

Indicator 7.1e: Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services (2024)



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.

Context

A scientific understanding of the characteristics and functions of Australian forest ecosystems, developed through research and development, underpins their management, and provides the basis for biological surveys, forest inventory, silvicultural regimes, health surveillance, and assessment of sustainable forest management.

Key points

- Australia's capacity to conduct and apply research and development to improve the scientific understanding of forests and delivery of forest products has followed a declining trend due to changes in funding and delivery models by state and territory governments.
- The total number of forest-related researchers employed by state and territory agencies was reported as 118.9 full-time-equivalent (FTE) staff for 2020-21, an increase from the 87.5 FTE staff reported for 2015-16, but less than half of the 245.5 FTE staff reported for 2011-12.

Forest research and development capacity

Australia has developed a comprehensive knowledge-base of the ecological characteristics and functions of its unique forest ecosystems, based on more than 100 years of scientific research and monitoring in a wide range of geographic and climatic areas, to underpin sustainable forest management. However, Australia's capacity to conduct and apply research and development to improve the scientific understanding of forests and delivery of forest products has followed a declining trend due to changes in funding and delivery models by state and territory governments.

The total number of forest-related researchers employed by state and territory government agencies was reported as 118.9 full-time-equivalent (FTE) staff for 2020-21, increasing from the 87.5 full-time-equivalent (FTE) staff reported for 2015-16, but less than half of the 245.5 FTE reported for 2011-12 (Table 7.1e-1). The FTE values reported here are approximate and with low confidence for trends over time due to the difficulty of confirming the direct relevance of some research to forests. These values only reflect capacity with respect to human resources and not the extent to which human capacity may have been replaced by improved technologies.

Between 2015-16 and 2020-21, state and territory government research staff numbers increased in most fields of forest-related research, but between 2011-12 and 2020-21 staff numbers decreased substantially in most fields of

forest-related research (Table 7.1e-1). For a breakdown by state and territory of government research personnel, see [Table 6.2b-2 of Indicator 6.2b](#).

Table 7.1e-1: Full-time-equivalent state and territory government personnel engaged in forest-related research, by field of research

Field of research	State and territory government forest-related research staff (FTE)		
	2011-12	2015-16	2020-21
Fauna ecology including aquatic biota	63.4	18.8	22.4
Flora ecology	30.1	2.3	15.7
Timber use	5.5	1.8	13.4
Sustainable forest management	8.7	8.4	12.2
Fire ecology and fire behaviour	20.5	17.5	12.1
Forest health, forest pathology, biosecurity	16.7	6.6	11.1
Forest carbon	0.0	3.0	10.8
Spatial analysis and modelling	1.0	2.0	7.9
Resource and statistical analysis, remote sensing	1.4	3.7	4.5
Silvicultural research	29.2	1.9	2.4
Agroforestry	3.0	0.0	2.2
Tree breeding (not horticultural)	14.3	3.2	1.4
Climate change	9.5	0.5	1.3
Forest hydrology	11.5	1.6	0.7
Forest entomology	11.2	4.3	0.3
Forest Industries	15	9.6	0.2
Other	4.5	2.3	0.3
Total	245.5	87.5	118.9

FTE, full-time equivalent.

See [Table 6.2b-2 of Indicator 6.2b](#) for a breakdown of government research personnel by state and territory.

Source: State and territory data.

[Click here for a Microsoft Excel workbook of the data for Table 7.1e-1.](#)

Carnegie et al. (2022) reported a 50% reduction in forest health and biosecurity technical expertise between 2000 and 2020, and anticipate a further halving by 2035 based on knowledge of current personnel, likely future retirements and lack of recruitment.

Earlier studies investigating employment in forestry and forest products research and development (Turner and Lambert 2016) identified 276 researchers and technicians employed nationally in 2012-13. This represented a steady decline in research staff since about 1990, from a peak of 794 full-time-equivalent personnel in 1985. These values were calculated from a series of surveys that collected data on forestry and forest products research and development capacity over the period 1981-82 to 2012-13. The expertise of each researcher was not recorded for these surveys, but discussions with employing organisations indicated that there has been a greater decline in some areas of research, such as forest health, silviculture and forest hydrology, compared to others.

