

# Appendix A

## Comparison of international Montreal Process indicators with those used in SOFR 2003 and SOFR 2008

In reporting on the state of its forests, Australia uses the criteria developed by the international-level Montreal Process Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. It has adapted the indicators to better suit reporting on the country's unique forests. In SOFR 2003, 74 indicators were devised and used as the basis of reporting (SOFR 1998 did not use the criteria-and-indicators approach). However, some of the indicators proved difficult to measure and some were repetitive.

The national-level Montreal Process Implementation Group for Australia, which comprises representatives of the Australian Government and state and territory governments, reviewed the list of indicators in 2005 with the aim of eliminating duplication, ambiguity and gaps; as a result of that review, the list of indicators was reduced to 44. The final list of indicators underpins Australia's 2008 State of the Forests Report. The three sets of indicators are presented in Table A1.

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008**

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
<b>Criterion 1 – Conservation of biological diversity</b>				
1.1	Ecosystem diversity	Ecosystem diversity	1.1	Ecosystem diversity
1.1a	Extent of area by forest type relative to total forest area	Extent of area by forest type and tenure	1.1a	Area of forest by forest type and tenure
1.1b	Extent of area by forest type and by age class or successional stage	Area of forest type by growth stage distribution by tenure	1.1b	Area of forest by growth stage
1.1c	Extent of area by forest type in protected area categories as defined by IUCN or other classification systems	Combined with 1.1a	1.1c	Area of forest in protected area categories
1.1d	Extent of areas by forest type in protected areas defined by age class or successional stage	Combined with 1.1b		Combined with 1.1b
1.1e	Fragmentation of forest types	Fragmentation of forest types	1.1d	Fragmentation of forest cover
1.2	Species diversity	Species diversity	1.2	Species diversity
1.2a	The number of forest-dependent species	A list of forest-dwelling species	1.2a	Forest dwelling species for which ecological information is available
1.2b	The status (threatened, rare, vulnerable, endangered or extinct) of forest-dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment	Same as international	1.2b	The status of forest dwelling species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment
1.2c		Population levels of representative species from diverse habitats monitored across their range (moved from 1.3b)	1.2c NEW	Representative species from a range of habitats monitored at scales relevant to regional forest management

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
1.3	Genetic diversity	Genetic diversity	1.3	Genetic diversity
1.3a	Number of forest-dependent species that occupy a small portion of their former range	Amount of genetic variation within and between populations of representative forest-dwelling species	1.3a NEW	Forest associated species at risk from isolation and the loss of genetic variation, and conservation efforts for those species
1.3b	Population levels of representative species from diverse habitats monitored across their range	Included in 1.2c		
1.3c		Extent of native forest and plantations of indigenous species which have genetic resource conservation plans prepared and implemented	1.3b NEW	Native forest and plantations of indigenous timber species which have genetic resource conservation mechanisms in place
<b>Criterion 2 – Maintenance of productive capacity of forest ecosystems</b>				
2.1a	Area of forest land and net area of forest land available for timber production	Same as international	2.1a	Native forest available for wood production, area harvested, and growing stock of merchantable and non-merchantable tree species
2.1b	Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production	Same as international		Combined in 2.1a
2.1c	The area and growing stock of plantations of native and exotic species	The area, age class and future yields of plantations of native and exotic species	2.1b	Age class and growing stock of plantations
2.1d	Annual removal of wood products compared to the volume determined to be sustainable	Same as international	2.1c	Annual removal of wood products compared to the volume determined to be sustainable for native forests, and future yields for plantations
2.1e	Annual removal of non-timber forest products (e.g. fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable	Annual removal of non-timber forest products (e.g. berries, mushrooms, game, honey, wildflowers, tree ferns, possums), compared to the sustainable level	2.1d	Annual removal of non-wood forest products compared to the level determined to be sustainable
2.1f		Area and per cent of plantation established meeting effective stocking one year after planting	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
2.1g		Area and per cent of harvested area of native forest effectively regenerated		Combined in Indicator 2.1e
2.1h		Extent of exotic plantations managed according to documented procedures or management plans to maintain genetic resources		Not included in new indicator set
<b>Criterion 3 – Maintenance of ecosystem health and vitality</b>				
3.1a	Area and per cent of forest affected by processes or agents beyond the range of historic variation	Area and per cent of forest affected by processes or agents that may change ecosystem health and vitality	3.1a	Scale and impact of agents and processes affecting forest health and vitality

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
3.1b	Area and per cent of forest land subjected to levels of specific air pollutants (e.g. sulfates, nitrate, ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem	Area and per cent of forest land subjected to levels of specific air pollutants (e.g. sulfates, nitrate, ozone) or ultraviolet B that may cause negative impacts on forest ecosystem health and vitality		Not included in new indicator set
3.1c	Area and percentage of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g. soil nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles, wasps, etc)	Area and percentage of forest land with diminished or improved biological, physical and chemical components indicative of changes in fundamental ecological processes		Not included in new indicator set
			3.1b NEW	Area of forest burnt by planned and unplanned fire
<b>Criterion 4 – Conservation and maintenance of soil and water resources</b>				
4.1a	Area and per cent of forest land (including plantation) with significant soil erosion	<i>(Interim indicator) Area and per cent of forest land systematically assessed for soil erosion hazard, and for which site-varying scientifically based measures to protect soil and water values are implemented</i>		Not included in new indicator set
			4.1a NEW	Area of forest land managed primarily for protective functions
4.1b	Area and per cent of forest land (including plantations) managed primarily for protective functions (e.g. watersheds, flood protection, avalanche protection, riparian zones)	Same as international		Not included in new indicator set
			4.1b NEW	Management of the risk of soil erosion in forests
4.1c	Per cent of stream kilometres in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation	Same as international		Not included in new indicator set
			4.1c NEW	Management of the risks to soil physical properties in forests
4.1d	Area and per cent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties	<i>(Interim indicator) The total quantity of organic carbon in the forest floor (&lt; 25 mm diameter components) and the surface 30 cm of soil</i>		Not included in new indicator set
			4.1d NEW	Management of the risks to water quantity from forests
4.1e	Area and per cent of forest land with significant compaction or change in soil physical properties resulting from human activities	<i>(Interim indicator) Proportion of harvested forest area with significant change in bulk density of any horizon of the surface (0–30 cm) soil</i>		Not included in new indicator set
			4.1e NEW	Management of the risks to water quality in forests

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
4.1f	Per cent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variance of biological diversity from the historic range of variability	Same as international		Not included in new indicator set
4.1g	Per cent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation or temperature change	Same as international		Not included in new indicator set
4.1h	Area and per cent of forest land experiencing an accumulation of persistent toxic substances	Same as international		Not included in new indicator set
<b>Criterion 5 – Maintenance of forest contribution to global carbon cycles</b>				
5.1a	Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages	Same as international	5.1a NEW	Contribution of forest ecosystems and forest industries to the global greenhouse gas balance
5.1b	Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, coarse woody debris, peat and soil carbon)	Same as international		Considered in new Indicator 5.1a
5.1c	Contribution of forest products to the global carbon budget	Same as international		Considered in new Indicator 5.1a
<b>Criterion 6 – Maintenance and enhancement of long term multiple socioeconomic benefits to meet the needs of societies</b>				
6.1	Production and consumption	Production and consumption	6.1	Production and consumption
6.1a	Value and volume of wood and wood products production, including value added through downstream processing	Same as international	6.1a	Value and volume of wood and wood products
6.1b	Value and quantities of production of non-wood forest products	Same as international	6.1b	Values, quantities and use of non-wood forest products
6.1c	Supply and consumption of wood and wood products, including consumption per capita	Same as international	6.1c NEW	Value of forest-based services
6.1d	Value of wood and non-wood products production as percentage of GDP	Value of wood and non-wood products production as percentage of regional value of production	6.1d NEW	Production, consumption and trade of wood, wood products and non-wood products
6.1e	Degree of recycling of forest products	Same as international	6.1e	Same as 2003
6.1f	Supply and consumption/use of non-wood products	Same as international		Combined in Indicator 6.1d
6.2	Recreation and tourism	Recreation and tourism	6.3	Recreation and tourism
6.2a	Area and per cent of forest land managed for general recreation and tourism, in relation to the total area of forest land	Area and per cent of forest land available for general recreation and tourism	6.3a	Area of forest available for public recreation/tourism
6.2b	Number and type of facilities available for general recreation and tourism, in relation to population and forest area	Number, range and use of recreation/tourism activities available in a given region	6.3b	Range and use of recreation/tourism activities available
6.2c	Number of visitor days attributed to recreation and tourism, in relation to population and forest area	Number of visits per annum		Combined in new Indicator 6.3b

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
6.2d		Proportion of forest sites available for recreation and tourism which are impacted unacceptably by visitors		Not included in new indicator set
6.3	Investment in the forest sector	Investment in the forest sector	6.2	Investment in the forest sector
6.3a	Value of investment, including investment in forest growing, forest health and management, planted forests, wood processing, recreation and tourism	Same as international	6.2.a	Investment and expenditure in forest management
6.3b	Level of expenditure on research and development, and education	Same as international	6.2b NEW	Investment in research, development, extension and the use of new and improved technologies
6.3c	Extension and use of new and improved technologies	Same as international		Combined in new Indicator 6.2b
6.3d	Rates of return on investment	Same as international		Not included in new indicator set
6.4	Cultural, social and spiritual needs and values	Cultural, social and spiritual needs and values	6.4	Cultural, social and spiritual needs and values
6.4a	Area and per cent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values	(i) Area and per cent of forest land in defined tenures, management regimes and zonings which are formally managed in a manner which protects Indigenous peoples' cultural, social, religious and spiritual values, including non-consumptive appreciation of country	6.4a	Area of forest to which Indigenous people have use and rights that protect their special values and which are recognised through formal and informal management regimes
		(ii) Proportion of places of non-Indigenous cultural value in forests formally managed to protect those values	6.4b	Registered places of non-Indigenous cultural value in forests that are formally managed to protect those values
		(iii) Extent to which the management framework maintains and enhances Indigenous values including customary, traditional and native title use by Indigenous peoples and for Indigenous participation in forest management (not reported)	6.4c NEW	The extent to which Indigenous values are protected, maintained and enhanced through Indigenous participation in forest management
6.4b	Non-consumptive use forest values	Same as international	6.4d	The importance of forests to people
6.5	Employment and community needs	Employment and community needs	6.5	Employment and community needs
6.5a	Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment	Same as international	6.5a	Direct and indirect employment in the forest sector
6.5b	Average wage rates and injury rates in major employment categories within the forest sector	Same as international	6.5b	Wage rates and injury rates within the forest sector
6.5c	Viability and adaptability to changing social and economic conditions, of forest-dependent communities, including Indigenous communities	(i) Viability and adaptability to changing social and economic conditions, of forest-dependent communities	6.5c	Resilience of forest-dependent communities to changing social and economic conditions

