Australia's National
Science Agency

Highlights 2023

CSIRO acknowledges the Traditional Owners of the lands, seas and waters of the area that we live and work on across Australia. We acknowledge all Aboriginal and Torres Strait Islander peoples and their continuing connection to their culture and pay our respects to Elders past and present. CSIRO is committed to reconciliation and recognises that Aboriginal and Torres Strait Islander peoples have made and will continue to make extraordinary contributions to all aspects of Australian life including culture, economy and science.

Cover: (top) CSIRO Manufacturing team leader and scientist Katherine Locock with Phil Thompson, Co-Founder of Native Secrets, a CSIRO Kick-Start alumni company, discussing the benefits of white cypress as an essential oil on Country in Dubbo Wiradjuri Country.

White Cypress also known by *Callitris glaucophylla*, used as an essential oil for its antimicrobial benefits (bottom). Photo: Gary French CC BY NC

Chief Executive foreword

Australians have always turned to science to solve seemingly impossible challenges and pave the way to a brighter, more sustainable future. They have turned to science, and they have turned to CSIRO, and they continue to do that now.

CSIRO is committed to delivering the very best research to benefit the Australian community, brought to life by a team universally passionate, creative and committed to doing and enabling amazing science.

This report sets out the many ways CSIRO has impacted the community over the past 12 months. It highlights how we work across different time horizons and in a broad range of research fields.

We do research that improves health. Research that improves understanding and protection of our environment. Research that builds a more resilient and diverse economy. Research that drives productivity and sustainability in Australia's small to medium size companies. Research that addresses global challenges like pandemics and climate change and supports our economic prosperity today as well as the new industries and technologies that will shape our future. Often under-emphasised, but no-less important, we also do research that inspires wonder and creates hope.

No research organisation, no matter its size, can work effectively in isolation. So, we also collaborate with researchers in universities and research institutes in Australia and overseas, with colleagues in state and federal government departments and agencies, with small, medium, and large companies and with members of the community.

We are also incredibly privileged to be able to listen to, learn from and work with Aboriginal and Torres Strait Islander peoples whose insights, knowledge, approaches and creativity are built on 65,000 years of doing science on this continent.

Through all of this, and regardless of the research we do or who we work with, we continue to be guided by a single overarching principle – is what we are doing in the national interest, and will it benefit the Australian community? As this report highlights, the answer to those questions is a resounding yes.

Doug Hilton
Chief Executive, CSIRO

6,000+ people
delivering across 49 sites
in Australia and 2 overseas.

For every $1 invested in CSIRO,
at least $8.40 in value is returned,
equating to approx. $10.2 billion
in benefit to the nation.

1,400 international
collaborators and customers
across 87 countries.

200,000 students took part
in our education programs.

Women in leadership roles
increased 4.2 per cent.

Launched Indigenous research
grant and graduate programs.

Roy Morgan most trusted
government services brand
second year in a row.

Solving the greatest challenges

CSIRO solves the greatest challenges through innovative science and technology, working with governments, the research sector, industry, and the community.

A weather service for water quality

CSIRO's HydraSpectra sensor for installation at the AquaWatch pilot site at Keppel Bay on Darumbal Sea Country, monitoring sediment and dissolved carbon flow from the Fitzroy River towards the Southern Great Barrier Reef.

Internationally, water systems are being threatened by climate change, environmental degradation, industrial pollution and other contaminants. Existing water monitoring technologies are often limited in their reach and in their ability to forecast future events.

Together with foundation partner SmartSat Cooperative Research Centre (CRC), we're bringing together research, government and industry with an initial co-investment to design and develop the AquaWatch Australia Mission. It will deliver a world-first ground-to-space water quality monitoring system for Australia and the globe. CSIRO has established 15 test sites to demonstrate real-world applications of AquaWatch.

Once fully operational, the system will provide near real-time updates and predictive forecasting. It will globally support better water quality management, sanitation, aquaculture and environmental assessment, with early warning of harmful events such as toxic algal blooms, blackwater and runoff contamination. This will help increase the resilience of Australian communities who depend on water and improve outcomes for our natural environment after events like bushfires and floods.

Six challenges we are working with partners to solve:

Health and wellbeing

Enhance the health and wellbeing of all Australians.

