SDG 12 Responsible Consumption and Production

Overview

UQ's research portfolio drives sustainable production and circular economies through multi-disciplinary innovations. 2025 key achievements include the advancement of 4D drone monitoring for mine waste, the development of structural engineered timber and advanced biotechnology for industrial carbon recycling. Dedicated research centres, including the newly constructed Biosustainability Hub, the Australian Research Council Training Centre for Bioplastics and Biocomposites (CBB) and the Australian Centre for Water and Environmental Biotechnology (ACWEB), actively de-risk and scale eco-friendly materials, biodegradable food packaging and agricultural emission-reduction systems.

UQ also supports SDG 12 through policies, operational measures and impactful research. UQ's Procurement Policy 2024-2028 emphasises ethical sourcing, sustainability and responsible supplier engagement. Waste management initiatives and programs promote plastic-free lifestyles and more than 100 recycling stations support waste reduction for campus retailers. UQ extends sustainability practices to outsourced services and suppliers, aligning procurement with environmental and social responsibility.

Progress made in 2025 towards SDG 12 is reported here with reference to the following domains and enablers from UQ's Strategic Plan 2022-2025:

- learning and student experience
- research and innovation
- enriching our communities
- our global profile.

Related SDGs

- SDG 1 No poverty
- SDG 2 Zero hunger
- SDG 8 Decent work and economic growth
- SDG 9 Industry, innovation and infrastructure
- SDG 13 Climate action
- SDG 14 Life below water
- SDG 15 Life on land.

Learning and student experience

UQ students benefit from diverse learning opportunities broadly related to SDG 12. Recognising that environmental sustainability is not just a scientific challenge, but a business imperative, the UQ School of the Environment delivers the Sustainable Business Practice (ENVM7536) course, which bridges the gap between environmental science and corporate strategy, giving students the skills to drive sustainable decision-making in businesses and organisations. The course equips students with cutting-edge environmental, social and governance frameworks, real case studies and industry best practices. Students explore key topics like corporate social responsibility, environmental impact assessments and sustainable supply chains, learning how companies can reduce their ecological footprint while staying competitive. Another course offered is Foundations of Sustainable Development (ENVM7100), which draws on numerous case studies from around the world to illustrate the complexity of sustainable development issues, including those specifically associated with resources and waste and the circular economy.

Recognising that the sustainability principles are central to global industry operations, UQ extends this expertise into sector-specific learning. UQ offers United Nations Tourism (UN Tourism) accredited bachelor's, master's and doctoral level programs, promoting responsible, sustainable and universally accessible tourism. This accreditation ensures high-quality benchmarks for programs like the UQ Business School's Master of Tourism, Hotel and Event Management that includes a course on Tourism in Developing Economies (TOUR7053) and the Bachelor of Tourism, Hospitality and Event Management that includes a core course on Sustainability in Tourism, Hospitality and Events, examining the potential positive and negative impacts of tourism, hospitality and events on communities, economies and the environment, and providing students with strategies to manage these based on the principles of sustainable development.

Outside of the formal curricular of their programs, UQ students have opportunities to contribute towards SDG 12 through student-led clubs:

- UQ Innovation and Entrepreneurship Society (UQIES), which runs opportunities such as the Sustainability Innovation Challenge. A collaboration with UQ Ventures, this high-energy, fast-paced hackathon invited students to solve some of the biggest water challenges facing South East Queensland (SEQ) in 2025. With more than 3.7 million people relying on the SEQ Water Grid, participants were asked to imagine a future where conservation, restoration and innovation go hand in hand. More than just a weekend of brainstorming, the event brought together a record-breaking 140 students across 28 teams, spanning disciplines and experience levels. Sponsored by Seqwater, students came together to collaborate with industry experts and mentors, competing for a prize pool to bring their ideas to life. 4 teams placed in the competition, with solutions including software as a service that integrates with farming equipment to reduce water consumption, water-efficient turf and a sustainable, healthy cooking oil alternative made from algae.
- UQ Sustainable Innovators Club, which is centred around promoting sustainability on real-world issues, covering agriculture, water, energy and waste. The Club ran events in 2025 including talks, tours and workshops to improve and promote sustainable practices within the UQ community.