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
		(ii) Viability and adaptability of forest-dependent Indigenous communities	6.5d	Resilience of forest-dependent Indigenous communities to changing social and economic conditions
6.5d	Area and per cent of forest land used for subsistence purposes	Area of land available and accessible for Indigenous people to exercise their inherent rights to meet subsistence or individual and family cultural and spiritual needs		Combined into new Indicator 6.4c
<b>Criterion 7 – Legal, institutional and economic framework for forest conservation and sustainable management</b>				
7.1	Extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests, including the extent to which it:			
			7.1a NEW	Extent to which the legal framework supports the conservation and sustainable management of forests
7.1a	Clarifies property rights, provides for appropriate land tenure arrangements, recognises customary and traditional rights of Indigenous people and provides means of resolving property disputes by due process	Provides mechanisms to clarify property rights and establish appropriate land tenure arrangements that recognise traditional management practices and self-management as well as the existence of native title and the customary and traditional rights of Indigenous peoples		Combined in new Indicator 7.1a
7.1b	Provides for periodic forest-related planning, assessment, and policy review that recognises the range of forest values, including coordination with relevant sectors	Same as international		As above
7.1c	Provides opportunities for public participation in public policy and decision making related to forests and public access to information	Same as international		As above
7.1d	Encourages best practice codes for forest management	Encourages the development and application of best practice codes for forest management		As above
7.1e	Provides for the management of forests to conserve special environmental, cultural, social and/or scientific values	Provides for the management of environmental, cultural, social and/or scientific values in forests and ensures the participation of Indigenous peoples in all aspects of forest planning and management processes		As above
7.2	Extent to which the institutional framework supports the conservation and sustainable management of forests, including the capacity to:			
			7.1b NEW	Extent to which the institutional framework supports the conservation and sustainable management of forests

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
7.2a	Provide for public involvement activities and public education, awareness and extension programmes and make available forest-related information	Same as international		Combined in new Indicator 7.1b
7.2b	Undertake and implement periodic forest-related planning, assessment, and policy review including cross-sectoral planning and coordination	Same as international		As above
7.2c	Develop and maintain human resource skills across relevant disciplines	Same as international		As above
7.2d	Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and support forest management	Same as international		As above
7.2e	Enforce laws, regulation and guidelines	Same as international		As above
7.3	Extent to which the economic framework (economic policies and measures) supports the conservation and sustainable management of forests through:			
			7.1c NEW	Extent to which the economic framework supports the conservation and sustainable management of forests
7.3a	Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services	Same as international		Combined in new Indicator 7.1c
7.3b	Nondiscriminatory trade policies for forest products	Same as international		As above
7.4	Capacity to measure and monitor changes in the conservation and sustainable management of forests, including:			
			7.1d NEW	Capacity to measure and monitor changes in the conservation and sustainable management of forests
7.4a	Availability and extent of up-to-date data, statistics and other information important to measuring or describing indicators associated with Criteria 1–7	Same as international		Combined in new Indicator 7.1d
7.4b	Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information	Same as international		As above
7.4c	Compatibility with other countries in measuring, monitoring and reporting on indicators	Same as international		As above
7.5	Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services			

**Table A1: Comparison of indicators: Montreal Process, SOFR 2003, SOFR 2008 *continued***

No. in 1996 and/or 2003	International-level Montreal Process set of indicators (published 1996)	Indicators used in Australia's SOFR 2003	No. in 2008	Indicators used in Australia's SOFR 2008
			7.1e NEW	Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services
7.5a	Development of scientific understanding of forest ecosystem characteristics and functions	Same as international		Combined in new Indicator 7.1e
7.5b	Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest-related resource depletion or replenishment in national accounting systems	Same as international		As above
7.5c	New technologies and the capacity to assess the socio-economic consequences associated with the introduction of new technologies	Same as international		As above
7.5d	Enhancement of ability to predict impacts of human intervention on forests	Same as international		As above
7.5e	Ability to predict impacts on forests of possible climate change	Same as international		As above
7.5.f		Per cent of native forests and plantations that are formally supported by silvicultural and utilisation research support		Not included in new indicator set





# Appendix B

## Indicator 1.1d – Fragmentation metrics

**Table B1: Fragmentation metrics for Tasmanian bioregions, all forest types combined, by tenure, 1972 to 2002**

Bioregion	Number of patches <sup>a</sup>	Mean patch size	Mean nearest neighbour	Patch density	Edge density	Fragmentation: overall synthesis by bioregion
Forests in nature conservation reserves <sup>b</sup>						
Tasmanian Central Highlands	Decreased 3% 1972–92, then increased 2% to 2002	Increased 4% 1972–92, then decreased 4% to 2002	Increased 4% to 1992, then decreased 4% to 2002	Decreased 4% 1972–92, then increased 4% to 2002	Fluctuated within a 2% range	Decreasing fragmentation 1972–92, then increasing to 2002
King	Decreased 10% 1972–92, then increased 6% to 2002	Increased 20% 1972–92, then about the same to 2002	Increased 21% to 1992, then decreased 11% to 2002	Decreased 17% 1992–2002	Fluctuated within a 4% range	Large decrease in fragmentation 1972–92, then increasing to 2002
Tasmanian Northern Slopes	Decreased 2% 1972–92, then increased 2% to 2002	Increased 4% 1972–98, then decreased 2% to 2002	Fluctuated within a 5% range 1972–2002	Decreased 4% 1972–98, then increased 2% to 2002	Fluctuated within a 1% range 1972–2002	Decreasing fragmentation 1972 to 1992–98, then increasing to 2002
Tasmanian South East	Decreased 10% 1972–98, then increased 1% to 2002	Increased 14% 1972–98, then decreased 2% to 2002	Increased 60% to 1998, then decreased 1% to 2002	Decreased 11% 1972–2002	Decreased 6% 1972–92, then increased 1% to 2002	Large decrease in fragmentation 1972 to 1992–98, then increasing to 2002
Tasmanian Southern Ranges	Decreased 6% 1972–92, then increased 1% to 2002	Increased 15% 1972–92, then decreased 2% to 2002	Increased 25% to 1998, then decreased 1% to 2002	Decreased 7% 1972–92, then increased 2% to 2002	Decreased 5% 1972–92, then increased 1% to 2002	Large decrease in fragmentation 1972 to 1992–98, then increasing to 2002
Tasmanian West	Decreased 3% 1972–92, then increased 6% to 2002	Increased 4% 1972–92, then decreased 6% to 2002	Increased 3% to 1992, then decreased 7% to 2002	Decreased 4% 1972–92, then increased 7% to 2002	Decreased 1% 1972–92, then increased 4% to 2002	Decreasing fragmentation 1972–92, then increasing to 2002
Multiple-use public forests						
Ben Lomond	Decreased 2%	Increased 5%	Fluctuated within a 1% range	Decreased 5%	Fluctuated within a 3% range	Decreasing fragmentation
Tasmanian Central Highlands	Decreased 4%	Increased 8%	Fluctuated within a 3% range	Decreased 8%	Fluctuated within a 3% range	Decreasing fragmentation 1992–2002
Flinders	Decreased 5%	Increased 7%	Increased 6%	Decreased 7%	Decreased 7%	Decreasing fragmentation
King	Decreased 16%	Increased 32%	Increased 3%	Fluctuating within a 7% range	Decreased 16%	Decreasing fragmentation
Tasmanian Northern Slopes	Decreased 5%	Increased 11%	Increased 3%	Decreased 10%	Decreased 7%	Decreasing fragmentation
Tasmanian Northern Midlands	Increased 3%	Decreased 1%	Increased 4%	Increased 1%	Fluctuating within a 2% range	Increasing fragmentation

**Table B1: Fragmentation metrics for Tasmanian bioregions, all forest types combined, by tenure, 1972 to 2002 *continued***

