



Australia's National
Science Agency

Researching soils in Australia and the Pacific





Soil samples awaiting processing at the Australian National Soil Archive. Photo credit: CSIRO/Stuart Walmsley

CSIRO's soil research is broad and diverse – from archiving and analysing soil samples and data, we build an understanding of soil health and carbon trends across Australia. CSIRO supports soil research initiatives like the National Soil Monitoring Program and the Australian National Soil Information System, which provide data to support the sustainable management of soil across the country. We conduct targeted research on soil compaction and regenerative agriculture, with ongoing stakeholder engagement and training initiatives to enhance soil data utilisation and management across Australia. CSIRO also works with partners in the Pacific. Research teams explore opportunities to improve climate resilient agriculture, scale soil information systems, build capacity, and improve nutrient/soil management to support resilient farming systems. Our researchers also develop digital tools for data access and reporting, advancing soil monitoring and mapping projects in places such as Papua New Guinea.

Australian National Soil Archive

The [Australian National Soil Archive](#) is an important resource for current and future soil research. It holds more than 100,000 archived specimens collected from 23,000 sites across Australia. The oldest specimens in the archive date back to 1924, before widespread fertiliser and herbicide application started, providing a useful baseline of soil properties. The archive serves as a time capsule, allowing scientists to compare past and present soil conditions. It is a valuable resource for a range of soil studies, including carbon assessments, fertiliser and erosion studies and to study changes in soil condition over time.

Australian National Soil Information System (ANSIS)

ANSIS provides access to nationally-consistent soil data and information to support the sustainable management of soil. ANSIS has a range of tools to access and view soil data and information.

- The [ANSIS data portal](#) provides access to over 308,000 standardised soil site and analytical records
- The [ANSIS site report](#) allows data for any soil site available through ANSIS to be presented in an easy to read, editable, downloadable format
- The [ANSIS visualiser](#) uses colour to show differences in soil properties, turning complex soil data into clear, visual insights. Users can also view soil properties of interest on a scatter plot
- The [ANSIS summary tool](#) presents summary statistics for selected soil properties for user defined grid cells across Australia. Users can also view summary soil data of interest on a graph
- ANSIS is currently developing a proof-of concept Trends tool which will provide sub-regional summary statistics for selected soil properties for a user defined area of interest, with data split by available temporal time steps to show change and trend in soil data values over time.

ANSIS is supported by funding through the Australian Government Natural Heritage Trust (Department of Agriculture, Fisheries and Forestry) in collaboration with CSIRO. Visit the [ANSIS website](#) to find out more.

Climate-Resilient Agriculture in the Pacific

The Climate-Resilient Agriculture in the Pacific project aims to improve soil and food security for climate vulnerable Pacific communities. The project enables climate change adaption and improved resource-use efficiency by promoting conservation agriculture to achieve sustainable intensification. CSIRO is working with local partners in Fiji and Samoa to develop pathways for using conservation agriculture on farms. The project team uses farming systems models, socioeconomics, and field experiments and demonstration sites to assess the technical, socio-economic, and agronomic feasibility of conservation culture in Pacific Island countries. The project team is working with research institutions, extension officers, farming groups and local farm advisors, and the private sector in Fiji and Samoa to promote conservation agriculture and its benefits. Visit the [Climate-Resilient Agriculture in the Pacific](#) website to find out more about the project.

Developing a National Soil Health Framework

This project is developing an integrated Soil Health Framework that defines soil health and provides measurable, interpretable, and decision-useful indicators to generate the evidence base for sustainable soil management practices. The framework is designed to account for land use, soil type, and climate, enabling meaningful comparisons across different contexts. This will enable farmers to measure, monitor, manage and report the status of their soil health, thereby demonstrating their sustainability credentials whilst driving more resilient and profitable production systems. It will support grower decision-making while also producing data that can be consistently aggregated across scales. This project is funded by Grains Research and Development Corporation (GRDC). While the project is initially focused on grains, cross-commodity partnerships are being developed through the Soil Health Framework Collaboration Agreement.

Future Drought Fund

The five-year Department of Agriculture, Fisheries and Forestry (DAFF) Future Drought Fund Long Term Trials investment is investigating the efficacy of regenerative agriculture approaches across nine cropping and pasture sites in southern Australia with trials now commenced.

GRDC Sandy and Heavy Soils Projects

CSIRO is working with the Grains Research and Development Corporation (GRDC) and research partners to improve the productivity and resilience of constrained soils across Australian grain-growing regions. The Sandy Soils Project is developing practical approaches to diagnose and ameliorate constraints, sustain productivity gains following amelioration, and help growers manage spatial variability across sandy landscapes. Complementary research on heavy soils extends this focus across contrasting soil types, contributing to technical guidance for identifying and managing variable soil constraints. Together, these investments support development of regionally relevant management strategies and practical guidance to help growers improve soil function and crop productivity.