Research and innovation

UQ supports responsible consumption and production through targeted research that promotes circular economies, waste reduction and resource efficiency. Its interdisciplinary work helps industries adopt cleaner practices, develop bio-sourced materials and mitigate environmental impacts. By fostering strong industry collaborations, UQ contributes to global efforts to reduce pollution and conserve critical resources through scalable, practical systems.

Sustainable alternatives for manufacturing and production

How we achieved this

- As a faculty research centre under the Faculty of Engineering, Architecture and Information Technology (EAIT), Australian Centre for Water and Environmental Biotechnology (ACWEB) is a world-leading institution in water research and an emerging leader in environmental biotechnology. Comprising approximately 100 academic, research support and higher degree research personnel, the Centre maintains broad collaborative links with over 100 utilities, businesses, industry groups and research institutions globally. ACWEB's research portfolio is organised around 9 core research themes designed to achieve sustainable outcomes for the water industry, protect water resources and safeguard critical infrastructure:
  - advanced wastewater treatment
  - decarbonisation technologies
  - digitalisation of networks
  - drinking and recycled water
  - emerging contaminants
  - municipal organic solids
  - sewer and water infrastructure
  - sustainable Agri-industry
  - water, energy and carbon.

  In 2025, the Centre's active projects apply these cross-disciplinary themes to drive resource optimisation and sustainable production:
  - Transforming Australia's biosolids resource: ACWEB researchers play a leading role in the ARC Training Centre for the Transformation of Australia's Biosolids Resource, an active multi-year initiative dedicated to repurposing wastewater sludge into high-value agricultural and industrial materials. Through Project 1A 'waste stream blending' and Project 2C 'advanced thermochemical conversion via pyrolysis', the team develops cutting-edge processing routes to generate stable, advanced carbon materials, such as biochar and hydrochar, reducing waste volumes, transportation emissions and fossil fuel reliance.
  - Methane bioconversion to value-added liquid chemicals and in situ applications: Led by ACWEB researchers, this project addresses the barriers of large-scale gas transfer by developing an innovative microbial membrane biofilm reactor (MBfR)

system. The technology efficiently upcycles methane, which a potent greenhouse gas, into value-added liquid chemicals, solvents and single-cell proteins under micro-aerobic conditions. By transforming gaseous waste streams into sustainable alternatives for petroleum-based products, the project introduces practical biotechnology frameworks that support sustainable resource use and advanced circular production.

- 'Circular Economy', via renewable energy and resource recovery: This project integrates microalgae production into urban sewage infrastructure to naturally remove wastewater nutrients and capture atmospheric carbon dioxide. The resulting algal biomass is then utilised as a sustainable feedstock for anaerobic digestion, generating renewable biogas for electricity or liquefied natural gas. By replacing energy-intensive traditional treatment methods with innovative carbon capture and resource recovery, the project supports the industrial transition toward a carbon-neutral circular economy.
- Additives for low-cost emissions reduction in piggeries: This project tests and validates chemical additives to reduce fugitive methane from piggery manure and effluent. This is important for the Australian pork sector, representing as much as 60 per cent of overall supply chain emissions, and alternative solutions are currently cost-prohibitive for a large proportion of the sector.

Active projects initiated in 2025 are underway, with progress and SDG 12 outcomes to be detailed in subsequent years.

- UQ's Biosustainability Hub is a A$70 million facility that unites researchers, industry and government to develop sustainable, economically viable biological solutions to global challenges, focusing on:
  - mining and critical materials
  - energy and fuels
  - chemical manufacturing
  - food and ingredients
  - sustainable agriculture water
  - waste and functional materials.

  To accommodate its specialised infrastructure, construction on this state-of-the-art facility commenced in May 2025, expanding the Hub's physical footprint into a newly built space within UQ's Andrew N. Liveris Building to help accelerate translation by de-risking emerging green technologies for industry. The facility leverages Australian Government infrastructure, including the NCRIS-funded Q-MAP and IDEA Bio platforms for multi-omics and computational biology, alongside collaborative frameworks with 20 industry and 4 government partners.