Bioregion	Number of patches <sup>a</sup>	Mean patch size	Mean nearest neighbour	Patch density	Edge density	Fragmentation: overall synthesis by bioregion
Tasmanian South East	Decreased 10%	Increased 10%	Increased 10%	Decreased 13%	Decreased 9%	Greatly decreasing fragmentation
Tasmanian Southern Ranges	Increased 1% 1972–92, then decreased 5% to 2002	Decreased 3% 1972–92, then increased 8% to 2002	Decreased 7% 1972–1998, then increased 3% to 2002	Increased 3% 1972–92, then decreased 8% to 2002	Fluctuated within a 2% range	Increasing fragmentation 1972 to 1992–98, then decreasing to 2002
Tasmanian West	Increased 1% 1972–80, then decreased 8% to 2002	Decreased 2% 1972–80, then increased 13% to 2002	Increased 5%	Increased 2% 1972–1980, then decreased 13% to 2002	Increased 2% 1972–80, then decreased 7% to 2002	Increasing fragmentation 1972–1980, then decreasing greatly to 2002
Private forests						
Ben Lomond	Fluctuated within a 2% range	Decreased 9%	Fluctuated within a 1% range	Decreased 8%	Decreased 6%	Fragmentation fluctuating
Tasmanian Central Highlands	Fluctuated within a 1% range	Fluctuating within a 1% range	Fluctuated within a 2% range	Fluctuated within a 1% range	Fluctuated within a 3% range	Fragmentation fluctuating
Flinders	No change 1972–80, then increased 6% to 2002	Fluctuating within a 2% range	Increased 1% 1972–92, then decreased 5% to 2002	Fluctuated within a 2% range	Fluctuated within a <1% range	Fragmentation fluctuating
King	Decreased 1% 1972–80, then increased 8% to 2002	Decreased 6% 1972–92, then increased 5% to 2002	Decreased 7%	Fluctuated within a 3% range	Fluctuated within a 1% range	Fragmentation fluctuating
Tasmanian Northern Slopes	Decreased 4% 1972–80, then increased 9% to 2002	Decreased 5% 1972–92, then increased 13% to 2002	Increased 3% 1972–80, then decreased 8% to 2002	Fluctuated within a 7% range	Fluctuated within a 4% range	Fragmentation fluctuating
Tasmanian Northern Midlands	Fluctuated within a 5% range	Fluctuated within a 1% range	Fluctuated within a 7% range	Fluctuated within a 2% range	Decreased 4%	Fragmentation fluctuating
Tasmanian South East	Decreased 5% 1972–92, then increased 2% to 2002	Increased 10% 1972–92, then decreased 1% to 2002	Fluctuated within a 2% range	Fluctuated within a 6% range	Decreased 6% 1972–92, then increased 1% to 2002	Fragmentation fluctuating
Tasmanian Southern Ranges	Fluctuated within a 2% range	Decreased 5% 1972–92, then increased 3% to 2002	Fluctuated within a 2% range	Fluctuated within a 4% range	Fluctuated within a 3% range	Fragmentation fluctuating
Tasmanian West	Increased 4% 1972–92, then decreased 7% to 2002.	Decreased 3% 1972–92, then increased 9% to 2002	Decreased 13% 1972–92, then increased 7% to 2002	Fluctuated within a 6% range	Fluctuated within a 1% range	Fragmentation fluctuating

a See Table 17 in Indicator 1.1d for meanings of column headings.

b There was insufficient area of nature conservation reserves in Ben Lomond, Flinders and Tasmanian Northern Midlands bioregions for meaningful analysis.

**Table B2: Fragmentation metrics for Queensland bioregions, all forest types combined, by tenure, 1972 to 2002**

Bioregion	Number of patches <sup>a</sup>	Mean patch size	Mean nearest neighbour	Patch density	Edge density	Fragmentation: overall synthesis by bioregion
Forests in nature conservation reserves						
Banana–Auburn Ranges	Decreased 29%	Increased 47%	Increased 53% to 1998, then constant to 2002	Fluctuated within a 30% range	Fluctuated within a 4% range	Large decrease in fragmentation
Barakula	Decreased 6% 1972–92, then constant to 2002	Increased 8% 1972–92, then constant to 2002	Increased 13% to 1992, then constant to 2002	Fluctuated within a 13% range	Fluctuated within a 6% range	Decrease in fragmentation
Burnett–Curtis Coastal Lowlands	Decreased 45%	Increased 105%	Increased 96%	Decreased 53%	Decreased 37%	Decrease in fragmentation
Burnett–Curtis Hills and Ranges	Decreased 35%	Increased 76%	Increased 94% to	Decreased 43%	Decreased 35%	Large decrease in fragmentation
Carnarvon Ranges	Fluctuated within a 6% range	Fluctuated within a 7% range	Fluctuated within a 37% range	Fluctuated within a 7% range	Fluctuated within a 12% range	Fragmentation fluctuating
Inglewood Sandstones	Decreased 56%	Increased 132%	Extremely large increase	Decreased 56% 1972–99, then constant to 2002	Fluctuated within a 7% range	Large decrease fragmentation 1972–92, then increasing to 2002
Southeast Hills and Ranges	Increased 6%	Decreased 10% 1972–92, then constant to 2002	Decreased 27% 1972–98, then constant to 2002	Fluctuated within a 6% range	Fluctuated within a 4% range	Decrease in fragmentation
Woorabinda	Decreased 19%	Increased 29% 1972–98, then decreased 1% to 2002	Increased 25% 1972–98, then decreased 2% to 2002	No data	Fluctuated within a 6% range	Large decrease in fragmentation
Multiple-use public forests						
Banana–Auburn Ranges	Fluctuated within a 6% range	Fluctuated within a 8% range	Increased 22% 1972–80, then decreased 19% to 2002	Fluctuated within a 7% range	Fluctuated within a 5% range	Fragmentation fluctuating
Barakula	Increased 3% 1972–80, then decreased 8% to 1998, then constant to 2002	Decreased 2% 1972–80, then increased 8% to 2002	Decreased 1% 1972–80, then increased 10% to 2002	Fluctuated within a 13% range	Decreased 10%	Decreasing fragmentation
Burnett–Curtis Coastal Lowlands	Decreased 22% 1972–98, then increased 1% to 2002	Increased 48% 1972–98, then decreased 1% to 2002	Increased 18% 1972–98, then decreased 1% to 2002	Decreased 32%	Decreased 24%	Decreasing fragmentation
Burnett–Curtis Hills and Ranges	Fluctuated within a 5% range	Increased 15% 1972–98, then decreased 1% to 2002	Increased 15% 1972–98, then decreased 1% to 2002	Fluctuated within a 12% range	Decreased 14%	Fluctuating fragmentation
Carnarvon Ranges	Decreased 30%	Increased 48%	Decreased 14% 1972–92, then increased 40% to 2002	Decreased 33%	Fluctuated within a 9% range	Large decrease in fragmentation
Inglewood Sandstones	Increased 26% 1972–98, then increased 2% to 2002	Increased 38% 1972–98, then decreased 2% to 2002	Increased 32% 1972–98, then decreased 10% to 2002	Decreased 29% 1972–98, then constant to 2002	Decreased 11%	Increase in fragmentation
Southeast Hills and Ranges	Fluctuated within a 5% range	Fluctuated within a 4% range	Decreased 7% 1972–92, then increased 1% to 2002	Fluctuated within a 5% range	Decreased 6%	Fluctuating fragmentation
Woorabinda	Fluctuated within a 12% range	Increased 28% 1972–92, then decreased to 2002	Fluctuated within a 7% range	No data	Decreased 28% 1972–80, then fluctuated within a 3% range 1980–2002	Fluctuated fragmentation

**Table B2: Fragmentation metrics for Queensland bioregions, all forest types combined, by tenure, 1972 to 2002 *continued***

Bioregion	Number of patches <sup>a</sup>	Mean patch size	Mean nearest neighbour	Patch density	Edge density	Fragmentation: overall synthesis by bioregion
Private forests						
Banana–Auburn Ranges	Fluctuated within a 9% range	Fluctuated within a 12% range	Fluctuated within a 5% range	Fluctuated within a 10% range	Fluctuated within a range of 7%	Fragmentation fluctuating
Barakula	Fluctuated within a 5% range	Fluctuated within a 8% range	Fluctuated within a 6% range	Fluctuated within a 7% range	Fluctuated within a 8% range	Fragmentation fluctuating
Burnett–Curtis Coastal Lowlands	Fluctuated within a 5% range	Fluctuated within a 10% range	Increased 4% 1972–92, then decreased 5% to 2002	Fluctuated within a 4% range	Decreased 8%	Fragmentation fluctuating
Burnett–Curtis Hills and Ranges	Decreased 18%	Increased 41%	Increased 11%	Decreased 29%	Decreased 21%	Fragmentation decreasing
Inglewood Sandstones	Fluctuated within a 14% range	Fluctuated within a 20% range	Fluctuated within a 8% range	Decreased 23% 1972–80, then fluctuated within a 4% range to 2002	Decreased 4%	Fragmentation fluctuating
Southeast Hills and Ranges	Fluctuated within a 5% range	Fluctuated within a 7% range	Fluctuated within a 4% range	Fluctuated within a 7% range	Decreased 11% 1972–80, then fluctuated within a 1% range to 2002	Fragmentation fluctuating
Woorabinda	Decreased 21% 1972–92, then increased 5% to 2002	Increased 49% 1972–92, then decreased 5% to 2002	Fluctuated within a 12% range	No data	Decreased 30% 1972–80, then fluctuated within a 2% range to 2002	Fragmentation increasing

a See Table 17 in Indicator 1.1d for meanings of column headings.