- **Support healthier lives**
- **Infectious diseases prevention and preparedness**
- **Digital transformation of healthcare**
- **Health technology solutions**

Food security and quality

Grow the triple bottom line value of Australia's agri-food and fibre industries.

- **Profitable agricultural production**
- **Improved crops and animals**
- **High value foods and feeds**
- **Sustainable and trusted value chains**

Secure Australia and region

Safeguard Australia and our region from threats.

- **Biosecurity**
- **Defence and national security**
- **Sovereign resilience**
- **Stable and prosperous region**

Bright beginning for new supercomputer

Pawsey Supercomputing Centre on Wajuk Country in Perth, Western Australia.

This year we completed the Australian Government's $70 million technology upgrade to the Pawsey Supercomputing Centre in Perth and the introduction of its new supercomputer called Setonix – named after Western Australia's favourite animal, the quokka *(Setonix brachyurus)*.

Shortly after accessing the first stage of Pawsey's new Setonix system, researchers generated a highly detailed image of a supernova remnant – the remains of a dying star's explosion – using data gathered from the ASKAP radio telescope. We own and operate the telescope on Wajarri Yamaji Country in Western Australia.

The generation of this image illustrated that the first phase of Setonix has increased the computing power of the Pawsey Centre by 45 per cent. When fully operational, Setonix will allow for more processing of vast amounts of data coming from many scientific fields, and more science will be achieved in a fraction of the time.

Resilient and valuable environments

Enhance the resilience and value of our natural and built environments.

- **Resilience to climate risks**
- **Healthy ecosystems**
- **Resilient communities and built environments**

Sustainable energy and resources

Lower emissions to net zero while sustaining Australia's prosperity.

- **Electricity transition**
- **Industry and transport decarbonisation**
- **Sustainable prosperity from resources**
- **Value-added critical minerals**

Future industries

Create Australia's future sustainable jobs and industries.

- **Future high-tech industries**
- **Transition to sustainable industry**
- **Strengthen the innovation system**

Missions

Our missions program ensures we focus on the issues that matter the most: those which affect our quality of life, our economy and our environment.

Missions bring together research agencies, universities, industry, government and community to work collaboratively on outcomes that lead to positive benefit, new jobs and economic growth.

Since announcing the program in 2020, we have launched 8 missions with our partners and collaborators, each with an ambitious target to deliver by the end of this decade.

In 2023, we launched 2 of those missions: Minimising Antimicrobial Resistance and AquaWatch Australia.

Since 2020

8 missions launched

$442 m co-investment funding

1,181 mission-aligned projects

Hydrogen Industry

Launched: May 2021

Goal: Supporting global decarbonisation through a commercially viable Australian hydrogen industry comprising both domestic and export value chains by 2030.

Future Protein

Launched: September 2021

Goal: Leverage increasing global demand for high quality protein to create new Australian protein products and ingredients that earn an additional $10b in revenue by 2030.

Drought Resilience

Launched: September 2021

Goal: Reducing the impacts of Australian droughts by 30 per cent by 2030.

Trusted Agrifood Exports

Launched: September 2021

Goal: Increase the value of Australian food premiums by $10b by 2030, by building trust in the safety, quality, and provenance of our agrifood.

Ending Plastic Waste

Launched: March 2022

Goal: 80 per cent reduction in plastic waste entering the environment by 2030.

Towards Net Zero

Launched: October 2022

Goal: Helping Australia's hardest-to-abate sectors – including steel, aviation and agriculture – to halve their emissions by 2035.

Minimising Antimicrobial Resistance

Launched: February 2023

Goal: To halt the rising death rate and economic burden of antimicrobial resistance in Australia by 2030.

AquaWatch Australia

Launched: March 2023

Goal: Ensure quality water resources with an integrated ground-to-space national monitoring system by 2026.

Future Science Platforms

Our Future Science Platforms (FSPs) are investments in cutting-edge research. They explore the future science that will reinvent and create new industries for Australia and develop capabilities in tomorrow's researchers. Since 2016, we have invested $518 million and recruited more than 300 early career researchers to work on our FSPs.

