Endangered	WA recovery plan in place 2004 Endorsed as national recovery plan
Conospermum undulatum	Vulnerable	Vulnerable		Vulnerable	WA recovery plan in place 2009

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
					Endorsed as national recovery plan
Conostylis misera	Endangered	Vulnerable		Endangered	WA recovery plan in place 2008 Endorsed as national recovery plan
Darwinia apiculata *	Endangered	Endangered	Vulnerable	Endangered	WA recovery plan in place 2010 Endorsed as national recovery plan
Darwinia carnea[2]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2010
Darwinia collina[1]		Endangered	Vulnerable	Endangered	WA recovery plan endorsed as national recovery plan 2008
Darwinia ferricola *	Endangered	Endangered	Vulnerable	Endangered	WA recovery plan in place 2008 Endorsed as national recovery plan
Darwinia whicherensis[2]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2004
Diplolaena andrewsii		Endangered		Endangered	WA recovery plan in place 2015. National recovery plan not required Conservation advice approved 15/2/2018
Drakaea confluens	Critically endangered	Critically endangered	Vulnerable	Endangered	WA recovery plan in place 2014 Updated State plan 2010 Endorsed as national recovery plan
Drakaea elastica	Endangered	Critically endangered	Vulnerable	Endangered	WA recovery plan in place 2010 Endorsed as national recovery plan

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Eremophila glabra subsp. *chlorella*		Endangered		Endangered	WA recovery plan in place 2016 National recovery plan not required Conservation advice approved 15/2/2018
Eucalyptus x balanites[1]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2011
Grevillea acropogon		Endangered		Not listed	WA recovery plan in place 2012
Grevillea althoferorum (subsp. *fragilis*)		Critically endangered		Not listed at subspecies level; Endangered at species level	WA recovery plan in place 2004 Endorsed as national recovery plan
Grevillea brachystylis subsp. *grandis*		Critically endangered		Critically endangered	WA recovery plan in place 2013 Endorsed as national recovery plan
Grevillea corrugata		Vulnerable		Endangered	WA recovery plan in place 2017 National recovery plan not required Conservation advice approved 26/2/2013
Grevillea curviloba subsp. curviloba[2]		Critically endangered		Endangered	WA recovery plan endorsed as national recovery plan 2002
Grevillea curviloba subsp. incurva		Endangered		Endangered	WA recovery plan in place 2000 Endorsed as national recovery plan
Grevillea elongata[2]		Endangered	Vulnerable	Vulnerable	WA recovery plan endorsed as national recovery plan 2004
Grevillea fuscolutea		Vulnerable		Not listed	WA recovery plan in place 2010

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Grevillea maccutcheonii[2]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2004
Grevillea rara		Endangered		Endangered	WA recovery plan in place 2010 Endorsed as national recovery plan
Isopogon uncinatus[2]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2002
Lambertia echinata subsp. occidentalis[2]		Critically endangered	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2004
Lambertia orbifolia subsp. *orbifolia* ms	Endangered	Critically endangered	Not listed at subspecies level; Vulnerable at species level	Not listed at subspecies level; Endangered at species level	WA recovery plan in place 2004 Endorsed as national recovery plan
Lambertia orbifolia subsp. Scott River plains	Endangered	Endangered	Not listed at subspecies level; Vulnerable at species level	Not listed at subspecies level; Endangered at species level	WA recovery plan in place 2004 Endorsed as national recovery plan
Lasiopetalum pterocarpum		Critically Endangered		Endangered	WA recovery plan in place 2004 Endorsed as national recovery plan
Leucopogon sp. Flynn (F. Hort, J. Hort & A. Lowrie 859)		Critically endangered		Critically endangered	WA recovery plan in place 2016 National recovery plan not required Conservation advice approved 11/5/2018
Macarthuria keigheryi[1]		Endangered		Endangered	WA recovery plan endorsed as national recovery plan 2010
Rhacocarpus rehmannianus var. *webbianus*		Critically endangered		Not listed	WA recovery plan in place 2012