# Appendix C

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

**Table C1: Examples of forest-associated tree species for which genetic data are available**

Species	Common name	Genetic marker	Publications
<i>Eucalyptus kochii</i>	Oil mallee	RFLPs (nuclear)	Byrne M (1999). High genetic identities between three oil mallee taxa, <i>Eucalyptus kochii</i> , subsp. <i>plenissima</i> and <i>E. horistes</i> , based on nuclear RFLP analysis. <i>Heredity</i> 82:205–211.
<i>E. loxophleba</i>	York gum	RFLPs (chloroplast DNA)	Hines B and Byrne M (2001). Genetic differentiation between mallee and tree forms in the <i>Eucalyptus loxophleba</i> complex. <i>Heredity</i> 87:566–572.
			Byrne M and Hines B (2004). Phylogeographical analysis of cpDNA variation in <i>Eucalyptus loxophleba</i> (Myrtaceae). <i>Australian Journal of Botany</i> 52:459–470.
<i>E. marginata</i>	Jarrah	RFLPs, isozymes	Millar M, Byrne M, Coates D, Stukely M and McComb J (2000). Mating system studies in jarrah, <i>Eucalyptus marginata</i> (Myrtaceae). <i>Australian Journal of Botany</i> 48:475–479.
			Wheeler MA, Byrne M and McComb JA (2003). Little genetic differentiation within the dominant forest tree, <i>Eucalyptus marginata</i> (Myrtaceae) of South-Western Australia. <i>Silvae Genetica</i> 52:5–6.
		Chloroplast DNA	Wheeler M and Byrne M (2006). Congruence between phylogeographic patterns in cpDNA variation in <i>Eucalyptus marginata</i> (Myrtaceae) and geomorphology of the Darling Plateau, south-west of Western Australia. <i>Australian Journal of Botany</i> 54:17–26.
<i>E. occidentalis</i>	Yate	RFLPs (nuclear)	Elliott C and Byrne M (2003). Genetic diversity within and between natural populations of <i>Eucalyptus occidentalis</i> (Myrtaceae). <i>Silvae Genetica</i> 52:3–4.
<i>E. angustissima</i> subsp. <i>angustissima</i>	Narrow-leaved mallee	RFLPs (nuclear and chloroplast DNA)	Elliot CP and Byrne M (2004). Phylogenetics and the conservation of rare taxa in the <i>Eucalyptus angustissima</i> complex in Western Australia. <i>Conservation Genetics</i> 5:39–47.
<i>E. diversicolor</i>	Karri	Isozymes	Coates D and Sokolowski R (1989). Geographic patterns of genetic diversity in karri ( <i>Eucalyptus diversicolor</i> F. Muell.). <i>Australian Journal of Botany</i> 37:145–156.
<i>E. gomphocephala</i>	Tuart	Isozymes	Coates D, Keighery G and Broadhurst L (2002). Genetic and morphological variation, and the mating system in tuart. In: <i>Tuart</i> ( <i>Eucalyptus gomphocephala</i> ) and <i>Tuart Communities</i> . Wildflower Society of Western Australia, Perth Branch, Nedlands, 89–107.
<i>Acacia saligna</i>	Orange wattle	RFLPs (nuclear)	George N, Byrne M, Maslin B and Yan G (2006). Genetic differentiation among morphological variants of <i>Acacia saligna</i> (Mimosaceae). <i>Tree Genetics and Genomes</i> 2:109–119.
<i>E. grandis</i>	Flooded gum	Chloroplast DNA	Jones M, Shepherd M, Henry R and Delves A (2006). Chloroplast DNA variation and population structure in the widespread forest tree, <i>Eucalyptus grandis</i> . <i>Conservation Genetics</i> 7(5):691–703.

**Table C2: Examples of forest-associated fauna species for which genetic data are available**

Species	Common name	Genetic marker	Publications
<i>Setonix brachyurus</i>	Quokka	Allozymes, mtDNA	Sinclair E (2001). Phylogeographic variation in the quokka, <i>Setonix brachyurus</i> (Marsupialia: Macropodidae): implications for conservation. <i>Animal Conservation</i> 4:325–333.
<i>Phascogale tapoatafa</i>	Brush-tailed phascogale	mtDNA	Spencer P, Rhind S and Eldridge M (2001). Phylogeographic structure within <i>Phascogale</i> (Marsupialia: Dasyuridae) based on partial cytochrome b sequence. <i>Australian Journal of Zoology</i> 49:369–377.

# Appendix D

## Impacts of animals, plant pests and pathogens on ecosystem health

**Table D1: Impact of various vertebrates on ecosystem health and vitality in forest areas, by jurisdiction and tenure**

	ACT		NSW		NT		Qld		SA		Tas.		Vic.		WA	
	MUF	NCR	MUF	NCR <sup>a</sup>	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR
<b>Mammals</b>																
<b>Native</b>																
Dingo ( <i>Canis familiaris dingo</i> )	Y3		Y4	N-	Y1	Y1	Y3	Y3	N0	N0	N0	N0	Y1	N-	N-	N-
Kangaroo ( <i>Macropus</i> spp.)	Y4		Y3	N-	Y3	Y3	Y3	N3	Y4		N1	Y4	Y3	N-	Y3	Y3
Native rat	N-		N-	N-	Y3	Y3	Y3	Y3	Y1	Y1	N3	N3	Y3	N-	N	N
Pademelon ( <i>Thylogale</i> spp.)			Y1	N-		N-	Y3	Y3	N0	N0	Y5	Y4	Y0	N-		
Possum	N-		Y4	N-	Y1	Y3	Y3	Y3	Y1	Y1	Y5	Y4	Y3	N-	N	N
Wallaby (several species)	N-		Y3	N-	Y3	Y3	Y3	Y3	Y1	Y1	Y5	Y4	Y3	N-	N	N
<b>Exotic</b>																
European red fox ( <i>Canis vulpes</i> )	Y5		Y4	Y-	Y1	Y1	Y5	Y5	Y3	Y5	Y2	Y2	Y4	Y5	Y5	Y5
Feral cat ( <i>Felis catus</i> )	Y4		Y4	Y-	Y4	Y4	Y5	Y5	Y1	Y3	Y3	Y3	Y3	Y4	Y4	Y4
Feral deer (several species)	Y0		Y2	Y-	Y1	Y0	Y2	Y2	Y4	Y4	Y2	Y1	Y4	Y1	N	N
Feral dog ( <i>Canis familiaris</i> )	Y3		Y4	Y-	Y3	Y3	Y3	Y3	N1	N1	N1	N1	Y3	Y2	Y1	Y1
Feral donkey ( <i>Equus asinus</i> )			Y1	N-	Y4	Y4	Y1	Y0	N0	N0	N0	N0	Y0	N-	N	N
Feral goat ( <i>Capra hircus</i> )	Y5		Y3	Y-	Y1	Y1	Y5	Y4	N1	Y2	Y1	Y2	Y1	Y2	N	N
Feral horse ( <i>Equus caballus</i> )	Y2		Y3	Y-	Y4	Y4	Y1	Y4	N1	N1	N0	N0	Y1	Y2	N	N
Hare ( <i>Lepus capensis</i> )	Y3		Y1			N-	Y3	Y1	Y5		N1	N1	Y1	N-	N	N
House mouse ( <i>Mus musculus</i> )	Y3		Y3		Y3	Y1	Y3	Y3	Y1	Y3	N1	Y3	Y1	N-	N	N
Pig ( <i>Sus scrofa</i> )	Y5		Y5	Y-	Y5	Y5	Y4	Y4	N1	N1	N0	N2	Y1	Y2	Y4	Y4
Rabbit ( <i>Oryctolagus cuniculus</i> )	Y5		Y5	Y-	Y3	Y2	Y3	Y3	Y1	Y4	Y4	Y2	Y3	Y5	Y3	Y3
Rat, exotic (some <i>Rattus</i> spp.)	Y3		Y2		Y3	Y3	Y1	Y1	N1	Y1	N1	Y3	Y1	N-	N	N
<b>Amphibians</b>																
<b>Exotic</b>																
Cane toad ( <i>Bufo marinus</i> )			Y2	Y-	Y5	Y4	Y5	Y4	N0	N0	N0	N0	Y0			
<b>Birds</b>																
<b>Native</b>																
Cockatoo ( <i>Cacatua</i> spp.)			Y2	N-		Y0			N0	N0	N3	N3	Y3		Y4 <sup>b</sup>	N
Parrot			N-	N-		Y0			N0	N0	N3	N3	Y3		Y5 <sup>c</sup>	N
<b>Exotic</b>																
Blackbird ( <i>Turdus merula</i> )	Y5		N-	N-		N-		N0	N0	N0	N1	Y1	Y1		N-	N-
Common myna ( <i>Acridotheres tristis</i> )	Y4		N-	N-		N-	Y1	N0	N0	N0	N0	N0	N0		N-	N-
Starlings/sparrows ( <i>Sturnus vulgaris/Passer domesticus</i> )	Y4		N-	N-		N-	Y4	N0	N0	N0	N3	Y2	Y0		N-	N-

MUF = multiple-use public forest; N = not considered to be a problem; N- = not rated; NCR = public nature conservation reserve; Y = considered to be a problem  
 Impact scores: 0 = reported present but not problematic; 1 = occurs but restricted distribution, has little impact; 2 = restricted distribution and adverse impact; 3 = widespread distribution but having minimal impacts; 4 = widespread distribution and having adverse impacts locally; 5 = very widespread and having widespread adverse impact; - = not scored; blank = no data

a NSW only rated top-five threats in NCRs.

b Plantation only.

c Plantation only; Y2 for native MUF.

Source: State and territory agencies

**Table D2: Impact of various invertebrates on ecosystem health and vitality in forest areas, by jurisdiction and tenure**

	ACT		NSW		NT		Qld		SA		Tas.		Vic.		WA	
	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	PTM/ MUF <sup>a</sup>	NCR
Australian plague locust ( <i>Chortoices termanifera</i> )			Y5								N0	N0				
Autumn gum moth ( <i>Mnesampela privata</i> )	Y1		Y0				N1		Y4		Y3	N3	Y4	Y3	N1/N1	N0
Bees (several species)	Y4		Y0		Y3		N0		Y0		N3	Y3	Y0	Y1	N0/N1	Y1
Beetle, African black ( <i>Heteronychus arator</i> )			Y0				N0		Y1		N0	N0	Y1	Y1	Y4/N1	N1
Beetle, Christmas ( <i>Anoplognathus</i> spp.)	Y3		Y4		Y3		Y2		Y0		N1	N1	Y3	Y3	Y0/Y0	Y0
Beetle, five-spined bark ( <i>Ips grandicollis</i> )	Y1		Y3				Y4		Y4		N0	N0	Y3	Y3	Y4/Y4	N0
Beetle, leaf/flea (chrysomelids)			Y4		Y3		Y4		Y4		Y4	N3	Y4	Y4	Y2/Y0	N1
Beetle, longicorn (cerambycids)			Y4				Y3		Y3		Y4	N3	Y2	Y3	Y2/Y2	N1
Beetle, spring ( <i>Heteronyx</i> spp.)			Y4				Y4		Y1		Y4	N3	Y4	Y3	Y2/Y1	N1
Borers ( <i>Lepidoptera</i> )			Y4				Y4		Y2		N0	N0	Y4	Y2	N1/N1	N1
Cup moth ( <i>Doratifera</i> spp.)			Y0				N3		Y2		N0	N0	Y4	Y4	N1/N1	N1
Grasshopper (acridids)	Y1				Y3		Y4		Y3				Y4	Y1	N1/N1	Y1
Gum tree scale ( <i>Eriococcus</i> spp.)			Y0						Y0		Y3	N1	Y4	Y4		
Gumleaf skeletoniser ( <i>Uraba lugens</i> )			Y0				N1		Y1		Y3	N2	Y1	Y2	Y0/Y5	Y5
Leaf miner ( <i>Perthida glyphopa</i> )	Y1		Y0		Y3		N0		Y1		N3	N3	Y3	Y3	Y0/Y4	Y4
Lerps (psyllids)	Y4		Y4		Y3		Y3		Y1		Y4	N3	Y4	Y4	N0/N0	Y5
Monterey pine aphid ( <i>Essigella californica</i> )			Y5				Y3		Y4		Y1	N0	Y5	Y0		
Saw fly ( <i>Perga dorsalis</i> , <i>Pergagraptella bella</i> )			Y0				Y4		Y4		Y3	N1	Y4	Y1	N1/N1	N1
Termites ( <i>Cryptotermes</i> , <i>Coptotermes</i> spp.)			Y0				N3		Y0		Y4	N3	Y1	Y1	N1/N1	N1
Wasp, European ( <i>Vespula germanica</i> )	Y3		Y0		Y3		N0		Y0		Y4	Y4	Y1	Y1	N1/N0	N0
Wasp, siren ( <i>Sirex noctilio</i> )	Y3		Y4				N0		Y3		Y4	N0	Y4	Y0	N0/N0	N0
Weevils (curculionids)	Y1		Y0		Y3		N3		Y3		Y4	N3	Y3	Y1	Y3/Y1	N1
Wingless grasshopper ( <i>Phaulacridium vittatum</i> )	Y1		Y1				Y4		Y4		Y1	N1	Y1	Y1	Y4/Y1	N1