Round 1

- **Deep Earth Imaging**
- **Environomics**

Round 2

- **Responsible Innovation**
- **Precision Health**
- **Hydrogen Energy Systems**

Round 3

- **Space Technology**

Round 4

- **Quantum Technologies**
- **Microbiomes**
- **Valuing Sustainability**
- **Autonomous Sensing**
- **Collaborative Intelligence**

Round 5

- **Revolutionary Energy Storage Systems**
- **CarbonLock**
- **Immune Resilience**
- **Advanced Engineering Biology**

To develop new ways to remove and permanently lock away carbon from Earth's atmosphere, our CarbonLock FSP has conducted a feasibility study on reservoir engineering of in-situ carbonation.

Matured FSPs: The most promising technologies and outputs of these FSPs have transitioned into our Business Units for a new phase of development, adoption by research partners, or to follow other pathways to commercialisation.

Active Integrated Matter | 2017–22

Synthetic Biology | 2017–22

Probing Biosystems | 2017–22

Digiscape | 2017–22

Artificial Intelligence and Machine Learning | 2019–23

Driving innovation

Solving Australia's greatest challenges takes collaboration and innovation, which is why CSIRO has a range of programs to support the translation of Australia's world-class science into real-world solutions. These are just a few of those programs.

Start-ups

Our ON Innovation Program is helping Australia's publicly funded researchers and small to medium enterprises (SMEs) develop the skills they need to fast-track their technology and ideas into the market at pace. ON gives research teams the skills and confidence they need to translate their solutions into positive economic, environmental and social impact.

Since the ON Program began in 2015, it has helped more than 3,750 people from over 1,200 teams across 34 universities, 19 publicly funded research agencies and medical research institutions, including CSIRO. Those teams have created 70 companies and over 600 jobs. Post-program, ON participants have raised $311.6 million in investment capital and $305 million of commercialisation grant funding.

Nine teams from ON Accelerate 7 pictured here at the Showcase event which was held in May 2023.

Small and medium businesses

This year CSIRO facilitated more than 340 projects for over 290 SMEs, which injected more than $33.6 million into research and development (R&D). Those projects were delivered by 40 Australian research organisations, including 32 universities and CSIRO.

Our Innovate to Grow program provides SMEs free support to take their innovative, commercial ideas to the next level through R&D. Our experts guide SMEs to refine their ideas and understand the viability of their research before engaging them with universities or research institutes to deliver collaborative R&D projects.

The CSIRO Kick-Start program assists Australian small to medium enterprises (SMEs) and scale-ups by providing facilitation and dollar-matched funding to access CSIRO's research expertise and capabilities for company-led R&D projects. Since its inception in 2017, the CSIRO Kick-Start program has been a catalyst for over 260 small business projects, contributing just under $24 million in R&D activities. Collectively, these companies now hold a market value exceeding $2 billion.

CSIRO's Danyang Ying, Nutri V CEO Raquel Said and CSIRO's Andrew Lawrence with innovative veggie-loaded snacks developed through the Kick-Start program.

Industry and PhDs

Our CSIRO Industry PhD program (iPhD) offers a 4-year scholarship for PhD students to undertake a co-designed research project intended to develop their ability to understand industry needs and translate research into commercial outcomes.

Funded under the Australian Government's University Research Commercialisation program, the scholarship includes a 3-month industry engagement component, plus a professional development and training package. The student is jointly supervised by CSIRO, the industry partner and the host university.