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Sphenotoma drummondii		Endangered		Endangered	WA recovery plan in place 1999 National recovery plan not required Conservation advice approved 110/2008
Stylidium semaphorum		Critically endangered		Critically endangered	WA recovery plan in place 2011 National recovery plan not required Conservation advice approved 11/5/2018
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Critically endangered	Critically endangered		Critically endangered	WA recovery plan in place 2007 National recovery plan not required Conservation advice approved 24/12/2009
Thelymitra dedmaniarum	Endangered	Critically Endangered	Endangered	Endangered	WA recovery plan in place 2013 Endorsed as national recovery plan
Trithuria occidentalis (previously *Hydatella dioica*)		Critically endangered		Endangered	WA recovery plan in place 2012 National recovery plan not required Conservation advice approved 16/12/2008
Verticordia apecta		Critically endangered		Critically endangered	WA recovery plan in place 2012 National recovery plan not required Conservation advice received 19/07/2010
Verticordia fimbrilepis subsp. *fimbrilepis*	Critically endangered	Vulnerable	Endangered	Endangered	WA recovery plan in place 2011 Endorsed as national recovery plan
Verticordia plumosa var. *ananeotes*		Critically endangered		Endangered	WA recovery plan in place 2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
					Endorsed as national recovery plan
Wurmbea calcicola[2]		Vulnerable	Endangered	Endangered	WA recovery plan endorsed as national recovery plan 2008
Taxa with recovery plan being developed					
Calytrix breviseta subsp. breviseta[2]		Critically endangered		Endangered	National recovery plan required Conservation advice approved 1/10/2015
Conospermum densiflorum subsp. unicephalatum[1]		Endangered		Endangered	National recovery plan required Conservation advice approved 1/10/2015
Hypocalymma sylvestre		Endangered		Endangered	State recovery plan being prepared National recovery plan not required Conservation advice approved 11/5/2018
Laxmannia grandiflora subsp. *brendae*		Vulnerable		Not listed	State recovery plan being prepared
No recovery plan in place or in preparation					
Anigozanthos viridis subsp. terraspectans[1]		Vulnerable		Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Austrostipa bronwenae[2]		Endangered		Endangered	National recovery plan not required Conservation advice approved 15/2/2018
Banksia serratuloides subsp. serratuloides[2]			Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Caladenia hoffmanii[2]		Endangered		Endangered	National recovery plan not required Conservation advice approved 16/12/2008
Conospermum galeatum[2]		Critically endangered		Critically endangered	National recovery plan not required Conservation advice approved 11/5/2018
Darwinia foetida[2]		Endangered		Critically endangered	National recovery plan not required Conservation advice approved 11/6/2009
Eucalyptus recta[1]		Vulnerable		Endangered	National recovery plan not required. Conservation advice approved 11/6/2009
Grevillea thelemanniana[2]		Not listed		Critically endangered	National recovery plan not required Conservation advice approved 15/2/2018
Lepidosperma rostratum[1]		Endangered		Endangered	National recovery plan not required Conservation advice approved 16/12/2008
Synaphea sp. Pinjarra Plain (A.S.George 17182)[2]		Endangered		Endangered	National recovery plan not required Conservation advice approved 15/2/2018
Synaphea sp. Serpentine (G.R.Brand 103)[2]		Critically endangered		Critically endangered	National recovery plan not required Conservation advice approved 15/2/2018
Thomasia glabripetala[1]		Vulnerable		Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Thomasia montana[1]		Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Taxa with regional flora management program published or in preparation					
Acacia anomala *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Acacia aphylla *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 03/07/2008
Acacia brachypoda	Endangered	Vulnerable		Endangered	National recovery plan not required Conservation advice approved 26/03/2008
Anthocercis gracilis *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Banksia (previously Dryandra) aurantia	Not listed	Vulnerable		Critically endangered	National recovery plan not required Conservation advice approved 16/12/2008
Banksia (previously Dryandra) mimica *	Endangered	Vulnerable	Endangered	Endangered	National recovery plan not required Conservation advice approved 26/03/2008
Banksia goodii	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 01/10/2008
Bossiaea sp. Frankland (E.M. Sandiford EMS 896)		Endangered		Not listed	
Caladenia christineae *	Vulnerable	Endangered	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Caladenia dorrienii *	Endangered	Endangered	Endangered	Endangered	National recovery plan not required Conservation advice approved 16/12/2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Caladenia excelsa *	Endangered	Endangered	Vulnerable	Endangered	National recovery plan not required Conservation advice approved 26/03/2008
Caladenia harringtoniae *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Chamelaucium roycei ms *	Vulnerable	Vulnerable	Vulnerable	Listed Vulnerable as Chamelaucium sp. *S coastal plain* (R.D.Royce 4872)	National recovery plan not required Conservation advice approved 29/04/2014
Darwinia acerosa *	Endangered	Endangered	Endangered	Endangered	National recovery plan not required Conservation advice approved 01/10/2008
Daviesia elongata (previously subsp. *elongata)*		Vulnerable		Listed Vulnerable as Daviesia elongata subsp. elongata	National recovery plan not required Conservation advice approved 26/03/2008
Diuris drummondii	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Diuris micrantha	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 03/07/2008
Diuris purdiei		Endangered	Not listed	Endangered	National recovery plan not required Conservation advice approved 26/03/2008
Drakaea micrantha	Vulnerable	Endangered	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Eleocharis keigheryi		Vulnerable		Vulnerable	National recovery plan not required. Conservation advice approved 16/12/2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Eucalyptus x phylacis[2]		Critically endangered	Endangered	Endangered	National recovery plan not required. Conservation advice approved 1/10/2015
Gastrolobium argyrotrichum		Critically endangered		Critically endangered	National recovery plan not required Conservation advice approved 11/5/2018
Gastrolobium hamulosum[1]		Critically endangered	Endangered	Endangered	National recovery plan not required Conservation advice approved 1/10/2008
Gastrolobium modestum	Vulnerable	Vulnerable		Vulnerable	National recovery plan not required Conservation advice approved 29/04/2014
Gastrolobium papilio[2]		Critically endangered	Endangered	Endangered	National recovery plan not required Conservation advice approved 29/04/2014
Goodenia arthrotricha		Endangered		Endangered	National recovery plan not required Conservation advice approved 15/2/2018
Grevillea brachystylis subsp. *australis*		Endangered		Vulnerable	National recovery plan not required Conservation advice approved 01/10/2008
Grevillea bracteosa		Endangered		Not listed	
Grevillea christineae	Endangered	Endangered		Endangered	National recovery plan not required Conservation advice approved 01/10/2008
Grevillea flexuosa *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 01/10/2008
Jacksonia velveta ms		Endangered		Endangered	National recovery plan not required