National forest research and development organisations

Over the period 2017 to 2024, Australia's capacity to conduct and apply forest research and development nationally has been coordinated and delivered through several organisations, including:

- the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)
- the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Forest and Wood Products Australia (FWPA)
- Australian Forest and Wood Innovations (AFWI) (previously the National Institute for Forest Products Innovation)
- the Terrestrial Ecosystem Research Network (TERN)
- the Long Term Ecological Research Network

Australia also supported international forest research through the Australian Centre for International Agricultural Research (ACIAR) over the period 2017 to 2024.

See [Supporting information to Indicator 7.1e](#) for descriptions of the national forest research and development organisations.

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

National forest research and development organisations

The activities of the national-level organisations with capacity to conduct and apply forest research and development presented in the [Key information for Indicator 7.1e](#) are briefly described below.

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

ABARES – within the Australian Government Department of Agriculture, Fisheries and Forestry – provides integrated economic, scientific, and social science research for policy development, including in forestry. ABARES also coordinates the preparation of [Australia's State of the Forests Report](#), and publishes the [Australian Forests and Wood Products Statistics](#) and *Australian Plantation Statistics* series, and undertakes or coordinates other nationally relevant research on Australia's forests aimed at improving sustainable forest management and the sustainable and profitable delivery of forest goods and services.

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO is Australia's national science research agency. In 2024, up to 15 staff were working directly on forest-related research for CSIRO. This compares to 25 staff working on forest related research in 2017, in turn down from 235 staff (including 85 scientists) working in CSIRO Forestry and Forest Products in 2000 (Kile et al. 2014).

Between 2018 and 2024, forest research was mainly conducted through the Living Landscapes program of CSIRO Land and Water. This program has focused on sustainable forest production, modelling carbon and water balances in forests, growing and managing forests in developing countries for poverty alleviation, predicting risk from bushfires and bushfire management, and more recently agroforestry. CSIRO is also undertaking work on recognition and quantification of the range of natural capital benefits of native forests, plantations, and agroforestry systems, including biodiversity, agricultural co-production, carbon, pollination, and amenity and cultural values, as well as production of more traditional forest products.

Over the period, research addressed questions including:

- the trade-offs between managing forests for timber and non-timber goods and services
- adding value to agricultural enterprises with forests, through analysis of costs and benefits of varying land use practices
- water uptake by forests and implications for forest management aimed at control of catchment water supplies and water quality
- the ways that forest production depends on, and impacts on, natural capital, and approaches to monitor change in natural capital stocks and flows in forested landscapes
- growing and managing forests in developing countries for livelihood enhancement
- carbon sequestration by planted and natural forests, and carbon accounting methodologies
- predicting risk from bushfires, effectiveness of prescribed burning and suppression and emergency responses, including potential impacts of future climates and fire regimes on fuel loads and risk.

CSIRO research is performed mostly in collaboration with other national, state and territory research agencies, universities and research institutions, as well as international research agencies.

Forest and Wood Products Australia (FWPA)

FWPA is an industry-owned not-for-profit company jointly funded for eligible research and development by the forest and wood products sector (through levies) and the Australian Government. It invests in R&D projects

relevant to the Australian forest and wood products sector, and undertakes promotional and marketing activities for the sector. Current investments are delivered through five programs:

1. Promoting the advantages of wood products
2. Aligning products to market needs
3. Assisting value chain optimisation
4. Increasing resource availability and reducing risk
5. Impacting decision making and industry capability.

Completed research aimed at improving forest industry productivity and competitiveness, informing industry's climate change response, increasing investment, increasing forest usage, and ensuring that the sustainability of forests, wood products and services are effectively communicated.

Research in wood product manufacturing has led to the identification of new products and methods for processed forest products. For example, new applications for timber in construction, new timber treatments and new export markets.

Australian Forest and Wood Innovations (AFWI)

AFWI originated as the National Institute for Forest Products Innovation with the aim of promoting innovation in Australia's forest and wood products industry. It was established in 2018 by a combined initial commitment of \$12 million from the Australian, South Australian, Tasmanian and Victorian Governments to establish Innovation Hubs in South Australia, Tasmania and Victoria. Additional financial support was contributed by industry.

AFWI aims to grow Australia's forest and forest products industry by exploring and facilitating innovation in the forest products sector in areas such as forest management, timber processing, wood fibre recovery, value-adding, advanced manufacturing and the bio-economy.