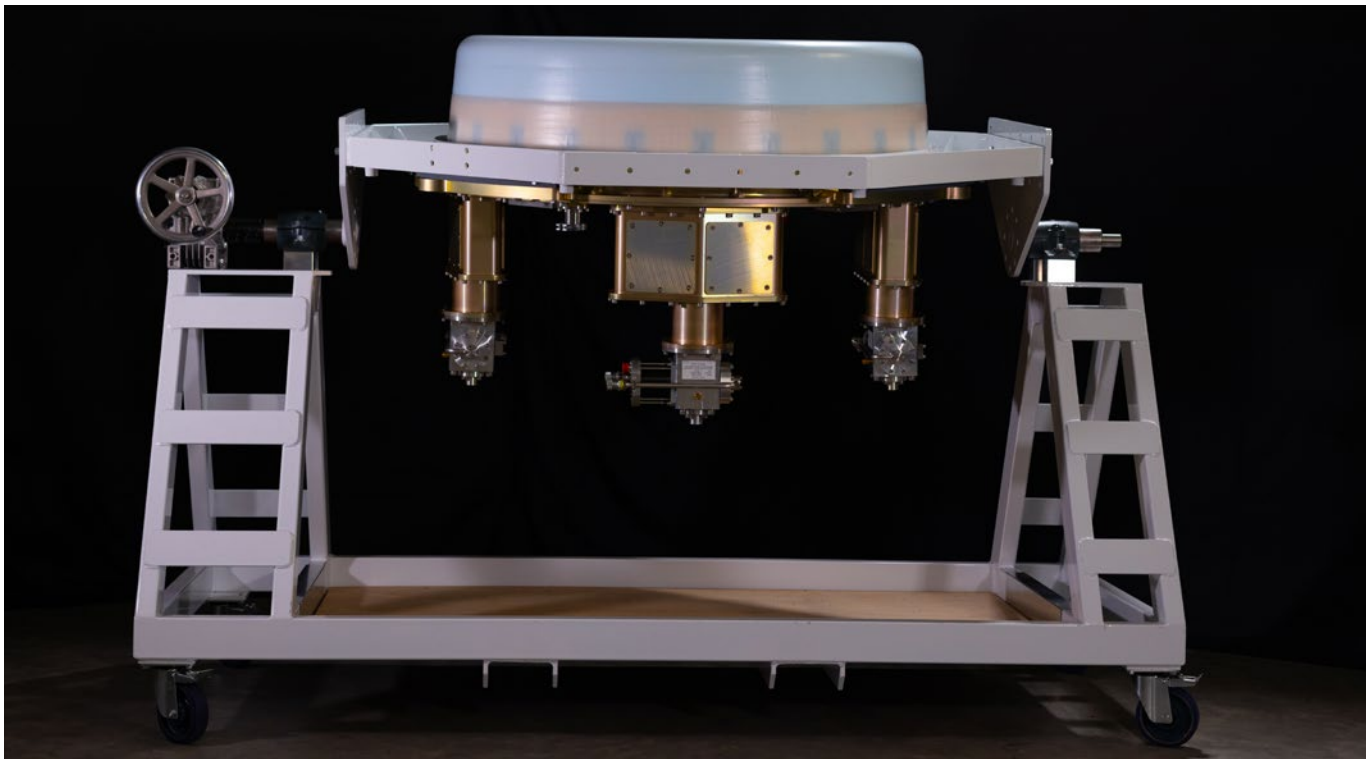
PhD student Elizabeth O'Connor (right) commenced in early 2023, undertaking her iPhD with Wanless Waste Management, Queensland University of Technology and CSIRO, to address regulatory barriers impacting recycling and circular economy development in Australia. The aim is to identify policy reform options and investigate potential mechanisms, processes, and organisations through which legislative change can ideally be influenced and achieved.

Venture capital

Main Sequence, the deep technology venture fund founded by CSIRO, invests in translating publicly funded Australian research into global companies that create jobs and grow our economy.

Since 2017, Main Sequence has helped to build 53 deep technology companies, including 8 in FY2022–23, all of which have created over 2,120 technology jobs. Every dollar invested by Main Sequence has attracted over $4.35 in co-investment from other venture funds, strategic investors and angel investors.

They do this through turning science and research into breakthrough companies like Quasar Satellite Technologies, a space startup commercialising CSIRO's phased array technology. Quasar is working to solve 2 space industry challenges: tracking satellites in space and communicating with multiple satellites at once, to provide a world-leading ground station service for satellite operators and users.



Quasar's first-generation S-band multibeam phased array (1.8 m in diameter). Credit: Quasar Satellite Technologies.

Driving collaboration

Work with us

We're working with universities, business, and government to build new industries for Australia.

We partner with organisations small and large in several ways including:

- mission-orientated research collaboration
- global collaboration
- research and development
- innovation services
- funding and programs
- accessible labs and facilities.