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
					Conservation advice approved 16/12/2008
Kennedia glabrata *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 03/07/2008
Kennedia lateritia (previously *macrophylla*) *	Endangered	Endangered	Vulnerable	Endangered	National recovery plan not required Conservation advice approved 03/07/2008
Lasiopetalum rotundifolium[1]		Endangered	Presumed extinct	Endangered	National recovery plan not required Conservation advice approved 16/12/2008
Lechenaultia laricina *	Endangered	Vulnerable	Vulnerable	Endangered	National recovery plan not required Conservation advice approved 16/12/2008
Leptomeria dielsiana[2]		Presumed extinct	Endangered	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Melaleuca sciotostyla[1]		Endangered	Vulnerable	Endangered	National recovery plan not required Conservation advice approved 29/4/2014
Microtis globula *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Petrophile latericola[2]		Critically Endangered	Endangered	Endangered	National recovery plan not required Conservation advice approved 16/12/2008
Ptychosema pusillum[1]		Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Pultenaea pauciflora *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
					Conservation advice approved 16/12/2008
Reedia spathacea	Endangered	Endangered		Critically endangered	National recovery plan not required Conservation advice approved 7/1/2009
Spirogardnera rubescens *	Endangered	Vulnerable	Endangered	Endangered	National recovery plan not required Conservation advice approved 01/10/2008
Stylidium asymmetricum		Endangered		Not listed	
Synaphea sp. Pinjarra (R.Davis 6578)[2]		Critically endangered		Critically endangered	National recovery plan not required Conservation advice approved 24/12/2009
Synaphea stenoloba[2]		Critically endangered		Endangered	National recovery plan not required Conservation advice approved 24/12/2009
Tetraria australiensis *	Vulnerable	Vulnerable	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 26/03/2008
Thelymitra stellata *	Endangered	Endangered	Vulnerable	Endangered	National recovery plan not required Conservation advice approved 01/10/2008
Tribonanthes purpurea		Vulnerable		Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Verticordia carinata		Vulnerable		Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Verticordia densiflora var. *pedunculata*		Endangered		Endangered	National recovery plan not required Conservation advice approved 03/07/2008