In Victoria, the Gippsland Centre supported two rounds of projects with budgets totalling approximately \$8.5 million, with the second round commencing in 2022. Projects focussed on innovations in timber processing, forest productivity improvement and plantation management.

In South Australia, the Mount Gambier Centre supported three rounds of projects with a total investment of approximately \$14.5 million, on topics including plantation sustainability, biosecurity and forest health, improvements in forest operations, plantation productivity and improvements in timber utilisation.

In Tasmania, the Launceston Centre supported two rounds of projects with budgets totalling approximately \$10 million. Most projects focussed on timber processing, with others in areas such as forest operations, natural capital assessment, biodiversity monitoring and pest management.

The 2022-23 October Federal Budget committed \$100 million over five years for an expanded Australia-wide scope to support research and development to address national challenges in the forest and wood products industries, under the operational name of AFWI. Under this funding the University of the Sunshine Coast and University of Melbourne were identified as new AFWI research centres.

Terrestrial Ecosystem Research Network (TERN)

TERN provides infrastructure and networks that enable Australia's ecosystem science community to collect and integrate ecosystem data across broad spatial and temporal scales. It is designed to examine Australian ecosystems and ecosystem processes from targeted monitoring at the local level, through to surveillance monitoring at regional scales, and continental scale observation and modelling. TERN has built on significant past research on understanding Australian ecosystems – including forests – by collating, calibrating, validating and standardising existing datasets.

TERN is designed to connect ecosystem scientists, enabling them to collect, contribute, store, share and integrate data across relevant disciplines. Examples relevant to Australia's forests include:

- OzFlux, a network of towers around Australia that continuously measure the exchanges of carbon dioxide, water vapour and energy between the terrestrial ecosystem and atmosphere. Twenty-six active OzFlux sites include forest types ranging from open woodland and savanna to tall, wet eucalypt forest and rainforest
- AusPlots, a plot-based surveillance monitoring program, undertaking baseline assessments of ecosystems across the country. AusPlots Forests monitoring plots are distributed through tall eucalypt forest ecosystems around Australia
- the Australian SuperSite Network (ASN) is a national network of multidisciplinary ecosystem observatories including ten SuperSites that each represent a significant Australian biome. The network includes a range of forest types from mulga woodlands to tall eucalypt forest and tropical rainforest.

The Warra Long-Term Ecological Research site is one of the TERN Supersites and part of the TERN AusPlots program, as described in a Warra Case study in the [Supporting information for Indicator 7.1e](#).

Warra was also part of the Long Term Ecological Research Network (LTERN). Between 2012 and 2018 LTERN integrated key established plot networks across Australia to tackle critical questions associated with the impacts of disturbance on Australian ecosystems, drawing together a range of existing long-term ecological monitoring programs to examine Australian ecosystems in new ways. Warra has continued operating since LTERN ceased in 2018.

LTERN was composed of 12 ecological plot networks across Australia that had been actively monitored for several years, and in some cases decades. These plot networks spanned a number of ecosystems including tropical savannas, tall eucalypt forests, mallee woodlands and shrublands, alpine regions, and deserts. The networks also covered multiple land tenures and land uses including plantation forestry, conservation, restoration, tourism and agriculture. These networks were designed to monitor biodiversity and better understand disturbance regimes associated with fire, logging, livestock grazing, invasive species, extreme weather events and climate change.

The Australian Centre for International Agricultural Research (ACIAR)

The Australian Government supports international forest research through ACIAR. The ACIAR Forestry Program contributes to conservation and rehabilitation of natural resources for establishment, management and sustainable use of forests, and provides social, economic and environmental benefits to partner countries and Australia.

The program provides scientific support to understand the role of forestry and its potential to improve livelihoods of smallholder farmers and their communities. It focuses on aspects of forestry value chains that have good economic potential and benefits for communities.

Specifically, the Forestry Program aims to:

- improve livelihoods of smaller holders and communities by enhancing sustainable land and forest management
- foster economic growth through legal, sustainable and value-adding forest industries in developing countries
- contribute to the Australian Government's international forest-policy priorities, combating illegal logging and reducing deforestation.

Areas of focus include development of silvicultural systems, forest restoration, improved germplasm, harvesting and processing approaches, and the management of threats.