MUF = multiple-use public forest; N = not considered to be a problem; NCR = public nature conservation reserve; Y = considered to be a problem  
 Impact scores: 0 = reported present but not problematic; 1 = occurs but restricted distribution, has little impact; 2 = restricted distribution and adverse impact; 3 = widespread distribution but having minimal impacts; 4 = widespread distribution and having adverse impacts locally; 5 = very widespread and having widespread adverse impact; - = not scored; blank = no data

<sup>a</sup> Plantations/MUF

Source: State and territory agencies

**Table D3: Impact of various plant pests (weeds) on ecosystem health and vitality in forest areas, by jurisdiction and tenure**

	ACT		NSW <sup>a</sup>		NT		Qld		SA		Tas.		Vic.		WA	
	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR
Blackberry ( <i>Rubus fruticosus</i> agg. <i>Rubus vulgaris</i> )	Y4		Y4	Y-			Y4	Y4	Y2	Y2	N1	Y2	Y4	Y4	b	b
Bracken fern ( <i>Pteridium esculentum</i> )	Y1	Y1	N-	N-			Y3	Y3	Y4	N-	Y4	N3	Y4	Y1	N-	N-
Broadleaved weeds			Y3	Y-			Y4	Y-	Y4	Y1	Y4	Y4			Y4	Y4
Cobbler's peg, Canadian fleabane ( <i>Erigeron canadensis</i> )			N0	N-			Y4	Y4	Y5	Y1	N0	N0	N1	N0		
Crofton weed/mist flower ( <i>Ageratina</i> spp., <i>Eupatorium</i> spp.)			Y4	Y-			Y4	Y4	N0	N-	N0	N0		N0	N0	N0
Eucalypts ( <i>Eucalyptus</i> , <i>Conyobia</i> spp.)			N-	N-			N3	N3	Y1	N-	Y4	N3	N3	N0	Y2	Y2
Grass, gamba ( <i>Andropogon gayanus</i> )			N0	N-			Y4	Y4	N0	N-	N0	N0				
Grasses, exotic (not separately identified)	Y4		N-	Y-	Y4		Y5	Y5	N1	Y1	Y1	Y4			Y4	Y4
Great brome ( <i>Bromus diandrus</i> ), soft brome ( <i>B. molliformis</i> )			Y2	N-			Y5	Y2	Y4	Y2	N0	Y1		N	Y3	Y3
Horehound ( <i>Marrubium vulgare</i> )			Y1	Y-			Y4	Y4	N1	Y1	N0	Y1	N1	Y2	N0	N0
Lantana ( <i>Lantana camara</i> )			Y5	Y-	Y1		Y5	Y5	N0	N-	N0	N0	N0	N-	N0	N0
Paterson's curse/salvation Jane ( <i>Echium plantagineum</i> )			Y4	Y-			Y4	Y2	N1	Y1	N0	N0	N1	Y2	Y3	Y3
Prickly pear ( <i>Opuntia</i> spp.)			Y4	Y-			Y3	Y3	N0	N-	N0	N0	N1	Y2	Y3	Y3
St John's wort ( <i>Hypericum perforatum</i> )	Y2		Y4	Y-			Y1		N1	Y1	N0	N0	Y3	Y2	Y2	Y2
Thistle (several species)			Y3	Y-			Y4	Y-	Y4	Y1	Y2	Y4	N3		Y1	Y1
Vines, creepers – bridal ( <i>Asparagus asparagoides</i> ); rubber ( <i>Thubergia grandiflora</i> ); others			Y0	Y-			Y5	Y5	Y2	Y2	N0	Y2	N1	Y3	Y4/Y5	Y4/Y5
Water hyacinth ( <i>Eichhornia crassipes</i> )			N0	Y-			Y4	Y4	N0	N-	N0	N0	N0	N-	N	N
Wattles ( <i>Acacia</i> spp.)							N3	N3	Y4	Y2	Y4	Y2	N3	Y3	Y5	Y5

MUF = multiple-use public forest; N = not considered to be a problem; NCR = public nature conservation reserve; Y = considered to be a problem

Impact scores: 0 = reported present but not problematic; 1 = occurs but restricted distribution, has little impact; 2 = restricted distribution and adverse impact; 3 = widespread distribution but having minimal impacts; 4 = widespread distribution and having adverse impacts locally; 5 = very widespread and having widespread adverse impact; - = not scored; blank = no data

a NSW only rated top-five threats in NCRs.

b *Rubus fruticosus* is not relevant to Western Australia. The species relevant to Western Australia are *R. anglocandicans* (Y4); *R. ulmifolius* (Y2); *R. laudatus* (Y2).

Source: State and territory agencies



**Table D4: Impact of various pathogens on ecosystem health and vitality in forest areas, by jurisdiction and tenure**

Pathogens	ACT		NSW		NT		Qld		SA		Tas.		Vic.		WA	
	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	MUF	NCR	PTN/ MUF <sup>a</sup>	NCR
<i>Armillaria</i> spp.			Y1				Y1			Y1	Y3	N3	Y4		Y1/Y4	Y4
<i>Aulographina eucalypti</i>			Y0				Y4									
<i>Cyclaneusma minus</i>			Y3				N-		Y3/ Y4		Y4	N0			N1/N0	N0
<i>Dothistroma septospora</i>			Y4				N-				Y2	N0			N1/N0	N0
<i>Kirramyces eucalypti</i>			Y4				Y4									
<i>Mycosphaerella</i> spp.			Y3				Y3		Y4		Y4	N3	Y3		Y2/Y1	Y1
<i>Phelinus noxius</i>							Y4				N0	N0			N-	N-
<i>Phytophthora cinnamomi</i>			N1	Y-			Y1		N-	Y2	Y2	Y2	Y4		Y1/Y5	Y5
<i>Piliidiella</i> (formerly known as <i>Coniella</i> ) spp.			Y0				Y4									
<i>Quambalaria corycup</i>											N0	N0			Y0/Y4	Y4
<i>Quambalaria pitereka</i>			Y5				Y5									
<i>Rigidoporus vinctus</i>							Y4								N-	N-
<i>Sphaeropsis sapinea</i> (formerly known as <i>Diplodia pinea</i> )			Y4				Y3		Y3/ Y4		Y3	N0			Y1/Y0	N0

MUF = multiple-use public forest; N = is not considered to be a problem; NCR = public nature conservation reserve; Y = is considered to be a problem

Impact scores: 0 = Reported present but not problematic; 1 = occurs but restricted distribution, has little impact; 2 = restricted distribution and adverse impact; 3 = widespread distribution but having minimal impacts; 4 = widespread distribution and having adverse impacts locally; 5 = very widespread and having widespread adverse impact; - = not scored; blank = no data

a Plantations/MUF.

Source: State and territory agencies

# Appendix E

## State and territory legislation related to the harvesting of non-wood forest products

### New South Wales

The New South Wales *National Parks and Wildlife Act 1974* protects all native fauna (mammals, birds, reptiles and amphibians) and flora. The protection of fauna is extended by the Act to the protection of threatened interstate fauna. It is an offence to harm any protected fauna or flora without a licence or, in the case of fauna, without consent of the owners of private or Indigenous land. Under the *Forestry Act 1916*, Forests NSW (formerly the Forestry Commission of New South Wales) can legally issue licences to take protected fauna, with the exception of endangered fauna. Forests NSW may not license the removal of protected native plants unless it is satisfied that they would otherwise be destroyed by lawful forestry activities under the Forestry Act. An exception to this is in certain protected areas such as wildlife refuges, in which Forests NSW can authorise harvests. Animals not native to Australia fall under the control of the *Non-Indigenous Animals Act 1987* but also need a permit to be imported, kept, moved, transported or liberated without a permit (Bates 2002).

The *Threatened Species Conservation Act 1995* provides for the conservation of threatened species, populations and ecological communities of animals and plants. The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development, including the amendment of other Acts to provide for the facilitation of the appropriate assessment, management and regulation of actions that may damage critical or other habitat or otherwise significantly affect threatened species, populations and ecological communities. This includes the insertion of offences into the *National Parks and Wildlife Act 1974* relating to harming (of listed threatened species, populations and ecological communities (animals)) and picking (of listed threatened species, populations and ecological communities (plants)), buying, selling or possessing threatened species or populations (animals or plants) and damaging of critical and other habitat. Part 2A of the *Threatened Species Conservation Act 1995* establishes the Biodiversity Banking and Offsets Scheme. The scheme enables the establishment of biodiversity banking sites, the creation of biodiversity credits, the trading of biodiversity credits, and the use

of credits to offset development otherwise impacting on biodiversity values.