  Alongside this 2025 infrastructure expansion, UQ researchers partnered with Woodside Energy to patent a groundbreaking gas fermentation technology that converts methane and carbon dioxide into sustainable proteins for animal feed. This circular economy innovation has the potential to reduce reliance on imported fishmeal

for aquaculture, while creating new opportunities for low-emission manufacturing and more resilient food production systems.

- Headquartered at UQ, Australian Research Council (ARC) Training Centre for Bioplastics and Biocomposites (CBB) drives advancements toward SDG 12 by pioneering bio-derived and biodegradable alternatives to fossil-fuel-based plastics. Its work integrates transdisciplinary research spanning materials engineering and waste transformation across the entire circular value chain. Partnering with major consumer-goods manufacturers, such as Kimberly-Clark, Plantic Technologies and the Australian Packaging Covenant Organisation (APCO) that represents over 2,000 industry members, the Centre de-risks and accelerates the commercial scaling of green manufacturing, systematically guiding industries toward sustainable consumption frameworks. A key achievement in 2025 was the biodegradable tree guard prototype. In July 2025, CBB researchers co-developed this water-resistant tree guard prototype made from bacteria-produced biopolymers (PHAs) and wood sawdust under the Koala Habitat Restoration Partnership Program, which was field-tested by the Queensland Trust for Nature (QTFN) to replace plastic guards and eliminate retrieval costs.

  Other research highlights in 2025 include:

  – Dr Clement Chan led the research team to blend polyhydroxyalkanoate (PHA) with wood flour to achieve material cost reductions and improved toughness, advancing the technology from laboratory scale to a pilot trial of 2,500 manufactured medication trays at the Royal Brisbane and Women's Hospital to evaluate end-user acceptance.

  – Dr Ian Levett developed a novel PHA-based biodegradable polymer coating for controlled-release fertilisers, with early-stage trials demonstrating extended nutrient release times to mitigate persistent microplastic waste accumulation in agricultural soils caused by conventional non-degradable coatings.

  – Dr Emilie Gauthier advanced the development of high-performance starch-based films for food packaging, focusing on lab-scale research to improve water resistance and processability while optimising extrusion and solution coating techniques to maintain mechanical strength.

  – Dr Sam Lawless investigated chemical modifications and reactive extrusion processes to enable PHA film blowing, producing thin, flexible and ambient-biodegradable prototype films comparable to conventional plastics for future packaging and agricultural mulch applications.

- UQ researchers from EAIT and the Sustainable Minerals Institute (SMI) are developing innovative drone and sensor technology to improve the monitoring of mine waste and enhance safety and land rehabilitation. This method combines electromagnetic measurements and geochemical data and offers a more efficient alternative to costly, less accurate drilling techniques. The technology allows for 4D monitoring throughout the lifecycle of a mine, significantly reducing the need for laboratory testing. This development is being funded by Rio Tinto for 3 years from 2024 and will make progress towards a more sustainable approach to waste management and land rehabilitation in mining operations.