State and territory forest-related research and development capacity

The following sub-sections, by state, contain information as supplied by states in addition to the information presented in the [Key information for Indicator 7.1e](#):

New South Wales

Department of Primary Industry

The Forest Science Unit of the Department of Primary Industry is responsible for forest research that supports the sustainable use of native forests and productive plantations in New South Wales. The unit has technical expertise and capability in field-based research, biometrics, spatial modelling, remote sensing, geographic information systems and cost-benefit analysis. Research groups within the Forest Science Unit include:

- Forest Carbon
- Forest Ecology
- Forest Health and Biosecurity
- Forest Resources.

The unit's research outcomes play a key role in shaping policy, industry and environment management decisions that share a common aim: ecologically sustainable forest management through active and adaptive management.

Department of Climate Change, Energy, the Environment and Water

The Biodiversity Indicator Program is the New South Wales Government's flagship biodiversity monitoring program, and is a framework to inform strategic data collection, knowledge synthesis and outlook reporting required under the NSW *Biodiversity Conservation Act 2016*. The technical methods and suite of indicators bring together field monitoring, environmental modelling and remote sensing to assess and report on the status and trends of biodiversity across New South Wales. In May 2020, the NSW Environment, Energy and Science group published the first state-wide assessment of biodiversity in New South Wales, the [Biodiversity Outlook Report](#). This will input into the future management of the environment in New South Wales, including forested lands, with future assessments allowing detection and measurement of the status and trends of biodiversity in response to environmental events.

The Environment, Energy and Science group within the Department of Climate Change, Energy, the Environment and Water also conducts research across a range of areas relating to the health of the environment in New South Wales. Areas covered include climate change, pollution, land and biodiversity and water. Forest-related projects include:

- Growth stage and rainforest mapping
- Classification and mapping of standardised Plant Community Types for monitoring forest extent and improved forest type mapping
- Modelling and mapping of Threatened Ecological Communities
- Koala habitat suitability modelling
- Enhanced Remote Piloted Aircraft based survey methods for arboreal mammals including koalas
- Fire Ecological Carrying Capacity modelling including predicting impacts of climate change
- Terrestrial Light Detection and Ranging (LiDAR) for forest structure and condition monitoring
- Fire Extent and Severity Mapping including spectral recovery of burnt canopies.

Environment Protection Authority

Forest-related research by the NSW Environment Protection Authority guides the regulation of native forestry, and contributes to environment protection through habitat mapping (e.g. koala habitat, threatened ecological

communities), technical review of regeneration standards, and technical input into a range of forest monitoring programs.

Natural Resources Commission Forest Monitoring and Improvement Program

The Forest Monitoring and Improvement Program delivered information and evidence to support the strategic and adaptive management of forests and forest practices on both public and private land. The program provided independent advice to forest managers in NSW on how policies and on-ground management can be improved through the evaluation of forest monitoring data, performance benchmarking and research.

The program generated datasets for baselines and trends using new and traditional methods. This includes datasets for forest extent and condition, the forest carbon balance, species occupancy and distribution, soil health, water quantity and quality in forested catchments, baselines and trends in wood supply, the forest road network, and Indigenous cultural values.

Northern Territory

Table 7.1e-2 presents native forest research capacity in academia reported at Charles Darwin University in the Northern Territory across the fields of research for 2020-21. This is in addition to the territory government research personnel reported in Table 7.1e-1 (and [Table 6.2b-2 in Indicator 6.2b](#)).

Table 7.1e-2: Full-time-equivalent personnel in academia engaged in native forest research in the Northern Territory (at Charles Darwin University) in 2020-21, by field of research

Field of research	2020-21 (FTE)
Fire ecology	3.0
Flora ecology	2.0
Fire behaviour	1.0
Climate change	1.0
Forest carbon	1.0
Spatial analysis, modelling and remote sensing	1.0
Forest hydrology	0.5
Total	9.5

FTE, full-time equivalent.

Source: Charles Darwin University.

[Click here for a Microsoft Excel workbook of the data for Table 7.1e-2.](#)

Queensland

For 2020-21, Queensland reported a total of 25 FTE forest researchers in government agencies, primarily through the Queensland Department of Agriculture and Fisheries (QDAF). Approximately half these personnel undertake research in forestry production, forest pathology, and entomology and biosecurity (in collaboration with the University of the Sunshine Coast and the NSW Department of Primary Industries) to underpin forest resources and protection. Research also covers areas such as upskilling Indigenous Ranger networks on forest biosecurity to enhance Australia's forest biosecurity and silvopastoral systems to increase future forestry resources and mitigate carbon emissions in collaboration with grazing industries.