The *Environmental Planning and Assessment Act 1979* also has provisions relevant to the harvesting of non-wood forest products. The clearing of remnant native vegetation or protected regrowth for tourism (and other purposes) requires approval under the *Native Vegetation Act 2003* unless the clearing is a permitted activity.

### Queensland

Queensland's *Nature Conservation Act 1992* provides for the ecologically sustainable use of protected animals, and adopts an ecosystem approach. It envisages a protective framework that specifically allows the ecologically sustainable use, including commercial use, of protected wildlife. Commercial activities within areas managed by Queensland Parks and Wildlife Service operate through a licensing system that controls the taking, keeping and use of protected wildlife in protected areas under section 63 of the Nature Conservation (Protected Areas Management) Regulation 1996, in state forest under section 27 of the Forestry Regulation 1988, and in recreation areas under section 26 of the *Recreational Areas Management Act 1988* (commercial tour operators and commercial filming and photography) (EPA Qld 2007). A conservation plan subject to public consultation is needed for any proposed take of wildlife species that have a higher conservation status than 'common'.

### Northern Territory

Regulations under the *Territory Parks and Wildlife Conservation Act 2001* manage the use of native flora and fauna through a permit system. A permit to 'take or interfere with wildlife' is issued to people wishing to take native flora or fauna from the wild. The Department of Natural Resources, Environment and the Arts regulates this permit system; if the integrity of a species is starting to be compromised by commercial use, the department develops a management plan for that species. Such management plans are in place for cycads, crocodiles, magpie geese and the red-tailed black cockatoo.

In 1994, the Northern Territory Government adopted a set of guiding principles for advancing nature conservation and environmental protection in its *Conservation Strategy for the Northern Territory*. The strategy recognised that Territorians use and value wild plants, animals and ecosystems in a variety of ways. However, the goals set out in the strategy did not provide clear guidelines and direction about the sustainable use of wildlife; instead, guidelines and objectives were established in *A Strategy for Conservation through Sustainable Use of Wildlife in the Northern Territory of Australia*. That strategy encourages the sustainable use of wildlife for commercial purposes where landholders are the beneficiaries, and encourages the development of management plans.

## Western Australia

Under Western Australia's *Conservation and Land Management Act 1984*, the Department of Environment and Conservation (formerly known as the Department of Conservation and Land Management, or CALM) is responsible for administering the *Wildlife Conservation Act 1950*, which provides for the conservation and protection of all native flora and fauna in Western Australia. The department employs a system of licensing, area and species-specific management, and monitoring. A management plan for the commercial harvesting of protected flora in Western Australia for 2003–08 was developed by CALM to satisfy the requirements of the national *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In the Wildlife Conservation Act, flora is defined as 'any plant, including any wildflower, palm, shrub, tree, fern, creeper or vine which is either native to Western Australia or declared to be flora under the Act and includes any part of flora and the seeds and spores thereof'. This plan does not cover species listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendix I or listed as threatened under the EPBC Act. A commercial purposes licence is required for the commercial use of protected species on Crown or private land. In the case of Crown land, the proponent of a commercial purposes licence must demonstrate that it has an area in which to harvest the species as well as written permission from the government agency that is managing that land (Nature Base 2007).

## South Australia

The South Australian *National Parks and Wildlife Act 1972* provides the state's legislative framework for the conservation of wildlife in its natural environment. This framework allows the Department for Environment and Heritage to monitor, prevent and control the illegal exploitation of protected wildlife and regulate legal activities such as hunting. Protected animals include only indigenous and migratory birds, mammals and reptiles. The department administers a permit system, under which a permit is needed to take any protected species, except where the

Minister for Environment and Heritage declares otherwise, based on a threat to crops or property. The Minister may also declare an open hunting season for protected animals of specified species, except those listed as endangered. Flora is also protected under the National Parks and Wildlife Act; a permit is needed to take native plants on any reserved land, including forest reserves or other Crown land, as well as certain native plants on private land (Bates 2002).

## Tasmania

Wildlife in Tasmania is protected by the Wildlife Regulations 1999. 'Wildlife' is defined as all living creatures except stock, dogs, cats, farmed animals and fish. Open season may be declared by the responsible minister for particular species of wildlife, such as wallabies, possums, deer, wild duck and mutton-birds (Bates 2002). The *Tree Fern Management Plan* was formulated and additions made to Tasmania's *Forest Practices Act 1985* to improve the sustainability of the tree-fern harvesting industry.

## Victoria

In Victoria, wildlife (defined as vertebrate species indigenous to Australia, some non-native game species and terrestrial invertebrate animals that are listed under the *Flora and Fauna Guarantee Act 1988*) is protected under the *Wildlife Act 1975*. Protected species can become locally unprotected if they are causing damage to property or crops. The responsible minister can issue a closure notice that prohibits or regulates the taking, destroying or hunting of any species of wildlife in any area (Bates 2002). A licence or authorisation is needed to take, destroy or disturb wildlife in a state wildlife reserve, with game reserves and wildlife sanctuaries being exceptions. Flora is protected under the Flora and Fauna Guarantee Act; it may include indigenous and non-indigenous species. A permit is needed to take, trade in, keep, move or possess protected fauna.

## References

Bates G (2002), Nature Base (2007), Queensland EPA (2007) (list at the back of the report).

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# Acronyms and abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics	ForestWorks	National Skills Company for the Forestry and Forest Products, Furnishing and Pulp & Paper Industries Ltd (formerly FAFPESC)
ABS	Australian Bureau of Statistics	FPA	Forest Practices Authority (Tas.)
ACT	Australian Capital Territory	FTA	free trade agreement
AFCS	Australian Forest Certification Scheme	FWPA	Forest and Wood Products Australia
AGO	Australian Greenhouse Office	IBRA	Interim Biogeographic Regionalisation of Australia
ANZECC	Australian and New Zealand Environment and Conservation Council	ILC	Indigenous Land Corporation
BRS	Bureau of Rural Sciences	ILUA	Indigenous land use agreement
CALM	Department of Conservation and Land Management (WA – now DEC)	IPCC	Intergovernmental Panel on Climate Change
CAR	comprehensive, adequate and representative	IUCN	International Union for Conservation of Nature
CBS	clearfell, burn and sow silviculture system	JANIS	Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee
CCA	community conservation area (NSW)	MAC	Maningrida Arts and Culture
CDEP	Community Development Employment Program	MIG	Montreal Process Implementation Group for Australia
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	MODIS	Moderate-resolution Imaging Spectroradiometer
CRC	cooperative research centre	NCAS	National Carbon Accounting System
CSIRO	Commonwealth Scientific and Industrial Research Organisation	NFI	National Forest Inventory
DAFF	Department of Agriculture, Fisheries and Forestry (Australia)	NLWRA	National Land & Water Resources Audit
DEC	Department of Environment and Conservation (WA – formerly CALM)	NSW	New South Wales
DECC	Department of Environment and Climate Change (NSW – formerly Department of Environment and Conservation)	NT	Northern Territory
DEW	Department of the Environment and Water Resources (now DEWHA)	PIRSA	Department of Primary Industries and Resources South Australia
DEWHA	Department of the Environment, Water, Heritage and the Arts (formerly DEW)	Qld	Queensland
DFTD	(Tasmanian) devil facial tumour disease	RFA	regional forest agreement
DSE	Department of Sustainability and Environment (Vic.)	RPCC	Research Priorities and Co-ordination Committee
EMS	environmental management system	SA	South Australia
EPA	Environment Protection Authority (SA), Environmental Protection Authority (WA), Environmental Protection Agency (Qld)	SEEDS	Social, Environmental and Economic Data System (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cwlth)	SLA	statistical local area
FAFPESC	Forest and Forest Products Employment Skills Company	SoE	State of the Environment
		SOFR	<i>State of the Forests Report</i>
		Tas.	Tasmania
		UNFCCC	United Nations Framework Convention on Climate Change
		Vic.	Victoria
		WA	Western Australia