Integrated Soil Carbon Science and Modelling – supporting sequestration evidence and incentives

CSIRO's integrated soil carbon research and modelling capability provides a critical foundation for developing science-based approaches to soil carbon sequestration, greenhouse gas accounting and incentive design. This capability brings together new laboratory infrastructure, advanced measurements, long-term field experiments, national monitoring datasets and process-based models to improve understanding of how soil carbon responds to climate, soil properties and land management. By linking observations of microbial processes, carbon fractions and nutrient cycling with paddock-, regional- and national-scale modelling, these efforts help translate fundamental science into robust estimates of sequestration potential, permanence, additionality and uncertainty. Improved data integration and cross-scale model evaluation will strengthen the evidence base used to identify effective management practices, target investment and assess project outcomes. Collectively, this work supports the development of credible carbon accounting methods and policies, helping ensure that incentives for soil carbon sequestration are environmentally sound, measurable and appropriate for Australia's diverse agricultural systems.

Low Emissions Intensity Farming Systems (LEIFS) initiative

The Low Emissions Intensity Farming Systems (LEIFS) initiative is a partnership (2025-2030) between CSIRO, the Grains Research and Development Corporation (GRDC), the Western Australian Department of Primary Industries and Regional Development (WA DPIRD), the New South Wales Department of Primary Industries and Regional Development (NSW DPIRD), and, the South Australian Research and Development Institute (SARDI) and Primary Industries and Regions SA (PIRSA). LEIFS will equip growers with the knowledge and tools to understand their GHG accounts, compare performance against regional baselines, and make emissions informed decisions. Action Research Networks across state partners will build capability in GHG accounting, build understanding of on farm emissions sources, and demonstrate the impact of low emissions practices. Parallel research will improve baseline data and enable assessment of emissions performance within the regional context. Farm-scale scenario analysis will clarify trade-offs across production, profitability and emissions. Through collaboration with growers, advisers, and industry LEIFS will support credible low emissions performance while maintaining productivity and profit goals.

National Greenhouse Gas (GHG) inventory from the land sector – improvement for Full Carbon Accounting Model (FullCAM) framework

Full Carbon Accounting Model (FullCAM) development has played a critical role in supporting Australia's National Greenhouse Gas Inventory by providing a scientifically robust framework for estimating carbon stock changes and greenhouse gas emissions across agricultural and natural systems. Over the past decade, CSIRO has led major improvements to the agricultural components of FullCAM, including enhanced representations of carbon inflow and soil biogeochemical processes. These developments have been underpinned by extensive field measurements, long-term experiments and national datasets, ensuring that model predictions are grounded in observations from diverse Australian environments. Recent work has focused on improving the quantification of uncertainty, integrating advanced modelling approaches and developing computationally efficient surrogate models to support national-scale simulations. Ongoing investments through national projects continue to strengthen FullCAM's capacity to support greenhouse gas accounting and the Australian Government's commitments under international agreements such as the United Nations Framework Convention on Climate Change.

National Soil Monitoring Program (NSMP)

CSIRO is working in partnership with the Department of Agriculture, Fisheries and Forestry (DAFF) to deliver the National Soil Monitoring Program (NSMP). NSMP involves the collection of approximately 30,000 soil samples from 3,000 sites across Australia (from diverse agricultural regions) to generate rigorous, nationwide soil health data. The program collects physical, chemical, biological, and spectral measurements to establish baseline conditions and track trends in soil carbon, nutrients, acidity, biodiversity, and other attributes. Visit the [National Soil Monitoring Program website](#) to find out more about the project.

Pacific Soils Project

The Pacific Soils Project Phase II is being implemented across Fiji, Samoa, Tonga and Vanuatu, with a focus on scaling soil information systems, capacity building, and improved nutrient/soil management to support resilient farming systems. The project has established and operationalised the [Pacific Soils Portal](#), including governance, data harmonisation, and delivery of accessible soil information across multiple Pacific countries. The project has built regional technical capability, including training in soil sampling, laboratory methods, and emerging tools such as MIR/NIR spectroscopy for rapid soil assessment. The project continues to strengthen knowledge networks and engagement, through extension activities, field training, and resources linking soil data to farm management and policy use.

The Pacific Soils Project is funded by the Australian Centre for International Agricultural Research (ACIAR). Visit the [Pacific Soils Project website](#) to find out more about the project.