The other half conduct research in timber utilisation through the QDAF Salisbury Research Facility, which houses more than 3,100 m² of laboratories, processing equipment and office space, and is the base for the QDAF Forest Products Innovation Team to undertake forest products research and development on semi-commercial, pilot and laboratory scales. This location combines Australia's largest science and technical expertise and facilities in:

- engineered wood-based composites technology

- kiln drying and sawmilling technology
- timber grading and advanced mechanical wood properties testing
- wood anatomy and wood identification
- wood product design and manufacture
- timber preservation and performance testing
- adhesives/adhesion testing and development.

QDAF R&D partnerships target research to improve wood products, processing and protection systems with:

- new engineered wood products and building systems for the construction industry
- more efficient wood processing systems
- innovative wood products suited to the new forest resources
- technical solutions for the forest and timber industry sectors.

Tasmania

Collaborative research in Tasmania has been carried out through a hub of the National Institute for Forest Products Innovation (NIFPI), with two rounds of projects commencing in 2018 and 2021 respectively. NIFPI research hubs are located in South Australia, Tasmania and Victoria (see above).

Sustainable Timber Tasmania

Sustainable Timber Tasmania's Forest Management Branch undertakes, and collaborates in, research into native forest silviculture, plantation silviculture, biology and conservation (including forest health surveillance), and together with the Parks and Wildlife Service, Department of Natural Resources and Environment, manages the Warra Long-Term Ecological Research Site in southern Tasmania ([see Case study 7.1e-1](#)). Sustainable Timber Tasmania collaborates with research providers, including universities and the CSIRO, on research focused on plantation wood properties research, management of ecosystems in a changing climate, fire management, management of threatened species, ecological research (including fauna and flora), and natural capital accounting.

Forest Practices Authority

The Forest Practices Authority (FPA), the regulator of forestry in Tasmania, monitors the implementation and effectiveness of the Forest Practices Code and undertakes research that can be applied during forest management. Research and monitoring done by the FPA supports improvement of the Forest Practices Code and is conducted in collaboration with researchers, students and staff in government departments, universities (both in Australia and overseas), institutions, private companies and consultants.

The FPA's research priorities include:

Earth science and cultural heritage

- landscape-scale erosion history and mitigation of erosion risks (e.g. landslides)
- determining the influence of Aboriginal-lit fires on vegetation and landscape character
- determining the principles of carbon sequestration in Tasmanian native forests
- measuring changes of soil carbon stocks under plantation management
- monitoring active karst development and determining the causes of serious erosion in karst terrain
- recording and characterising geo-conservation sites
- procedures for systematic recording and protection of cultural heritage.

Biodiversity

- assessing the effectiveness of management for threatened forest fauna and flora species

- research on the ecology of threatened species that facilitates improved understanding of the areas and habitats used by threatened species
- research on the impact of forest practices (including harvesting, fire etc.) on biodiversity values
- assessing the implementation of management for threatened species
- research to underpin climate change adaptation and mitigation strategies within the Tasmanian forestry industry
- research and monitoring results are published as student theses, FPA Scientific Reports, and in Australian and International journals.

Victoria

In March 2018, the Victorian government announced the ‘Delivering greater community value from our forests’ initiative, which included an extensive program of pre-harvest and landscape scale surveys for forest-dependant species impacted by harvesting, especially threatened species, to be undertaken by the Department of Energy, Environment and Climate Action (DEECA) under the Forest Protection Survey Program. The aims being earlier detection of conservation values such as animals and plants and their habitats that are either threatened or of high conservation value in areas of state forest scheduled for harvesting.

In Victoria, the number of full-time equivalent (FTE) employees in academia engaged in forest-related research and development in 2020-21 was estimated at 34.5 FTEs, as shown by field of research in Table 7.1e-3. This includes roles funded by DEECA through the Integrated Forest and Ecosystem Research program, Natural Hazards Research Australia projects and the Arthur Rylah Institute, plus those funded by VicForests. This is in addition to the state government research personnel reported in Table 7.1e-1 (and [Table 6.2b-2 in Indicator 6.2b](#)).