- The UQ-led ARC Research Hub to Advance Timber spears an advanced manufacturing transformation to drive the construction sector toward net-zero emissions. By integrating engineering, architecture and environmental sciences, the Hub optimises natural resource management by shifting production up the value chain to create high-value engineered wood products from low-value fibre. Furthermore, it champions waste reduction by embedding circular design principles to extend building lifespans and enable end-of-life component repurposing. Actively bridging the gap between technical innovation and commercial policy, representative milestones achieved under this sustainable manufacturing framework in 2025 include:
  - organising World Conference on Timber Engineering (WCTE) 2025 in July, with Director Professor Keith Crews highlighting timber's role in a circular economy and sustainable design.
  - attending Osaka World Expo 2025 in October, with researchers promoting sustainable timber design at the Australian Pavilion to focus discussions on modular, low-carbon prefab housing methodologies.
  - launching Queensland Future Timber Plan in October, with the Queensland State Government unveiled a long-term strategy, backed by advisory input from the Hub, to secure sustainable wood supply chains required for one million new homes by 2044. The plan establishes a critical mandate to expand the state's plantation estate by 25,000 hectares by 2050 and modernise forest management systems to utilise timber as a renewable, low-carbon alternative to emissions-intensive concrete and metal.
- During 2025, UQ researchers published 'Tuning Reaction Pathway with Surface Metal Cocatalyst for Ethylene Production via Photocatalytic Methane Conversion', which highlights their work to develop a cleaner, highly efficient method to convert the potent greenhouse gas methane into valuable ethylene. This breakthrough utilised a novel palladium-gold alloy catalyst combined with titanium dioxide, harnessing intense sunlight to drive the reaction at room temperature and eliminating the energy-intensive high temperatures required by traditional fossil-fuel-powered processing. Following successful laboratory testing, the technology is envisioned for future deployment across 2 primary scales: decentralised configurations integrated directly into livestock facilities to capture agricultural emissions and large-scale industrial configurations where photocatalyst beds are paved onto factory or mining site rooftops. To ensure economic viability for mass adoption, the research team is currently exploring replacing the expensive gold components with cheap, widely available iron.
- In 2025, researchers from UQ's Business School produced and launched a landmark Sustainable Packaging Trends Report that delves into 12 key trends across 4 priority areas shaping the future of sustainable packaging. From innovative waste management strategies to cutting-edge design principles for circularity, it explores the multi-faceted approach required to address the complex challenges of packaging sustainability. This report brings together insights from a comprehensive range of industry, research and government experts to provide a roadmap for stakeholders. This report was supplemented by a short industry document detailing the repots key findings in relation to sustainable packaging trends, priorities and recommendations.

Enriching our communities

Beyond the direct impact of its education and research programs, UQ is committed to enriching communities by supporting and promoting the SDGs in both external engagement activities and campus operations. For SDG 12, this extends to ensuring UQ has ethical procurement practices, responsibly manages the natural resources it consumes and actively pursues opportunities to reduce and effectively manage waste.

Ethical sourcing policy

As stated in UQ's Procurement Policy 2024-2028, all procurement activities, decisions and decision-making processes will be consistent with applicable legal, regulatory, contractual and policy obligations and accountabilities, and demonstrate sound ethical behaviour. Those engaging in procurement transactions must:

- retain and appropriately manage contract documents, including any variations and extensions
- act with integrity and demonstrate ethical behaviour in accordance with UQ's values, the Staff Code of Conduct, UQ's Procurement Policy 2024-2028, Procurement Procedure and the Probity and Integrity in Procurement Procedure
- ensure that any actual, perceived and/or potential conflicts of interests relating to procurement are declared, recorded and effectively managed.

Sustainability is an element of UQ's ethical sourcing requirements and is defined in policy as: purchasing goods or services in a way that meets UQ's current requirements and promotes and protects economic, environmental, ethical and social outcomes.

To drive these social outcomes, UQ uses its buying power to enrich local communities. Guided by the Queensland Government's Queensland Procurement Policy (2023), UQ takes a responsible public procurement approach and works to consider social enterprises, Indigenous businesses, Australian Disability Enterprises (ADEs) and local businesses in applicable sourcing activities. Work with Indigenous businesses is supported by the UQ Indigenous Procurement Strategy (2022-2025). The strategy outlines the University's goals relating to engaging with Indigenous businesses, building relationships and targeted spend levels.

UQ offers training and support to staff around socially responsible procurement including online courses and workshops supported by procurement staff and 3rd parties. In addition, UQ supports inclusive procurement by promoting the use of supplier databases to connect staff with verified suppliers who promote social, economic and environmental impact.

Policy extensions to suppliers

UQ's procurement planning process, as set out in the University's Procurement Policy 2024-2028, requires the inclusion of sustainability considerations in all purchasing decisions. Additionally, UQ wants ethically, environmentally and socially responsible suppliers. Suppliers are expected to meet the requirements of the Queensland Government Ethical Supplier Threshold and the UQ Supplier Standards. These standards outline UQ's principal expectations of its suppliers and the standards in place to help UQ meet its responsible, social and legal requirements.