Find out more about how to work with us at: csiro.au/work-with-us

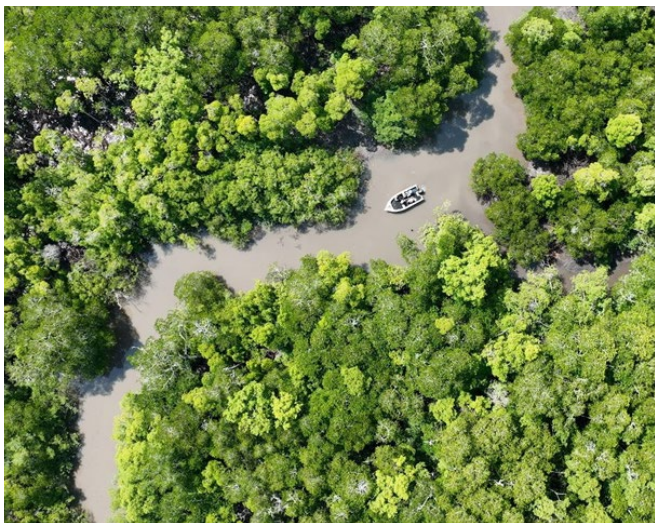
Partner with us

We're also incredibly privileged to be able to listen to, learn from and work with Aboriginal and Torres Strait Islander peoples whose insights, approaches, knowledge, and creativity are built on 65,000 years of doing science on this continent.

We're committed to a science landscape in respectful partnership with Indigenous Australia delivering innovative, sustainable, holistic solutions to meet our greatest national challenges. For example, we've been working with Indigenous organisation Tiwi Resources, which represents the 8 clan groups of the Tiwi Islands in the Northern Territory, to identify a suitable location for a new extensive prawn farm pilot site.

Northern Australia's Top End is the ideal climate for growing farmed prawns in a sustainable way. Extensive prawn farming hasn't yet been tried in Australia, but there is an established and successful extensive prawn farming industry in Vietnam and we've established a demonstration site in Darwin to lead the way.

Ron Poantumilui, a senior leader of the Wurankuwu People, said the various groups of the Tiwi Islands see real potential for the positive impacts in developing aquaculture on the islands, including economic benefits that can flow through generations to come.



Locations on the Tiwi Islands are being investigated as sites for future extensive prawn farms to grow Australia's home-grown prawn produce.

Learn with us

A trusted leader in STEM (science, technology, engineering, and mathematics) education, our programs aim to inspire the pursuit of STEM among students, to equip them with skill sets for tomorrow's workforce, and to strengthen collaboration between industry and communities across Australia. We engaged over 200,000 students in our programs and helped to upskill over 5,500 teachers to feel more confident in teaching STEM.

This year we launched the Living STEM program, which works with schools and communities in Western Australia to connect local Indigenous knowledge with the Australian science curriculum. Living STEM supports primary and secondary school teachers to bring Aboriginal and Torres Strait Islander knowledges into the classroom through hands-on inquiry projects to increase student engagement.