Table 7.1e-3: Full-time-equivalent personnel in academia engaged in forest-related research in Victoria, by field of research

Field of research	2020-21 (FTE)
Spatial analysis and modelling	9.6
Fire ecology and fire behaviour	6.8
Fauna ecology including aquatic biota	4.2
Sustainable forest management	3.5
Silvicultural research	3.1
Forest health, forest pathology, biosecurity	2.7
Climate change	1.4
Forest carbon	1.1
Forest hydrology	1.1
Resource and statistical analysis, remote sensing	0.6
Timber use	0.3
Agroforestry	0.0
Flora ecology	0.0
Forest entomology	0.0
Forest Industries	0.0
Other	0.0
Tree breeding (not horticultural)	0.0
Total	34.5

FTE, full-time equivalent.

Source: State data.

[Click here for a Microsoft Excel workbook of the data for Table 7.1e-3.](#)

University-based research capacity

Much of our scientific understanding of Australia's forests is developed in universities, with the capacity for forest research present at several Australian universities. Research is carried out both by university research staff and by students enrolled in Honours, Masters or Doctoral degrees. Universities produce high-quality, peer-reviewed research that adds to the development of assessment methodologies and the scientific understanding of Australia's forests, as needed to underpin sustainable forest management.

Many academic institutions contribute to the range of forest research programs established under research agencies funded by the Australian Government, as well as research agencies funded by state and territory governments. In addition, research centres and facilities at universities provide focal points for research training and collaboration, including with other universities, government agencies and the private sector.

Eight Australian universities reported activities in the field of forestry sciences in the Australian Research Council's most recent and final Excellence in Research for Australia national report titled *State of Australian University Research 2018-19* (ARC 2019): the Australian National University, Murdoch University, Southern Cross University, the University of Melbourne, the University of Queensland, the University of Tasmania, the University of the Sunshine Coast, and the University of Western Sydney.

The University of South Australia also maintains a forestry research and development hub known as Forestry Research Mount Gambier, established in 2018.

Research in forest products also occurs at Monash University (the Australian Pulp and Paper Institute), Queensland University of Technology (through the Biorefineries for Profit project), and native forest research occurs at Charles Darwin University (Table 7.1e-2).

The summaries of university research areas below generally relate to the period 2016 to 2023.

Australian National University

The Fenner School of Environment and Society at the Australian National University takes a multi-disciplinary approach to research, research training and policy in environment and sustainability, including issues relating to the management, conservation and sustainability of forest ecosystems. Research focuses on management of native forests and woodlands, including forest ecology, landscape restoration, wildlife conservation, ecologically sustainable forestry, and the effects of fire and climate. The School includes economists, hydrologists, historians, ecologists, foresters, geographers and climatologists, working both nationally and internationally.

Murdoch University

The State Centre of Excellence on Climate Change, Woodland and Forest Health at Murdoch University focuses on tree, woodland and forest decline under climate change, with the aim of restoring biodiversity values, and developing policies and action for the restoration of woodlands and forests.

Southern Cross University

Researchers in Southern Cross University's Forest Research Centre investigate the ecology of native forests in Australia and overseas, as well as studying how native forests and plantations can sustainably produce wood products, environmental services and carbon. Particular areas of focus include tropical and subtropical forestry and agroforestry, computer modelling for forest management and decision-support systems, forest ecology and management, forest genetics, new products from trees, mixed-species plantations, and community engagement in land-use planning.

University of Melbourne

The School of Agriculture, Food and Ecosystem Sciences at the University of Melbourne conducts research on a range of forest-related themes, including forests and water, forest carbon, forest dynamics, forest ecology and silviculture, fire management and forest molecular biology and genetics. The School also supports research on the innovative use of timber products through the Sustainable and Renewable Forest Products Group.

University of Queensland

The Centre for Future Timber Structures, University of Queensland, is a Centre of Excellence for the education of future timber industry professionals and innovation in the use of timber in the built environment. Areas of research include fibre-reinforced timber composites, fire safety of timber structures, and timber use in advanced manufacturing.

University of the Sunshine Coast

The Forest Industries Research Centre (FIRC), located at the University of the Sunshine Coast, Queensland, focuses on complex forestry value chains, and the economic and environmental sustainability of forest industries. Research disciplines include genetics and genomics, silviculture and stand management, forest health and pest management, ecology and biodiversity management, timber and biomass harvest and haulage, fibre quality and value, timber processing and biorefinery, renewable energy and biofuels, and timber construction materials.