Suppliers have access to resources relating to procurement activities through the Supplying to UQ webpage.

Waste tracking, reduction and disposal

UQ is actively working to reduce waste through a range of initiatives aimed at minimising disposable items and landfill including:

- reuse and recovery. UQ promotes the reuse of materials through initiatives like furniture repurposing and equipment donation through UQ WarpIT, a waste action reuse portal that allows UQ staff to post unwanted items for donation or claim items for work purposes.
- education and engagement. UQ provides resources to staff and students to encourage responsible waste disposal and sustainable behaviours, and the use of reusable coffee cups through campus cafe discounts.
- sustainable event management. UQ maintains a Sustainable Event Guide to help staff and students minimise waste generations at events.
- organics collection and composting. UQ collects organic waste, including paper towels from bathrooms and food scraps from kitchens and food outlets, to divert compostable materials from landfill.
- recycling programs. UQ provides clearly labelled recycling bins across campuses to encourage proper sorting of recyclables such as paper, cardboard, plastics, batteries and e-waste.
- construction waste mandate. UQ requires all campus construction and refurbishment projects to implement the waste hierarchy of ‘avoid, reduce, reuse, recycle, recover and dispose of waste’ as outlined in the UQ Design Standards.

Hazardous waste disposal

All chemical waste must be disposed of safely in accordance with the UQ Chemical Waste Operating Procedure. This procedure outlines the requirements for the disposal of laboratory and other chemical waste to minimise reactivity, toxicity or risk to humans or the environment during collection, storage and transportation prior to disposal. Laboratory staff must complete training before they start work with hazardous chemicals, with details provided in the training and induction requirements section of the UQ staff health and safety training and induction website.

Minimisation of plastic use

To minimise the use of plastics, most cafes within the University actively replace single-use plastics with biodegradable cups, containers, wrappings and cutlery while offering discount for bring-your-own (BYO) coffee cups. In addition, UQ has installed over 30 water refill stations across its two main campuses, encouraging the use of reusable bottles to eliminate single-use plastic beverage containers.

Sustainability reporting

UQ is committed to supporting progress across the SDGs through sustainable operations, teaching and student-support, community outreach, partnerships and research. UQ is a signatory to the Talloires Declaration and the University Campus Sustainability Declaration.

In addition to voluntary reporting, UQ fulfills mandatory sustainability reporting requirements, including compliance with the National Greenhouse and Energy Reporting Scheme (NGERS).

Our global profile

By working with a range of partners through its research and development activities, UQ seeks to have a global impact and contribute tangible progress towards SDG 12.

How we achieved this

- In 2025, the Australia Awards Fellowship continued to support a strategic collaboration between the Australia and Monolia to strengthen Mongolia's mining sector and accelerate its transition to green energy. The initiative focused on professional development, knowledge exchange and capacity building, equipping Mongolian stakeholders with the skills and expertise needed to implement more sustainable and inclusive practices. Through engagement with Australian experts and institutions, the program promoted responsible resource management, improved social and environmental performance and encouraged the adoption of cleaner technologies. It also fostered inclusive participation by creating opportunities for women, Indigenous peoples and persons with disabilities, helping to build a more equitable and resilient mining and energy sector.
- Researchers from UQ's Sustainable Minerals Institute delivered the course 'Developing Carbon Conscious Mining in Mongolia', which was funded by the Australian Government's Department of Foreign Affairs and Trade and supported by UQ's International Development Unit, to promote carbon-conscious mining practices in Mongolia. The course empowered 22 participants, including from the Mongolian National Mining Association (MNMA), its member companies and stakeholders, to understand key concepts of climate change and actions required, applying global sustainability insights to local challenges. This was the first short course delivered in Mongolia combining with both online and in-person learning approaches, marked a significant step toward greener mining practices in the country. Through a blend of learning approaches, the course brought together mining professionals to explore how mining can align with global climate goals. Participants gained practical knowledge on carbon markets, sustainable mining, carbon credit and its calculation methods.
- The 'Gas to food for an innovative and advanced circular bioeconomy' project seeks to transform waste gases generated from biological sludge during wastewater treatment into high-quality proteins suitable for livestock, aquaculture and human consumption. By converting sludge into synthesis gas or biogas, the initiative addresses challenges in carbon emissions and waste management. The innovative platform captures and reassembles carbon emissions into valuable feed products, reducing reliance on