Papua New Guinea Resource Information System (PNGRIS)

The Papua New Guinea Resource Information System (PNGRIS) project aims to improve the nation's resource information system to deliver improved soil and land data for step-change advancements to Papua New Guinea's integrated land use planning capability. The project also engages in mid-infrared soil spectroscopy (MIR) capacity building with Papua New Guinea University of Technology. Case study digital soil mapping is being completed in the Markham Valley with the Papua New Guinea Coffee Industry Council and Papua New Guinea Forest Research Institute. GrowPNG and the National Agricultural Research institute are supporting the project with local community and industry engagement. The Papua New Guinea Resource Information System is funded by the Australian Centre for International Agricultural Research (ACIAR). The Papua New Guinea Department of Agriculture and Livestock is supporting in-country leadership and coordination of systems delivery with the Papua New Guinea Department of Information Communication and Technology.

Soil Compaction in Cotton Farming Systems

Soil compaction due to machinery traffic costs Australian agriculture more than \$1 billion per year, and it has significant impacts on fertiliser and water (both irrigation and rainfall) use efficiency, and energy use on farms. Research funded by Cotton Research and Development Corporation (CRDC) is developing new technology for mitigating soil compaction impacts in cotton-based systems. This research will benefit from expanding its scope to cotton-grain systems by simultaneously considering the mechanisation requirements of both systems such that soil compaction can be minimised or avoided, and operating efficiency optimised.

Soil Organic Carbon Monitoring (SOC-M) Project

The Soil Organic Carbon Monitoring (SOC-M) Project is Australia's first national initiative to quantify long-term changes in soil organic carbon across major agricultural regions. Building on the Soil Carbon Research Program (SCaRP, 2009–2012), the project resampled 308 sites between 2022 and 2025 using standardised field and laboratory methods and compiled two decades of land-management data.

The results showed a modest overall increase in soil organic carbon stocks over the past decade, with climate, soil properties and management practices such as residue retention and reduced tillage influencing carbon outcomes. SOC-M also delivered major advances in analytical capability through the use of infrared spectroscopy, nuclear magnetic resonance and machine-learning approaches, while archiving more than 3,600 soil samples in the Australian National Soil Archive. As Australia's first dedicated spatial and temporal soil carbon monitoring network, SOC-M provides a critical foundation for greenhouse gas accounting, carbon farming initiatives and future national monitoring programs.

Stress Testing Regenerative Agricultural Practices

The Stress Testing Regenerative Agricultural Practices project aims to rigorously study regenerative cropping and pasture management to boost drought resilience in southern Australia's dryland farming systems. It is farmer-led with scientific support from CSIRO, involving five long-term trials across key eco-climatic zones and four large demonstration trials. The data collected will be modelled to predict outcomes of different management scenarios, helping stakeholders visualize impacts on soil resilience and sustainable productivity. The project is funded by the Australian Government Department of Agriculture, Fisheries and Forestry.

Terrestrial Ecosystem Research Network (TERN) Landscapes

Australia's terrestrial ecosystem research network (TERN) Landscape monitoring platform conducts environmental monitoring and landscape observation using remote sensing techniques to characterise and monitor Australian ecosystems at a landscape and continental scale. The landscape observation platform also undertakes modelling and synthesis activities to extrapolate and interpolate from observational data to produce modelled data products. TERN is funded by the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). Visit the [TERN Landscapes webpage](#) to find out more about the project.

Understanding nitrogen cycling in cotton soils, and the timing of nitrogen availability to plant roots

CSIRO is investigating how plant-available nitrogen is supplied at four critical stages of cotton growth: pre-plant, first flower, boll fill and cut-out. Understanding nitrogen cycling – including nitrate, ammonium and organic nitrogen – will help growers and consultants match fertiliser inputs to crop demand, protect yield potential, improve fertiliser efficiency and reduce environmental impacts. Two field experiments are underway: one in a long-term rotation trial established in 1995 at the Australian Cotton Research Institute (Field 6, Grey Vertosol), and another on a farm near Griffith, NSW, on a Transitional Red-Brown Earth. Soil sampling at each growth stage is characterising microbial activity, nutrients and carbon. Three randomised treatments compare continuous cotton, cotton–long fallow–faba bean, and cotton–long fallow–cotton, each receiving a single nitrogen application of 300 kg/ha. The results will link nitrogen availability and its microbial drivers with cotton productivity and soil carbon. Funded by the Cotton Research and Development Corporation, the project runs from 2023 to 2027.



CSIRO scientist discussing conservation agriculture with project partners in Fiji

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delivering solutions for a productive,
sustainable and secure future.

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