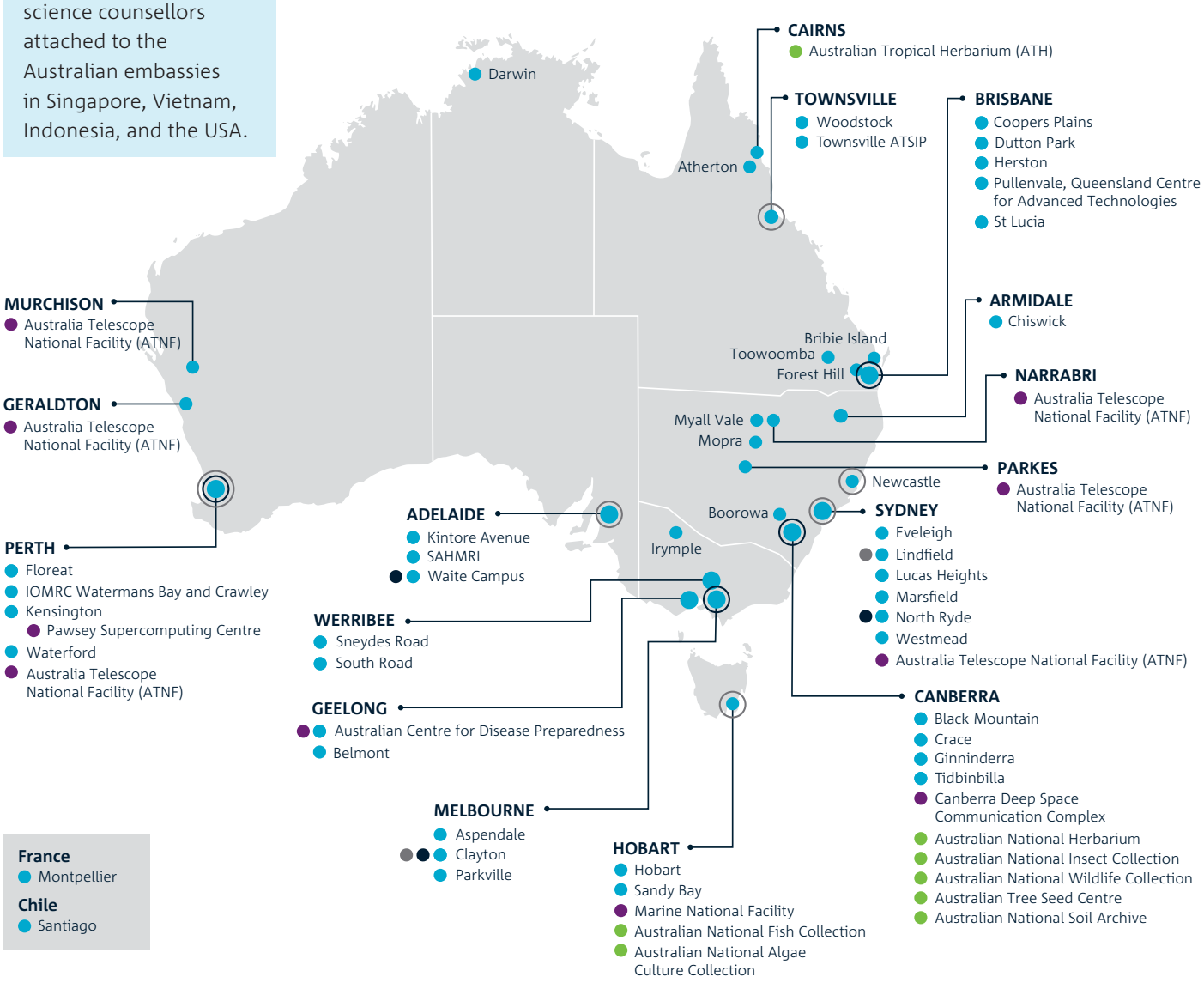
In March, we launched our national STEM Together initiative and its 'Future Shapers' recognition program, which creates opportunities for students in Years 5 to 10 who come from underrepresented groups in STEM. This includes Aboriginal and Torres Strait Islander students; girls; and students from regional and lower opportunity schools. Thirty Future Shapers co-designed their own prize to take their specific interest in STEM further. The prizes ranged from multi-day STEM camps, face time with experts, equipment and technology, and behind the scenes tours of CSIRO and industry sites.

Our locations

At 30 June 2023, we operated 49 sites across Australia and 2 sites overseas.

Our people also access desks or small areas of land for research purposes in 31 minor locations. We have one international office in Santiago, Chile, and one laboratory in Montpellier, France.

We have accredited science counsellors attached to the Australian embassies in Singapore, Vietnam, Indonesia, and the USA.



- CSIRO site
- Global precinct
- National centre
- Collaboration Hub
- Testing Services
- National facility
- National collection

CSIRO staff work at **sites** throughout Australia and overseas.

Our **global precincts** bring together partners to support research and development of global standing and scale. Our **national centres** are research centres of national standing and scale.

We host Australia's national **research facilities** and scientific **collections** that are available to Australian and international users.

Our **collaboration hubs** are spaces dedicated to translating research outcomes to industry.

Our **testing service centres** provide testing and certification services for industry.

Global precincts
Canberra – National Agricultural and Environmental Sciences Precinct
Brisbane – Ecosciences Precinct
Perth – National Resource Sciences Precinct
Clayton – Australian Manufacturing and Materials Precinct

National centres
Sydney – Digital Services
Hobart – Marine and Atmospheric Sciences
Adelaide – Food, Health and Nutrition
Perth – Space Sciences
Townsville – Tropical Innovation
Newcastle – Energy Technology

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Creating a better future for everyone.

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