imported feed ingredients and supporting local production. This circular bioeconomy approach enhances sustainability, mitigates environmental impact and provides economic benefits. The project combines interdisciplinary expertise to advance bioprocessing technologies and create renewable outputs, contributing to food security and environmental conservation.

- The 'Engineering Pseudomonads for sustainable production of oleochemicals (BioOlé)' project aims to develop a sustainable microbial platform for producing functionalised fatty acids from sugar industry by-products as eco-friendly alternatives to petroleum and palm oil. Using the host strain Pseudomonas taiwanensis VLB120, the project focuses on producing ω-amino and ω-carboxy fatty acids with industrial applications in polyamides, cosmetics, surfactants and lubricants. By leveraging low-cost carbon sources like molasses, BioOlé offers an economically viable and environmentally sustainable solution for chemical industries. The collaboration combines expertise in fatty acid metabolism engineering and bioprocess engineering to establish efficient production methods, benefiting Queensland's agro-industrial sector and Germany's chemical industries.
- As part of the Sustainable Minerals Institute, UQ's Global Centre for Mineral Security co-founded this 'Coalition for responsible sand and silicates' to address the environmental and social risks of sand and silicate extraction, both of which are vital yet frequently sourced unsustainably. Since 2022, the coalition has promoted supply chain due diligence and responsible sourcing, shaping new standards and practices through international forums, studies and stakeholder engagement. Throughout 2025, the initiative advanced the conditions for coordinated, cross-sectoral action through several major milestones:
  - May 2025: Organisation for Economic Co-operation and Development (OECD) Forum closed-door consultation with more than 40 organisations on advancing responsible business conduct in sand and silicate supply chains.
  - July 2025: Barcelona co-design workshop on value proposition and organisational design, hosted by Roca Group.
  - November 2025: Publication of OECD study, 'Due Diligence for Responsible Sand and Silicate Supply Chains'.
  - December 2025: Interim Council meeting, London. Decision to launch the full Coalition in 2026.
- Developed by UQ to help tourism destinations build climate mitigation capacity and decarbonise tourism, the Tourism destination decarbonisation toolkit is based on research and real-world case studies to provide practical strategies across 9 decarbonisation areas. It is designed for destination management organisations (DMOs) to develop a coherent and comprehensive climate mitigation plan for systemic change and includes a mobile-friendly website to increase accessibility. In 2025, the toolkit was disseminated internationally and nationally as a practical resource to support climate action in tourism destinations. Internationally, the research informed European policy through expert contributions to the 2025 VivaCITY whitepaper, the CETT Tourism Policy Dialogue in Spain and international keynotes across Europe and Peru. Nationally, the toolkit was translated into practice through applied workshops

with Capricorn Coast stakeholders and Ecotourism Australia certified destinations, translating research into actionable climate governance frameworks to support SDG 12 through more responsible tourism planning.

- The 'Biofunctional spider silk and engineered living materials for sustainable waste stream treatment' project aims to create biohybrid membranes using recombinant spider silk functionalised with catalytic proteins, engineered microbial cells or peptides to remove contaminants like pharmaceuticals and industrial chemicals from wastewater and off-gas. It also focuses on recovering valuable resources such as rare earth metals, supporting the shift from wastewater treatment to resource recovery in a circular bioeconomy. By integrating expertise from UQ, TUM and the Bayreuth team, the project will deliver proof-of-concept membranes for pollutant degradation and metal binding. It supports SDG 6 and SDG 12, with applications in water, mining, chemicals and environmental biotech sectors.