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Verticordia fimbrilepis subsp. *australis* *	Endangered	Endangered	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 03/07/2008
Verticordia plumosa var. *vassensis*		Endangered		Endangered	National recovery plan not required Conservation advice approved 01/10/2008
Taxa removed from the Western Australian list, and recommended for removal from the Schedules to the *Endangered Species Protection Act* **					
Asterolasia nivea *	Vulnerable	Priority 4	Vulnerable	Vulnerable	National recovery plan not required Conservation advice approved 16/12/2008
Taxa removed from the Western Australian list and the Schedules to the *Endangered Species Protection Act* **					
Aponogeton hexatepalus		Priority 4	Vulnerable	Not listed	
Asterolasia grandiflora *		Priority 4	Vulnerable	Not listed	
Centrolepis caespitosa	Endangered	Priority 4	Vulnerable	Not listed	
Cryptandra congesta	Not listed	Priority 4		Not listed	WA recovery plan in place 2010
Eucalyptus goniantha subsp. *goniantha*		Not listed	Vulnerable	Not listed	
Hydrocotyle lemnoides		Priority 4	Vulnerable	Not listed	
Laxmannia jamesii *	Vulnerable	Priority 4	Vulnerable	Not listed	
Myriophyllum trifidum (previously *Meziella trifida*) *	Vulnerable	Priority 4	Vulnerable	Delisted 6/03/2013	
Schoenus natans		Priority 4	Vulnerable	Not listed	

Taxon	1998 Western Australian threat status	2018 Western Australian threat status	1998 C'wlth *Endangered Species Protection Act* status #	2018 listing of species under EPBC Act	Status of recovery plan (including interim recovery plans) under either EPBC Act or WA State plan
Trithuria australis (previously Hydatella leptogyne)		Priority 4		Delisted 6/3/2013	
Verticordia plumosa var. *pleiobotrya*		Not listed		Delisted 16/9/2015	

Notes:

1) Species has less than 20 per cent chance of being present in suitable habitat within the RFA region. Source: Department of the Environment and Energy, Environmental Resources Information Network Species Profile and Threats (SPRaT) Database, July 2018.

2) Source: Department of the Environment and Energy, Environmental Resources Information Network Species Profile and Threats (SPRaT) Database, July 2018.

The Commonwealth 'Endangered' category also includes species listed by WA and the IUCN as Critically Endangered.

* Species marked with an asterisk have a specific Conservation Statement prepared for them. Conservation statements were prepared as partof the comprehensive regional assessment phase of the WA RFA for species (within the WA RFA region) listed as endangered or vulnerable and for which recovery plans or interim recovery plans have not or are not being prepared.

** This Act ceased on 16 July 2000 as it was repealed by the *Environment Reform (Consequential Provisions) Act 1999*. It was replaced by the EPBC Act 1999.

EPBC Act listed Ecological Communities

Community name	EPBC Act listing[1]	EPBC listing date effective	Status of conservation advice and recovery plans[2]
Aquatic Root Matt Community 1 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 July 2000	RP approved; RP required
Aquatic Root Matt Community 2 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 July 2000	RP approved; RP required
Aquatic Root Matt Community 3 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 July 2000	RP approved; RP required
Aquatic Root Matt Community 4 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 July 2000	RP approved; RP required
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	16 July 2000	RP approved; RP required
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	16 September 2016	CA approved; RP not required
Clay Pans of the Swan Coastal Plain	Critically Endangered	27 March 2012	CA approved; RP required
Corymbia calophylla – Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	16 July 2000	CA approved; RP approved; RP required
Corymbia calophylla – Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	16 July 2000	CA approved; RP approved; RP required
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	4 December 2015	CA approved; RP not required
Scott River Ironstone Association	Endangered	23 May 2013	CA approved; RP required
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	16July 2000	CA approved; RP approved; RP required

Community name	EPBC Act listing[1]	EPBC listing date effective	Status of conservation advice and recovery plans[2]
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	16 July 2000	CA approved; RP approved; RP required
Shrublands on southern Swan Coastal Plain ironstones	Endangered	16 July 2000	RP approved; RP required
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	10 August 2013	CA approved; RP required

Notes:

(1) EPBC Act listing as at 24 July 2018
(2) CA – Conservation Advice; RP – Recovery Plan