# Glossary

<b>Acidity, acidification</b>	Chemical terms relating to corrosiveness. Acidification refers to increasing levels of acidity, for example in soil. Soil acidification can damage soil and vegetation.		
<b>Age classes</b>	Groupings of a similar age; for example, plantations established between 1990 and 1994 are in a five-year age class.		
<b>Aggregate retention</b>	Trees retained in clumps or clusters in forests harvested for timber.		
<b>Biodiversity</b>	The variety of all life forms – plants, animals and microorganisms, their genes and the ecosystems they inhabit. ‘Genetic diversity’ is the diversity within each species, ‘species diversity’ is the variety among species, and ‘ecosystem diversity’ is the diversity of different communities formed by living organisms and the relations among them.		
<b>Biogeographic</b>	Relating to the study of the distribution of living things (referring to that distribution).		
<b>Biological diversity</b>	See <i>Biodiversity</i> .		
<b>Biomass</b>	Plant and other material of biological origin.		
<b>Biome</b>	A large, regional ecological unit, usually defined by some dominant vegetative pattern.		
<b>Bush sawn/ hewn timber</b>	Timber cut from logs in the forest using portable equipment.		
<b>Carbon accounting</b>	Estimation of the amount of carbon in an ecosystem and changes in the amount stored. Carbon accounting in forests includes estimating changes, arising from activities such as reforestation, in the amount of carbon stored.		
<b>Carbon sequestration</b>	The removal and storage of carbon from the atmosphere in vegetation and soils.		
<b>Carbon sink</b>	Components of the land and biomass where carbon is held in non-gaseous form in the long term.		
<b>CAR reserve system</b>	A reserve system based on three principles: including the full range of vegetation communities ( <i>comprehensive</i> ); ensuring that the level of reservation is large enough to maintain species diversity, as well as community interaction and evolution ( <i>adequate</i> ); and conserving the diversity within each vegetation community, including genetic diversity ( <i>representative</i> ). The CAR reserve system is made up of dedicated reserves, informal reserves and areas where values are protected by prescription. Dedicated, or formal, reserves are set aside for conservation through areas such as national parks. Informal forest reserves are areas set aside for conservation purposes in forests that are otherwise production forests,		
		<b>Certification</b>	such as special protection zones in state forests. Areas where values are protected by prescription within production forests are those that cannot be practically protected by formal or informal reservation (e.g. riparian vegetation or rare and dispersed values). See <i>Forest certification</i> .
		<b>Clearfelling</b>	A silvicultural system in which all trees in large areas are harvested in one operation. Trees needed to provide wildlife habitat or streamside reserves or for other purposes may be retained.
		<b>Clonal propagation</b>	Production of identical copies of a plant, allowing maximum benefit to be gained from proven superior individuals occurring in nature or developed by breeding.
		<b>Closed forest</b>	Forest in which the tree crown cover, viewed from above, ranges between 80% and 100% of the land area.
		<b>CO<sub>2</sub> equivalent</b>	Measurement unit used to express the effect in the atmosphere of various greenhouse gases as units of CO <sub>2</sub> (carbon dioxide).
		<b>Code of forest practice</b>	A set of principles, procedures, guidelines and standards that specify minimum acceptable practices in harvesting and associated forest management operations.
		<b>Community</b>	See <i>Plant community</i> .
		<b>Coppicing</b>	A traditional silvicultural method in which young tree stems are cut down to near ground level. In subsequent growth years, many new shoots emerge; after a number of years, the coppiced tree is ready to be harvested again.
		<b>Cording</b>	The practice of placing large (5–30 centimetre diameter) woody material on extraction tracks before harvesting in order to minimise erosion (see also <i>Matting</i> ).
		<b>Crown cover</b>	The area of ground covered by tree canopies, ignoring overlaps and gaps within individual canopies.
		<b>Crown cover density</b>	Measure of crown cover.
		<b>Crown land</b>	Land owned by the government.
		<b>Data</b>	Statistics, usually in a quantitative form.
		<b>Deforestation</b>	A type of land clearing involving the permanent removal of tree cover.
		<b>Dicotyledon</b>	A plant with two embryonic leaves (the first leaves of the seedling).
		<b>Dieback</b>	A symptom of disease in trees and other vegetation in which the foliage dies progressively from the extremities; commonly used in reference to native forests affected by cinnamon fungus ( <i>Phytophthora cinnamomi</i> ) or woodland forests affected by salinity.

<b>Dispersed retention</b>	Retention of individual trees scattered throughout an area in forests harvested for timber.	<b>Forest-dependent species</b>	A species that requires a forest habitat for at least part of its lifecycle. In many cases, our ecological understanding of the species is not sufficient to determine whether it is wholly, partly or cyclically forest-dependent.
<b>Ecologically sustainable forest management</b>	The integration of commercial and non-commercial values of forests so that the welfare of society (both material and non-material) is improved, while ensuring that the values of forests, both as a resource for commercial use and for conservation, are not lost or degraded for current and future generations.	<b>Forest-dwelling species</b>	A species that uses a forest habitat for all or part of its lifecycle.
<b>Ecosystem</b>	The biotic and abiotic components of an environment that interact to produce a flow of energy and cycling of nutrients. Ecosystems are extremely difficult to define practically because of high variation, temporal changes and lack of discreteness.	<b>Forest structure</b>	The three-dimensional layout of a forest. The uppermost vertical layer is formed by the canopies of the tallest trees, and there may be no, one or more understorey layers. Ground surface characteristics (amount of litter, presence of dead fallen wood, stoniness) and the presence of vines also contribute to forest structure. Structure is usually important in the creation of habitat for a wide range of species.
<b>Ecosystem diversity</b>	See <i>Biodiversity</i> .	<b>Formally managed</b>	Includes management required by legislation or other agreements for which legislation allows (e.g. memorandums of understanding, partnerships, management agreements, access agreements, informal understandings) for the protection of places through management zones, prescriptions and/or codes of practice, where these management techniques lead to all relevant sites being actively managed or protected on the ground.
<b>Ecosystem health</b>	The state of ecosystem processes (energy, nutrient, hydrological and biological processes) that maintain the vitality of the ecosystem.	<b>Fragmentation (of habitat)</b>	The emergence of discontinuities (fragmentation) in an organism's preferred environment (habitat). Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment or by human activity, such as land conversion, that can alter the environment on a much shorter timescale.
<b>Edge effect</b>	In relation to forests, the effect of non-forest environmental influences on parts of the forest adjoining non-forested land.	<b>Freehold</b>	See <i>Private forest</i> .
<b>Endangered species and communities</b>	Species/communities at high risk of imminent extinction if factors causing population decline continue.	<b>Fuel load</b>	The total amount of combustible material in a defined space.
<b>Endemic</b>	Species of plants or animals that occur naturally in a region or country (see also <i>Exotic</i> ).	<b>Gall</b>	A proliferation and modification of plant tissue caused by various parasites, from fungi and bacteria to insects and mites.
<b>Even-aged forest</b>	Forest in which trees are all about the same age or of the same age class, even though they may vary in size because of their different rates of growth.	<b>Genetic diversity</b>	See <i>Biodiversity</i> .
<b>Exotic</b>	Species of plants or animals found in a region where they do not occur naturally (see also <i>Endemic</i> ).	<b>Geographic information system</b>	A system for capturing, storing, analysing and managing data and associated attributes that are spatially referenced to the earth.
<b>Farm forestry</b>	Establishment and/or management of trees on farmland for commercial, aesthetic and/or environmental reasons.	<b>Global carbon cycle</b>	The movement of carbon between different parts of the earth, including the storage of carbon in those parts.
<b>Fibreboard</b>	A category of engineered wood panel products made from pulpwood and/or wood-processing residues such as woodchips, sawmill shavings and sawdust and a resin or binder, pressed into panels. Types of fibreboard (in order of increasing density) include particleboard, medium-density fibreboard, high-density fibreboard and hardboard.	<b>Greenhouse gases</b>	Gases that affect the temperature of the earth's surface and climate. They include water vapour, ozone, chlorofluorocarbons, carbon dioxide, methane and nitrous oxide. The 'enhanced greenhouse effect' refers to changes in the earth's climate as a result of increasing levels of greenhouse gases in the atmosphere due to human activity.
<b>Foliar</b>	Of or relating to a leaf or leaves.	<b>Group selection</b>	A silvicultural system in which groups (small patches) of trees are selected for harvesting, leading to a forest comprising patches of differently aged trees.
<b>Forest</b>	A land area, incorporating all living and non-living components, dominated by trees usually having a single stem and a mature or potentially mature stand height exceeding 2 metres, and with existing or potential crown cover of overstorey strata about equal to or greater than 20%. This definition includes native forests and plantations and areas of trees that are sometimes described as woodlands.		
<b>Forest certification</b>	A process whereby the sustainable forest management credentials of a forest are investigated and certified by a third party.		

<b>Growing stock</b>	The total volume of wood in all living trees in a forest at a particular time.	<b>Mosaic/patchwork (of vegetation)</b>	Vegetation composed of patches of different types, perhaps arising from periodic disturbance (such as fire or timber harvesting) or related to differences in soil or landform.
<b>Gymnosperm</b>	A plant, such as a cycad or conifer, the seeds of which are not enclosed within an ovary.	<b>Multiple-use public forest</b>	Publicly owned state forest, timber reserves and other forest areas on which a range of forest values is managed, including timber harvesting, water supply, conservation of biodiversity, recreation and environmental protection. Such forests are managed by state and territory agencies in accordance with relevant Acts and regulations.
<b>Habitat</b>	The total of environmental conditions and resources surrounding and available to an organism.	<b>Native</b>	Located within the organism's natural range (see also <i>Non-native</i> ).
<b>Hand pollination</b>	The mechanical transfer of pollen grains (male reproductive cells) to the plant carpel, the structure that contains the ovule (female reproductive cell); used when natural, or open, pollination is inadequate or undesirable.	<b>(Public) Nature conservation reserve</b>	Crown land that is formally reserved for environmental, conservation and recreational purposes. Nature conservation reserves include national parks, nature reserves, state and territory recreation and conservation areas, and formal reserves in state forests and on Crown lands reserved to protect water-supply catchments. They do not include informal reserves and those pending gazettal. The harvesting of wood and non-wood forest products is generally not permitted.
<b>Hardwood</b>	Timber from flowering trees, such as eucalypts, irrespective of the physical hardness of the timber; also used to refer to the trees that have such timber.	<b>Non-native</b>	Located outside the organism's natural range (see also <i>Native</i> ).
<b>Harvesting</b>	As part of forest management, cutting (felling) of trees to produce timber products.	<b>Non-wood forest product</b>	A product of biological origin, other than wood, derived from forests. Examples are game animals, seeds, berries, mushrooms, oils, foliage, medicinal plants and forage.
<b>Hybridisation</b>	The process of crossing breeds or cultivars of a single plant species, or crossing plants of different taxa (subspecies, species or genera).	<b>Old-growth forest</b>	Ecologically mature forest in which the effects of disturbances are now negligible.
<b>Indigenous (of people)</b>	Of Aboriginal or Torres Strait Islander descent.	<b>Open forest</b>	Forest in which the tree crown cover, viewed from above, ranges between 50% and 80% of the land area.
<b>Informal forest reserve</b>	See <i>CAR reserve system</i> .	<b>Other Crown land</b>	Crown land reserved for a variety of purposes, including utilities, scientific research, education, stock routes, mining, use by the defence forces, and use by Indigenous communities.
<b>Integrated pest management</b>	A pest control strategy that uses an array of complementary methods, such as natural predators and parasites, pest-resistant varieties, cultural practices, biological controls, various physical techniques and chemicals.	<b>Parasitoid</b>	An organism that spends a significant proportion of its life attached to or within a single host organism, which it ultimately kills (and often consumes) in the process.
<b>Introgression</b>	The movement of a gene from one species into the gene pool of another.	<b>Particleboard</b>	A panel product made by compressing wood particles (usually from softwood timber) and resin; commonly used in flooring and joinery.
<b>Land clearing</b>	Permanent removal of vegetation.	<b>Photosynthesis</b>	A process in plants in which energy from sunlight and carbon dioxide from air are used to produce plant matter, and in which oxygen is released.
<b>Land tenure</b>	See <i>Crown land, Leasehold forest, Multiple-use public forests, Nature conservation reserve, Other Crown land, Private forest and Unresolved tenure</i> .	<b>Phyllode</b>	A widened and flattened stalk attaching a leaf to the stem. The leaf is reduced, and the phyllode performs photosynthesis.
<b>Leasehold forest</b>	Forest on Crown land held under leasehold title and generally regarded as privately managed; includes land held under leasehold title with special conditions attached for designated Indigenous communities.	<b>Plantation</b>	Stands of trees of native or exotic species, created by the regular placement of seedlings or seeds.
<b>Log landing</b>	Any place where logs are laid after being yarded and before transport to the worksite.		
<b>Matting</b>	The practice of placing small (<5 centimetre diameter) woody material on extraction tracks before harvesting to minimise erosion (see also <i>Cording</i> ).		
<b>Monocotyledon</b>	A plant with a single embryonic leaf (first leaf of the seedling).		
<b>Montreal Process</b>	The informal agreement by the Montreal Process Working Group of (currently 12) countries to work towards the implementation of a comprehensive set of criteria and indicators for the conservation and sustainable management of temporal and boreal forests.		