The National Centre for Timber Durability and Design Life, launched at the University of the Sunshine Coast in November 2016, is a strategic initiative of FWPA aimed at ensuring Australian design guides and standards remain

world-class in light of climate change, new engineered timbers and changes in building design. Partners include the University of the Sunshine Coast, the University of Queensland and the Queensland Department of Agriculture and Fisheries.

University of Tasmania, including the Australian Research Council Centre for Forest Value

Research aimed at improving forest management in Tasmania's forests is conducted by the University of Tasmania as well as several other research institutions nationwide, including CSIRO, the University of Melbourne, the Australian National University, and the University of Southern Queensland. Much of recent research effort occurred through the Australian Research Council Centre for Forest Value (since 2016) and the Australian Research Council Industrial Transformation Training Centre for Forest Value on the University of Tasmania's Hobart campus (2016 to 2021), which succeeded the National Centre for Future Forest Industries (2012 to 2015).

The Australian Research Council Centre for Forest Value has been funded from a range of sources including Forest and Wood Products Australia, the Regional Research Collaboration Program, the National Institute for Forest Products Innovation (Gippsland), Flora Australia, the Holsworth Wildlife Research Endowment and BirdLife Australia. Research themes span the forest supply chain: sustainable forest production and certification, product and manufacturing and supply chain integration, and information management.

Western Sydney University

The Western Sydney University Hawkesbury Institute for the Environment operates the world's only 'free air carbon dioxide enrichment' (FACE) experiment in native forest (EucFACE), as well as a series of Whole-Tree Chambers in the Hawkesbury Forest. EucFACE is designed to predict the effects of rising atmospheric carbon dioxide (CO₂) levels on Australia's native forests, including trees, animals, soil and grasses. The Whole-Tree Chambers provide enclosed, controlled environments for trees up to nine metres tall, in which researchers manipulate air temperature, soil moisture, irrigation, CO₂ levels and humidity to determine the integrated effects of altered climates on tree physiology.

Case study: Warra Long-Term Ecological Research site

Warra is a complete land observatory within the Terrestrial Ecosystem Research Network (TERN), monitoring the environment at all three of the spatial scales at which TERN infrastructure operates. At the finest scale is the Warra Supersite, consisting of an 80-metre instrumented tower and adjoining 1-hectare plot, which provides the intensive measurements needed to monitor ecosystem processes. At the intermediate ecosystem/landscape scale, Warra contains four one-hectare plots in the AusPlots Forest Network, used to characterise and detect changes in soil characteristics and in vegetation composition and structure. At the widest scale, Warra operates as a calibration and validation site for the TERN Landscape Platform, which provides TERN's remote-sensing capability and allows monitoring of changes at the continental scale. All measurements in the Warra TERN platforms are done using nationally consistent methods, and all data are quality-checked before being lodged on the TERN data portal for free access and use by stakeholders.

In January 2019, much of the southern and eastern sections of the Warra site were burnt by bushfire. All of the 'Icon' studies and TERN infrastructure were damaged by the fire. Monitoring equipment on the 80-metre tower was reinstated by May 2019, the four burnt one-hectare plots were re-measured, and new Light Detection and Ranging (LiDAR) and hyperspectral datasets were acquired for the five-by-five kilometre calibration and validation plot for the TERN Landscapes Platform. A severe windstorm in September 2021 then caused the 80-metre tower to fall, which destroyed all the tower's monitoring equipment. The tower and equipment have not been replaced due to the high cost of unplanned road repairs and uncertainty regarding the ongoing management of the site.

The Warra Long-Term Ecological Research site continues to support other significant research activity. Over 220 research projects have now been conducted at Warra, many ongoing. This research has generated 430 reports and publications, including over 140 in international peer-reviewed journals. Forty publications using data obtained from Warra were produced in the period 2017-2022. However, the focus for research done at Warra has shifted from management of forests for wood production, towards understanding disturbances from fire and from climate change, particularly in the *Eucalyptus obliqua* tall forest ecosystem, and how risks of adverse effects from these disturbances may be managed.

<http://www.warra.com>

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More information

Learn more about [Criterion 7 of Australia's State of the Forests Report](#).

Web agriculture.gov.au/abares/forestsaustralia/sofr/

Download a [Microsoft Excel workbook of the data presented in Indicator 7.1e](#).

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Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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