Source: Department of the Environment and Energy, Environmental Resources Information Network Species Profile and Threats (SPRaT) Database

WA Threatened Ecological Communities

Community Name	WC Act Listing	Status of WA plan
Aquatic Root Mat Community Number 1 of Caves of the Leeuwin Naturaliste Ridge	Critically Endangered	DBCA recovery plan completed 29 May 2008
Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge	Critically Endangered	DBCA recovery plan completed 29 May 2008
Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge	Critically Endangered	DBCA recovery plan completed 29 May 2008
Aquatic Root Mat Community Number 4 of Caves of the Leeuwin Naturaliste Ridge	Critically Endangered	DBCA recovery plan completed 29 May 2008
Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain	Endangered	DBCA recovery plan completed Oct 2012
Banksia attenuata woodlands over species rich dense shrublands	Endangered	DBCA recovery plan completed 10 August 2016
Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	Priority 3	
Claypans with mid dense shrublands of Melaleuca lateritia over herbs	Priority 1	DBCA recovery plan completed 14 October 2015
Corymbia calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	Vulnerable	
Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain	Critically Endangered	DBCA recovery plan completed Sept 2011
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain	Critically Endangered	DBCA recovery plan completed 31 Jan 2000
Corymbia calophylla woodlands on heavy soils of the southern Swan Coastal Plain	Vulnerable	
Dense shrublands on clay flats	Vulnerable	DBCA recovery plan completed 14 October 2015
Eucalypt woodlands of the Western Australian Wheatbelt	Priority 3	
Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	Vulnerable	

Community Name	WC Act Listing	Status of WA plan
Herb rich saline shrublands in clay pans	Vulnerable	DBCA recovery plan completed 14 October 2015
Herb rich shrublands in clay pans	Vulnerable	DBCA recovery plan completed 14 October 2015
Low lying Banksia attenuata woodlands or shrublands	Priority 3	
Mount Lindesay - Little Lindesay Vegetation Complex	Endangered	
Rimstone Pools and Cave Structures Formed by Microbial Activity on Marine Shorelines	Endangered	
Scott River Ironstone Association	Endangered	DBCA plan completed 7 April 2015
Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Critically Endangered	DBCA plan completed 1 November 2006
Shrublands and woodlands on Muchea Limestone	Endangered	DBCA Recovery plan completed 28 February 2000
Shrublands on dry clay flats	Endangered	DBCA recovery plan completed 14 October 2015
Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	Critically Endangered	DBCA recovery plan completed 21 November 2005
Southern wet shrublands, Swan Coastal Plain	Endangered	
Subtropical and Temperate Coastal Saltmarsh	Priority 3	

Appendix C: Recommendations at the combined first and second five-yearly review

1. The Parties clarify some matters in A Report on Progress with the Implementation of the Regional Forest Agreement for the South–West Region of Western Australia in a revised published (online) version.
2. The Parties develop an agreed statement or addendum of the legislative and administrative changes at Commonwealth and State level that affect the Regional Forest Agreement.
3. The Parties recommit to timely and regular reviews of the implementation of the Regional Forest Agreement recognising the scope of reviews will change as the RFA is progressively implemented.
4. The Government of Western Australia agrees on the mechanism to achieve external input into Research and Development (R&D) priorities and opportunities to expand cooperative research programmes.
5. The Government of Western Australia continues to periodically review the sustained yield in relation to the changing biotic and abiotic risk factors.
6. The Parties review the indicators used for ESFM assessment in the FMP 2014-2023 as part of the next 5-yearly Regional Forest Agreement to ensure they adequately address each of the Montreal Criteria.
7. The Parties assess the adequacy of the compliance provisions related to the FMP 2014-2023 as part of the next 5-yearly Regional Forest Agreement review.
8. The Government of Western Australia considers the development of a comprehensive forest health assessment system.
9. The Parties ensure the climatic trends evident in the Regional Forest Agreement region are considered in future forest management planning and management for forest goods and services including conservation, wood and catchment water yields.
10. The Government of Western Australia undertakes an analysis of the adoption of research outputs into management practice as part of the process of determining future research priorities.
11. The Parties review policy settings that affect the utilisation of wood harvested in the Regional Forest Agreement region in light of changing economic circumstances, technology and the opportunity for climate change mitigation.
12. The Parties review the need for updating key data sets and any steps that should be taken to ensure ongoing access to historical data sets.
13. The Parties' consideration of the scope of the next 5-yearly Regional Forest Agreement review should ensure the ongoing Regional Forest Agreement requirements are met in FMP 2014-2023 particularly in relation to:
    a. ESFM
    b. protection of threatened flora and fauna, and that
    c. the indicators of ESFM are sufficiently comprehensive to cover social, economic and environmental aspects of forest management.