<b>Plant community</b>	A recognisable association of a number of plant species.	<b>Roundwood</b>	Sawlogs, pulpwood, poles, etc, in round form.
<b>Plywood</b>	A panel product made by gluing veneers of wood together; commonly used in construction and joinery.	<b>Salinity/salinisation</b>	The amount of salt in water or soil. Salinisation is the process of increasing salinity levels, such as occurs in soils and streams when saline groundwater rises towards the surface following clearing of forests for farmland.
<b>Private forest</b>	Forest on land held under freehold title and under private ownership; includes land held under freehold title with special conditions attached for designated Indigenous communities.	<b>Salvage harvesting</b>	The commercial or non-commercial harvest of trees that are dead or dying due to insect attack, disease, drought, fire, etc.
<b>Provenance</b>	The place of origin of a plant or animal.	<b>Sawlogs</b>	Logs used to manufacture sawn timber.
<b>Pteridophyte</b>	A vascular plant (a plant with xylem and phloem) that neither flowers nor produces seeds, but reproduces and disperses only via spores.	<b>Sawn timber</b>	Timber produced by sawing logs into particular sizes; also called 'sawnwood'.
<b>Pulpwood</b>	Timber used to manufacture pulp or paper products.	<b>Sclerophyll</b>	Plants and vegetation, such as eucalypts and acacias, that have tough leaves adapted to arid climates.
<b>Recycling</b>	The collection, separation and processing of materials for manufacture into raw materials or new products.	<b>Selective or partial logging</b>	A silvicultural practice in which trees above a certain specified size are removed singly or in groups while regrowth, pole timber or habitat trees are retained to maintain uneven-aged forest.
<b>Regeneration</b>	New trees arising naturally or with human assistance after harvesting, fire or other causes have removed all or some of the overstorey. Plant species vary widely in the site conditions that they need in order to regenerate.	<b>Shrubland</b>	Vegetation dominated by woody plants that are multi-stemmed at the base or by single-stemmed plants that are less than 2 metres tall at maturity.
<b>Regional forest agreement</b>	An agreement between the Australian Government and a state government about the long-term management and use of forests in a region.	<b>Siltation</b>	The deposition of silt (fine soil and mineral matter); refers to the degradation of watercourses due to soil erosion.
<b>Remote sensing (remotely sensed data)</b>	Obtaining data with a sensor some distance from the object. Sensors rely on the detection of energy, such as light and heat, emitted from or reflected by the object. Remotely sensed data are data obtained by such methods.	<b>Silvicultural practices</b>	The methods used in managing forest establishment, composition and growth.
<b>Re-sawing</b>	Cutting timber along the grain to reduce larger sections into smaller sections or veneers.	<b>Silviculture</b>	The science and technology of managing forest establishment, composition and growth.
<b>Resolution (image)</b>	A measurement of the output quality or detail of an image, usually given as pixel size (the size of the square areas recorded). Higher resolution means more image detail; for example, an image with 1 m × 1 m pixels is of higher resolution than an image with 1,000 m × 1,000 m pixels.	<b>Single tree/small group selection</b>	The harvesting of single trees or small groups of trees of various ages; a method suitable for promoting regeneration of shade-tolerant species.
<b>Ringbarking</b>	Killing a tree by cutting the sapwood in a ring around the trunk.	<b>Single tree selection</b>	A silvicultural system in which individual trees are selected for harvesting. This system may be used in types of forest, such as tropical rainforests, in which regeneration can occur in patches created by individual trees falling or being removed.
<b>Riparian zone</b>	The interface between land and a flowing water body. Plant communities along river margins are called 'riparian vegetation'.	<b>Softwood</b>	Timber from cone-bearing trees, such as conifers, irrespective of the physical softness of the timber; also used to refer to the trees that have such timber.
<b>River regulation</b>	The control or modification of the natural flow of a river or stream, most commonly by the use of dams.	<b>Soil erosion hazard</b>	The susceptibility of soil to erosion.
<b>Rotation</b>	In forestry, the planned number of years between regeneration and final harvesting of a stand of trees. Rotation length is used in forest management planning to determine sustainable yield. Due to variability in growth, market demand and other factors, the actual age at final harvesting is likely to be more or less than the planned rotation.	<b>Species diversity</b>	See <i>Biodiversity</i> .
		<b>Stochastic events</b>	Random or chance events that influence ecosystems, such as fires or floods.
		<b>Stocking</b>	A description of stand density, which can be measured in a number of ways: number of trees, basal area or volume per unit area, or percentage of crown closure.

<b>Strandboard</b>	An engineered wood product formed by layering strands (flakes) of wood in specific orientations. The product may have a rough and variegated surface, with the individual strips lying unevenly across each other.
<b>Stripfelling</b>	The practice of felling alternate strips of the forest, leaving uncut strips in between to provide seed and shelter.
<b>Structure</b>	See <i>Forest structure</i> .
<b>Subspecies</b>	A taxonomically recognised subdivision of a species.
<b>Sustainable development</b>	Development that meets current needs without compromising the ability of future generations to meet their own needs.
<b>Sustainable forest management</b>	A set of objectives, activities and outcomes consistent with maintaining or improving the forest's ecological integrity and contributing to people's wellbeing now and in the future.
<b>Sustainable yield</b>	Yield of forest products (e.g. timber, water) that ensures that the functioning of the forest ecosystem as a whole is maintained and the flow of products continues indefinitely.
<b>Taxon</b>	A classification of plants or animals (e.g. a species or genus).
<b>Tenure</b>	Title to land as controlled by legislation (see also <i>Land tenure</i> ).
<b>Translocation</b>	The deliberate transfer of plant material from one area to another for the purpose of conservation. The plant material may be in the form of seeds, cuttings or propagated seedlings.
<b>Uneven-aged forest</b>	Forest with more than one age class closely intermingled on the same site.
<b>Unresolved tenure</b>	Areas where tenure is unknown or for which there are no data.

<b>Value adding</b>	The process of converting raw timber or forest products into one or more higher valued products.
<b>Veneer</b>	Thin slices of wood, usually thinner than 3 millimetres, glued and pressed onto core panels (typically wood, particleboard or medium-density fibreboard) to produce flat panels.
<b>Veneer logs</b>	Logs used to manufacture veneers or plywood.
<b>Virgin fibre</b>	In pulp and paper manufacture, fibre used for the first time, as opposed to fibre recovered from paper and reused.
<b>Vulnerable species and communities</b>	Species and ecological communities under threat of extinction that are believed likely to move into the 'endangered' category in the near future if the factors causing population decline continue.
<b>Watershed</b>	The dividing line between two drainage basins, shedding water in either direction.
<b>Watertable</b>	The underground level at which the ground is saturated with water, where the water pressure is equal to atmospheric pressure.
<b>Water yield</b>	The amount of water that flows out of a catchment.
<b>Wilderness</b>	Land that, together with its plant and animal communities, 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 can provide opportunities for solitude and self-reliant recreation.
<b>Woodchips</b>	Wood that is converted from logs into small chips before being used in fibre products.
<b>Woodland</b>	Sparse forest in which the tree crown cover, viewed from above, ranges between 20% and 50% of the land area.

## Unit abbreviations

CH <sub>4</sub>	methane
CO <sub>2</sub>	carbon dioxide
ha	hectare
kg	kilogram
km	kilometre
m	metre
m <sup>2</sup>	square metre
m <sup>3</sup>	cubic metre
mm	millimetre
Mt	megatonne (10 <sup>6</sup> tonnes)
MW	megawatt (10 <sup>6</sup> watts)
t	tonne
TJ	terajoule (10 <sup>12</sup> joules)

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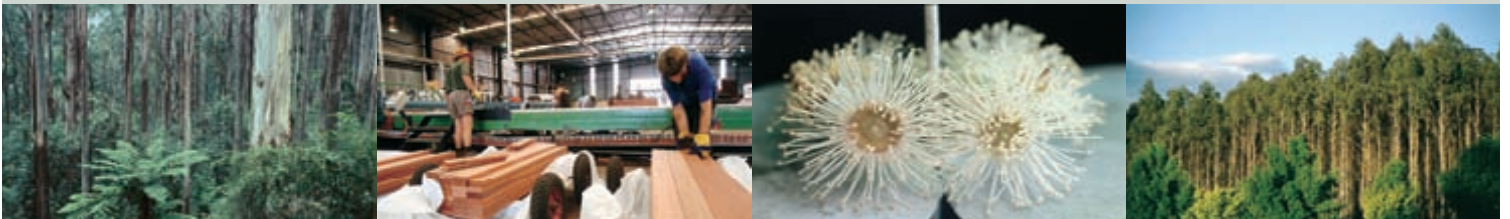
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