Appendix D: Recommendations at the third five-yearly review

1. WA considers the means by which its legislative, policy and institutional framework can deliver a clear and consistent interpretation of the contribution that forests outside of reserves (including private land) should make to the conservation of biodiversity across the range of temporal and spatial scales.
2. WA considers mechanisms to foster a common understanding within government and amongst land managers, resource-users, scientists, non-government organisations, the media and the wider community, of the role and contribution of forests outside of reserves to the conservation of biodiversity.
3. The Parties consider a means to better evaluate and publicly report on the socio-economic impacts associated with the harvesting and processing of wood products from native forests, including: transparent reporting of the accounting methods; costs and returns to government; and the opportunity costs related to other uses of the forest.
4. The Parties consider ways to foster improved and ongoing participation of stakeholders in the WA RFA process.
5. The Parties consider the legal form of any future WA RFA to better clarify the commitments that are legally-binding and those commitments that are more performance-based. Where practical, the WA RFA should focus on desired outcomes rather than prescribed actions or process.
6. The Parties re-affirm their commitment to deliver transparency and certainty of outcomes under the WA RFA, noting that-
    i. the WA RFA should be regularly updated as required in response to new information and changes to operating environments;
    ii. all changes should follow a formal amendment process;
    iii. all proposed changes should be publicly released for comment;
    iv. the Parties should formally consider and respond to any submission from a person who can demonstrate a direct and material disadvantage from the proposed changes.
7. WA considers the means by which it may work towards the collation of data, including KPIs and Sustainability Indicators, and the synchronising of relevant reviews and reports to meet state and national obligations, including the FMP, WA RFA, national State of the Forests Report and Montréal Process.
8. The Parties address the information gaps and suggested corrections noted in this report by way of the Joint Government Response and consider attaching a label to the on-line versions of the two progress reports (Period 1 & 2 and Period 3) to briefly explain their status, the process of review (including submissions on the report and the independent review), and to clarify that any additions or amendments to the report are detailed in the Joint Government Response to each report.
9. The Parties consider amending the timeframe for completing the joint reviews/report pursuant to Clause 37 of the WA RFA to ensure that there is sufficient time to complete the work and to report in a practical and timely manner.

10. The Parties ensure that there is a 'whole of government' approach to the preparation of the progress reports, by ensuring that relevant government agencies are involved in the finalisation of the reports prior to their public release.
11. The Parties agree to include a table of legislative and administrative changes at Commonwealth and State level that affect the Regional Forest Agreement in all future five-yearly reports, together with an analysis of the impact of these changes on the capacity of the Parties to implement the commitments in the Agreement.
12. WA considers reviewing its regulatory framework to-
    i. Develop an annual consolidated compliance monitoring report for the FMP, to clearly outline: the respective roles and responsibilities of organisations; the methodology for monitoring; the periodicity of reporting (e.g. annual and five-yearly); and the consolidated results of monitoring, including trend data from previous reports.
    ii. Improve the manner in which the nature, number and outcomes of investigations, including enforcement actions, are transparently reported in publicly-available reports (e.g. annual and five-yearly reports).
13. WA considers the need to translate the forest management guidance documents into a condensed and practical form suitable for use by forest contractors and operators.
14. The Parties consider how trends in employment and skills that are directly and indirectly related to activities under the FMP can be better captured for reporting under the ESFM framework.
15. The Parties clarify the extent to which mining sites, following rehabilitation, are expected to contribute to the principles of ESFM and to the long-term maintenance of forest values and ecological health.
16. WA clarifies the role and contribution of private forests to the objectives of the WA RFA and the current mechanisms for fostering ESFM on private land, including the mapping of forest ecosystems and inventory of known or predicted values.
17. WA considers undertaking regular review and reporting on the purpose and outcomes of all forest-related research projects with respect to the degree of relevance to, and uptake by, forest managers over time.

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